

# *Development of a regional innovative system based on “triple spiral” model*

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**Abstract** — Creation of a regional innovative system, which introduces a mechanism of technological entrepreneurship, is particularly topical for the Russian Far East. In the present context the traditional views on formation of the regional innovative systems are subject to review. Most efficiently this process is arranged within a “triple spiral” model. This paper presents the content of the “triple spiral” model, analyzes actors’ motivation for implementing innovations and a networking cooperation. It is concluded that regional actors exert influence on intensity and forms of universities, businesses and government involvement into the processes, as well as on aspects of using knowledge and technology transfer. A hypothesis was formulated, that in case of creation a mechanism of cooperation between all the actors of the “triple spiral” – university, government and business – innovative ventures in the engineering-industrial center of the Russian Far East might receive more rapid development. In order to confirm the hypothesis, mechanisms and forms of university involvement into the mentioned processes, current issues and limitations, aspects of using knowledge and technology transfer on the territory of advanced development “Komsomolsk” are studied. Based on the analysis a significant role of a technical university in development of innovative ventures on the territory of advanced development Komsomolsk is justified. It is determined by three types of interaction with enterprises of innovative cluster in Khabarovsk region: implementation of educational programs in priority fields of study, refresher course and advanced professional training; conduct of applied research together with businesses; shared use of university’s innovative infrastructure. It is proved that networking cooperation within the school community while using innovative infrastructure enables to form in the region a long-standing link on reformation and creation of scientific knowledge into a new and revised product (technology). This research is aimed to explain an intentional development of an innovative system in the region based on the “triple spiral” model. The authors have carried out an analysis of networking cooperation in the process of knowledge exchange (transfer) between the actors of innovative infrastructure of university and region. The directions of innovation-activity chains “Education – science – technologies – business” have been defined along the lines of a national technological initiative. The recommendations on increasing the effectiveness of knowledge transfer, level of innovative activity, actors’ educability are suggested. The results of the research may be

used by governmental authorities and the participants of the networking cooperation aiming at formation of the “triple spiral” model.

**Keywords** — *territory of advanced development, engineering-industrial center, technological entrepreneurship, «triple spiral», networking*

## I. INTRODUCTION

These days the government of the country is coping with the task to build Russian economy in a global international division of labor in Asia-Pacific region, at that in the most high-tech and highly-productive occupations [1]. In the Russian Far East this task is performed by creation of the territories of advanced development – special zones, where an attractive investment environment for the development of the regional innovative systems is to be created [2].

Setting up a new business, based on an innovative knowledge-intensive idea (technological entrepreneurship) as a competitive advantage, is directly connected with creation of regional innovative systems (M. Polanyi) [3, 4, 5].

Cooperation in a form of “double spiral” between a government, which determines industrial development, and a business remains to be a leading concept of the world innovation policy [6]. However, the “triple spiral” model, developed in the beginning of the 21<sup>st</sup> century based on the estimated role of research institutions in innovative sphere, has got widespread in the current times. The authors of this theory Henry Etzkowitz and Loet Leydesdorf have reached the conclusion, that “university activities reorient on business model, where practical use of academic results plays an essential role” [7]. Advantages of the “triple spiral” model as an instrument of regulation of innovative policy and practices in regional local and technological systems lie in expended variety of “development drivers” [6]. Cooperation of the three actors (university – government – business) arises at every step of creation of an innovative product [8].

At the same time researchers and experts at this field point out that “involvement of universities in educational, academic and innovative activities varies depending on historical factors, different scales, nature of a governmental policy and institutional structures”, there is no unique model of networking cooperation [9, 10].

The aim of this research is to find out an existence of a systematic coordination of actors from academic and business communities with government authorities on the territory of advanced development, determine directions of innovative entrepreneurship development.

## II. MATERIALS AND METHODS (MODEL)

In coordination between the actors in the “triple spiral” model two main ideas are observed. The first promotes a university to play the main role as a guide and key element in the relationships with business and government. The second idea considers the actors of the “triple spiral” – university, government, business – from the perspective of social communications theory, as coevolving subsystems of the society, which change their institutional structure while cooperating with each other. With that each institutional area engenders new types of connections and structures, which lead to a network integration [11, 20]. “Each of the three institutes partly takes on the roles of other institutional areas: universities engaged in education and scientific researches set up new companies at university incubators; business partly renders educational service; government serves as a public entrepreneur and a venture capital investor...” [12]. Universities, which develop into entrepreneurial universities, combining teaching, research and business activities, have a considerable role.

The authors and researchers of the collective action model in order to predict the directions of the development of the actors of the “triple spiral” model are trying to find out what each of these actors is driven by [13]. Viale R., Etzkowitz H. note that “without addressing to the analysis of internal dynamics of epistemological and cognitive factors of knowledge acquirement, we cannot ultimately explain, as well as predict the further directions of the institutional development” [14]. According to Golovko N. any system, striving for any corporate actions, has to take regard to certain restrictions and measures which will “force” the actors to participate in the corporate activity [15].

Motivations for cooperation within the “triple spiral” are different for every actor. For the state (government of the country) it is creation of regional innovative systems, in which the areas of priority of the national technological initiative assign a direction. In the Russian Far East the government has set up a target of rapid development of the regions, improving competitiveness of deep processing products.

The main motivating factor for a business always remains profit; its increase is possible through innovative entrepreneurship. It is especially relevant for a business in the Far East regions, where the factors of production are reasonably higher.

For universities in the Russian Far East a driving factor for reorganization is determined by specific problems and challenges of these territories; for instance, an adverse trend in the amount of prospective students as a result of a long-term

migration from the Russian Far East. Moreover, national factors: narrow and specific character of jobs in mono-cities; high competitiveness between the universities for the perspective students; higher school education reform. One of the positive outcomes of the higher school education reform is securing favorable conditions for effective development of small and medium enterprises in innovative sphere based in higher education institute (Federal law 217). As a result universities rapidly develop their innovative infrastructure, raise entrepreneurs. This method has grounds, as according to Shumpeter, entrepreneurship is the main channel of transformation university knowledge into innovations [Carayannis et al., 2015; Proskuryakova et al., 2015].

In order to implement the institutional transformations at universities and other organizational structures suitable tools of stimulation are needed. They include strategies of federal, regional and municipal authorities; competitive programs; masterplans, etc. Due to a unique structure of institutional actors and areas of accountability of the authorities, the “triple spiral” model obtains different configurations in different regions.

The elements of the “triple spiral” model in the territory of advanced development Komsomolsk. Komsomolsk-on-Amur – is an industrial center of the Russian Far East. There was created the territory of advanced development Komsomolsk, which specializes on high-tech manufacturing in the field of aircraft engineering, metal industry and commercial production.

An important requirement of the territory of advanced development is creation of a small-scale innovative enterprises cluster around high-tech manufacturing. On the territory under analysis it is Komsomolsk-on-Amur aircraft manufacturing plant named after Yuri Gagarin, for the operation of which the residents of the territory of advanced development have to produce components for aviation equipment. Innovative engineering cluster of aircraft engineering and shipbuilding founded in Khabarovsk region also needs small-scale high-tech enterprises; the anchor residents of the cluster are city-forming enterprises of Komsomolsk-on-Amur.

However, such unique for city problems (high cost of production, monospecialization of the economy, narrow application of labor market, underdevelopment of social infrastructure) create some certain risks. As a result, considerable efforts are expended in order to take on investors and residents to the territory of advanced development Komsomolsk; small business does not side with technological processes of city-forming enterprises.

Along with that, in the city there is a Komsomolsk-on-Amur state university, which is a leader in innovative activities in Khabarovsk region; innovative infrastructure has been well developed there (Technological park, Shared knowledge center, Center of engineering, etc., business incubator is under construction). Small-scale innovative enterprises are established at the university.

University is developing in obedience to a reform of higher education, according to which “rapid development of a region must become a strategic target of universities”. Thus, Komsomolsk-on-Amur state university has a mission to supply the programs of the territory of advanced development with “qualified workers, scientific and technology concepts,

commercialization of inventions”. This entails innovative entrepreneurship in the region based at the university [16]. Assistance in development in students and pupils business culture and skills plays a significant role.

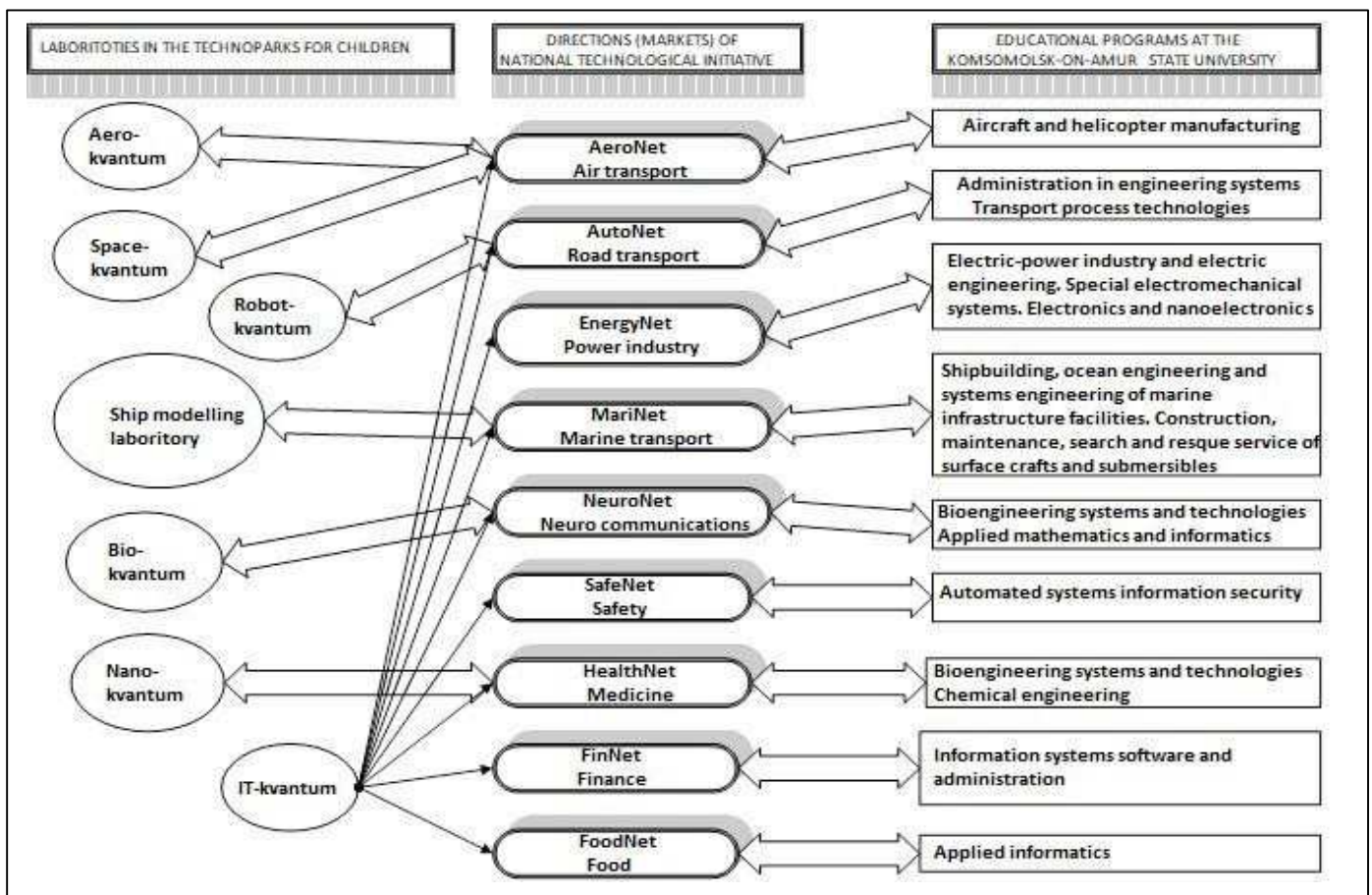
Participation of the Komsomolsk-on-Amur State University in development of innovative entrepreneurship is realized in two main directions: business education and business activities. Business education implies development in students and graduates of an entrepreneurial spirit through organizations of specialized courses, foundation of laboratories and platforms for collaboration with enterprises; business activity includes setting up university start-ups, intellectual property assets, and implementation of collaborative scientific projects [17].

As it was mentioned above, an innovative entrepreneurship most effectively is developing in the “triple spiral” model, in presence of networking cooperation. In Komsomolsk-on-Amur the networking cooperation “School-university-business” in an educational process has been performed for several years. The town administration implements a project “Education for life, education for the future”, with cluster-oriented education as the main focus. This provides in the city

and technical focus, starting from a kindergarten and school ending with manufactures and laboratories of universities and enterprises” [18].

The necessary infrastructure for development of engineering education for children of pre-school and school age already exists in the city – this is a technology park for children “Kvantorium”; “Future technologies school” based on the Komsomolsk-on-Amur State University. New facilities such as Engineering school, Innovative interactive center “Evrastika” (a technology park for children) are under construction.

Development of engineering education for children in the city proceeds in full accordance with the directions of national technological initiative: laboratories of the technological parks correspond to the market of the national technological initiative. Bachelor’s and Specialist’s programs in the Komsomolsk-on-Amur State University go at the same direction. That means that the directions in the chain “education – science – technologies – business” correspond to each other (Fig. 1).



cooperation between schools, businesses, vocational education and training institutes, included in territorial-economic branch clusters.

The “triple spiral” model lays in a “concept of development of engineering education in Khabarovsk region”; according to the concept it is necessary to “develop and introduce cross-cutting curriculums, programs, workshops with engineering

Fig. 1. Match of training programs in the technological parks for children, and fields of study at the Komsomolsk-on-Amur State University with labor market of the national technological initiative

On the territory of advanced development Komsomolsk infrastructure for business, innovative entrepreneurship is being actively built with the support of the federal, regional and municipal authorities. Interregional competence center, and certification, standardization and test center have started

operating. A business incubator and an industrial park “Parus” are being built. Free spaces of Amur shipbuilding plant are intended to be given for the technological park.

Nowadays there are concrete directions in the chain “education – science – technologies – business”. First of all, it is a course for the national technological initiative “Aeronet (air transport)”. At this field the preparation of pre-school and school children, students and post-graduates for scientific research, design and experimental and business activities (Fig. 2). The same relates to the other directions of the national technological initiative: Autonet, Energy, Marine vessels, Neuro communications, Safety, Medicine.

The result of such networking cooperation is becoming obvious: small-scale innovative enterprises, which satisfy demands of high-technology businesses – airline, shipbuilding manufacturers, oil refinery, a metallurgical plant, and energy enterprises are set up in the Komsomolsk-on-Amur State University based on the scientific research results of the university. The next step could be that such innovative enterprises become residents of the territory of advanced development.

Thus, the university is actively involved into a formation of a regional innovative system. Usually knowledge, generated by students, teachers and enterprises, remains “tired” to their carriers. This leads to the situation when highly-qualified graduates contribute to improvement of quality of local labor forces.

of a particular innovative actor, but also on the quality of coordination between them.

On the territory of advanced development Komsomolsk there is not yet a developed and extensive network between major and medium size companies, small businesses, scientific centers, universities, the authorities, non-commercial structures, etc.

In order to increase the effectiveness of knowledge transfer, level of innovative performance, educability, a system-based coordination ensured by academic, business communities together with the authorities is required [19].

Further researches are connected with fulfillment of the following tasks: detailed plan of functions and tasks of each object of infrastructure; design of perspective directions of the innovative-activity chains “education – science – technologies – business”; establishment of coordinative cooperation between the actors of the “triple spiral” model; development and introduction of the cross-cutting programs, modules, project in engineering and technical field.

Analyzing the experience of the regions, implemented the “triple spiral” model, it can be suggested to form a special council and an association, on the financed-sharing basis, which will organize various projects, also in cooperation with other regions. This would lead to a significant effect of mobilization, when the investments towards one of the actors will bring positive effects not only to the other actors, but to the external

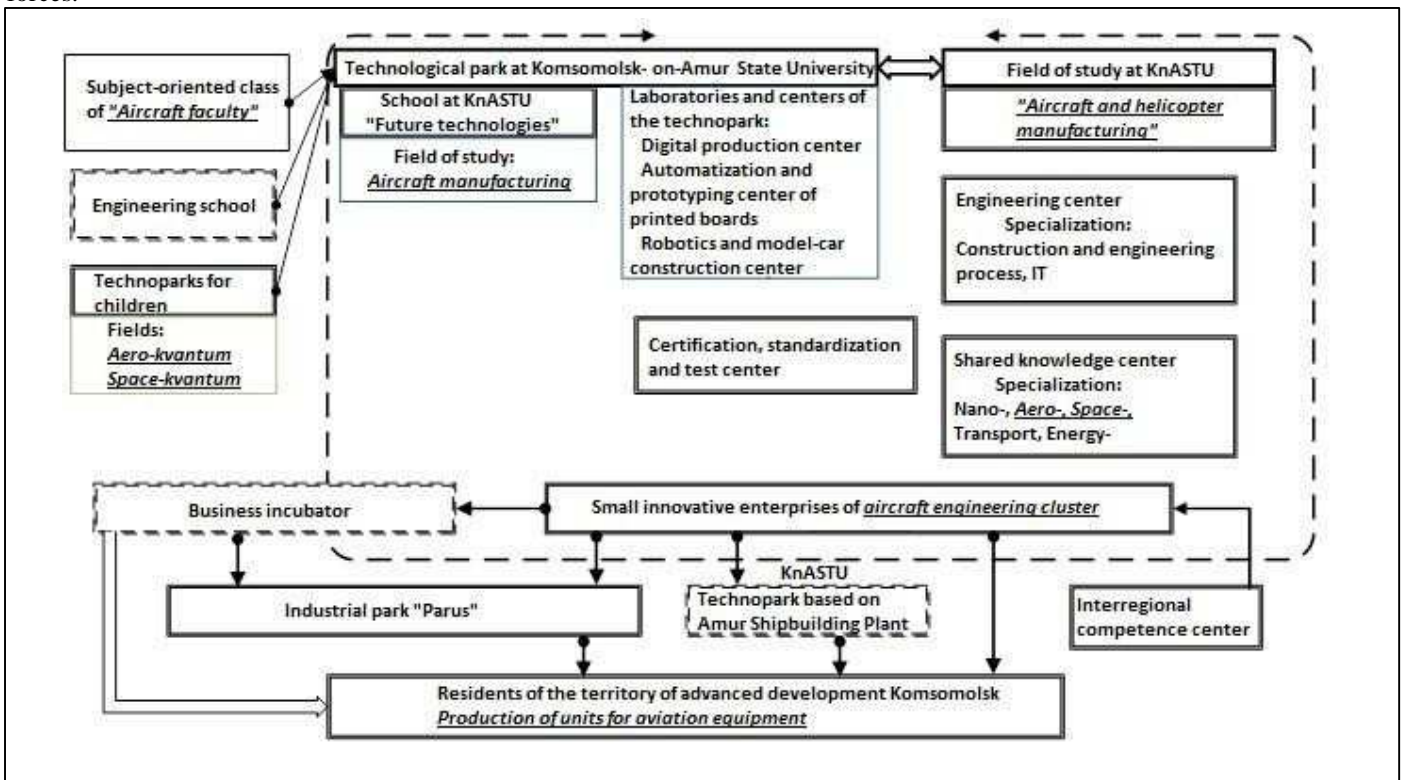


Fig. 2. Innovation-activity chain “Education – science – technologies – business” in the field “AeroNet Air transport” according to the national technological initiative

According to contemporary views, effectiveness of innovative development depends not only on the productivity

context including modernization of the labor market, stimulation of the transformational changes in economy, improvement of the quality of life in local communities.

### III. RESULTS AND DISCUSSION

- A. Explained a strategic role of the state university in development of an innovative entrepreneurship in the engineering-industrial centre of the Russian Far East.
- B. Conducted an analysis of the networking cooperation within an innovative infrastructure of the university and the region on the territory of advanced development Komsomolsk.
- C. Proved, that the networking cooperation within school community while using the innovative infrastructure helps to build a long-standing chain of regional innovative system development.
- D. Identified regional directions in the chain “Education – science – technologies – business” according to the field of the national technological initiative.
- E. Suggested recommendations for increasing a level of innovative performance, educability on the local level

### IV. CONCLUSION

Most efficiently the process of formation of a regional innovative system is arranged within the “triple spiral” model.

The model of the networking cooperation between a university, government and business depends on the aspects of the educational system, arrangements inside universities and on the functions they accomplish, as well as on particular characteristics of a regional ecosystem. Consequently, a critical condition for the effectiveness of the tools of the “triple spiral” is their adaptation “on site”.

An essential role in the rapid development of the engineering-industrial center in the Russian Far East performs a local state university.

By applying the networking cooperation within the school community, based on common use of innovative infrastructure, there occurs a development of innovative entrepreneurship on the territory of advanced development Komsomolsk.

The directions of the innovation-activity chains “Education – science – technologies – business” are organized along the lines of the national technological initiative.

In order to achieve a tangible result in the development of technological entrepreneurship, it is necessary to make the cooperation between different actors of the “triple spiral” model complementary and balanced.

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