Design is link in cross-disciplinary projecting

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Abstract. The article briefly describes the ways of overcoming a gap between the industry and professional training in the USSR. There are some offers of researchers about using in Russia industrialized countries’ experience and elimination of this gap in the XXIth century. You can see the increasing value of design in conditions of the fourth industrial revolution. The main part of cross-disciplinary researches as the most effective form of design training is accented in this article. The relevance of experience of the USSR in development and improvement of the sphere of domestic professional education of the XXIth century is emphasized. There are some offers about integration of traditions of the higher school into the USSR and the best foreign practices for the purpose of overcoming a gap between the received skills in education and requirements of the industry express. There is a conclusion about a key role of the public technical and humanitarian higher educational institutions as integrators of innovative developments in education, industry, economy and culture in the XXIth century.

1. Introduction
One of the main tasks in the higher school in Russia in the XXI century is the problem of overcoming a gap between theoretical training and practical use of the received skills in conditions of production. Situation is aggravated with the fact that professional education can't provide in the compressed temporary terms with workers and experts of professional level. Later it responds to changes in labor competences [1] which become relevant under the influence of the developing industrial production on the basis of new technological way. According to the report of the OECD "Getting Skills Right: Assessing and Anticipating Changing Skill Needs” - 2015, in all the word both workers and employers identify a gap between the expected and real competences of workers and also dissatisfaction of workers with knowledge and skills received by them in educational institutions and demanded on production. This problem exists even in the countries in which traditionally high level of innovative and industrial development: Japan, the USA, Germany [2]. An exit from the created situation introduction to educational process of cross-disciplinary design training as most effective way overcoming a gap is represented in this article.

2. Problems between education and industry
Works of the following authors are the scientific base: A.M. Aleksankov, S.I. Leshchenko, A.N. Lavrentyev, K. Schwab, A. Chekmarev, Y. Nazarov, S. Tverdokhlebov, A. Komissarov, N.Y. Danilevsky, N.A Koveshnikova, N.V.Bryzgov, E.V.Zherdev. It is necessary to reveal design’s role as link in cross-disciplinary projection and its part in economy development of the XXI century.
The industry is primary in relation to professional training. It sets the tone and sets tasks for a professional studying irrespective of a social system [1]. Introduction of new technological lines at some Russian enterprises is advanced by the existing curricula and programs in educational institutions, creating a situation at which the term of life cycle of technologies becomes comparable to terms of training of the student that creates threat of disappearance of "perspective" professions by which the university has only preparation and the state accreditation. The educational institution in this case will be forced to recustomize educational process to other end in the middle of a training cycle. A problem of the Russian institutions is the conservatism in creation of training programs, rigidity of standard regulation of educational activity, insufficient integration with the industrial enterprises, stagnancy in creation of educational routes which is aggravated with lack of approach which purpose is the student [2].

Claus Schwab is the president of the World Economic Forum in Davos says that the mankind is on the threshold of the fourth industrial revolution which has begun at a turn of the new millennium and leans on digital revolution. The main features are a mobile Internet, tiny production devices, artificial intelligence and the studying cars. But waves of breaks are expected in the most various areas: from interpretation of information which is written down in human genes to nanotechnologies from renewable energy resources before quantum calculations. Synthesis of technologies and their interaction in physical, digital and biological domains make fundamental difference of the fourth industrial revolution from all previous revolutions. It will make system impact on mankind, it is capable to change not only the fact "what" and "how" we do, but also the one "who" we are. Fundamental and its global character means that it will become an integral part of all countries, economic systems, branches and people. Therefore the basic value is gained by forces which address on the multilateral cooperation which doesn't have scientific, social, political, national and industrial borders. The fourth industrial revolution has the creative beginning and is focused on needs of the person [3].

Design as the special sphere of projecting activity capable to synthesize in a whole of competence and technology from different spheres of knowledge. The problem of educating future designers according to the culture, science and industry is very important in modern design [4]. The ability of researchers to work at a basis of the cross-disciplinary principle has exclusive value with introduction of the concept of "design thinking" in the higher education. For example in Japan Leading Graduate School is created for providing financial support of the cross-disciplinary researches allowing doctoral candidates to cultivate cross-disciplinary thinking of global leaders. In Austria a number of the universities create programs for development of cross-disciplinary approach, in Finland the interdisciplinarity and a possibility of a transfer of skills and knowledge became an integral part of the national program of development of education [2].

In 1999 the regular meeting of the congress of the International council of the organizations for industrial design gave modern definition: "Design is the creative design activity directed to creation of multilateral properties of products, processes, services and systems throughout all their life cycle" [5]. In a post-industrial society in the conditions of mass information specialists who possess a non-analytic, namely synthesizing mindsets are required [6].

The relevance of industrial design for the industrialist at creation stages and at a stage of ideological development of a product, allows not only to draw conclusions on technological and economic importance of industrial design, but also to see the forthcoming global changes connected with implementation of the concept which is put in the fourth industrial revolution. Demand for a unique product, personalisation, customization, identity and biofeatures of the person, allow to speak not only about formation of the vector defining the direction of development of industrial design but also allow to consider possibilities of industrial design at design of "thing" in production [5]. Designers are "innate synthesizers of information, always occupying a unique position between the world of design, image and its materialization" [7].

3. Russian historical experience
In 1846 St. Petersburg Academy of Arts on the academic council decided: "It is necessary to take art for the main beginning of all works of the industry because it develops each branch to the highest perfection and that therefore it has to be connected to polytechnical school and to society of the industry, for achievement of a common purpose [8].

In February 12th, 1902 in Russia "Regulations on art and industrial institutions" was accepted. The principle of development practical skill in the course of training has been legalized [9]. In Imperial Central art and industrial Stroganov Art School there were twenty workshops. There was the diploma of the artist-application engineer who can receive it after the termination of general education course and studying of craft matter in all workshops [10].

In 1910 Stolyarov Ya.V a professor of applied mechanics and theory of creation cars from Kharkiv institute in the work "Several Words about Beauty and Equipment" identifies beauty with expediency. He claimed that the real designer is the artist because the talent represents him mix of imagination and intelligence, intuition and strict criticism [11].

In the Soviet Russia in 1918 “Stroganov Art School and School of painting, sculpture and architecture” have been integrated and transformed to "The 1st State Free art workshops" [12]. In 1920-1930 there was a unique cross-disciplinary educational institution. It was the “Highest state art and technical workshops" (HSATW), since 1927 reorganized into "Highest state art and technical institute" (HSATI). The principle of projects covered also engineering and design disciplines where mutual understanding of the artist and engineer was reached on the basis of designing, composition, invention and organization of production. Name of some HSATI specializations: artist-technologist, engineer-artist [13].

In the USSR relationship between the industry and professional education were harmonious. Speed of development technology and technologies was comparable to the speed of training specialists, ready to work with them [1]. In 1970-1980th in the conditions of integration of science and technology and dynamic introduction of results of this integration into practice, industrial design began to be considered as one of the main levers of innovative transformations to the fields of economy as a method of "creative" disclosure of the market. The design becomes important means of the embodiment of technology in the forms clear to the ordinary consumer [6]. About 25% of creative capacity of the Designers’ Union of the USSR has been involved in industrial design. The complete structure of the state design was developed in the system of the All-Union Research Institute of an Industrial Art (AURIIA) and ten of its parts has been developed in the cities of the USSR, group of the branch special art-design offices (SADO) and SADO network at the enterprises where the main work on design of future industrial products [14]. Each large branch of mechanical engineering had in the USSR in the 60-70th the head design bureau [14].

The resolution of Ministers’ Council of the USSR № 821 (October 18th, 1968) "About improvement of using achievements of an industrial art in the national economy" have been assigned to Russian Research Institute of an industrial art: forecasting and control of consumer properties of mechanical engineering products and goods culturally - household purpose, development of scientific methods of assessment, development of interindustry projects state standards on the general technical and esthetic requirements to quality of industrial products, coordination of research works on ergonomics problems, methodical management of art design offices, departments and groups at the enterprises and the organizations of the ministries and departments [15]. Russian Research Institute of an industrial art practically curtails the activity with the collapse of the USSR. All branches are closed, education is stopped. Hundreds of qualified designers have lost their work. The link between design and the industry was interrupted. It was the most important component of goods competitiveness in the international and internal markets [14].

From 60th in all higher educational institutions of the USSR students studied in the student's design offices (SDO). It was the voluntary student's associations organized for involvement of students to research work, improvement of quality of preparation and education of future experts worked. In the 70th the following forms of research activity of students have appeared: student's research institutes,
scientific centers, student's design groups, scientific expeditions. Scientific work of students became a part of educational process. Traditional Soviet system of the higher education had a number of advantages. For example, potential for the choice of professional specialization, professional or scientific activity. It had also shortcomings - tough orientation to concrete specialties with not variable creation of all curriculum [2]. Traditionally large enterprises in the USSR were based on the principle of a full cycle at the minimum cooperation [16].

4. Prospects of development Russian education

Komissarov A. says that studying of modern technologies it is important not to lose values of simple skills and abilities which passed from father to son earlier. At schools a manual training at which children could turn a detail on the machine, create models have practically disappeared. It is impossible to become the textbooks engineer. At the real engineer the spatial imagination and physical feeling of any detail has to be developed [17]. The best foreign practices indicate the following tendencies of system changes in the educational environment to improve it in the XXI century:

1. Projecting method allows increasing efficiency of educational process from the first stage of understanding and identification of problems to a final stage of practical work. It is connected with adaptive education which main component is training through practical activities in subjects of the market, industry and science;

2. Making creative spaces as integration platforms of students of various specialties, business sector, industry, academic and professional education. The main condition of such platforms is collaboration over the projects initiated by the real economy sector;

3. Creation of interuniversity platforms (university hubs) unlike network interaction of the universities. This creation of platforms in the form of the scientific and educational centers created with participation and under the auspices of various universities [2].

Experience of the countries with hi-tech economy demonstrates effective work of branch of the "system integrators" acting as professional intermediaries between the customers of difficult products and contractors ready to do the accessories on the specialization. It is opportunity for the Russian higher education institutions to receive unique material resources, laboratories, machines and the equipment. Tasks of is higher education institutions are creation of the small innovative enterprises (SIE), increase in their quantity, generation of patents, and research works. If higher education institutions begin to form around themselves "system integrators" having allowed to lean on the material resources, it will create the absent interface of cooperation of science and the industry [16].

In modern Russia the state university incorporating the humanitarian and technical personnel potential and the corresponding material and technical resources has competitive advantage over other educational institutions of the country. Unlike specialized public and private institutions (architectural, art and industrial, pedagogical, etc.), technical higher education institutions are capable to integrate on the platform scientific and design developments of experts from different fields of knowledge, to solve the strategic problems facing economy. On the other hand, specialized higher education institutions are more considerable, personnel potential in the corresponding fields of knowledge, but are deprived of a real opportunity to conduct cross-disciplinary researches, involving in design of representatives of other specialties.

Aleksankov A.M. considers relevant creation of cross-disciplinary scientific and educational "creative spaces" (by an example of the foreign universities: Design Factory in Aalto University, Finland, FabLab network, etc.) in a format of the scientific and educational centers focused on creation of the environment for cross-disciplinary project work of students and graduate students over the orders initiated by the industrial sector. He considers "creative space" as the integral and main structure providing educational process not additional but compulsory education, complaining about rather low independence of students, traditional for higher education institutions of the Russian Federation. The most effectively centers will work according to programs of training of masters when the main educational base is already mastered at the level of a bachelor degree [2]. Geopolitician Danilevsky N.Ya. considers more productive an emphasis on domestic tradition. He puts on one of the
first places welfare of the people education: "Education isn't spread on an arbitrariness as the dress code or administrative device changes. It should be hadn't spread from outside and develop from within. Its course would be more slowly but is more true and more useful" [18].

Synthesis of traditions of the Russian, Soviet education systems of the XX century and the best practices of economically developed countries is the most perspective. Experience of the USSR in activity of the Student's Design Offices (SDO) will be the main. But special design bureaus will have not branch, but cross-disciplinary orientation which will become a basis and their design activity has to be coordinated to educational process on a voluntary basis of participants of the project. The design will carry out a role of the cross-disciplinary manager and ideological inspirer of projects. The purpose of "creative" special design bureau is overcoming a gap between educational, research activity and practical using of the results in training and production. Active part of students will be involved in experimental design activity with the purpose of creation innovative product in the sphere of science, equipment and art by cross-disciplinary design. The main objectives of similar structure have to become:

- Creation of the experimental platform for cross-disciplinary research and design developments;
- Conducting the innovative design developments aimed at the decades ahead for which there is no stable financing (because of their novelty and existence of financial risks);
- Participation in commercial design developments, including on a competitive basis on condition of coincidence of their essence to a paradigm of educational process;
- Coordination of activity special design bureau with work of educational structural divisions with educational workshops, uses of their scientific, production potential in implementation of projects. The maximum adaptation of academic projects and the Final Qualification Works (FQW) to the interests of higher education institutions and needs of the industry;
- Participation of special design bureau in the organization of a student's work practice;
- Tracking and analysis of global trends in development of science, equipment, art. Introduction of offers on regular updating of curricula, proceeding from rates of development of science, economy, needs of employers. Participation in development of innovative educational programs;
- Selection of candidates for receipt for a postgraduate study for continuation of scientific activity;
- Vocational guidance of school students.

Existence of several design groups of students and teachers of technical and humanitarian specialties becomes a condition of effective work of "creative" special design bureau. The balance between humanitarian and technical competences of experts, their expected contribution to process of cross-disciplinary researches is defined by the purposes and tasks facing each project. Activity of "creative" special design bureau will become the test platform for adjustment of contractual interuniversity agreements in the future that will allow higher education institutions to improve the indicators on strategically important directions of development without additional financing.

5. Conclusion

In Russia state technical-humanitarian institutions in XXIth century has to undertake a role of the locomotive not only in education, but also in the sphere of the industry, economy and culture. And the developed training programs and plans have to set as the purpose development in pupils of research and inventive competences that will make them effective participants of cross-disciplinary design. Respectively, design training at a voluntary basis, but within educational process on older years of a bachelor degree becomes a form of activity of special design bureau and to make obligatory on magistracy.

The main problem in Russia often calls its technological backwardness from the countries with the high level of industrial development. All hopes for the future are traditionally pinned on introduction of the advanced foreign technologies in production and on expectation of breakthrough inventions. But
there is a question: "How traditional for modern Russia to replace "strategy" of the catching-up development with the strategy of the advancing development?" The answer is necessary to see clearly the purpose which is set before the higher school by time. C. Schwab believes that, first of all, it is necessary to focus on the correct understanding of fundamental conditions, but not to concentrate on technical aspects. He cites the supporter of the theory of evolution Martin Novak, professor of mathematics and biology of Harvard University that cooperation is "the only thing that will save humanity"[3].

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