Smart technologies in education and formation of entrepreneurial competencies

Galina Burdakova 1*, Anton Byankin 1, Ilya Usanov 1, Ludmila Pankova 2

1 Komsomolsk-on-Amur state University, Lenina av., 27, Komsomolsk-on-Amur, 681013, Russia
2 Peter the Great St. Petersburg Polytechnic University, Politechnicheskaya str., 29, Saint Petersburg, 195251, Russia

* E-mail: galinabu@rambler.ru

Abstract. Currently, the universities role in Russia is seriously changing: universities call up to become the locomotives of economic development in the region, using their potential in education and science. Special results are expected in process development through the commercialization of know-how created in higher educational institutions. The commercialization includes the entrepreneurship promotion. In order to increase competitiveness and fulfill a special mission, many Russian universities set such ambitious goals for themselves. In an entrepreneurial university, the commercialization of new knowledge is becoming one of the main goals, while educational activities are aimed at training of scientists, specialists having scientific knowledge, and entrepreneurs. The study purpose is to identify the needs of students learnt in the university in the formation of innovator's competencies; substantiation of the possibility for using Smart-technologies in the development of entrepreneurial competencies in the industrial center of the Far East. As a result of the study, the motives of future graduates to engage in business activities were identified; the factors hindering the development of innovative entrepreneurial activity (IEA) were studied; as well as the need to obtain specific knowledge, abilities and skills at each stage of the IEA. It is shown that the formation of innovator's competencies should be carried out with the help of Smart-education, using the network interaction (based on the triple helix model), a digital format system; student’s orientation to the priority trends of intellectual, scientific and process of the country and region development. The study results can be used by leaders of higher educational institutions to develop the entrepreneurial university functions.

1. Introduction

In Russia, a new role of universities is widely discussed, universities call for “...to become centers of technology and personnel development, true intellectual locomotives for branches of economy and regions” [1–4]. Special results are expected from the commercialization of know-how created in higher educational institutions. The commercialization implies the promotion of entrepreneurship at the university, which for now does not match educational and scientific activities. Nevertheless, many Russian higher educational institutions set such ambitious tasks for themselves; universities from the “Top 100 Universities of the Russian Federation” are particularly active in this field; [5–9]. The foreign practice has proven that well-developed entrepreneurial universities can bring great economic and social benefits both to their region and the whole country [10, 11].
Commercialization of high-tech projects on the basis of universities is particularly relevant for the economy of the Far East, which is characterized as a whole by considerable share of the extractive industries; only in large urban agglomerations of the Khabarovsk and Primorsky territories the concentration of high-tech industries is observed. The status of the engineering capital of the Far East is firmly established for Komsomolsk-on-Amur; there is a state university, the strategic objective of which is “to become a resource center for the development of economy, innovative entrepreneurship and socio-cultural environment of the region” [12].

In the entrepreneurial university, educational activities are becoming aimed at training of scientists, specialists having scientific knowledge, and entrepreneurs — innovators. Herewith, it is necessary to take into account that the digital economy changes the education format that principally changes the philosophy and even the ideology of education — what to teach, for what to teach [13, 14]. Incentive of innovation-entrepreneurial activities at the university should begin with the formation of sufficient relevant awareness.

2. Purpose of the study
The study purpose is to identify the needs of students learnt in the university in the formation of innovator’s competencies; substantiation of the possibility for using Smart-technologies in the development of entrepreneurial competencies in the industrial center of the Far East. To achieve the aim, proceed as follows: identify the motives of future graduates to engage in business activities; study the factors hindering the development of innovative entrepreneurial activity (IEA); as well as study the need to obtain specific knowledge, abilities and skills at each stage of the IEA; justify the possibility to use the education smart-technologies.

3. Study method
The innovators — students or teachers who establish their own research or technology companies — are valuable for the university for two reasons. Firstly, they increase the university competitiveness; secondly, innovators provide for contribution to the region economy by means of the creation of new high-tech work places [15]. In the promotion of technology entrepreneurship in the university, the formation and development of competences of the innovator, entrepreneurial thinking among students takes one of the central places. The previously performed analysis of the federal state educational standards and study plan of engineering trends for the preparation of Komsomolsk-on-Amur State University has showed that the development of competencies related to business planning and creation of small innovative entrepreneurship is possible in the framework of organizational and managerial type of professional activity. However, only one of 13 considered engineering trends of training — 27.03.05 “Innovatika” provides for its implementation in the study plan [16].

To solve the study problems, questionnaire survey method was used. With the help of questionnaire survey, the motives of future graduates to engage in business activities were identified; the factors hindering the development of innovative entrepreneurial activity (IEA) were studied; as well as the need to obtain specific knowledge, abilities and skills at each stage of the IEA. The research object was the students of 3–4 courses of bachelor's and master's degrees in engineering trends of faculties’ preparation: computer technologies; aircraft manufacture; energy, transport and marine technologies, as well as the institute of computer-aided design of machine-building technologies and equipment. The sample size is 148 persons. With a total respondents’ population of 2000 persons and a confidence interval of 5%, the confidence level is 85%.
4. Research results

A key resource for development of innovative entrepreneurship on the university basis is an enterprising student or a teacher who is able to bring the know-how to the market and establish a new company. At the heart of the motives of future graduates to carry on business are the reasons why people want to carry on their own business. This list comprises: work in the relevant field of activities; self-actualization; implementation of their ideas, developments; acquisition of independence; high income, etc. The authors found it interesting to compare the results of processing the university student questionnaires with the survey results of Shell LiveWIRE — the UK largest online community for young entrepreneurs aged 16–30 years (2004) [17]. With some difference in the total share of respondents who have chosen one or another motive as the main one, a great similarity in the motives ranking attracts the attention (table 1).

Table 1. A number of respondents who have chosen the main motives to engage in business activity, % of a number of respondents.

| Motives to engage in business | According to the results of students survey in the Komsonomolsk-on-Amur State University | According to the results of the survey performed by Shell LiveWIRE Young Entrepreneurs of the Year Awards, Finalists Report, 2004 |
|-----------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Work in the field of activity | 43                                                                                             | 52                                                                                             |
| Self-actualization          | 35                                                                                             | 53                                                                                             |
| Implementation of their ideas, developments | 27                                                                                             | 43                                                                                             |
| Acquisition of independence and success | 20                                                                                             | 48                                                                                             |
| High income                 | 16                                                                                             | 28                                                                                             |

The motives similarity is explained by common human values: the most satisfaction is seen in interesting work and personal fulfillment; in both surveys, the possibility of obtaining high income was only in the 5th place. A separate comment is the difference in the results of assessing the motive “getting independence and success”. According to a survey of the UK on-line community, almost half of the respondents indicated this motive as the main one. At a university in the Far East of Russia — only 20%, and about half of the graduates would like to get a job at the enterprises of the city. The pattern is determined by the individuality of people, their risks liability. There is no doubt that in the world as a whole, the people individuality has increased compared with the previous generation. Truly speaking, it is lesser in Russia than in America or Western Europe. This may explain the low motivation of students for independence. However, Komsonomolsk-on-Amur has such the reality that work in a large company may be more risky than self-employment, since even such large enterprises of the city as Komsonomolsk-on-Amur Aircraft Plant (KnAAZ) regularly optimize its staff [18].

Based on the results of motivation, it can be said that the vast majority of innovators belong to the category of voluntary entrepreneurs. Among the senior students of Komsonomlsk-na-Amure State University (KnASU), 18% of them consider the opportunity to engage in entrepreneurial activity.

During the study, the factors hindering the development of innovative entrepreneurial activities among students (university graduates) were surveyed and ranked. The greatest problems are associated with: lack of initial capital; lack of (incompleteness) appropriate knowledge, abilities, and skills (1 rank – the highest); lack of comprehensive relations (rank 2); lack of a business plan for idea implementation (rank 3), as well as the lack of innovation / development (rank 4). But at the forefront there was the question of the need to acquire the knowledge and skills necessary for the organization and implementation of innovative business activities. The survey has showed that four out of five respondents have such a need.
Innovation-entrepreneurial activity (IEA) can be represented in the form of two cycles (1 - creation and mastering the production of innovative products; 2 - bringing the products to the market and its promotion) and a number of stages, each of which is characterized by the presence of a specific set of key tasks [19, 24]. Performance of a specific task requires very specific competence. The results of assessing the students need in obtaining specific knowledge and skills at each stage of innovation and entrepreneurial activity are given in table 2 (5 points — the greatest need).

Table 2. Assessing the students need in obtaining specific knowledge, abilities, and skills at the stages of innovation and entrepreneurial activity.

| Stage of innovation and entrepreneurial activity | Weighted average assessment | Rank |
|-----------------------------------------------|-----------------------------|------|
| Stages for creation and production of innovative products (works, services) |                                |      |
| Research scientific work                      | 3.24                        | 5    |
| Development activities and production process preparation | 3.06                        | 6    |
| Preliminary analysis of the market and business planning | 3.75                        | 1    |
| Creation of small innovation enterprise and production mastering | 3.64                        | 2    |
| Stage of products (work, service) market and their promotion |                                |      |
| Detailed market analysis at the promotion stage | 3.52                        | 4    |
| Creation of marketing plan for business promotion | 3.63                        | 3    |

Weighted average assessments show that students have a significant need for obtaining knowledge, abilities, and skills at all stages of innovation and entrepreneurial activities (over 3 points out of 5). The highest need is found at the following stages: “Preliminary market analysis and business planning” (3.75 points), “Creation of small innovative enterprise and production mastering” (3.64), “Detailed market analysis at the promotion stage” (3.52), “Creation of marketing plan for business promotion” (3.63). The need at the stages of research scientific works (3.24), as well as development activities and production process preparation (3.06) is well below. This seems to be logical, since the main educational programs to train the students of engineering fields are mostly oriented to research scientific and design activities. According to the results of these assessments, it was concluded that it is necessary to develop and implement educational programs to form innovator competencies in students of the university.

Russian and foreign practice of training in technology entrepreneurship shows that the important condition for competencies development is the creation of comfortable environment [20]. For this purpose, it is advisable to create research and educational centers on the basis of universities, focusing on the network interaction (based on the triple helix model), using the digital format systems in training; student's orientation to the priority trends of intellectual, scientific and process of the country and region development (figure 1). This approach fully complies with the concept of Smart Education, in which “...an intelligent friendly adaptive environment for continuous development of knowledge, abilities, and competencies of students in the interests of the society and the state...” is created due to “...new sources and cognitive technologies which will be used along with the conventional lectures, seminars, etc.” [21].
Figure 1. The conditions of competence development innovator (technological entrepreneur).

Komsomolsk-on-Amur State University is very successfully moving in the direction of network interaction, with a focus on the priorities of process development of the Russian Federation — science and technology initiative (STI). The authors in their previous publications pointed that in Komsomolsk-on-Amur there are quite specific paths in the innovation-activity chain “education-science-technologies-business” in the scientific and technology initiative: Aeronet, Avtonet, Energy, Maritime transport, Neuro-communications, Security. These areas have the well developed innovation infrastructure to prepare preschool children, schoolchildren, students and graduate students for research scientific works, design and entrepreneurial activities [22], [25].

A logical continuation in this chain could be the interaction with the Science and Technology Initiative University “20.35” — the first university in Russia that provides professional human development in the digital economy. The STI University “20.35” implements the digital format of education when the educational modules needed by a student are individually concentrated in various education establishments with the strongest courses.

It is important for KnASU that the STI University is focused on training of participants of the National Technology Initiative, since the Khabarovsk territory has been selected in the regional STI competition, STI projects are implemented here and working groups of the regional STI model are created. With the participation of the KnASU technology park in 2017, a project session “Marinet NTI projects in ensuring sustainable development of Russia” was held. In addition, “Smart-education is the union of educational institutions and faculty for implementation of joint educational activities in the Internet network based on the general standards, agreements, and technologies” [23]. In this vein, an agreement on arrangement of networking cooperation between MAI and KnASU for implementation of educational programs was signed.

Advantages of using the Smart Education technologies for the university:
— ability to objectively form a competencies model that greatly simplifies creating of special education programs, seminars, trainings and master classes.
— solving the problem of access to the knowledge repository, combining tools for accumulation, storage, updating and access to educational and methodical content. A teacher will not have to
independently create educational information content from scratch, but, herewith, he/she can use the best educational practices for individual competencies.

— building an individual educational path for students — he/she can choose the optimal teaching form and time; use those teaching methods which most fit his/her personal characteristics.

5. Conclusions
1. The Russian universities are conscious of the need to become the locomotives of economic development in the region, using their potential in education and science.
2. The most significant motives for carrying on entrepreneurial activities among students are: self-realization (objective achievement); implementation of their ideas/developments, independence, obtaining high income in the market.
3. The dominant graduates’ milestones are work at the enterprises of the city; however, one fifth of graduates consider the opportunity to engage in entrepreneurial activity in the future.
4. A serious obstacle to arrangement of innovation and entrepreneurial activities is the absence of innovator's competencies.
5. The needs of students in obtaining innovator’s knowledge, abilities, and skills are available at all innovation and entrepreneurial activity stages. However, such needs are higher at the stages required for business creation and development than at the stages of research scientific works, development activities, and production process preparation.
6. The formation of innovator's competencies should be carried out with the help of Smart-education, using the network interaction (based on the triple helix model), a digital format system; student’s orientation to the priority trends of intellectual, scientific and process of the country and region development.

The trends of further research are related to arrangement of the Smart-education technology for formation of innovator's competencies.

Acknowledgments
The article is prepared in the framework of the grant paper of the Russian Foundation of Basic Research, project No. 17-02-00285-OGN\18.

References
[1] Plenary session of the 21st conference of the Russian Rectors’ Union, http://kremlin.ru/events/president/transcripts/57367
[2] Certificate of the priority project “Universities as the centers of innovations creation space”, http://kremlin.ru/events/president/transcripts/25681
[3] Presidium of the President of the Russian Federation 2016 Universities as the centers of innovations creation space: Certificate of the priority project (Report No. 9 dated October 25, 2016)
[4] Crowley E, Broder D, Edstrem K, Ostlund S and Malmqvist Y 2015 Rethinking of engineering education (Moscow: Higher School of Economics)
[5] Ministry of Education and Science of the RF 2017 The action plan for implementation of competitiveness program improvement (“road map”) of the State Federal-Funded Educational Institution of Higher Professional Training (SFFE IHPT) “Far Eastern Federal University” as of 2013–2020, https://www.dvfu.ru/upload/medialibrary/f7f/.pdf
[6] Ministry of Education and Science of the RF 2017 The action plan for implementation of competitiveness program improvement (“road map”) of the State Federal-Funded Educational Institution of Higher Professional Training (SFFE IHPT) ‘Kazan (Privolzhsky) Federal University’ as of 2013–2020, https://kpfu.ru/portal/docs/F1911434708/DK_3.etap_21.06.2017.pdf
[7] Ministry of Education and Science of the RF 2017 The action plan for implementation of competitiveness program improvement (“road map”) of the State Federal-Funded
Educational Institution of Higher Professional Training (SFFE IHPT) “Tomsk Polytechnic University” as of 2013–2020. https://tpu.ru/download/document?id=1651

[8] Government of RF 2010 Development program of the State Federal-Funded Educational Institution of Higher Professional Training (SFFE IHPT) “Saint Petersburg State University” until 2020, https://spbu.ru/sites/default/files/programm_2.pdf

[9] White square journal 2017 TOP 100 universities in Russia, https://wsjournal.ru/rejting-top-100-universitetov-rossii-2017/

[10] Twaalfhoven B 2002 Choice for life: European entrepreneur (Ghent: Vlerick Leuven Gent Management School)

[11] The impact of Innovation. Economics Department of BankBoston (now Bank of America), http://www.saveourheritage.com/Library_Docs/Bank%20Boston%20Impact%20of%20Innovation.pdf

[12] Development program SFFE IHPT “Komsomolsk-on-Amure State University” for 2018–2021, https://knastu.ru/media/files/page_files/page_1200/strategy/Programma_strategicheskogo_razvitiya_KNAGU_2018_2021.pdf

[13] Challenge 20.35. ASI. Ekaterinburg: Publishing solutions 4 108

[14] Education 20.35. Future. ASI. Ekaterinburg: Publishing solutions 6 300

[15] Wissema Y G 2009 Third Generation University (Cheltenham: Edward Elgar)

[16] Byankin A S and Burdakova G I 2018 Scientific and Technical Reports of SPbGPU. Economics 11 (1) 136–145

[17] Shell 2004 Shell LiveWIRE Young Entrepreneurs of the Year Awards, https://www.shell-livewire.org/award/153/young-entrepreneur-of-the-year-award

[18] The social and economic development forecast of the urban district “The City of Komsomolsk-on-Amur” for a long-term period until 2032, https://www.kmscity.ru/assets/activity/progress/long_term_prognosis_2330_pa.pdf

[19] Byankin A S and Burdakova G I 2016 Industrial policy in the digital economy: problems and prospects (Saint Petersburg: Publishing House of Polytechnic University)

[20] Int. Conf. “Formation of professional entrepreneurial competencies of the youths in the entrepreneurship education process” (Moscow: Synergy)

[21] Glukhov V V and Vasetskaya N O 2017 Questions of Teaching Methodology in Higher School 6 (21) 8–17

[22] Burdakova G I, Byankin A S and Vakhrusheva V O 2017 Scientific and Technical Bulletins of SPbGPU. Economics 10 (6) 172–181

[23] Tikhomirov V P and Tikhomirova N V 2012 ICT in education: pedagogics, educational resources and quality assurance: Int. Conf. Materials 17–19

[24] Babkin A V, Kudryavtseva T J and Utkina S A 2013 World Applied Sciences Journal 28 (10) 1408–1413

[25] Vinogradova E Yu, Andreeva S L, Babkin A V and Galimova A I 2017 Proc. of 2017 IEEE 6th Forum Strategic Partnership of Universities and Enterprises of Hi-Tech Branches 63–66