Federal State-Funded Institution of Higher Education – Tomsk State University of Control Systems and Radioelectronics (TUSUR University)

Rector

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Outline of the Development Program of the University for 2021–2030

within the framework of the Strategic Academic Leadership Program Priority 2030

Tomsk, 2021

This Outline of the Development Program of Federal State-Funded Institution of Higher Education – Tomsk State University of Control Systems and Radioelectronics for 2021–2030 (the Development Program, the university) was created in accordance with Resolution No. 729 of the Government of the Russian Federation dated May 13, 2021, Decree No. 642 of the President of the Russian Federation "On Strategy of Scientific and Technological Development of the Russian Federation" dated December 1, 2016, Decree No. 474 of the President of the Russian Federation "On National Development Goals of the Russian Federation through to 2030" dated July 21, 2020, Resolution No. 20-p of the Government of the Russian Federation "On Strategy for Development of the Electronic Industry of the Russian Federation through to 2030" dated January 17, 2020, "Strategy of Social and Economic Development of the Tomsk region through to 2030", and provisions of laws and regulations that define the focus areas for development of science, education and technology.

This university development program reflects the intention to make the highest possible contribution to the fulfillment of national development goals of the Russian Federation in education, science, digital economy, and to the achievement of priority social and economic development of the Tomsk region and the Russian Federation, and for that purpose identifies the following strategic directions of growth:

– ensuring a global competitive advantage of the Russian higher education, modernization of the educational process that includes the creation of an effective system for identification, support and development of abilities and talents in children and young people;

– ensuring the position of the Russian Federation among the top 10 countries in terms of research and development;

– digital transformation of the economy of the Russian Federation that includes delivery of advanced training of highly skilled professionals for the digital economy, creation of cross-cutting digital technologies and transformation of high-priority sectors of the economy and the social sector.

This Program Outline has been supported by:

– Security Council of the Russian Federation, Ministry of Industry and Trade of the Russian Federation, Roscosmos, Administration of the Tomsk region.

1 Current status and results of university development from 2010 to 2020. Target model and its key aspects.

1.1 Key development results in the previous period and available groundwork

TUSUR is a research and entrepreneurial university focused on world-class research in electronics and space-and-missile industries, information technology (IT) and information security in collaboration with high-tech enterprises and institutes of the Russian Academy of Sciences. It delivers training of professionals for and makes a significant contribution to continued national security, technological and economic development of the country and the region.

Today, TUSUR is comparable with the leading institutions of higher education in Russia, as evidenced by the following:

– it is a **category 1** organization based on assessment of performance of research and education institutions by the Ministry of Higher Education and Science;

– it is ranked in the Times Higher Education WUR 2021 (**1001+** globally (**17th** in Russia)), and is **220th** globally by Industry Income;

– it has more than 11.5 thousand students (16.5 % of them, international (according to the QS Emerging Europe and Central Asia 2019, TUSUR was **seventh** among Russian universities by that indicator)). Students at TUSUR represent 42 Russian regions and 36 countries of the world (Côte d'Ivoire, Zimbabwe, Madagascar, Bolivia, Thailand, Israel, etc.);

– it is a **top five** university in Russia in terms of income from industry (extra-budgetary funds) in 2020 – 972 million rubles (41% of the university's total budget); its output per faculty member is more than 1.8 million rubles.

The initial situation of TUSUR is characterized by a number of unique competencies and substantial scientific and technological groundwork. In accordance with the provisions of the State Program "Strategy of Scientific and Technological Development of the Russian Federation" and with a vision to drive the transition to advanced digital intelligent technologies, robotic systems and new materials, and for the purpose of training of professionals for the digital economy, TUSUR has created new-generation R&D infrastructure:

– three regional NTI centers for the Siberian, Ural and Far Eastern Federal Districts with a focus on cross-cutting technologies: Wireless Communication and the Internet of Things; Sensorics; Quantum Technologies. These facilities allowed TUSUR to become the only Russian university to join the US-based international Industrial Internet Consortium.

– Nanotechnology REC, first such center east of the Urals that delivers the full cycle of study, design and prototyping for a range of units, from microwave micro and nanoelectronics to modules, communication and radar systems;

– two research institutes delivering the closed technology cycle (from idea (TRL 0-3) to the final product (TRL 7-9)): Research Institute of Microelectronic Systems (RI MES) and Research Institute of Space Technology (RI ST);

– first in the SFD test range for 5G communication systems which is supporting the design and engineering of small base stations at frequencies of up to 28 GHz, created in collaboration with Micran and MTS and with the support of the Administration of the Tomsk region;

– the Digital Economy center, the first such center at a Russian university, which promotes the development of new competencies in students, faculty and business that are necessary to achieve the target values of the program in terms of the share of "digital" industries in the structure of the country's GDP.

– Druzhba Student Business Incubator, the first such organization in Russia, a hub that fosters the generation of high-tech, knowledge-intensive businesses and supports the development of technology-based student entrepreneurship;

– IT Cube Center for Robotics and Creative Technologies, focused on early career guidance for school students using a modern work-study complex in its educational trajectories (laboratories, design bureaus, testing centers for mobile and VR applications, robots, etc.).

Today, TUSUR is the leader among Russian universities in distance learning technologies that is offering online training to more than 11.5 thousand students, both those studying on-campus and those pursuing purely distance programs. Delivery of network partnership programs in collaboration with other universities of the Tomsk region makes it possible to leverage the accumulated experience and utilize it within the

Digital University model of the United Tomsk Universities (UTU).

The priority objective of the research and education complex of the Tomsk region is to establish the region as one of the leading Russian centers of education export, which is to be achieved through the support of interdisciplinarity and connection with technology exports. TUSUR is a leader in the project and is responsible for building joint international activities and developing a common export strategy of Tomsk universities in order to attract and support international talents – future young researchers and employees for companies operating in high-tech sectors of the national and regional economy.

One uniquely distinctive aspect of the university is its support and promotion of technology-based student entrepreneurship. Every year, more than 1,200 students and more than 320 teams complete the acceleration program at the Student Business Incubator (SBI). Over the past 10 years, this activity has helped create more than 210 successful small innovative businesses with a total annual turnover of over 70 billion rubles. As a result, alumni of TUSUR have created a new regional economy, the knowledge economy, with prominent companies such as Micran, Elcom+, Tomsk Electronic Company and others becoming its foundation. Today, TUSUR is the leader of the "Technology Entrepreneurship" project in the Tomsk Consortium of Universities and Scientific Organizations.

Currently, TUSUR is the central organization in the IT and Electronics sector of the Tomsk Technological Special Economic Zone.

One of the key tools designed to drive the priority areas for modernization and technological development of the Russian economy is technology platforms, as defined in the list established by Protocol 2 of the meeting of the Government Commission on High Technology and Innovation dated 01.04.2011. Today, TUSUR participates in 12 technological platforms in key areas of research: "National Space Technology Platform"; "National Information Satellite System"; "Microwave Technologies"; "Ocean Exploration"; "Innovative Laser, Optical and Optoelectronic Technologies – Photonics"; "Development of Russian LED Technologies", etc.

The innovation infrastructure of the university and its cooperation with industrial partners and institutes of the Russian Academy of Sciences allowed the scientific schools

of TUSUR to earn nation-wide recognition. The outstanding work, inventions and achievements by the university's researchers that have had a significant impact on scientific and technological development have received State Prizes of the Russian Federation in science and technology (3 awards) and Prizes of the Government of the Russian Federation in education, science and technology (6 awards).

1.2 Mission and strategic goal

The **mission of TUSUR** as a research and entrepreneurial university is to create a cultural, academic, scientific and innovative environment that would drive high achievements of its graduates whose work and expertise put high technologies to service of the state, the society, and the world.

The strategic goal of TUSUR is to create a leading center of excellence in the country for the electronic and space-and-missile industry, IT and information security by obtaining and implementing new knowledge based on world-class research for the purpose of ensuring the technological sovereignty of the Russian Federation and the security of its critical infrastructure.

The new image of the university will be created by achieving the following objectives:

in education:

– development and implementation of new educational technologies in collaboration with industrial partners for training and shaping of a new brand of talents who possess *future skills* in information and communication technologies, microelectronics and new-generation communication systems;

– development of a network teaching model together with other members of the United Tomsk Universities that would support the development, testing and mass implementation of new content and technologies for training of professionals for the IT cluster of the country and the region;

in research and innovation:

– delivery of breakthrough fundamental research and developments in a consortium with leading scientific institutes of the Russian Academy of Sciences and research and academic organizations with an expertise in IT, cybersecurity, electronics,

biomedical technologies;

– overcoming technological barriers, commercialization of scientific knowledge and support of high-tech business in the electronic and space-and-missile industry, IT and information security for the purpose of creating competitive products and services for the global market;

– creation of advanced scientific and industrial infrastructure for the implementation of new solutions through establishment of centers of excellence in line with the university's areas of expertise;

in international activity:

– development of international activities and the export strategy in order to expand the boundaries of talent acquisition and improve the quality of international recruitment to undergraduate and postgraduate programs through the offer of bilingual competitive training and research programs and technologies;

– international and professional public accreditation of key educational programs offered by the university;

in entrepreneurship:

– creation of a regional network platform IoT-Quarter in the Tomsk Technological Special Economic Zone in order to create a network of world-class high-tech companies;

– creation of a comfortable innovative, growth-driving environment (ecosystem) for generation of a mass wave of inter-university student startups (universe environment of opportunities).

1.3 Key characteristics of the target model of university development, comparative analysis with the target model of the university based on reference indicators

The 2030 target model of TUSUR envisions the university as a national center of excellence that provides professional training and applied knowledge in electronic and space and missile industries, IT and information security addressing the key challenges that our country faces in strategic industries, and on its recognition as one of the leading universities in the world.

An analysis of world university rankings – Academic Ranking of World Universities, Times Higher Education World University Rankings, QS Top 50 under 50 – shows that young engineering universities with up to 10–15 thousand students manage to concentrate their activities on just a few areas of breakthrough research and through that achieve the highest level of progress.

In order to determine the key characteristics of the 2030 target model of the university, identify scenarios of its development and recognition as one of the world's leading universities, a reference group of world's four universities was selected: California Institute of Technology (Caltech), USA; University of Twente, the Netherlands; Pohang University of Science and Technology (Postech), South Korea; Carnegie Mellon University, (USA).

TUSUR is comparable to the California Institute of Technology in its research focus on engineering, mainly in the area of defense technologies. The University of Twente is developing the concept of an entrepreneurial university, and similarly, TUSUR has a long and positive experience generating spin-off companies. TUSUR shares with Pohang University of Science and Technology its narrow focus of research and the need to overcome a certain mentality gap with and isolation from recognized big-city centers of science and education. TUSUR made comparable to the Carnegie Mellon University by its similar number of students and its recognition by international university rankings. All reference universities demonstrate a strong focus on science and technology as their core research expertise (the core research expertise of TUSUR is: "Physics and astronomy" – 33.0%, "Engineering" – 20.4%, "Computer science" – 13.5%, "Materials science" – 10.8 %).

By 2030, the Development Program will help TUSUR as an industry and technology leader become an integrator of new cross-platform solutions and technologies in electronics, communication systems, IT and security, and become a top **500** university in the world university rankings published by QS and THE, and a top **200** university in the world university subject rankings published by QS and THE for computer science and natural science, increasing the values of annual key performance indicators: university budget – from 2.2 to 6 billion rubles; new startups – from 10 to 50 companies; number of theses defended – from 15 to 50; education export – from 0.15 to 1.0 billion

rubles; papers indexed in international citation databases – from 370 to 1000; income from R&D – from 0.6 to 2.45 billion rubles; number of students – from 12 to 15 thousand (Figure 1).

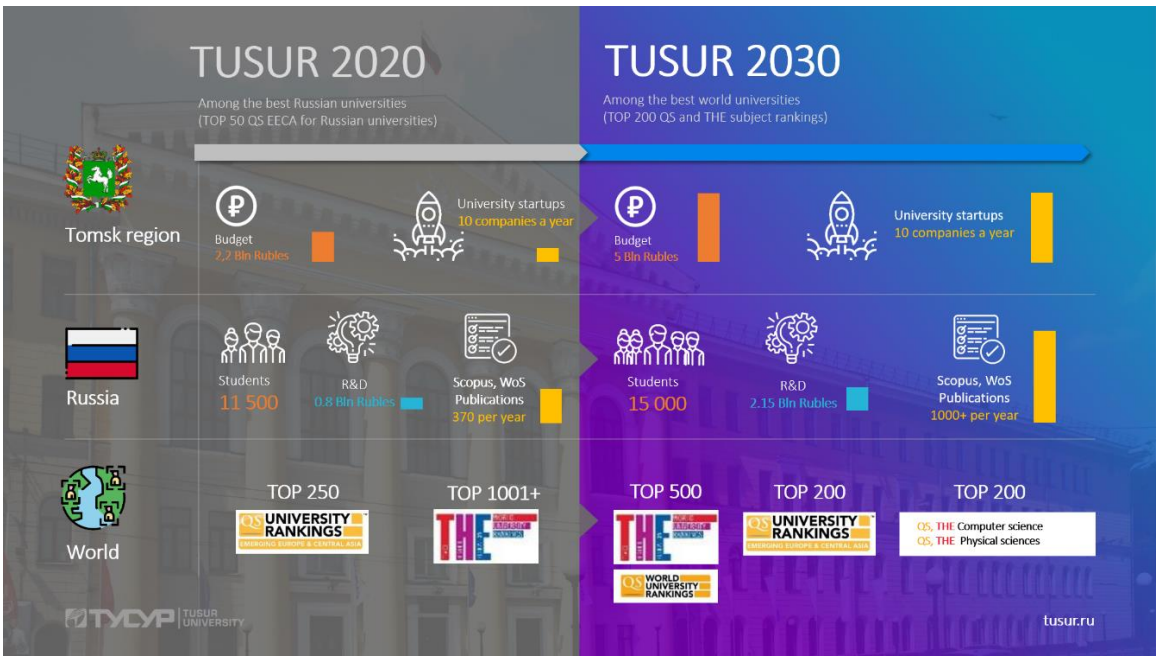

Figure 1 – Target model

1.4 Unique aspects of strategic positioning and areas for development

Radical changes in the global and national economy, transformation of the society, recovery from the negative impact of the global pandemic, high level of uncertainty in the key markets all require a revision of the processes for transition to sovereign technology platforms that are independent of foreign suppliers, staff, and skills. As a research and entrepreneurial university, TUSUR is prepared to become the launch pad for a flexible refocus on new tasks in the electronic and space and missile industry, IT and information security.

The focus of research and teaching at TUSUR is a complex of deep technologies – knowledge-intensive solutions at the intersection of fundamental knowledge, complex engineering and digital skills, all aimed at the objectives identified by the State Program "Strategy of Scientific and Technological Development of the Russian Federation" and the National Project "Science and Universities". The university's priority areas for development are:

1. Microelectronics and new-generation communication systems – carrying out

research and development, as well as targeted training of highly skilled engineering professionals and retraining of specialists in the format of a Training Factory with a focus on domestic microelectronics and radiophotonics, radio engineering and telecommunications systems, for which purpose a new infrastructure facility will be created in the Tomsk region – the Unified Multifunctional Coordination Center for Microelectronic Systems. It will integrate the Research Institute of Microelectronic Systems, the Microwave Equipment Design Center, the Engineering Center, training and technology laboratories, regional NTI centers, as well as the Nanotechnology Research Center, which is part of the National Nanotechnology Network of the Russian Federation.

2. IT, secure digital environment and cyber-physical systems – creating a foundation of technology and human resources that would support the transition to Industry 4.0 through the development of key digital technologies: cyber-physical systems and secure data exchange interfaces.

3. Space science and engineering – creating an advanced scientific and technological groundwork in the field of the space and missile industry through the development and engineering of breakthrough technological solutions, world-class intelligent complexes and systems. The core infrastructure element that will be supporting the project is the Research and Education Center of Space Technologies and Engineering.

4. Biomedical technology – developing technologies, software and hardware complexes and systems for preservation of the public health and well-being through the development of new approaches to diagnosis, treatment and aftercare.

5. Management and infrastructure transformation – implementing the target model of the university through transformation of its core operations, as well as through harmonized cooperation with partners within the United Tomsk Universities (UTU) project.

1.5 Main limitations and challenges

The electronic industry supports the development of many industries – from medicine to space exploration. At a government meeting on March 25, 2020, the Prime Minister M. V. Mishustin noted that today the industry has achieved some success,

especially when compared with the situation a decade ago, with the average annual growth rate of about 10%. At the same time, Russia still exports most components from other countries and cannot fully satisfy its domestic demand. The share of domestic products in the defense segment is about 85%, and about 30% in the civilian segment. On the global market, the share is barely 1%. In order to overcome the country's dependence on imports, it is necessary to learn to design and produce domestic electronic components, as well as to achieve the highest possible level of localization of the production chain within the country.

TUSUR is prepared to become the supplier of human resources for the creation of new scientific and technological solutions. The following limitations were identified for the achievement of this objective:

in teaching and research:

– mismatch between the professional and educational standards and the needs of the real sector of the economy;

– the need to ensure a continuous improvement of the quality of teaching and research, expand the range of scientific and educational services offered and intensify cooperation with industrial partners;

– the inbreeding HR policy within the university that focuses on building a conservative hierarchical corporate culture and is based on harnessing the in-house potential, which prevents the organization from changing its existing standards of operations on a larger scale and with preservation of its stability, impacting the external environment in order to expand the ability of the university to influence the scientific, technological and socio-economic agenda, or implementing an active behavioral paradigm;

– poor integration of degree programs and supplementary educational programs at due to the difference in institutional formats of their implementation becomes an obstacle to creating a fully functional service-oriented educational model capable of supporting the principle of lifelong learning.

in innovation:

– resistance of the economy and society to innovation, which hinders the practical application of R&D results;

– sanctions and bans on access to foreign technologies and materials which make it difficult to carry out research and development of modern competitive electronic products.

2 Plans to achieve the target model: university policies in its key focus areas

2.1 Education Policy

The university is successfully developing innovative educational models and technologies necessary for the implementation of the Program, including the "school–university–enterprise" concept of continuous training that is delivered through specialized departments created in collaboration with industry partners and schools; the technology of PBGL that is integrated into the educational process (with more than 320 teams training using this technology every year); a digital ecosystem that was created to support the educational process; more than 150 supplementary educational programs that are currently available. One of the tools for improvement of the quality of educational operations is the mechanism of PPA (9 PDPs are currently accredited).

Implementation of the project-team paradigm and the principle of lifelong learning ***in the context of the activities (а, г, д, м, п)***

The educational process will be redesigned through the transformational upgrade of PDPs and SEPs in accordance with the principles of lifelong learning and the implementation of the project paradigm based on the interaction of real-sector enterprises with the university ecosystem in order to drive students' motivation to build professional competencies and acquire entrepreneurial skills. The following objectives are identified:

– to implement the concept and organizational and technological processes of multi-level PBGL at all stages of the educational process, integrating students of partner universities, including UTU members, in projects, using the resources of SEPs and with reference to the Atlas of New Professions in the future skills concept when developing new or upgrading the content of existing training programs (including those offered in foreign languages);

– to introduce a modularized training system with adaptive educational paths, including through the integration of PDPs with SEPs and the possibility of a systematic transition to an educational concept based on the "2+2+2" model, where the student is

given the opportunity to choose a specialization (focus) at least twice during their training – in their second year of study and after completing their Bachelor degree;

– to create a system of continuous development and assessment of meta-skills of PDP and SEP students using the technology of preventive performance monitoring based on big data analysis throughout the entire educational cycle.

The implementation of these activities will increase the employability of graduates, enhance the efficiency of production, increase the share of graduates who find employment in sectors of the economy where the expertise of TUSUR lies, ensure a balanced development of students capable of making a significant contribution to the economy of the region, and of Russia.

Adoption of a service-oriented training concept into the educational process *in the context of the activities (а, г, д, м, п)*

Transformation of the educational process implies the introduction of a service-oriented learning concept, the main goal of which is to improve the quality of the educational process using an innovative approach to learning. The following objectives are identified in this process: to include "intensive training schools" in PDPs that would be aimed at building the future skills necessary for the comprehensive development of students; to introduce elements of gamification into the educational process; to include an Education Design course in all Bachelor and Specialist degree programs that would be aimed at adapting students to new conditions and opportunities of the educational process; to implement educational practices aimed at adapting students with disabilities to life at the university.

One of the main objectives of TUSUR is to train highly qualified professionals who possess both hard and soft skills. The introduction of a service-oriented training concept will contribute to the adaptation of students to the scientific and technological challenges of the world economy, the requirements of the university, the educational process, drive students' motivation for self-development and self-fulfillment, the development of their soft skills in self-management and time management, and their adoption of the university's corporate culture.

Implementation of the education policy of TUSUR will make it possible to achieve the following results: increase the quality of training and the adaptive abilities of graduates that are strongly sough-for in the VUCA world; bridge the gaps between the

key participants of the educational ecosystem and the labor market – the graduate, the state and the real sector of the economy; root professionals in the national segment of the world economy through access to comfortable living conditions, among other measures (using of the resources of the UTU campus); coordinate the list and content of training programs with the UTU partner universities, supporting the promotion of the UTU brand in order to attract highly motivated and talented prospective students.

2.1.1 Provision of conditions for acquisition of digital competencies and skills in digital technologies in students, including IT students

TUSUR is among the top ranking universities in information technology (32nd in the RAEX ranking). The university is training professionals for the digital economy with primary focus on: mathematics and mechanics; computer science and computer engineering; information security; electronics, radio engineering and communication systems, etc. Two activity trajectories are proposed for Bachelor, Specialist and Master programs: for students enrolled in IT programs; and for students enrolled in programs other than IT. This differentiation is due to the structure of the student population at the university where more than 70% of total students pursue IT programs.

Pioneering projects within the IT trajectory will be driving the transformation of the educational ecosystem through the creation of two greenfields (new educational concepts) based on the project-team paradigm in the format of international business academies: the DAT and the IoT-Academy.

For more than 20 year, the University has been consistently developing, implementing and refining its e-learning technologies, which today allows it to expand the range of its potential students by expanding the geography of recruitment, and offers an opportunity of education without any interruption to an individual's career.

The current level of solutions used at TUSUR makes it possible to deliver online Master degree programs, including those in IT, which is an area of expertise for the university. One important prerequisite in the training of IT professionals via distance learning is to create the appropriate conditions for an effective learning process, where the student not only masters certain technologies, but also acquires the skills of fast and high-quality assimilation of cognate disciplines. The online Master program for training of professionals for the IT industry at TUSUR is designed for programmers with some

basic experience and is meant to help them build skills that are highly desired in the real production sector in development of comprehensive software products and solutions, without focusing the future professional's skills on narrow (niche or currently trending) technologies. A graduate with a Master degree in IT from TUSUR is qualified for the position of a leading specialist in various sectors of the economy – from the development of mobile applications to artificial intelligence systems. The training of such a developer allows the flexibility to switch from one technology stack to another.

The variable part of PDP curricula in IT (for Bachelor and Specialist degrees, in the last two years of study) will integrate disciplines whose titles, credit value and content correspond to modules of CPE programs at TUSUR that provide instruction for acquisition of digital economy skills in cognate IT programs.

The following activities are planned for the non-IT trajectory:

– integration of at least 25% of the scope of relevant training programs with content that is focused on the development of conditionally environmental synthetic skills that is formulated as "...**can integrate into the digital economy environment (use digital services, platforms, environment) in the course of adaptation and personal development under the conditions of the developing digital economy of the country"**;

– delivery of professional retraining programs (1008 hours workload) for students in Bachelor (starting from the 3rd year) and Specialist (starting from the 4th year) programs, aimed at creating digital skills in engineering of algorithms and programs for practical application, and building skills in applying and mastering digital technologies necessary for a new type of professional activity.

Both full-time and part-time PDP students will have access to software for digital economy skill-building (and other purposes) that was created and provided by TUSUR and its network partners, including UTU members.

TUSUR is a leader in the field of IT education, and as such has the resources to satisfy the need for digital skill development in non-IT students. In addition, TUSUR is prepared to position itself as a regional and national IT hub that, together with its partners, including the Innopolis University and the UTU members, is ready to be providing educational services for third-party consumers for the development of their

digital skills (through classical and hybrid forms (including the adaptive learning model) of the core higher education and supplementary programs, MOOCs and other activities).

The model of training of IT entrepreneurs created at TUSUR and implemented through motivational, educational and consulting activities in the form of intensive courses, project sessions, modules, hackathons, competitions under the auspices of the SBI and the university's Tochka Kipeniya is proposed for further development in the following directions: by holding general audience-oriented scientific lectures, seminars, master classes and workshops designed to promote the development of digital skills together with regional NTI centers of competence in Wireless Communication Technologies and the Internet of Things, Sensorics, Quantum Technologies, and in collaboration with the university's partners (SAMSUNG, MTS, ROSATOM, etc.).

TUSUR has a well-developed technical and information infrastructure for the development of digital skills, information about which is always available within the framework of PDPs. The educational process of the university utilizes about 3,550 personal computers and laptops connected to its local network with internet access via the university's broadband WiFi network. The university expects to upgrade at least 20% of the equipment and licensed software used in the educational process every year in order to be able to build the expected level of skill in accordance with the global trends in digitalization, increase the minimum connection speed in the local network up to 1 Gbit/s, the minimum speed of the WiFi network, up to 400 Mbit/s, and the total bandwidth of the university's internet channel, up to 15 Gbit/s.

In the creation of the ecosystem of the educational space, including its segments designed to promote acquisition of digital skills, the infrastructural aspect will address the upgrade of existing IT solutions and the development of an educational blockchain service that will then be implemented in the UTU infrastructure, providing the recording of students' digital footprint with elements of predictive analytics.

2.2 Research Policy and Innovation and Commercialization Policy

2.2.1 Current groundwork and available resources, including the description of integration and cooperation with other organizations

The competitive ability of TUSUR is based on its scientific schools, well-developed infrastructure and state-of-the-art facilities and resources for research, close ties with industrial partners, including those based abroad, knowledge-intensive businesses and collaboration with institutes of the Russian Academy of Sciences.

Figure 2 shows the chart of the research and innovation infrastructure at TUSUR.

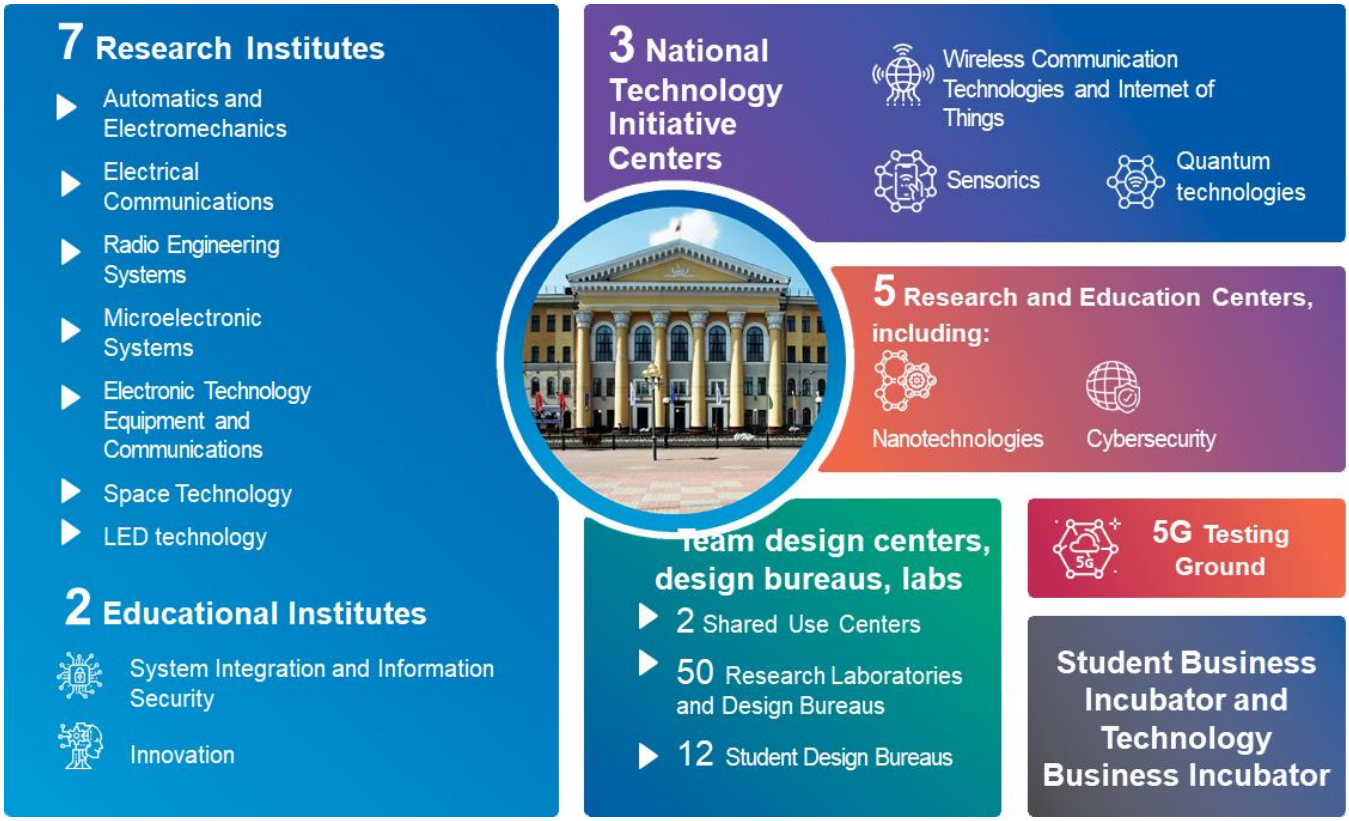

Figure 2 – Research and innovation infrastructure

The total number of research staff at TUSUR in 2020 was 145, while the income from R&D carried out by the university staff was 630.9 million rubles. Research output per staff member is more than 1,8 million rubles. TUSUR is a top five university in terms of this indicator and ranks 220th by Industry Income in the Times Higher Education World University Rankings 2021. Over the past 10 years, the university faculty published 2,135 papers in journals indexed by the Scopus and WoS databases, obtained 588 patents, and published 336 monographs.

TUSUR maintains close partnerships with enterprises in the real sector of the economy, among the key partners of the university are leading enterprises in the radio-electronic, aerospace industry and the information security sector: Information Satellite Systems Reshetnev, Progress Rocket Space Centre, Almaz-Antey, NPO Lavochkin, Orbita, Micran, CKBA, NIIPP, Detal, Milandr, Aladdin R. D., Kompozit, Elesy, Russian Railways, Yuzhmorgeologiya, LEMZ, Siberian Chemical Combine, Energoneftemash, Elcom+, Elecard Group, Infotex, etc.

From 2011 to 2020, TUSUR carried out R&D for real sector enterprises worth a total of 7.5 billion rubles, including 16 projects under the Federal Target Program "Research and Development in Priority Areas for the Russian Science and Technology Sector in 2014-2020" for a total of 1.5 billion rubles; 11 comprehensive projects under the Decree of the Government of the Russian Federation No. 218 dated April 9, 2010 in collaboration with high-tech companies for a total of more than 6 billion rubles.

The university routinely carries out joint research with institutes of the Russian Academy of Sciences, among them: Institute of High-Current Electronics SB RAS (Tomsk), Institute of Strength Physics and Materials Science SB RAS (Tomsk), Zuev Institute of Atmospheric Optics SB RAS (Tomsk), Institute of Microwave Semiconductor Electronics RAS (Moscow), Institute of Semiconductor Physics SB RAS (Novosibirsk), Nikolaev Institute of Inorganic Chemistry SB RAS (Novosibirsk), Technological Design Institute of Scientific Instrument Engineering SB RAS (Novosibirsk), Institute of Automation and Electrometry (Novosibirsk), Institute of Automation and Control Processes FEB RAS (Vladivostok), etc.

2.2.2 Key priorities and directions of the Research Policy and Innovation and Commercialization Policy and their projected results

In order to drive the scientific and innovative potential of TUSUR, the university’s resources and knowledge capital are planned to be focused on broad breakthrough areas implemented in the form of the following strategic projects: microelectronics and new-generation communication systems; space science and engineering; IT, secure digital environment and cyber-physical systems; biomedical technology; management and infrastructure transformation.

Special attention will be paid to the development of research areas where the university is able to obtain fundamentally new scientific results, create new technical solutions and technologies for enterprises in the real sector of the economy, in particular: 5/6G communication systems, industrial Internet of Things technologies, microelectronics and radiophotonics, printed electronics technologies, space instrument engineering, engineering biology, artificial intelligence, cybersecurity and cyber-physical systems.

Introduction of new technologies in the economy and the social sphere is planned to be carried out by **expanding the mechanisms of technology brokering**, creating **engineering services** for enterprises of the real sector, which will make it possible to build cross-functional, interdisciplinary project teams to address specific problems of production processes and businesses. That process will be supported by the new **"skill market"** powered by the University and its partners.

Intellectual property will be commercialized through the development of tools offered by the Technology Transfer Center, special activities to create the conditions for generation of high-tech entrepreneurs (acceleration programs and start-up studios at the SBI and TBI, structure of the TT SEZ), activities designed to promote collaboration between science and high-tech businesses (creating conditions where businesses initiate new laboratories at the university, building mutual awareness, providing functional services for business).

The university's internal policy for improvement of research activities within the Master, Postgraduate and Doctorate studies is currently undergoing a transformation from the current model to a new service model with a focus on breakthrough areas, including cross-cutting support tools and key activities within the strategic project "Management and Infrastructure Transformation": scholarship support for students research; support for participants of international scientific events and internships; support for publications in top-rated journals; a seamless mechanism for internal grant support for research and innovation projects by young researchers, postgraduate and undergraduate; a program for support and development of scientific schools.

The development strategy of the university will put emphasis on contributing to the initiation and implementation of comprehensive interdisciplinary research and development programs designed to meet the challenges that exist for various industries,

the region and the country as a whole. TUSUR is currently contributing to the following such programs:

– comprehensive research and development full innovation cycle program "Global Information satellite Systems", initiated by JSC Information Satellite Systems Reshetnev (ISS Reshetnev);

– comprehensive research and development full innovation cycle program "Robotic Technologies for Nuclear Decommissioning", initiated by the SSC of the Russian State Scientific Center for Robotics and Technical Cybernetics;

– state program "Development of the Electronic and Radioelectronic Industry" from 2023 to 2027;

– federal research and development program for genetic technologies from 2019 to 2027.

In order to produce world-class domestic solutions, TUSUR creates and develops consortia with a focus on strategic breakthrough areas. Within the consortia, the university not only carries out fundamental and applied research, but also acts as a link between research organizations of the Russian Academy of Sciences and the industry, ensures that the results of fundamental research reach technology readiness levels 6–9 and are further implemented in the economy and the social sphere.

2.2.3 Expected effects from policy implementation in terms of impact on the achievement of the national development goals of the Russian Federation, the development of the region/industry, as well as other areas for development of the university

In accordance with the Strategy of Scientific and Technological Development of the Russian Federation, the university defines its priority areas as those that will deliver the scientific and technological results and produce technologies that will become the foundation for the innovation-driven development of the domestic market of products and services, the stable positions of Russia in the international market, and will ensure:

– the connectedness of the territory of the Russian Federation through the creation of intelligent transport and telecommunications systems, continued leadership in the

development of international transport and logistics systems, exploration and use of outer space and airspace, the World Ocean, the Arctic and Antarctica;

– development of network-based organization of research, development and innovation activities, including through research, engineering and production consortia, cluster forms of high-tech business development.

TUSUR contributes to the achievement of the national goals by implementing a set of activities, the progress of which will be monitored through their key performance indicators as identified in the passports of the National Projects "Science and Universities", "Small and Medium-Sized Enterprises", "Healthcare", "Education". Key indicators identified of the National Projects that are targeted by the activities of the Strategic Development Program are as follows:

1) the university's position in the THE, QS, ARWU world university rankings;

2) the university's position in the THE, QS, ARWU world university subject rankings;

3) number of papers in journals indexed by the international citation databases Scopus and WoS;

4) amount of extra-budgetary income from the implementation of comprehensive research and development programs (projects), federal research and development programs and projects of the centers of the National Technology Initiative, etc.;

5) internal expenditures on research and development from all sources of funding;

6) income from intellectual property;

7) share of faculty under the age of 39 in the total faculty.

The implementation of the Research Policy and the Innovation and Commercialization Policy is aimed at satisfying the needs of high-tech sectors of the Russian economy in highly qualified human resources, results of knowledge-intensive applied research and development that offer global competitiveness and a high added value.

2.3 Youth Policy

The Youth Policy at TUSUR is brought into action through a variety of activities: through more than 20 cultural and creative clubs, 25 student self-government

associations, 29 sports clubs, 10 resident teams at the SBI, volunteering and environmental organizations. More than 50% of students are engaged in extracurricular activities. TUSUR has a private infrastructure for the support of its Youth Policy: the university has a sports and training complex and mixed-use sports complexes, spaces for creative and club-based activities, Underground international center of culture and education, IT-CUBE Center for Robotics and Creative Technologies, etc. Together with the regional authorities and local government bodies, as well as in collaboration with public associations of the region, TUSUR has developed road maps and signed agreements for cooperation in youth policy implementation in Tomsk and the Tomsk region.

The main priorities for development of the Youth Policy at TUSUR are:

1) to introduce the project-based approach in the implementation of the Youth Policy;

2) to organize student self-government bodies in accordance with the principles of university co-management;

3) to improve the openness and quality of education;

4) to support scientific communities;

5) to build professional skills and facilitate employment of graduates;

6) to develop of sports with the priority given to team sports.

Main objectives: to increase students' motivation for teamwork, innovation and creativity; to create conditions for development of the creative potential of students and young researchers, and their engagement in extracurricular activities; to develop and implement support mechanisms available to young researchers and young professionals at the university (under 35 years old); to transform the mechanisms for development of health-conscious practices and the moral and patriotic compass among students and young researchers.

Implementation of the project and activity paradigm in the student guidance model *(P)*

Goal: to ensure a well-balanced personal education to promote the formation of a mature worldview, acquisition of a multicultural experience, development of students' own view of the spheres of life and a proactive life philosophy.

Within the framework of this activity, a system (forms and methods) of student guidance at the university and educational modules will be developed based on the priority breakthrough activities, which will engage students in the implementation of socially significant projects at different levels: university, regional, national, international, which will ensure a high-quality transition of student guidance from the conventional model of "interest-based clubs" to the activity model of "interest-focused projects". These modules will be included in the PDPs in accordance with the requirements of the Ministry of Education and Science of the Russian Federation. The implementation of this set of activities will be aimed at creating conditions for promotion of innovation and project activity among young people and their engagement in creativity and sports as an integral part of professional success in life; providing conditions for foreign language acquisition, student mobility as an integral part of multicultural communications, acquisition of intercultural communication skills; developing volunteer and patriotic movements.

Expected results: increase in the share of students motivated for creativity who actively contribute to volunteering, club and creative projects, up to 80%; increase in the share of students who are participants and winners of national and international competitions (by the time the Program in completed, at least 10% of the total number of full-time students); increase in the number of student clubs and movements up to 100.

Transformation of the student motivation system *(П)*

Goal: to enhance student motivation and efficiency (performance) in the academic, scientific and extracurricular activities.

This activity will target the system of student self-governance, which is meant to involve students in management of the university. A set of tools will be created that will facilitate identification of best student activities, record their achievements, and a new motivation system and a procedure for internal grant support for student initiatives will be created in order to integrate the student activity agenda in the TUSUR development strategy.

Objectives: to create a system for identification and support of talents who are able to generate and implement new ideas, ensure their socialization and self-fulfillment; to create a system of motivation for individual and team achievements, to convert achievements into additional privileges, to create a student's skill passport throughout

their entire study period. To create a favorable environment for student initiatives to develop personal growth trajectories (creativity, scientific interests, volunteering and healthy lifestyle).

Expected results: introduction of a digital student card that supports conversion of achievements into access to new university services; increased student motivation; increased level of measurability of student achievements by virtue of their performance record accessible via their digital cards; strong relationships with employers, including through the differentiation of the graduate database. As a result, the value and content of student life will be improved, as will students' contribution to the life of the university.

2.4 Human Capital Management Policy

Human capital and human resources are the most important elements in the university management system. Development of the human resources of the university ensures a constant gain of human capital for the purposes of its strategic goals. In that context, it is necessary to:

– develop the HR policy that is aimed at attracting highly skilled professionals and ensuring their professional growth;

– maintain continuity of staff, ensure qualitative growth of scientific and instructional schools and management teams, attract young people;

– build and develop a comfortable multicultural university environment that promotes professional and personal growth of staff.

In pursuit of these goals, the university has created a comfortable environment that is designed to drive the development of human capital. Professional growth is available through professional development opportunities, short-term and medium-term training programs, with criteria for promotion established for each employee. An incentive system in the form of performance-based employment contracts has been introduced for faculty and for administrative staff, where individual rankings are calculated for employees based on their performance, with financial incentives for good results, which motives staff to develop their competencies and skills. The staff motivation system at the university provides for a range of incentives.

In accordance with the university Development Program and the principle of continuous development of human capital, it is necessary to improve the Human Capital Management Policy in terms of the efforts to attract talent and generate opportunities to help it grow. The changes in the Human Capital Management Policy are based on the following principles:

– shift of focus towards the development of key skills of employees and their professional growth within the framework of self-development trajectories;

– development of the staff motivation system that increases loyalty and the degree of connection to the university's mission;

– building of an open, comfortable environment that provides growth trajectories and career options, frees employees from excessive paperwork and allows them to focus on their core activities;

– improvement of the corporate culture practiced by the university employees, with a focus on building consciousness, work ethics.

Activities for the implementation of the Human Capital Management Policy:

– creating a talent succession pool of the university;

– training and employment of the most promising young people, including foreign students, as part of research teams and management teams of the university;

– developing regulatory documentation in accordance with the requirements of the quality management system;

– creating a career management system;

– creating a healthy competitive environment;

– developing non-material and material incentives aimed at identifying individual abilities for development, achieving personal goals through pursuit of the strategic objectives of the university;

– enhancing internal internationalization of the university and the development of a multicultural and multilingual environment both in education and research;

– inviting leading international professors to give lectures and conduct short advanced training programs;

– creating opportunities for employee participation in international projects and internships.

The expected synergetic effect will manifest in the consistent transformation of human capital into financial capital through the development of staff, increase of their commitment to the university's development goals through growth of their income and implementation of their key professional skills.

2.5 Campus and Infrastructure Policy

The university's property complex includes 168 facilities, including buildings, structures, premises and linear objects.

The total area of the property complex is 133,204 sq m, including: lecture, laboratory and research facilities – 77,362 sq m, dormitories – 46,115 sq m, other facilities – 9,727 sq m.

Healthy and active living among students and faculty is encouraged and promoted with the support of the university's own sports complex, the Sennaya Kurya rowing camp, and the Obskaya recreation facility. PE classes and team sport competitions are held on outdoor sports grounds.

The main goal of the university's campus policy is to integrate its own infrastructure into the UTU Interuniversity Student Campus by creating a common multifunctional space for teaching and research that would make it possible to integrate various university platforms into a single efficient system enhanced with digital services.

Implementation of the Infrastructure Policy will be carried out in the following directions: transformation of the university campus spaces into multifunctional zones; creation and construction of centers of excellence in the form of training and research factories with a focus in microelectronics and new-generation communication systems, biomedical technologies; transformation of the campus into a single comfortable university platform that supports the testing of new technologies and youth initiatives and development of efficient communications and acquisition of versatile personal and professional skills; creation of a single corporate digital platform integrated with campus services for students and staff, accessible for an inclusive educational process and comfortable living.

Activities for development of facilities and resources for teaching, research, creative, social and humanitarian activities of universities, including upgrade of the instrument base of universities (e)

Transformation of teaching spaces

Goal: to create conditions for self-education and self-expression, creativity, generation of "new knowledge", group communication.

Objectives: to ensure the accessibility and openness of teaching spaces for students, staff and partners of the university; to ensure mobility and rapid transformation of the university's zones (facilities), creation of free-use spaces; to increase the utilization of the university's spaces and infrastructure, energy efficiency and safety.

Expected results: flexible utilization of space, including the UTU campus, for the goals and objectives of the university, its staff and students; engagement of staff and students in the life of the university, their increased performance; introduction of new energy-efficient technologies, reduction of infrastructure maintenance costs; positioning of the university in the regional, national and international agenda.

Campus upgrade

Goal: to transform the location of residential and educational buildings into a comfortable, accessible educational platform that highlight the culture and traditions of the university integrated into the UTU campus and the urban environment.

Objectives: to provide comfortable conditions for work, study, living, recreation, communication and social needs.

Expected results: increased appeal of the university to students, staff, as well as to prospective students and potential employees.

2.6 University management system

The university management system must be aligned with the strategic goals as identified in the National Project "Science and Universities" and is a necessary tool that ensures global competitiveness, academic autonomy and financial independence of the organization.

Currently, the university implements a classical management system with a linear organizational structure. Its main administrative units are faculties and institutes that

consist of departments, laboratories, RECs, and have a certain degree of independence when making decisions and choosing research directions.

One distinctive feature of the current management system is that research institutes and design bureaus operate as standalone divisions, which allows them to respond to technological challenges and address research problems more quickly. This management system ensures the continuity and integrity of scientific schools and teaching staff. At the same time, this system has a number of drawbacks, such as the limited interaction between faculties and research institutes with regard to high-potential areas of research and technology, mutual isolation of research teams, uneven distribution of resources and insufficient digitalization of business processes.

In order to achieve the goal, fulfill the objectives and improve the efficiency of university management, it is necessary to carry out a set of activities aimed primarily at the transformation of research and teaching units through the implementation of five strategic projects.

Implementation of these strategic projects envisions the creation of centers of excellence that will drive the formation of a flexible management system that makes use of project-based principle of operation in order to address complex strategic objectives in education, research and innovation:

– microelectronics and new-generation communication systems: multifunctional Center for Microelectronic Systems and IoT Academy;

– IT, secure digital environment and cyber-physical systems: DAT and REC Cybersecurity;

– space sciences and engineering: REC Space Technologies and Engineering and the international Siberian Cosmology Center;

– biomedical technologies: Network Medical Research Center.

At the same time, in order to ensure effective management and coordination of divisions, it is necessary to transition to a digital university model with a shared information environment for assessment of the activities and performance of all participants in the process, as well as for decision-making and provision of necessary information and forecast data.

A special focus in university management is on the system for development and support of inter-university technology-based student entrepreneurship, which is based on

a model of personalized learning trajectories for each student with an emphasis on either the "entrepreneur" trajectory or on the "education as a startup" trajectory. A project management office with a digital platform and a project market will be organized in order to regulate and coordinate the technology-based student entrepreneurship system with the business incubation facility and specialized technology parks that connect enterprises with young innovative teams.

The Program will be managed by the Project Management Office, a new body that will include members of the university's senior management and Academic Council. The Project Management Office will be supporting the implementation of activities, projects within the Program, organizing and monitoring the projects, as well as reporting to the university's Academic Council on the progress in implementation of the Program.

2.7 Financial model of the university

The current financial model is based on the principles of cost accounting and maximum independence in the management of financial resources of divisions. At the stage of budgeting, a regressive scale of deductions into the centralized fund is applied: the higher the income of any specific division, the lower the percentage of deductions that it must contribute. This encourages an additional inflow of financial resources and increases the appeal of financial relationships at the university.

The process of budgeting, which has been the practice at the university for more than 20 year, ensures a balance of its revenue and expenditure parts. After the budget is approved by the Academic Council, it becomes a regulatory document and ensures sustainable financing of all activities at TUSUR.

Figure 3 shows the structure of the university's income over the past 10 years and the 2021 plan.

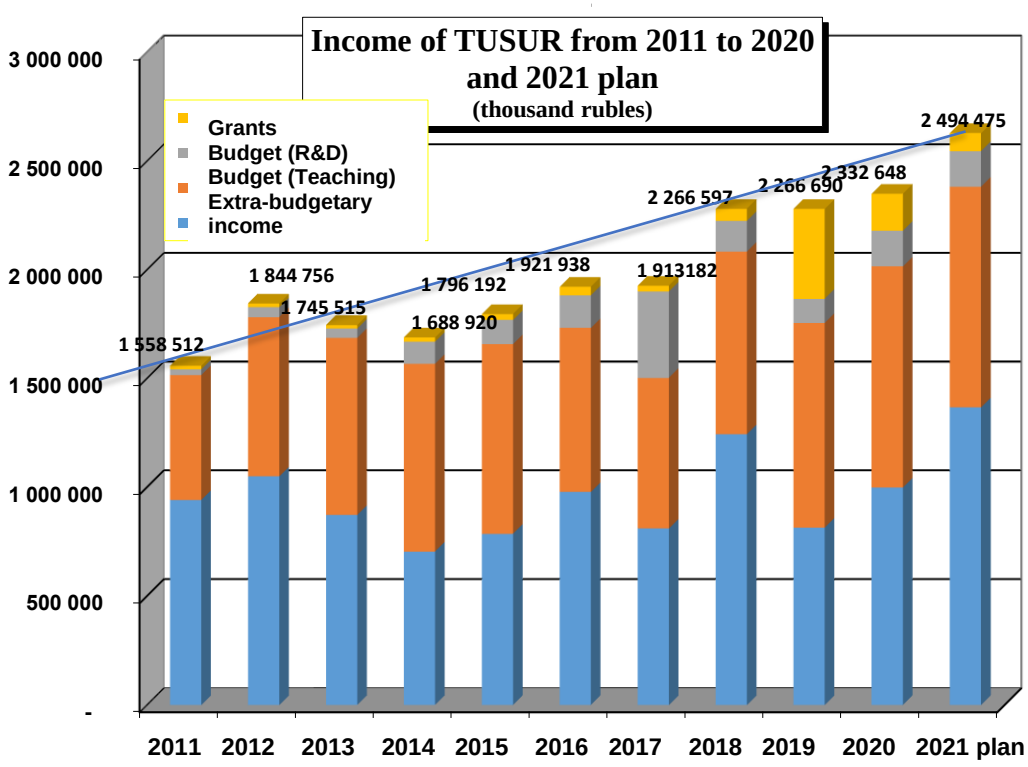

Figure 3 – Income structure at the university over the past 10 years and 2021 plan

Analysis of the income structure shows that over the past 10 years, the consolidated budget of TUSUR has increased by 50%, which indicates a stable development of the university. That was made possible by an increase in the volume of educational services, including those provided for a fee, due to the development of distance learning technologies, continuing professional education, by offer of a number of new programs in IT, cybersecurity, electronics, etc. that are appealing to young people, as well as by the well-developed research infrastructure that provides access to state-of-the-art research and production equipment.

Figure 4 shows the structure of primary income sources for 2020.

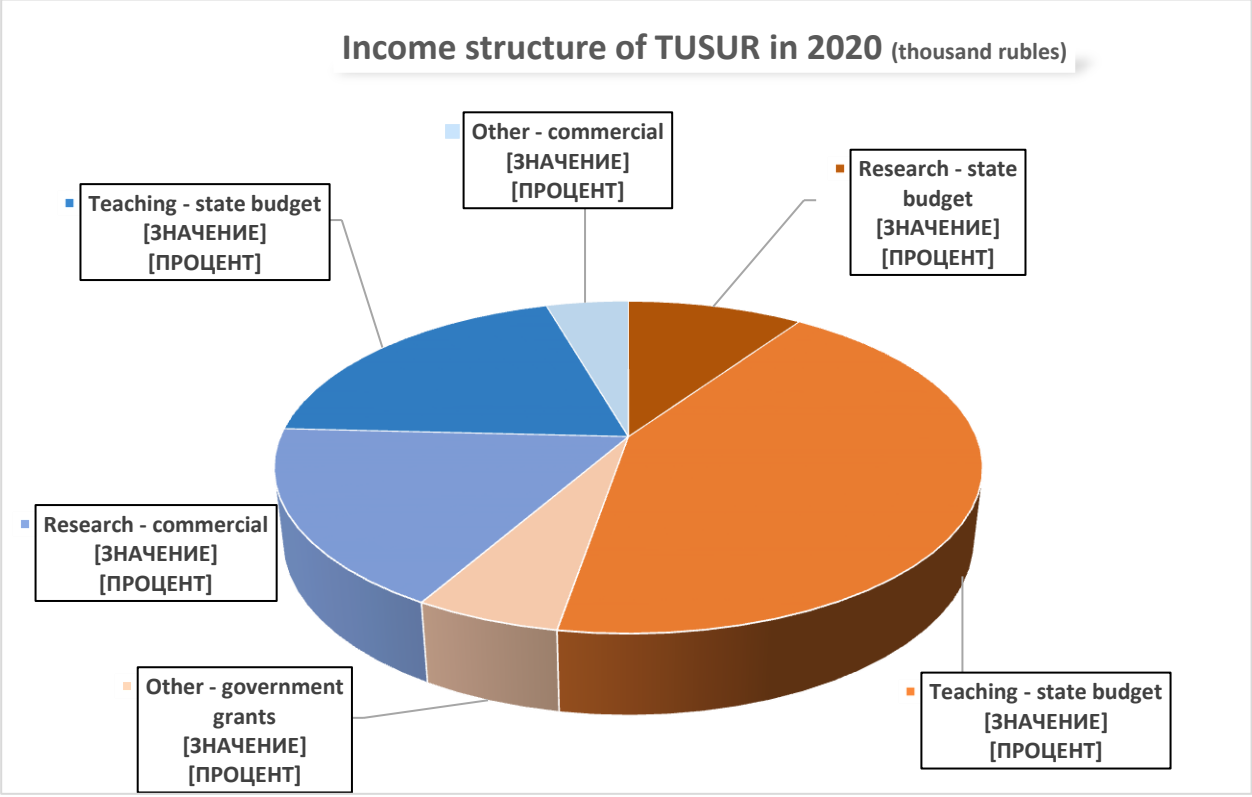

Figure 4 – Structure of primary income sources in 2020.

The chart above shows that the share of extra-budgetary income in the consolidated budget is at 42%, the share of research carried out at the expense of budgetary and extra-budgetary sources of funding is at 27%. As a result, the university's research output per faculty member is more than 1.8 million rubles, which is one of the best results among Russian universities.

Figure 5 shows the structure of the main types of expenditures at the university for 2020.

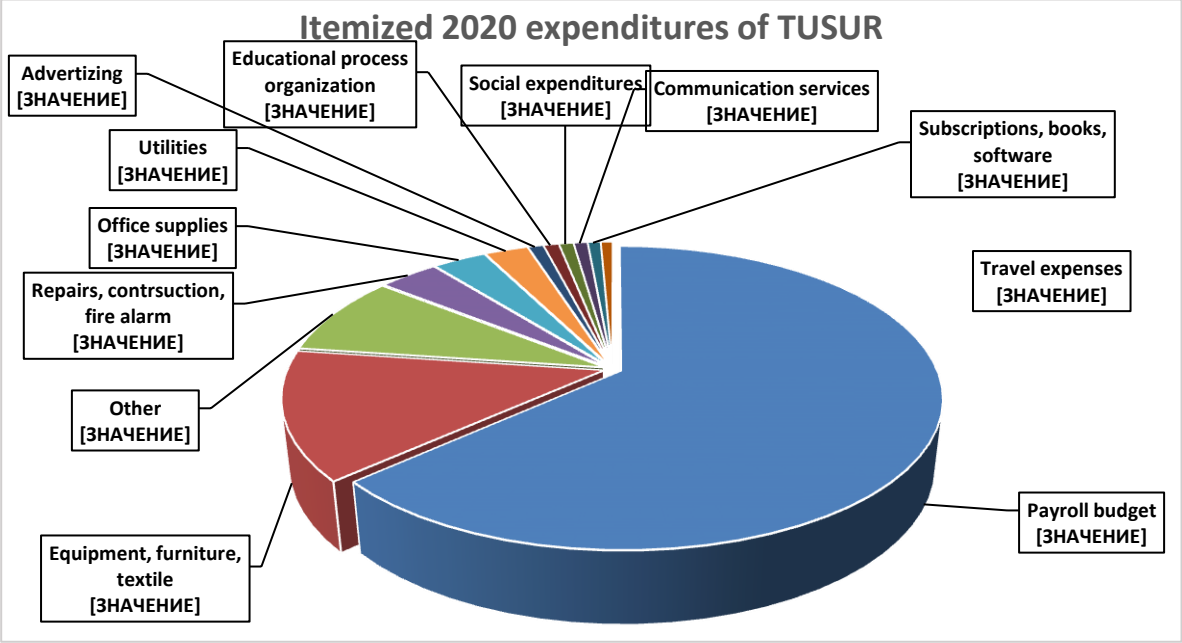

Figure 5 – Structure of primary types of expenditures in 2020.

Next, let us consider the ways to improve the financial model of the university for the period through to 2030. The main economic objective of the university is to ensure sustainable and efficient financial and economic development, satisfaction of the needs of staff, students and other categories of consumers. To that end, investments must be made in material, technical, innovation-supporting, intellectual infrastructure and effective recovery of total costs must be achieved. The following mechanisms will be used to address this problem:

1) optimization of the university's business processes;

2) development of educational services and training programs;

3) promotion of the commitment of university divisions to and responsibility for results, support for high-potential structural changes that support the university's positioning as an entrepreneurial university;

4) attraction of additional financial resources from growth of the volume of R&D, income from innovation and international business;

5) carrying out of advanced research funded from the university's internal resources for the purpose of developing and accumulating its human capital;

6) creation of consortia with institutes of the Russian Academy of Sciences, universities, leading national and regional enterprises;

7) implementation of a project-oriented flexible marketing, pricing and management policy when performing works and services;

8) enhancement of efficient utilization of the university's material and financial resources, development of an effective result-oriented budgeting and controlling system;

9) improvement of the incentive system through the integration of the project-based and goals-management approaches and evaluation of performance in order to invite an influx and continued employment of highly skilled staff.

TUSUR expects to increase its consolidated budget by more than 2.5 times over the next 10 years, increasing the share of extra-budgetary funds to 57%.

Over the course of 10 years, the financial model of the university income will see a change in the ratio of income from education and income from research and innovation, which are the main sources of income, coupled with their growth overall (Figure 6).

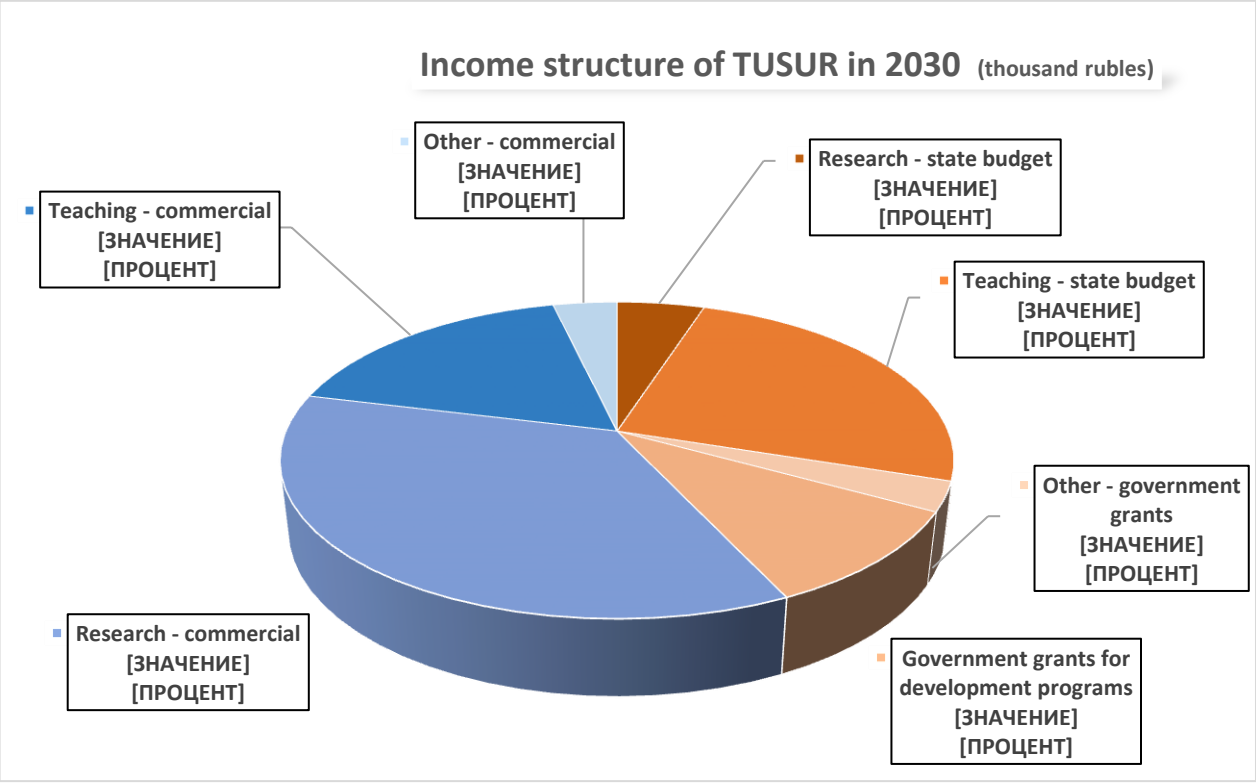

Figure 6 – Income structure of TUSUR in 2030

In research and innovation, income is expected to grow due to the focus of resources on the broad breakthrough areas described in section 3, as well as due to innovations, since TUSUR as a research and entrepreneurial university places its stake on training of entrepreneurial teams with an expected output of at least 50 teams per year, with some of

them having their own startups at the time of graduation, including those created through public-private partnership.

In education, income is expected to grow due to an increased provision of educational services – modular distance learning and supplementary paid educational services that should gain additional appeal following the transformation of the educational process. Additionally, TUSUR expects to launch new high-demand degree programs in its core areas – electronics, communications and IT, which should result in recruitment of fee-paying students and, as a result, in increased income from education.

The stability of this financial model is ensured by planning responses to potential risks. The key risks are: decrease in the grant program funding, decrease in the demand for educational products and services, decrease in the volume of knowledge-intensive products. The risk response system will include: creation of a reserve fund, development of a system for rapid testing of educational product ideas, expansion of channels for scientific and technological cooperation with enterprises and research institutes.

The income structure of the university, in the context of its development goals in education, research, knowledge and technology transfer, commercialization and youth policy, will be changed without disrupting the balance of the revenue and expenditure parts of the consolidated budget. The future cost structure will be transformed in accordance with the progress on the university's strategic goals of development.

2.8 Digital Transformation Policy

The digital transformation of TUSUR is developed in the context of the National Program "Digital Economy of the Russian Federation" and in accordance with the Strategy of Digital Transformation of Science and Higher Education of the Ministry of Education and Science of the Russian Federation. It is aimed at high-technology-based reengineering of all critical processes of the university's operations and, ultimately, at achieving a high level and "digital maturity" of the university's main policies.

As of today, TUSUR has created a model (vision) of digital transformation and implemented some of the support services for its primary (teaching, research, innovation management) and supporting (administrative, financial and economic processes)

activities. The university has created and successfully operates an electronic information and education environment (EIEE), which includes a distance learning system that makes it possible to deliver a continuous high-quality educational process and enables students to complete their curricula regardless of their location. A total of more than 150 internet resources and services function in the university's information space. This year, TUSUR ranked 41st in Russia in the Webometrics ranking, having been visible to the rankings since 2009.

Within the framework of the Program, TUSUR will transition to the digital model of operation "University as a Platform Service", which will include the creation of a shared information space (SIS) of the university.

The SIS will be developed based on the concept of CALS (Continuous Acquisition and Life cycle Support) and will ensure digital support of all business processes of the university. An important part of the digital ecosystem development strategy is its integration with intelligent subsystems that support decision-making. As a result, the content and structure of the university's SIS needs to satisfy some qualitatively new requirements in terms of both the functionality of all software components and the methods of working with them. Essentially, the process will be a shift from digitalizing the current business processes to developing and implementing conceptually new digital solutions based on the collection, analysis and utilization of data in the management of the university. The digital ecosystem of TUSUR will be integrated into the "Digital University" of the UTU at the level of service-oriented interaction.

Implementation of a decision support system based on big data and artificial intelligence

Within the framework of this activity, a conceptually new information technology will be created that will be powering real-time management of the university by monitoring the state of all operations (teaching, research, campus infrastructure), including using the resources of a new situation center. The following objectives will be addressed as part of this activity:

– a system for collection of high-detail semistructured data on student and staff activity will be developed, which is necessary for building multivariate hierarchically coordinated analytical structures;

– a predictive analytics system based on fuzzy logic and artificial intelligence models will be developed, which will support the construction of personalized development trajectories for students and staff and is intended for a data-based simulation of operations management;

– digital technologies for analysis and planning of research and financial operations of the university will be improved.

Digital transformation of teaching and research

The digital transformation of teaching and research will require the creation of mechanisms that ensure maximum engagement of students in the learning process, their continued focus, and collection of feedback with subsequent adjustment of their learning trajectories. The following objectives will be addressed as part of this activity:

– an intelligent system for management of (meta) skill building and assessment in PDP and SEP students will be created, making use of elements of gamification and the technology for big data analysis-based predictive performance monitoring throughout the entire training life cycle;

– an educational blockchain service will be implemented within the framework of the UTU with its subsequent upscaling to a nation-wide level, which will provide the recording and trusted management of students' digital footprint with elements of predictive analytics and the functionality for creation of personalized digital intellectual maps for students and researchers, including the system environment for storage and publication of intellectual assets;

– a set of shared services for access to digital testing grounds will be created and made available for researchers in IT, cyber-physical systems, cybersecurity systems, quantum computing, electronic and radio-electronic components, etc.

Creation of a high-quality digital infrastructure of TUSUR

The unified digital infrastructure of the university must correspond to the needs of the main stakeholders of the process of education both in relation to real-life objects and in a fully digital form. The following objectives will be addressed:

– open platforms for collaborative work of students and university staff will be created; the service will be available as an element of the campus infrastructure integrated into the UTU spaces, as well as a component of the TUSUR SIS, including elements of virtual and augmented reality;

– the capacity of network and server equipment, end-user equipment, user and resource management system services will be upgraded;

– a single technical support system and a competence center will be created in order to provide consulting, guidance and expert support for users of the TUSUR digital ecosystem.

2.9 Open Data Policy

As a personal data processor, TUSUR carries out the collection on personal data in accordance with the applicable legislation. Where the legislation establishes no provisions with regard to collection of personal data, the university operates only with the consent of the concerned individual. A special list of personal data collected and processed at TUSUR has been created.

Such data is collected through personal contact, obtained from third parties, information services of the university that the individual may use. The university receives personal data from prospective students, undergraduate students, postgraduate students, candidates and other individuals.

The data is processed and stored in different divisions of the university, on different media and using different technologies. The media and technologies are selected based on the concept of the university's development, proven reliability, current trends and principles of information storage.

The purpose of processing personal data depends on the subject and may be for compliance with the labor legislation, legislation on education, or for any other goals that the university is obliged or wishes to achieve. The amount of information thus processed always corresponds to the minimum required for any given purpose.

The university always strives to maintain the data updated and accurate in relation to the purposes of its processing.

When the purposes of processing is achieved, personal data is destroyed in accordance with the established procedure and using the methods that prevent any restoration of that data.

The processing of personal data may be terminated only upon receipt a written

request to that effect.

Personal data is kept strictly confidential at all stages of its processing.

Access to personal data may be provided to third parties:

– based on an explicit consent of the individual;
– if so required by the legislation, subordinate regulations and other binding documents;
– upon request from a public agency that the university is obliged to fulfill;
– when processing is delegated to a third party.

The university takes all possible measures to ensure the security of the processed personal data: restricting access to it for employees and partners, encrypting communication channels, carrying out constant monitoring, and implementing physical security measures to prevent any unauthorized use of personal data.

Methods for ensuring the security of personal data are subject to periodic reviews in order to improve the effectiveness of the security measures. The university carries out regular internal audits of the security measures in place with regard to personal data.

All data in the university's information systems is backed up on a daily basis and is stored in the storage systems of TUSUR.

Given the current trends in digital technologies and the increasing volume of digital information, the university intends to further improve its information security systems, namely:

– use latest software and hardware data security tools;
– create and organize the operations of an cybersecurity operational center.

2.10 Policy in integration and cooperation with universities and research institutes of the Tomsk region (United Tomsk Universities)

The Tomsk region has a unique scientific and educational landscape. It is home to 11 universities, 12 research institutes of the Siberian Branch of the Russian Academy of Sciences and the Federal Medical-Biological Agency. More than 58 thousand people receive education in the universities of the region, every eighth resident of the city is a university student. Nearly every region of Russia is represented in the student population of Tomsk universities, along with more than 90 countries of the world. The region ranks

6th in Russia in terms of the share of researchers under the age of 39 (56.8% in 2019). Over the past 7 years, the Tomsk region has been leading in the ranking of innovative development of the federal subjects of Russia, steadily occupying the fourth line by aggregate indicators. The share of products from high-tech and knowledge-intensive sectors in the GRP of the Tomsk region in 2018 was 21%, which is above average both for the country (20.7%) and for the Siberian Federal District (17.9%).

Tomsk is an intellectual and innovative center of the region and North Asia, and is one of the hundred Best Student Cities in the world according to QS.

2012 saw the creation of the Association of Non-Profit Organizations "Tomsk Consortium of Universities and Scientific Organizations". Today, the Consortium unites 18 partner organizations, including 7 universities and 11 academic institutes. As the next step for further integration, the Consortium launched the United Tomsk Universities project for joint activities in teaching, research and innovation in line with the National Goals, the goals of the concept of Sustainable Development, the implementation of the Strategy of Scientific and Technological Development, and national projects.

The fundamental principles of the United Tomsk Universities are: gradual and balanced integration of universities and scientific organizations (while remaining distinct legal entities) through joint infrastructure, teaching, interdisciplinary research, cooperation with industry, international competitive development; coordination of development within a common strategy.

Policy focus: proportionality of the resources and competencies of the United Tomsk Universities to global projects, formation of new markets of the future at the junction of fundamental knowledge and complex engineering, creation of a single point of contact through which large industrial partners enter the scientific and educational space of Tomsk, creation of common services and infrastructure in order to increase their efficiency and save resources, effective positioning in the domestic and international landscape of education and research.

Goals of the United Tomsk Universities: to drive the modernization and innovation-powered development of the education system of the Tomsk region; to create favorable conditions for the joint management of universities and research organizations in their activities in teaching, research, technology and innovation, to develop networking

cooperation between these organizations; to train professionals for priority directions of scientific-technological development of the Russian Federation, industries and the social sphere, to develop and implement breakthrough research and development, new creative, social and humanitarian projects, as well as to introduce high technologies to the economy and social sphere; to drive the international competitive growth of universities and research organizations through joint positioning on the global stage.

Objectives of TUSUR within the UTU: to achieve a synergetic effect from the key regional projects of the United Tomsk Universities coordinated by TUSUR (Technology Entrepreneurship and Education Export) through competent leadership based on many years of experience, a balanced distribution of activities among all participants and the absence of overlapping functions (it is the project-based approach of TUSUR is used in management of joint activities of the United Tomsk Universities).

Competitive growth of the university and the United Tomsk Universities is inextricably connected with the following goals:

Untapped potential. Joint and coordinated recruitment of talented international prospective students and staff from high-priority geographic regions with untapped potential in order to improve the efficiency of the educational international environment within the university and to attract graduates for employment in high-tech companies from innovative environment of the university.

Single Entry Point. Reduction of barriers by creating a full cycle of digital services based on the single-entry-point principle: university promotion, recruitment of prospective students, admissions, support during the studies, search for internship programs and employment opportunities, up-to-date information about cultural entertainment opportunities and psychological support.

International Recognition. International positioning of TUSUR and the United Tomsk Universities, including through their recognition in the world institutional and subject rankings by THE, QS, MosIUR, development of joint electronic resources, unified targeted advertising, SMM, international media. Promotion of the Tomsk brand as one of the best student cities of Russia and the world.

Exclusive Education Programs and Technologies. Development and implementation of programs in English, including those delivered in network and hybrid forms, tied to Russian high-tech products, as well as international accreditation.

TUSUR has traditionally been a center of attraction for students from the CIS countries, and for the university, this region remains a priority. According to the university's forecast, this trend will remain unchanged over the next 10 years, although the competition for talented applicants will grow significantly more intense. In terms of education exports beyond the CIS, TUSUR will focus on the countries of French-speaking Africa, Latin America and Southeast Asia, since these regions have an unsatisfied demand for high-quality engineering education and traditionally share strong ties with Russia. By 2030, the total number of international students (in all types of programs, full-time and fully distance) at TUSUR will increase almost one and a half times – from 2.2 thousand to 3.5 thousand people, and the recruitment geography will expand from 36 to 45 countries. In total, the United Tomsk Universities will have about 100 thousand students total, about 30 thousand of them will be international students.

TUSUR plans to create its representatives offices in the form of "technology and knowledge transfer bridges" in the world's leading centers of innovation. Today, the university's environment includes more than 20 spin-off companies that offer stable ways for new startups created in Tomsk to enter international markets and provide competent support for their internationalization. By 2030, entrepreneurs hailing from TUSUR will have 30 international offices and will have contributed to the establishment of up to ten representative offices of the UTU outside Russia: in Mongolia, Kazakhstan, Belarus, Japan, Vietnam, China, Singapore, Canada, the United States.

3 Strategic projects aimed at achieving the target model

3.1 Microelectronics and new-generation communication systems (SP 1)

3.1.1 Goal of the strategic project

The goal of this strategic project is to create new scientific and technological directions and world-class technologies, to master breakthrough industrial electronic technologies, as well as to develop human resources in monolithic microwave integrated circuits (MMIC) and intelligent power electronics systems to ensure the import independence and the priority goals of the Russian Federation in security of its critical information infrastructure.

3.1.2 Objectives of the strategic project

In research, innovation and technology commercialization:

– to develop technologies for design and engineering of microwave electronics, photonic and nanoelectronic MMIC based on A_3B_5 heterostructures with topological norms up to 65-45 nm;

– to propose new methods of pulse and radio frequency measurements, modeling and extraction of parameters of microelectronic products and components, to create of devices for their implementation with elements of artificial intelligence;

– to study the methods for increasing the spectral efficiency of data transmission systems, to create algorithms, protocols and API cores for 5^{th} and 6^{th} generation communication systems, to develop devices, software and hardware complexes and systems of the industrial Internet of Things;

– to study and develop methodological and technological solutions for communication, surveillance and identification and to test group interaction modes of unmanned robotic complexes for various applications;

– to create domestic tools for computer-aided design and synthesis of MMIC topologies, electrodynamic modeling systems, libraries of component models focused on the industrial processes of Russian factories;

– to develop regulatory support in the field of metrology, standardization and certification of microelectronic technologies and microwave microelectronics in cooperation with industry representatives – members of the consortium.

In education and human capital management:

– to create and update degree programs ("Electronics, Radio Engineering and Communication Systems", "Photonics, Instrumentation, Optical and Bioengineering Systems and Technologies", "Nanotechnologies and Nanomaterials") for training of designers and process engineering in the format of a Training Factory in order to provide conditions that recreate the conditions of real high-tech enterprises as closely as possible, and to attract representatives of the electronic industry;

– to provide training and retraining in the form of supplementary educational programs implemented by regional NTI centers with a focus on cross-cutting technologies "Wireless Communication and the Internet of Things", "Sensorics" and "Quantum Technologies";

– to create a separate training trajectory "IoT-Academy" (Internet of Things Academy).

In the youth policy:

– to develop student design bureaus that will become points of emergence and growth for engineering divisions of the university;

– to create and develop training and research laboratories Unmanned Aircraft Systems, Robotics and Artificial Intelligence in order to engage university and school students in projects in the field of electronics, design, radio engineering and instrumentation of robotic complexes for various applications.

In the campus and infrastructure policy:

– to create a multifunctional Center for Microelectronic Systems that will be providing targeted training for designers and process engineers in the field of microelectronics, nanoelectronics, radiophotonics and developing a world-class, home-produced electronic component base in the format of a Training Factory;

– to open the center for collaborative design of microelectronic systems that will be providing network interaction with design centers at the stages of product development, prototyping and testing;

– to create a distributed range for 5G and 6G communication systems for the development of the industrial Internet of Things;

– to open a basic operational control center for unmanned aircraft systems within the experimental area "Taiga".

3.1.3 Expected results of the strategic project

Implementation of the strategic project will address an important state-level objective of developing new technology and process solutions in the field of microwave electronics, photonic and nanoelectronic MMIC and intelligent power electronics systems for new markets of neurotechnology and artificial intelligence, industrial internet and robotics, and will produce the following results:

– at least 10 R&D projects carried out in collaboration with consortium members for enterprises in the real sector of the economy;

– at least 450 papers published in leading peer-reviewed journals indexed by the WOS and Scopus databases;

– at least 30 technical solutions and technologies delivered to enterprises of the real sector of the economy;

– at least 20 knowledge-intensive businesses created in the focus area of the strategic project;

– at least 2500 professionals trained for the electronic industry enterprises;

– total income of the university from the activities associated with the strategic project is up to 750 million rubles per year by 2030;

– a unique facility of educational, scientific and technological infrastructure of the region and the country created – the Unified Multifunctional Coordination Center for Microelectronic Systems, which includes: a center for collaboration design of monolithic microwave and radiophotonic integrated circuits; a research and process equipment sharing center for the production of microwave and radiophotonic MMIC; joint research laboratories in partnership with industrial enterprises; laboratories and a process plant for research and training of designers and process engineers and training of designers and process engineers in the format of a Training factory.

3.1.4 Description of the strategic project

The project is managed by its Research Supervisor Professor Leonid Ivanovich Babak, a prominent researcher, Doctor of Engineering Sciences.

The strategic project includes the following projects:

– Development of key elements of manufacturing and modeling technologies for microwave, photonic and photonic-electronic integrated circuits based on silicon-on-insulator and SiGe semiconductor materials, and radio frequency and optoelectronic modules based on them;

– Nonlinear ultrashort pulse and ultrahigh frequency radio metering, modeling and extraction of parameters of natural media, substances, materials and products;

– Study and development of methodological and technological solutions for communication, surveillance and identification and development of functional services using unmanned aircraft systems;

– Development and study of methods for increasing the spectral efficiency for communication systems;

– Development of information exchange systems for a group (swarm) of robotic devices;

– Expert electromagnetic compatibility system for automated design of elements of radio-electronic devices;

– Electron-beam synthesis of multilayer ceramics and metal coatings by a forevacuum plasma electron source;

– Self-action and interaction of light beams in waveguide and diffraction periodic structures based on lithium niobate and photopolymer materials with a liquid-crystal component;

– Fundamental aspects of research in photonics of nonlinear, waveguide and periodic structures;

– Creation and development of the youth training and research laboratory of Unmanned Aircraft Systems;

– Laboratory of Robotics and Artificial Intelligence;

– Training in the form of supplementary educational programs with a focus on cross-cutting technologies of the NTI: "Wireless Communication and the Internet of Things", "Sensorics" and "Quantum Technologies";

– Regulatory support in the field of metrology, standardization and certification of microelectronic technologies and microwave microelectronics;

– Support of the infrastructure of the research and process equipment sharing center Impulse;

– Supports of the infrastructure of the center for collaboration design Microwave Microelectronics and Radiophotonics;

– Development and implementation of training programs for designers and process engineers in the format of a Training Factory.

3.2 IT, secure digital environment and cyber-physical systems (SP 2)

3.2.1 Goal of the strategic project

The goal of the project is to create the groundwork of technology and human resources for the transition to Industry 4.0 through the development of key digital technologies: cyber-physical systems based on machine–machine and human–machine interaction, and secure data exchange interfaces using new-generation communication networks; to design networks based on new principles of quantum technologies; to develop and create high-potential cybersecurity methods; to train human resources. The project is designed to address an important state-level objective as identified in Decree of the President of the Russian Federation 400 dated 02.07.2021 "On the Strategy of the Sovereignty of the Russian Federation in the Information Space, Increasing the Security of the Information Infrastructure of the Russian Federation and its Sustainable Operation" and the Strategy of Scientific and Technological Development.

3.2.2 Objectives of the strategic project

In research, innovation and technology commercialization:

– to develop self-organizing networks for mobile objects;

– to create secure protocols for quantum systems and networks;

– to simulate data transmission processes in new-generation communication networks, to analyze and develop secure protocols for network machine-to-machine communication;

– to develop and modify methods for predicting and detecting anomalies based on machine learning and artificial intelligence in order to increase the level of cybersecurity of critical information infrastructure objects;

– to develop speech and bioelectric human-machine interfaces;

– to create models and algorithms for big data analysis in order to detect and investigate digital cybercrimes;

– to study the social and humanistic aspects of the transition to Industry 4.0: the integration of cyber-physical systems in industry, machine-to-machine and human-machine communication, the use of artificial intelligence methods;

– to design cyber-physical systems for the industrial Internet using artificial intelligence methods for prediction of technology breakdowns, detect anomalies, etc.;

– to develop of hardware components of new-generation telecommunications networks;

– to design trusted authentication systems, including biometric systems, based on artificial intelligence methods.

In the education policy:

– to create a distinct training trajectory DAT;

– to develop and offer advanced training and professional retraining programs in: Internet of Things, Cybersecurity, Machine Learning and Artificial Intelligence; to integrate these programs into the curricula of the Bachelor, Master and Specialist-level programs within the degree groups "Computer Science and Computer Engineering" and "Information Security";

– to offer Master in programs modeling, development and security of cyber-physical and quantum systems.

In the youth policy:

– to open specialized student clubs for the Internet of Things and Artificial Intelligence based on the Samsung IT Academy, cybersecurity and quantum cryptography;

– to hold master classes and open lectures for school students for education on cybersecurity, digital hygiene, IoT systems, quantum and other technologies.

In the human capital management policy:

– to provide continuous training/retraining for teaching staff using elements of supplementary education, as well as internships in leading universities and organizations both in Russia and abroad in order to shape individual career trajectories of teaching staff.

In the infrastructure policy:

– to create a quantum network in order to conduct research and use in training programs on quantum cryptography and quantum distribution of cryptographic keys;

– to organize a data processing center for the purposes of research and training in the field of artificial intelligence;

– to organize a cyber range for practice in detecting and responding to incidents in cyber-physical systems;

– to create a range for testing the interaction of mobile objects (including unmanned objects) in cyber-physical systems.

3.2.3 Expected results of the strategic project

Implementation of the strategic project will produce the following results:

– research laboratories created at the REC Cybersecurity for activities in artificial intelligence, cybersecurity and design of cyber-physical systems: quantum communications and quantum cryptography; detection, analysis and prevention of network attacks; cloud solutions, big data and artificial intelligence; security of cyber-physical systems;

– by 2030, the total income of the university from the research focus of the strategic project has reached 500 million rubles per year and income from R&D with industrial partners, 250 million rubles per year;

– more than 300 papers on the research focus of the strategic project published in leading peer-reviewed journals indexed in the WoS and Scopus databases;

– at least 15 knowledge-intensive businesses in line with the research focus of the strategic project, the income from intellectual property rights will be more than 10 million rubles;

– 5 new Master programs with a focus on key digital technologies, 5 professional retraining programs available; at least 250 students obtain an additional qualification;

– at least 2000 professionals with an expertise in advanced digital technologies trained.

3.2.4 Description of the strategic project

The strategic project is managed by its Research Supervisor Professor Alexander Alexandrovich Shelupanov, a prominent Russian researcher, Honored Worker of the Higher Education of the Russian Federation, recipient of three Prizes of the Government of the Russian Federation for achievements in education, science and engineering, Doctor of Engineering Sciences.

The strategic project includes the following projects:

– Secure protocols of machine-to-machine communication in cyber-physical systems;

– Interaction interfaces in cyber-physical systems;

– Detection, prevention and investigation of incidents in cyber-physical systems;

– Hardware and software technologies of cyber-physical systems;

– Authentication technologies in cyber-physical systems.

3.3 Space Sciences and Engineering (SP 3)

3.3.1 Goal of the strategic project

To create an advanced scientific and technological groundwork for the space-and-missile industry through the development and creation of breakthrough technological solutions, world-class intelligent complexes and systems, the development of fundamental methods of space exploration and the theory of quantum gravity, to ensure a competitive growth and scientific priority of Russia, as well as to provide training in this area.

3.3.2 Objectives of the strategic project

In the research and innovation policy:

– to create and develop a new generation of digital intelligent power supply and control systems for communication, navigation and Earth observation spacecraft;

– to develop multifunctional automated test complexes of spacecraft systems relying on domestic elements and components;

– to develop the scientific foundation and technological principles for creation of intelligent (smart) coatings based on compounds with phase transitions for optical solar reflectors for thermal stabilization of spacecraft, including for nuclear power facilities and other industries;

– to create photo- and radiation-resistant coatings using nanotechnologies for the space-and-missile industry;

– to create methods for processing and analyzing spatiotemporal sets of multispectral and hyperspectral data from satellites and unmanned aerial vehicles in order to identify trends in changes in the types of the Earth's surface;

– to create a unified gravitational theory describing the structure and evolution of outer space as a whole, as well as to search for astrophysical effects indicating its structure, in order to predict any potential man-triggered hazards;

– to formulate and develop new theories of modified gravity that best correspond to astrophysical and cosmological observational data.

In the education policy:

– to develop and offer new degree programs, advanced training and professional retraining programs in: design and materials science, intelligent power and nanoelectronics, power supply systems for autonomous objects, automated test complexes and systems for the space-and-missile industry, and to integrate these programs into the curricula of the Bachelor, Master and Specialist-level programs within the degree groups "Design and Technology of Electronic Devices", "Information Systems and Technologies", "Control in Engineering Systems", "Electronics and Nanoelectronics";

– to develop an international network program in English for Masters and Doctorate-level students in "Nanotechnologies in Radiation and Space Materials Science";

– to launch of a new degree program in theoretical cosmology and fundamental astrophysics;

– to develop and direct the activities of industry-initiated departments: Department of Space Radioelectronic Devices; Department of Design of Radioelectronic Deans; Department of Microelectronics, Information Technologies and Control Systems.

In the youth policy:

– to open specialized youth R&D centers and classes for design and engineering of single-unit and three-unit CubeSat small (miniaturized) satellites within the framework of the Center for Creative Technologies and Robotics;

– to conduct master classes and open lectures for school students on space exploration, space instrumentation, the Internet of Things and other technologies.

In the human capital management policy:

– to provide continuous training/retraining for teaching staff using elements of supplementary education, as well as internships in leading universities and organizations both in Russia and abroad in order to shape individual career trajectories of teaching staff.

In the campus and infrastructure policy:

– to create a research and education center in the field of space technologies and engineering that would include a number of research institutes and laboratories, as well as a unique set of equipment for system verification and detailed experimental testing of information exchange between network structures and scalable digital energy-converting systems of automated spacecraft based using artificial intelligence;

– to create the Siberian International Center for Cosmology (SICC) in order to drive the development of new theories of modified gravity that best correspond to astrophysical and cosmological observational data.

3.3.3 Expected results of the strategic project

Implementation of the strategic project will address an important state-level objective of developing and creating new intelligent complexes and systems, photo- and radiation-resistant coatings using nanotechnologies for the space-and-missile industry, will result in the creation of a unified gravitational theory describing the structure and evolution of outer space as a whole, and will produce the following results:

– at least 20 R&D projects completed by the new REC Space Technologies and Engineering and the Siberian International Center for Cosmology in collaboration with members of the consortium for space-and-missile enterprises;

– by 2030, the total income of the university from the research focus of this strategic project has reached 1.5 billion rubles per year and income from R&D with industrial partners, 1 billion rubles per year;

– at least 15 scientific and technological solutions delivered to the enterprises of the space-and-missile industry;

– more than 300 papers published in leading peer-reviewed journals indexed in the WoS and Scopus databases;

– at least 10 knowledge-intensive businesses created, the income from intellectual property rights will be more than 10 million rubles.;

– 3 new Master programs with a focus on key digital technologies, 5 professional retraining programs available; at least 250 students obtain an additional qualification;

– at least 2000 professionals with an expertise in advanced digital technologies trained.

3.3.4 Description of the strategic project

The strategic project is managed by its Research Supervisor Professor Yuri Alexeyevich Shurygin, a prominent Russian researcher, Honored Worker of Science and Engineering of the Russian Federation, recipient of the Prize of the Government of the Russian Federation for achievements in education, Doctor of Engineering Sciences.

– The project "Space Sciences and Engineering" is aimed at fulfilling the objectives of the Program for Innovative Development of the State Corporation Roscosmos for 2019-2025 (Protocol 45-NS) and addressing a set of key objectives in the space industry to support the national priorities of our country.

The strategic project includes the following projects:

– Development of automated testing and power-conditioning digital complexes for spacecraft based on artificial intelligence (AI) systems;

– Creation of the International Siberian Center for Cosmology;

– Development of a hardware and software complex for experimental testing of the system architecture and equipment for digital platforms for new-generation of spacecraft;

– Development of methods for extraction of information from heterogeneous remote data (from satellites and unmanned aerial vehicles) and its task-oriented analysis;

– Creation of the training and research laboratory of Onboard Complexes of Automated Spacecraft;

– Development of the technique for additive deposition of space materials at the nano, micro and macro levels using adaptively controlled sources;

– Development and implementation of training programs for circuit engineers and system engineers with an expertise in onboard radioelectronics;

– Development and implementation of training programs for designers and process engineers with an expertise in space instrumentation;

– Creation and development of the youth training and research laboratory of Nanosatellites;

– Support of the infrastructure of the research and process equipment sharing center Intelligent Power Electronics and Control Systems.

3.4 Biomedical technology (SP 4)

3.4.1 Goal of the strategic project

The main goal of this strategic project is to develop technologies, software and hardware complexes and systems that ensure preservation of the health and well-being of people who are at the risk of cancer and cardiovascular diseases, as well as diseases of a pandemic nature, through the development of new approaches to diagnosis, treatment and aftercare, as well as training of professionals for these areas in accordance with the State Program of the Russian Federation "Healthcare Development", Federal Programs "Control of Cardiovascular Diseases", "Control of Cancer" and the Strategy of Scientific and Technological Development.

3.4.2 Objectives of the strategic project

In the research and innovation policy:

– to create a health-saving technology of personalized aftercare using artificial intelligence and biofeedback methods;

– to create a technology for safe extraction, processing and storage of public health data for forecasting of global health parameters, including during pandemics;

– to create medical systems for high-tech diagnostics and treatment of cardiovascular diseases;

– to engineer hardware and software complexes for intellectual support of cancer treatment;

– to develop artificial intelligence methods for early diagnosis of neurodegenerative diseases;

– to implement medical systems for high-tech diagnostics and treatment of cardiovascular diseases;

– to implement hardware and software complexes for intellectual support of cancer treatment;

– to create a complex for extraction and processing of speech information;

– to provide an upgrade of thermal therapy devices and assess their effectiveness.

In the education policy:

– to develop and offer advanced training and professional retraining programs in: Medical Information Systems, Artificial Intelligence in Biomedicine, Simulation of Medical Systems and Their Effect on the Human Body; to integrate these programs into the curricula of the Bachelor and Master-level programs within the degree group 09.00.00.

In the youth policy:

– to promote healthy living and prevention of early onset and development of cardiovascular and neuropsychiatric diseases and cancers.

In the human capital management policy:

– to provide continuous training/retraining for teaching staff using elements of supplementary education, as well as internships in leading universities and organizations both in Russia and abroad in order to shape individual career trajectories of teaching staff.

In the infrastructure policy:

– to organize a center for extraction and monitoring of vital parameters of the population;

– to create a data processing center for the purposes of research and training in the field of artificial intelligence.

3.4.3 Expected results of the strategic project

Implementation of the strategic project will produce technologies, software and hardware complexes and systems that ensure the preservation of the health and well-being of people who are at the risk of cancer and cardiovascular diseases, as well as diseases of a pandemic nature, and will produce the following results:

– at least 20 new technical solutions and technologies delivered to healthcare organizations;

– at least 10 knowledge-intensive businesses created in the focus area of the strategic project;

– a center of excellence in biomedical technologies established, including:

center for extraction, collection, storage and processing of health indicators for the purposes of early diagnosis and prediction of critical diseases;

center for analysis and forecasting of global healthcare parameters for assessment of its performance under an increased workload;

center for aftercare problems that will utilize machine learning technologies to develop and implement new methods of aftercare for patients recovering from critical diseases;

two joint scientific laboratories in collaboration with industrial enterprises;

laboratories and centers for practice-oriented training and retraining;

process plant for R&D and training of process engineers in the format of a Training Factory;

– at least 7 R&D projects carried out in collaboration with consortium members for enterprises in the real sector of the economy. Prototypes of products, technology demonstration will be produced, intellectual assets will be transferred to industrial partners;

– at least 300 papers on the research focus of the strategic project published in leading peer-reviewed journals indexed by the WOS and Scopus databases;

– at least 300 professionals trained for analytical organizations, in particular for those carrying out the analysis of biomedical data;

– by 2030, the total income of the university from the research focus of the strategic project has reached 500 million rubles per year, with at least 50% of it coming from research carried out for enterprises of the real sector of the economy;

3.4.4 Description of the strategic project

The project is managed by its Research Supervisor Professor Evgeny Lhamatsyrenovich Choynzonov, a prominent Russian researcher, recipient of the Prize of the Government of the Russian Federation, Academician of the Russian Academy of Sciences, Doctor of Medical Sciences.

The strategic project includes the following projects:

– Technology of personalized aftercare using artificial intelligence and biofeedback methods;

– Early diagnosis of neurodegenerative diseases using artificial intelligence methods;

– Technology for safe extraction, processing and storage of public health data for forecasting of global health parameters, including during pandemics;

– Medical systems for high-tech diagnostics and treatment of cardiovascular diseases;

– Hardware and software complexes for intellectual support of cancer treatment.

3.5 Management and Infrastructure transformation (SP 5)

3.5.1 Goal of the strategic project

To achieve the university's target model by transforming its core activities based on breakthrough innovative development practices of the world's leading benchmarks, harmonized interaction with the Tomsk Consortium and the UTU management system.

3.5.2 Objectives of the strategic project

In the education policy:

In the context of cooperation with members of the UTU, the following objectives are identified:

– to implement the project-team paradigm and the principle of lifelong learning;

– to introduce a service-oriented learning concept into the educational process;

– to develop digital skills in students enrolled in all programs.

In the research and innovation policy:

– to create favorable conditions for research, recruitment and professional growth of young research and teaching staff by building a continuing development trajectory from a student to a young researcher, a highly skilled professional, which will ensure the sustainable development of the university, a stable influx of staff, and the creation and growth of research teams;

– to support publication activity, international and domestic academic mobility for the purposes of research networking, keeping the research agenda updated, increasing the recognition of the university and establishing business contacts with leading organizations in Russia and abroad;

– to create favorable conditions for the generation and development of knowledge-intensive entrepreneurship.

In the human capital management policy:

– to create a model for the development of competitive professional and supra-professional skills in teaching staff in accordance with the global trends and the HR needs of UTU members;

– to recruit world-class highly skilled staff for unique professional activity at the university.

In the youth policy, in the context of the UTU:

– to integrate a project-based activity approach into the implementation of the youth policy "Nothing for the Youth without the Youth"; to develop student self-government bodies in accordance with the principles of university co-management;

In the digital transformation policy:

– to create a complex of digital solutions covering all areas of the university's operations: research, teaching, campus and infrastructure management, administration and supporting processes;

– to build the digital ecosystem of the university, incorporated into the UTU infrastructure.

In international competitive growth of the university:

– to promote the appeal of the university environment as an element of the safe and comfortable UTU quarter to attract the most talented international students and employees;

– to create a full cycle of digital services in foreign languages based on the single-entry-point principle for admission, training, employment, recreation of international students and staff;

– to drive the international positioning of the university, including though its positions in world rankings;

– to develop export-oriented training programs in English, including dual degree programs, with partner universities from economically and technologically developed countries.

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3.5.3 Expected results of the strategic project

In education:

– a complex of university business processes that allow students to adapt to the scientific and technological challenges of the world economy, the requirements of the university and the UTU members, the training process; increased motivation of students for self-development and self-fulfillment, development of soft skills; adoption by students of the corporate culture of TUSUR and, as a result, training of highly skilled professionals and project teams who are capable of making a significant contribution to the economy of the region and the Russian Federation.

In research and innovation:

– new knowledge and technologies in the university's areas of expertise;

– higher number of highly skilled staff with expertise in the priority areas of the university's development and the Strategy of Scientific and Technological Development of the Russian Federation employed at the university (more than 80 Candidates and 20 Doctors of Sciences);

– new scientific schools and research teams in the priority areas of the university's development and the Strategy of Scientific and Technological Development of the Russian Federation, growing recognition of the university both in Russia and abroad;

– a sustainable mechanism for generation of entrepreneurs in knowledge-intensive business.

In human resources:

– a competitive environment that uses a system of performance assessment and incentives for teaching staff, driving achievements in the priority areas of the university's development in education.

In youth guidance:

– Full-Day University conditions that encourage students to build personal skills through their extensive involvement in university life, increased motivation, all-around development of their individual life trajectories.

In digital transformation:

– an effective digital ecosystem based on a shared information space between the university and the UTU.

In international competitive growth:

– expanded geography of talent recruitment, recruitment of highly skilled international professionals, increased number of international students, development of a comfortable and safe campus and city environment, bilingualism and multiculturalism, creation of world-class educational products.

3.5.4 Description of the strategic project

The strategic project is managed by Professor Victor Mikhailovich Rulevskiy, a prominent researcher, research administrator, Rector of TUSUR, Doctor of Engineering Sciences.

This strategic project is to be implemented through a combination of the university's key transformational components in the field of education, research and innovation, its management systems, infrastructure, integration of the university's policies and their harmonization with the new management system of the UTU.

This strategic project will be implemented through the following projects.

Project 1. The concept of multi-level diffusion PBGL (PBGL-2.0) and automated PBGL support systems

The project is aimed at further improving the PBGL technology using the resources of SEPs and at upgrading the current mechanisms of software and data support for the technology, which will ensure the motivated engagement of students in the training process from their first years of study, including through the model of training team freelancing. The project will lay the foundation for the transition from practice-oriented training to a profession-oriented project-based activity model, which will result, among other things, in a higher the number of students engaged in team implementation of full-cycle projects.

Project 2. Service-oriented learning concept

The project is aimed at transforming the educational activities of the university by integrating innovative educational elements into the training process that ensure the comprehensive development of soft and hard skills. The implementation of this concept means that students will have the opportunity to fully choose their own training trajectory based on predictive analysis of their performance at all levels of education using a personal bank of meta-skills and the integration of educational elements of network programs implemented with the members of the UTU.

Project 3. Concept of digital skill building

Within the framework of the project, two trajectories for digital skill building are proposed: a trajectory for students enrolled in IT programs, which provides for the transformation of the educational ecosystem by creating two greenfields based on the project-team paradigm in the format of business academies DAT and IoT Academy; and a trajectory for students enrolled in programs other than IT, which provides for the integration into curricula of content that is focused on development of skills that facilitate one's integration into the digital economy environment in the course of adaptation and personal development in the context of digital transformation, as well as implementation of continuing professional education programs designed to build digital competencies in algorithm creation and program engineering. Students enrolled in all PDPs will be offered to expand their curricula with short-term supplementary educational programs for digital skill building, developed and implemented by TUSUR and its network partners.

Project 4. Support for researchers

The project is aimed at creating an efficient model for formation of continuous development trajectories for researchers in the advanced frontier areas of the Strategy of

Scientific and Technological Development, as well as for inter-university research teams of the UTU, which will ensure the breakthrough development of the university's scientific schools, coupled with the continuous qualitative growth of its human capital.

Project 5. Ecosystem for generation and development of knowledge-intensive entrepreneurship

Introduction of a technology for identification and support of high-performing technology entrepreneurs in the UTU who are capable of flexible transformation in the rapidly changing market of research and development and who will be able to drive the breakthrough in the economy of the region and the Russian Federation.

Project 6. Development of competitive professional and supra-professional skills in teaching staff in accordance with global trends

The project is aimed at introducing mechanisms for continuous training/retraining for teaching staff using elements of supplementary education, as well as internships in leading universities and organizations both in Russia and abroad in order to shape individual career trajectories of teaching staff. As a result, the project will create an environment of elite, highly skilled professionals capable of implementing the core processes at the university to the highest international standard and with due consideration of the requirements of all stakeholders.

Project 7. Integration of the project-based activity approach into the youth policy "Nothing for the Youth without the Youth" and development of principles of student co-management

The project is aimed at transforming the methodology of student guidance at the university by prioritizing the core activities that will be engaging students through various-level socially important projects. The project will ensure comprehensive engagement of students in the management of the university. Within the framework of the project, it is planned to create a Youth Policy Directorate within the university structure that will facilitate the interaction between the university administration and the student community in order to overcome the barriers between various groups of the university society and produce a coordinated and relevant youth-focused agenda.

Project 8. Campus upgrade

The project is aimed at creating modern comfortable conditions for studying, living and extracurricular activities for students, young researchers and university staff.

The project provides for the transformation of educational spaces, provision of modern facilities and resources, upgrade of the sports and recreation infrastructure and public catering, major overhaul of buildings and dormitories of the campus. Within the framework of the project, the campus will be developed using the principles of landscape design and will integrate "green" innovative technologies that will contribute to the matters of safety, resource efficiency and environmental protection. The upgrade of the student campus will create a systematic, differentiated approach to the needs of international and non-local students that will be taking into account their preferences and capabilities, based on open access to the parameters and conditions of accommodation facilities, including the UTU campus.

Project 9. Education export and international competitive growth

The project is aimed at addressing the issues of attracting talented students and teaching staff from abroad. To achieve its goals, new efficient recruiting mechanisms will be utilized. Thanks to the inclusion of international focus in all the policies of the university, TUSUR will ensure its efficient international positioning, among other methods, by achieving higher positions in the world university and subject rankings. The project will drive the development and offer of programs in English, including network and hybrid programs, tied to Russian high-tech products, and their international accreditation.

Project 10. Creation of a managerial decision support system

The goal of the project is to create a complex of digital solutions that would cover all of the university's activities: research, teaching, campus and infrastructure management, administration and supporting processes.

Project 11. Creating the digital infrastructure

The project is aimed at upgrading the digital ecosystem of the university to ensure that it is capable of meeting the contemporary challenges, supporting the development of the university as a service-oriented platform, providing safe, uninterrupted, efficient operation of the IT services and systems of the digital university within the UTU infrastructure.

4 Key characteristics of interinstitutional networking and cooperation

4.1 Structure of key partnerships

In order to support the implementation of the university's Development Program as a member and core of the consortia, a unique, balanced multi-level management system based on the following principles will be created:

– agreement between the parameters of the control system;

– collegiate management;

– openness.

A consortium is an association of organizations aimed at productive, collaborative implementation of the University's Development Program, including the implementation of joint research and development projects, network training programs, and infrastructure sharing. Table 1 represents the structure of partnerships.

Table 1 – Structure of partnerships

	TUSUR SP	**Universities**	**Organizations of the Russian Academy of Sciences**	**Enterprises**
Consortia	Microelectronics and new-generation communication systems	MIET, LETI, Skoltech, MSU, SevSU	Institute of Nanotechnology of Microelectronics RAS, Institute of Atmospheric Optics RAS, Rzhanov Institute of Semiconductor Physics RAS	MICRAN, ELCOM +, STC, ISS, Research Institute of Semiconductor Devices, Milandr, T8, FT, Eltex Company, Research and Development Center “Polus”, Research and Production Center “Tair”, Microwave Systems, Ural Design Bureau “Detal”, ROBS,

				Scientific and Production Association "Airplatform"
	IT, secure digital environment and cyber-physical systems	TSU, ITMO, SPbPU	SPIIRAS	Aladdin, Infotex
	Space sciences and engineering	SibSAU, TPU	Institute of Strength Physics and Materials Science RAS, Siberian Research Institute of Agriculture and Peat RAS	ISS, Saturn, RSC Energia, NPO Lavochkin
	Biomedical technology	SibSMU	Tomsk National Research Medical Center, Institute of Strength Physics and Materials Science RAS	Biotok, NIIPP
	Management and infrastructure transformation	UTU		

The structure of key partnership might be subject to change as the Development Program progresses.

4.2 Description of the consortia created (planned to be created) as part of the Development Program

The goals and objectives of a consortium are to coordinate the activities of its member organizations, review and approve reports on the strategic project implemented within the framework of the university Development Program.

5 consortia will be created to support the above strategic projects:

– microelectronics and new-generation communication systems

– IT, secure digital environment and cyber-physical systems

– space sciences and engineering

– biomedical technology

– management and infrastructure transformation

These consortia will include Russian and international universities, research organizations of the Russian Academy of Sciences, and industrial enterprises.

Each consortium has a council that consists of representatives of member organizations.

Each consortium council is chaired by the Rector.

In furtherance of the strategic projects, the university plans to create consortia of scientific, educational, academic members of the UTU and industrial enterprises.

To ensure the successful implementation of the development strategy of the university as a member of the consortium within the UTU paradigm, a balanced management system will be created, based on the principles of openness, agreement between the parameters of the system and collegiate management.