Skoltech

Skolkovo Institute of Science and Technology

Strategic Action Plan

Contents

President's Foreword

Skoltech was conceived as a key element of the Skolkovo project with the purpose to create a foundation for high-tech industry in Russia, leveraging on the boost in research and entrepreneurship in science intensive areas of economy. In this paradigm, Skoltech acts as a catalyst, performing cutting-edge research in priority areas, promoting innovation and entrepreneurial activity while educating future leaders in science, technology and business.

To reinvent and innovate industry in Russia, in the digital world, a new line of commanders-in-chief is critical. The CTOs (Chief Technology Officer), CIOs (Chief Information Officer), CDOs (Chief Digital Officer) capable of working in a rapidly changing technology landscape – it is they who will stay ahead of the curve and make companies high-tech leaders.

We are unique in Skoltech to have all necessary ingredients to educate new generations of digital and technology leaders. And we will do.

Alexander Kuleshov
Skoltech President

Focus & Governance

//01


СКОЛКОВСКИЙ ИНСТИТУТ НАУ

Mission & Goals

Skoltech was founded in 2011 in a partnership with MIT with the vision of being a world-leading academic institute of science and technology.

As an academic institution, Skoltech primary mission is academic excellence in Target Domains. This includes performing cutting-edge basic and applied research and educating next generation of science, technology and business leaders.

Also, as a leading academic institution, Skoltech generates value in a form of professional education, advisory services, industry-funded research and results implementation, services of shared facilities, technology licensing and new enterprises established by the Institute's scholars, engineers, students and alumni. Therefore, Skoltech reinforces Russia's technology excellence in Target Domains and bridges the gap between research and industry.

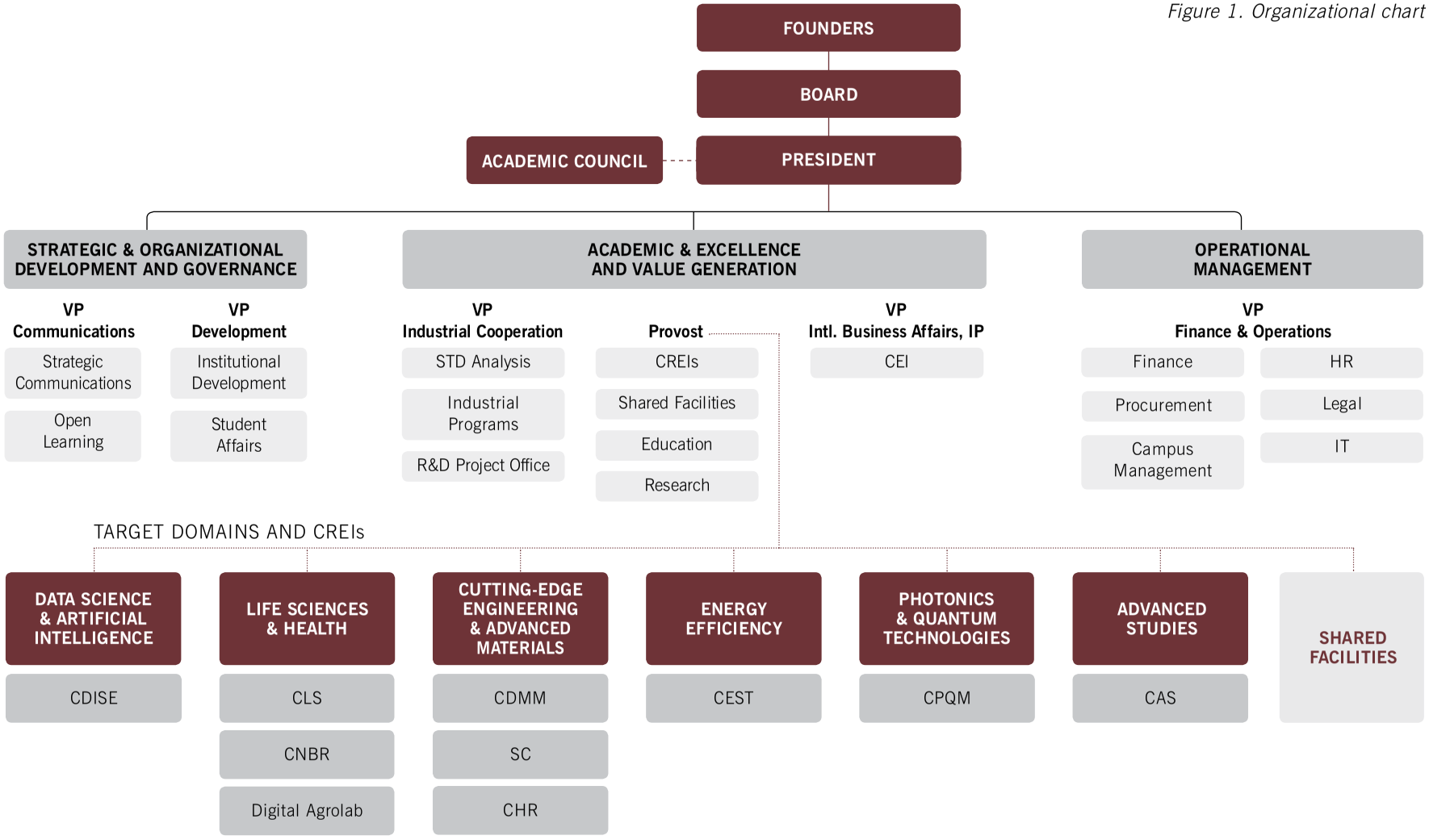
Skoltech forms a part of the Skolkovo community which creates a new, self-sustaining innovation ecosystem providing an engine for Russian high-tech industry and attracting foreign investments. In this paradigm Skoltech acts as a catalyst to foster cutting-edge research in the advanced areas of crucial importance for Russia, promote entrepreneurial activity and train internationally competitive specialists capable of working in a rapidly changing research and technology landscape. Furthermore, Skoltech adopts and disseminates advanced international practices in research, education, innovation & entrepreneurship to Russian universities and academic institutions. Therefore, in addition to direct monetary return, Skoltech creates indirect long-term economic and social impact.

During the planning period Skoltech will keep its commitment to the strategic goals set earlier:

1. Strategic and Organizational Development and Governance: ensure the Institute's focus on its vision, continuous development and shared governance.
2. Academic & Technology excellence: perform cutting-edge basic and applied research, educate next generation of science, technology and business leaders.
3. Value Generation: create business opportunities in a form of professional education, advisory services, shared facilities, industry-funded research and results implementation, technology licensing, new enterprises established by the Institute's faculty, students and alumni, also in collaboration with the Skolkovo Foundation.
4. Cooperation: being a part of the Skolkovo ecosystem, strengthen a global partnership network, build alumni network, serve and strengthen engagement with wider community.
5. Campus and Operational Management: deliver best-in-class space and infrastructure, ensure operational and maintenance activities enabling the Institute's vision.

The organizational chart supports the Strategy implementation by assigning functions in accordance with the goals set (Fig. 1). The chart also shows Target Domains – strategic areas of developing education, scientific, research and development, innovation activities, and the Centers as core drivers for implementing the Institute's strategic agenda.

Figure 1. Organizational chart



* Functions of Security & Internal Control are not reflected.

Human Capital Development

The Institute will ensure efforts to maintain international academic culture, while slowing down the growth of human capital compared to the previous three years, to take time to carry out assessment of CREI programs and make them more focused.

The human capital drivers (see Fig.2) present a framework of the academic community composition during the upcoming period with ± 5% accuracy. As it is shown, the planned numbers of faculty body and student cohort will gradually decrease the student-to-faculty ratio to provide a favorable learning and teaching environment comparable with the international peer institutions[1].

In the longer term, the Institute will keep sustainable growth of the faculty body and student cohort to reach the level of the initial Strategy[2] – 200 and 1200 respectively by 2024, allowing to fix a student-to-faculty ratio at the level of 6.0.

Figure 2. Human Capital Drivers

HUMAN CAPITAL DRIVERS	UNITS	2019	2020	2021
FACULTY	PERSONS	140	152	164
POSTDOCS & RESEARCHERS	PERSONS	250	270	300
ENGINEERING & TECHNICAL STAFF	PERSONS	130	155	185
STUDENT COHORT	PERSONS	1050	1050	1050
STUDENT / FACULTY RATIO	UNITS	7.5	6.9	6.4

The responsibilities, operational KPIs, respective tasks and a timeline are provided below.

[1] Massachusetts Institute of Technology (6.6), Hong Kong University of Science and Technology (7.4), Korea Advanced Institute of Science and Technology (6.0). Sources: official web pages.
[2] The Project Plan for Establishing and Developing the Skolkovo Institute of Science and Technology.

Responsibility	Provost
	Vice President for Development
Units involved	HR Department
	Student Department
	Open Learning Center
	CREIs, Strategic Communications Department

OPERATIONAL INDICATORS	2019	2020	2021
ACADEMIC PERSONNEL			
INTERNATIONAL OPEN CALLS FOR ACADEMIC PERSONNEL	+	+	+
% OF JUNIOR FACULTY (ASSISTANT PROFESSORS) HIRED FROM INTERNATIONAL MARKETS (FROM THE TOTAL NUMBER OF FACULTY HIRED PER YEAR)	30	35	40
% OF POSTDOCS HIRED FROM INTERNATIONAL MARKETS (PER YEAR, FROM THE TOTAL RESEARCH STAFF HIRED)	20	25	30
FACULTY WITH SIGNIFICANT ACADEMIC EXPERIENCE AT TOP-100 UNIVERSITIES (QS, THE), %	70	75	75
FACULTY CONTRIBUTED TO VALUE GENERATION OUTPUT, %	40	60	60
ACADEMIC VS NON-ACADEMIC PERSONNEL RATIO (%)[3]	70/30	70/30	70/30
STUDENT COHORT			
MSc AND PhD STUDENTS ENROLLED	390	400	420
GRADUATES FROM TOP-300 UNIVERSITIES (QS, THE), %	55	60	60
INTERNATIONAL STUDENTS ENROLLED, %	20	20	20
STUDENTS FINANCED FROM NON-SK FOUNDATION GRANT, % OUT OF INTAKE*	-	5	10
STUDENTS IN COMMUNITY BUILDING / CAREER SUPPORT PROGRAMS, % (REGISTRATIONS)	80	90	100
ACTIVE PROJECTS FOR UNDERGRADUATES AND GIFTED KIDS	3	3	3

* provided that tuition fee-based model is launched in 2019.

[3] Academic personnel – Institute's employees creating academic/ scientific knowledge, conducting teaching, research and innovation activities (faculty, inc. CREI Directors, heads of labs, researchers, postdocs, research engineers, lab technicians, research interns). Non-academic – Institute's employees at administrative and support positions.

	TIMELINE
Task 1: conduct recruitment of junior faculty and postdocs	**annually**
Actions: 1. Approve the plan for hiring faculty and postdocs. 2. Identify and implement marketing activities. 3. Implement International Open Call.	
Task 2: develop and implement student outreach and selection campaign	**annually**
Actions: 1. Develop a concept and a roadmap. Update admission regulations, develop an admission plan. 2. Participate at international recruitment events (QS fairs, tours etc.). 3. Arrange outreach activities (“Lectorium”, “Open Doors”, “Skoltech Promo”, “Skoltech ambassadors”, Olympiads). Increase coverage of universities/cities. 4. Develop and implement content projects, also in cooperation with media. 5. Organize events for young scientific talents and tech entrepreneurs. Organize the Institute’s participation in similar contests / conferences. 6. Publish information on Skoltech educational programs at visible national and international web-sources on higher education. 7. Define and implement internet marketing for promoting MSc and PhD programs, recruitment campaigns, visiting programs.	
Task 3: shape career development opportunities for academic personnel and students	**annually**
Actions: 1. Establish a framework on development of academic personnel accounting for long-term career paths, opportunities for tenure and non-tenure tracks, conditions for promotion. 2. Establish and implement programs / activities for career development (internal grants, mentoring, training courses, soft skills development, leadership programs, etc.).	

	TIMELINE
3. Establish Students Career Center. 4. Establish and implement programs / activities aimed at providing opportunities for students' career development and placement (academia, industry, startups). 5. Implement HR personnel research.	
Task 4: strengthen students and alumni community	**annually**
Actions: 1. Plan and implement programs for developing students community, including student life events. 2. Provide administrative support to student cohort, including migration, relocation, medical insurance, military registration and accommodation (if required), other administrative services. 3. Develop alumni community.	
Task 5: develop and implement a visiting program for faculty, postdocs and students	**annually**
Actions: 1. Develop a framework for visiting program, including target audiences, focus areas, procedures, quotes. 2. Promote the program focusing on leading Russian and international universities. Review the program efficiency, introduce adjustments if required. 3. Implement Global Campus initiative.	
Task 6: organize programs for undergraduates, also jointly with partners	**annually**
Actions: 1. Organize undergraduate research opportunities program jointly with leading Russian and international universities. 2. Organize summer schools for undergraduates.	
Task 7: organize programs for gifted kids	**annually**
Actions: 1. Develop a concept and a roadmap for talented high school kids. 2. Maintain partnership programs, e.g. with Skolkovo International Gymnasium, "Sirius" Educational Center, Kvantorium.	

	TIMELINE
3. Expand work with high school students through other centers and networks, on-line content and distant learning.	
Task 8: revisit performance evaluation and reward system	**2020**
Actions: 1. Develop and implement a system for mandatory annual assessment of academic personnel. 2. Develop and implement annual performance evaluation for non-academic personnel. 3. Develop and implement a reward system based on best international practices.	

Institutional Development

SHARED GOVERNANCE

Responsibility Vice President for Development
Units involved Institutional Development Department

	TIMELINE
Task 1: ensure development of shared governance model	
Actions: 1. Organize meetings of the Institute's collegial governance bodies, including Founders, Board of Trustees, Academic Council. 2. Maintain regulations and procedures of the Institute's collegial governance bodies. Prepare proposals and facilitate amendments.	as per schedule established
Task 2: organize rotation of the Academic Council, Committees	
Actions: 1. Prepare and submit a proposal on the Academic Council membership rotation. Ensure a transparent procedure for nominating candidates, involving the Institute's academic community. 2. Rotate the membership of the Academic Council Committees and Expert groups.	as per schedule established

STRATEGIC & ORGANIZATIONAL DEVELOPMENT

Responsibility Vice President for Development
Units involved Institutional Development Department

OPERATIONAL KPIs	2019	2020	2021
SAP UPDATE PERFORMED	+	+	+
CENTERS ASSESSMENT CONDUCTED			+
INSTITUTIONAL REPORTING SUBMITTED	+	+	+
INSTITUTE'S PARTNERSHIP WITH TOP-100 UNIVERSITIES (THE, QS RANKINGS)	1	1	1

	TIMELINE
Task 1: ensure regular update of the Strategic Action Plan	
Actions:	
1. Consolidate proposals for updating KPIs, tasks / actions applying mechanisms of shared governance.	Q2, annually
2. Organize the process of the SAP update ensuring comprehensive justification of amendments.	Q3, annually
3. Submit the updated SAP to the senior management and Board of Trustees' approval.	Q3 – Q4, annually
Task 2: design and facilitate Institute's organizational changes	
Actions:	
1. Establish function (office) responsible for the Institute's organizational development.	Q1 2019
2. Organize and facilitate development and revision of policies and procedures.	annually
3. Set a framework for assessing contribution of the Institute's top-management to achieving SAP operational and strategic KPIs (KPIs maps).	Q1 2020
4. Develop policies on implementing "KPIs maps", pilot the procedures.	2020

	TIMELINE
Task 3: facilitate the tuition fee model implementation	**annually**
Actions: 1. Oversee progress of implementing the tuition fee model. 2. Based on the progress results, elaborate and introduce adjustments. 3. Ensure tuition fee applied to international students.	
Task 4: organize the Centers' external assessment	
Actions: 1. Update the assessment framework accounting for previous reviews and international academic standards. 2. Establish review panels (advisory groups) composed of recognized experts from academia and hi-tech companies. 3. Facilitate assessment process. Based on the results ensure a revision of the Centers' plans for development.	Q1 2021 Q2 2021 Q3 2021
Task 5: monitor and report on the Institutional activities	
Actions: 1. Collect data on the Institutional KPIs, provide reporting to the senior management and stakeholders. 2. Form the common data sets on the Institute's performance for internal and external stakeholders. In cooperation with Strategic Communication team develop visualization approach. 3. Prepare and ssubmit statistics required by the RF legislation.	as per schedule established as per schedule established as per schedule established
Task 6: facilitate partnerships to ensure their alignment with the Institute's vision and strategic goals	**annually**
Actions: 1. Provide support for setting partnerships with Russian and international peer institutions (joint labs, consortia, academic exchange, double degree programs and other forms of cooperation). 2. Promote knowledge exchange with Russian and international universities (partnership events etc.)	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Strategic Communications

Responsibility	Vice President for Community Development & Communications
Units involved	Strategic Communication Department

OPERATIONAL INDICATORS	2019	2020	2021
GROWTH IN SKOLTECH BRAND RECOGNITION AMONG TARGET AUDIENCES	+10%	+10%	+10%
POSITIVE RESPONSE TO STRATEGIC COMMUNICATIONS WITHIN RUSSIA	+10%	+15%	+20%
ACTIVE PROJECTS WITHIN SKOLKOVO EDUCATIONAL HUB	2	2	2
ENDOWMENT	according to the plan		

	TIMELINE
Task 1: ensure liaison with mass media and information coverage of the Institute's key activities, brand advancement among targeted audience	**annually**
Actions: 1. Conduct brand development activities among prospective students, academia, business, general public. 2. Ensure liaison with mass media and PR offices of the Institute's partners. 3. Conduct Campus promotion activities, including organization of press tours and other types of business events with media partners, participation in partners' business events.	
Task 2: implement media projects aimed at attracting targeted audiences and science popularization	**annually**
Actions: 1. Develop and implement special media projects. 2. Manage the media resources, including internet site, official accounts in social media, photo and video storage.	

	TIMELINE
Task 3: ensure marketing and advancement of the Institute's brand	**annually**
Actions: 1. Develop and implement media and marketing campaigns aimed at attracting targeted audiences. 2. Develop, maintain and distribute the marketing materials.	
Task 4: organize and implement activities within Skolkovo Educational Hub, Skolkovo ecosystem	**annually**
Actions: 1. Develop and implement a partnership program, covering joint projects, faculty club meetings, job fairs with Moscow School of Management, New Economic School, Skolkovo Foundation, Agency of Strategic Initiatives, Worldskills Russia et al.	
Task 5: provide organizational support for Institute's events	**annually**
Actions: 1. Provide administrative support and services for organization of scientific conferences, seminars, round tables in accordance with the annual events plan. 2. Ensure organizational support on events and official visits.	
Task 6: support fundraising activities	**annually**
Actions: 1. Organize liaison with target audiences in accordance with fundraising plan. 2. Provide organizational and information support on fundraising events.	

Academic & Technology Excellence

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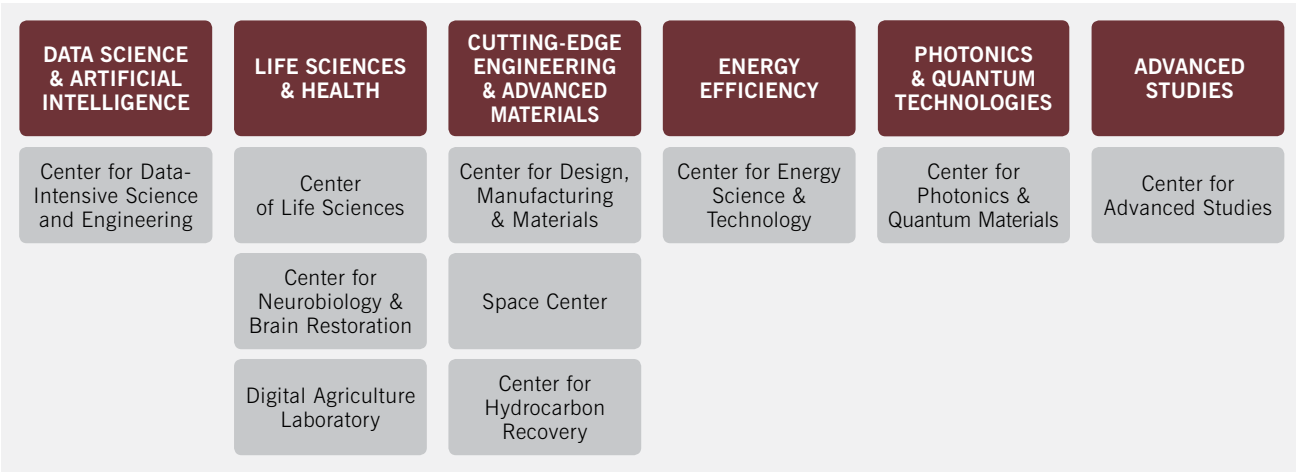
Centers in Target Domains

During the planned period Skoltech will strengthen expertise in Target Domains established based on technology priorities of Russia's and global agenda and experience accumulated. Each domain is a lever for academic & technology excellence as well as a foundation for value generation. The portfolio of Domains includes traditionally strong areas in Russia (Mathematics and Physics), as well as fields of high importance for the future, where Skoltech aims to be an international leader and a continuing source of future leaders for the Skolkovo community, Russia and the world. The thematic areas (research projects) within the Target Domains are identified and driven by the Centers.

Figure 3. Target Domains

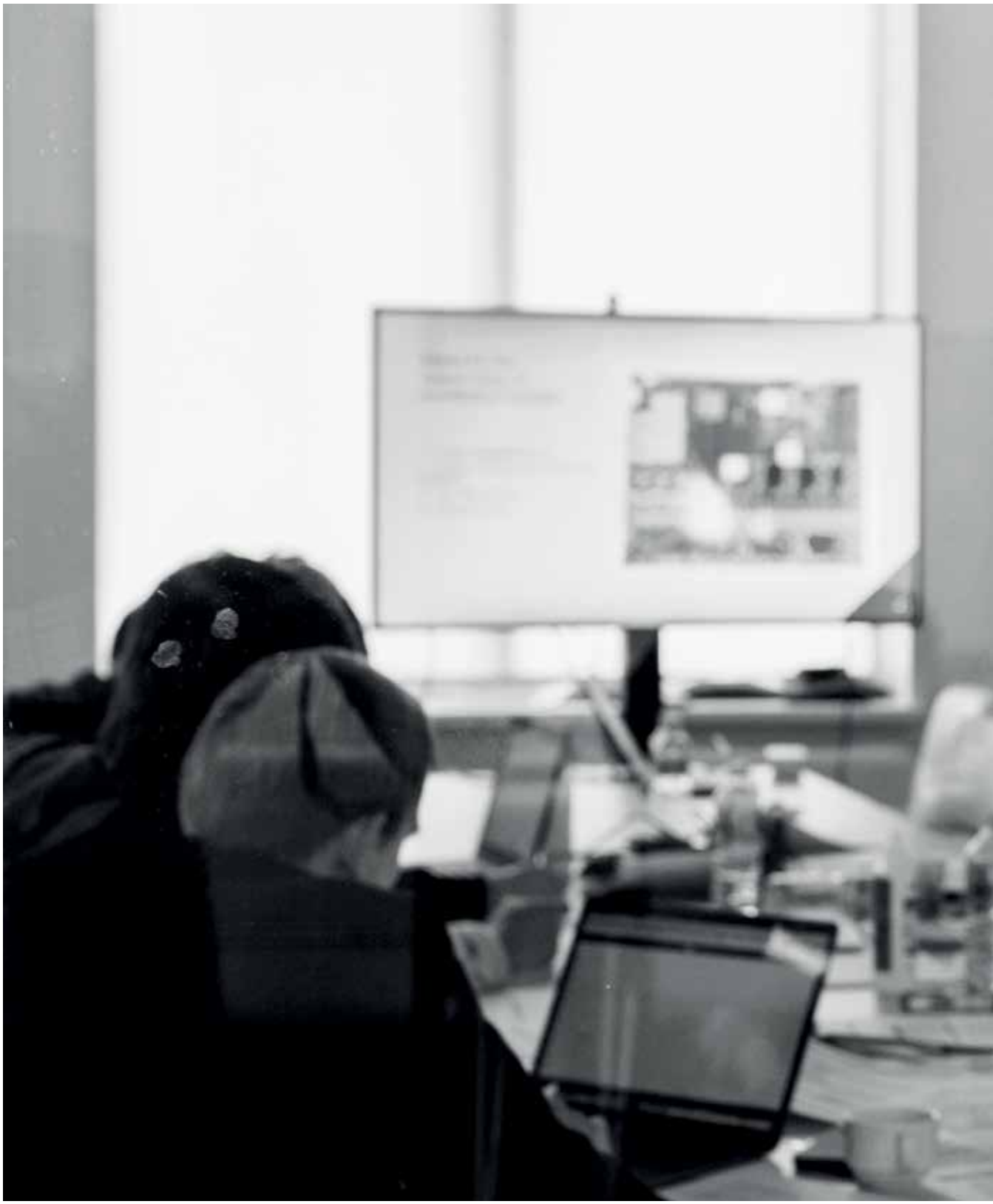


Being a small and flexible institute, Skoltech has a unique advantage to rapidly mobilize, adopt and adapt to even more interdisciplinary, inter-Target-Domain approaches and move into new emerging areas, that aim for innovations, provide leadership, open the way for breakout technologies, attract excellent faculty and students.

This strategy will facilitate the original Skoltech brand-building and boost the Institute's international competitiveness. It will also help to overcome the hurdle, that especially internationally leading scientists are hesitant to come or return to Russia, as they currently see more problems (international image of Russian science, obtaining up-to-date research tools and supplies quickly, etc.).

Finally, this strategy should also be a new way to attract additional funds from international scientific organizations, industry and donors.

DATA SCIENCE
& ARTIFICIAL INTELLIGENCE

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GOOD LUCK :)
#skoltech

Center for Computational and Data-Intensive Science and Engineering

Contributing to Skoltech strategic goals CDISE focuses on achieving academic excellence and making significant impact in the "Data Science & Artificial intelligence" Target Domain. It directs most of its efforts on performing world-class education for the next generation of science, technology and business leaders, and cutting-edge research & innovation in the following Target Areas:

- Artificial Intelligence (AI), especially Machine Learning and Data Mining, Natural Language Processing, Computer Vision, Big Data and their applications; computing techniques for AI; AI fundamentals research;
- Computational Technologies (CT), especially focusing on the development of novel computational and modelling methods capable of taking full advantage of most modern computer architectures, such as massive parallel and quantum computers;
- Information Processing and Transmission (IPT), including Information and Coding theory, Digital Signal Processing, Machine-to-Machine Communications, Internet of Things (IoT) and Wireless technologies.

The above classification is not strict, since all these areas are strongly interconnected and cross-fertilized, in particular by coupling of traditional mathematical modelling and data analysis & collection methods with machine learning.

The CDISE is an alternative to a traditional computer science department; the Center is a computational science center of excellence focused on addressing the challenges of the 21st century (exponential development of computational & communication technologies, generation of large amounts of data, development of AI, etc.) to accomplish a larger goal.

The CDISE mission is to contribute into making Russia one of the leading technological countries in the Target Areas as a catalyzing "knowledge hub" and provider of world-top technical & scientific expertise. The CDISE vision is to be an international academic platform for wide dissemination of knowledge & competences in the Target Areas as well as for development of new ones. There are three core activities for such platform: (i) intensive teaching on international level by MSc, PhD and professional education programs operated by CDISE; (ii) dissemination of expertise and providing advisory services to governmental bodies, industrial, high-tech, scientific and educational organizations; (iii) participation in industrial partners' research & innovation projects.

The strategic goals of CDISE are:

- to become a #1 choice in Russia among the students in the Target Areas (within the peers – STEM departments of HSE, MIPT, ITMO University, Bauman MSTU, Innopolis University);
- to make Skoltech a #1 internationally recognizable University in Russia in the Target Areas;
- to make Skoltech a top influencer (opinion leader) in the Target Areas for industrial, high-tech, governmental and professional organizations in Russia.

To succeed we have to achieve a highest student contest on CDISE MSc and PhD education programs within the peers stated above, a high demand and high level of average salaries of graduates in top technological Russian companies, a number of publications in Q1 journals and A/A* conferences in the Target Areas, presence of CDISE members in relevant governmental committees and international organizations.

To achieve the strategic goals by 2021 CDISE should:

- Develop and update educational programs and tracks to fit core changes in the Target Areas as well as in corresponding areas of the job market on an annual basis; structure, develop and widely distribute of educational materials;
- Attract and retain top-level specialists in the Target Areas; develop center's human capital through training and promotion of the Centre core team of academics, researchers and engineers as well as admin personnel; develop a visiting program for professors and researchers;
- Organize or take part in organization of internationally/nationally recognizable conferences / schools / hackathons;
- Develop joint laboratories with industry, including education-focused joint laboratories;
- Cooperate with CEI and Skolkovo Foundation for knowledge & technology transfer; participate in cross-CREI activities of Skoltech;
- Provide consulting, education & training services to industrial, scientific and educational partners & customers (both internal and external) from other sectors;
- Contribute to technology validation, certification and standardization in the Target Areas;
- Disseminate CDISE expertise to governmental bodies (including ASI, NTI, Digital Economics initiatives), high-tech companies and international organizations (e.g. ISO, UNESCO, IEEE) on topics relevant to Target Areas through participation in relevant committees, working groups, conference/workshop/seminar presentation etc.;
- Perform applied research, participate in large-scale priority governmental projects, create business opportunities in the following directions:

  - Digital Agriculture;
  - Chemical Informatics & Digital Pharma;
  - Digital Oil & Gas;
  - Additive Manufacturing & Digitalization of Metallurgical Technologies;
  - Predictive Technical Maintenance and Industrial Analytics;
  - Telecommunications & Wireless technologies;
  - Robotics & Autonomous Navigation;
  - Big Data Platforms; Web & Text Mining;
  - eSports;
  - Digital Biomedicine;
  - IoT comprising:
    - Industrial IoT;
    - Sensors;
    - Communication Technologies for IoT;
    - Telemedicine.

- Maintain and develop good working & training conditions for all categories of staff and students to satisfy high international standards; relocate to Campus; implement and maintain core laboratory facilities, including IoT laboratory and Center of Excellence, Soil Informatics laboratory, Wireless Sensing laboratory, Biomedical Image Analysis laboratory, Laboratory of mass-spectroscopy, Advanced Computing laboratory, and others;
- Localize all computational facilities in one place; design the Data Center and prepare its engineering infrastructure; develop and operate a high throughput & high-performance computing (HTC & HPC) cluster infrastructure for research & education computation and data manipulation tasks for the Center's staff and students as well as for users from other CREIs; constantly upgrade HPC cluster for it to stay in the top-10 supercomputers of Russia;
- Develop and optimize internal policies and management procedures to achieve high level of both academic excellence and sustainability; develop organizational structure of the Center.

Measurement of strategic KPIs should be defined in annual CDISE operational plan.

LIFE SCIENCES & HEALTH


Plan-AC

Center of Life Sciences

Merging the two Skoltech Biomed Centers into the joint Center of Life Sciences (CLS), with a unified educational program, presents an excellent opportunity for growth in this critically important area. The CLS is developed not only with the consideration of current trends in the world but also taking in mind the limitations inherent to Russia and Skoltech. These include limited research infrastructure, a very limited ability to procure reagents in a timely manner, lack of lab facilities at Skoltech, and uncertainties about financing needed to equip, maintain and operate the labs in future. Newly established neurobiology and agro-technology programs will coordinate efforts with Life Sciences on development of education, research and innovation components in these areas in conjunction with CLS established MS and PhD programs.

The four strategic directions of Life Sciences development at Skoltech are:

- Bioinformatics/Data-intensive Biology;
- Bioactive/Bioderived Products;
- Agro;
- Biomed.

All four areas will be developed in the future, though they will be handled differently because of their current state of maturity at the center.

Given the limitations mentioned above, a significant part of the CLS will continue to be dedicated to Bioinformatics/data analysis. This area is best developed at present. The current group of faculty engaged in this area, Gelfand, Bazykin, Pervouchine, Khrameeva and Ivankov is strong, internationally recognized, and stable. Additional growth in this area is needed to cover underrepresented directions such as structure-based drug design.

Experience around the world shows that bioinformatics must be intimately connected to data generation and experimental research to make a significant impact. Experimental research at Skoltech is less developed for obvious reasons, and next years must be dedicated to aggressive development in this area.

A loosely defined area of Bioactive/Bioderived Products unites scientists involved in research on prokaryotic organisms: Sergiev, Dontsova, and Severinov. This group is very prominent internationally, provides clear value potential (CRISPR, antibiotics). Development in this area will also be an evolutionary one and will specifically rely on bringing in new young faculty from among top graduates of our Ph.D. program. On average, it shall be possible to add one young faculty per year in this area.

The Agro direction is strategically important, but is also very wide, necessitating identifying more narrow areas for targeted development at Skoltech. For the foreseeable future, the main impetus in this area will be in the area of plants and crops. This focus will allow to synergize with the CDISE program in “soilomatics” and will provide opportunities for conducting research with immediate practical importance fulfilling unmet needs of Russian industry in areas such as genome-based selection of crop varieties particularly suited for Russia. Apart from several bioinformatics projects, there is currently no plant research at Skoltech, though we do have a steady stream of students with bachelor degrees in the plant science in our Master program whom we teach by inviting visiting professors from Russian institutions and through collaborations with Tel Aviv and Ber-Sheva universities. We will hire at least two reputable plant scientists as faculty, and secure support for them such that experimental research in plant genetics and plant physiology can be initiated at Skoltech campus by 2020. The first step in this direction is the introduction of plant genetics laboratory course in the academic year 2018 in collaboration with the Russian Academy of Science Institute of Plant Physiology with access to their lab facilities.

While Biomedicine in a broad sense was supposed to be at the core of biology research at Skoltech, it is the hardest area to

make an impact in. Presently, the faculty of CLS who can be considered as practitioners in this field are Zatsepin, Chudakov, and Lukyanov, a recently hired prominent cell biologist, whose presence tremendously strengthens this direction. The trend towards cell biology, as opposed to translational biomedicine per se, is strategically the right one for the center, for currently there are simply no conditions and/or expertise to do meaningful translational research at Skoltech. An evolutionary approach of admitting graduates of top Russian medical schools to our programs and using them as liaisons with these institutions and affiliated hospitals will be the strategy for long-term growth in this area. Both Chudakov and Lukyanov will spearhead this effort. In the meantime, there will be a freeze in hiring in this area, until Skoltech labs and facilities become fully operational and meaningful working partnerships with medical institutions can be developed.

There is already a fair amount of interaction between the Life Sciences faculty as well as with the faculty from other centers. This synergy is essential, and there will be efforts to promote this involving, among others, financial mechanisms such as setting aside special funds for development joint pilot projects involving collaborative projects. As has been the case before, projects involving other Russian universities, particularly happening through network and dual degree programs will also receive extra support. Much of success depends on Skoltech internal grants, which depend on available financial resources.

Several important administrative tasks need to be achieved for the Center to succeed in the long run.

1. Experimental research at CLS should provide top training opportunities for students, but cannot, realistically, compete with premier world centers at least in immediate future. As such, the current scheme of collaborative research, through academic mobility and joint grants programs is the most effective one. This program must be maintained at all costs financial difficulties notwithstanding. It will be made more competitive, through internal application/review process that would stimulate both best students and faculty. The vagaries of doing biomedical research in Russia make it very unlikely that top research-active job candidates will consider Skoltech as a place they will set their labs at. However, the steady stream of excellent Skoltech graduates who received training both at Skoltech and top abroad labs creates a window of opportunity to retain the best of them at Skoltech, first in positions of fellows and then young faculty. These people will become the face of CLS and, in fact, entire Skoltech in the future.

2. The well-equipped Skoltech molecular biology teaching lab allows “reverse” academic mobility – involving foreign students visiting Skoltech to perform research projects there. This practice has proven to be an excellent tool to increase awareness about Skoltech internationally and improve the pool of applicants to the program. The launch of the new campus will allow to extend this practice further. Likewise, the successful summer molecular biology and bioinformatics school for top seniors from Russian universities will become a regular event.

3. The Bio centers suffered from several expensive research contracts with third parties that were set for historical reasons and implementation of which does not contribute nearly enough to Skoltech, its faculty and students. The new contracts of this kind will only be set up in the interest of individual faculty or, preferably, faculty groups, along the model of NGP program.

4. Every faculty, researcher, and student of the center will be encouraged to submit grant proposals to outside agencies to support themselves and their research, to both fulfill Skoltech KPIs and make the financial position of the center sustainable.

These measures will go a long way to make the new CLS a clear leader in Russia and a force to reckon with in the world. The proposed rate of growth of faculty and appearance of operational laboratories will allow the Life Sciences educational program to keep up with existing KPIs and in fact exceed them by taking more students. Further, the broad scope of faculty activities will make it possible to introduce a Bachelor program, something that we envision happening, with approval from the university administration and faculty help, in 2021.

The success of the proposed strategy crucially depends on capital investments into the CLS lab facilities. Until now, thanks to the strengths of the existing faculty team and their extensive professional networks, CLS has generated internationally visible research output as well as built an outstanding educational program in Life Sciences received international accreditation. To maintain the current level of productivity and keep the center position as a leader in the Life Sciences research, steady financial and administrative support is required.


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Center for Neurobiology and Brain Restoration

Neurobiology is one of the most rapidly developing areas of modern biology. World leaders recognized mental health among health priorities within the global development agenda. Factors driving the development of neurobiology are longevity trends with accumulated disorders, a dramatic increase of information pressure on cognitive functions, and appearance of the next-generation bioengineering and high-processing computational technologies. At the same time, disruptions of brain functionality, both developmental and aging-dependent, now lead in terms of social and economic burden across developed countries.

Over the past years, Skoltech has actively developed neurobiology competencies that lead to establishing a dedicated Center for Neurobiology and Brain Restoration (CNBR). The Center's primary mission is to foster basic and cutting-edge applied research in the development of new tools and techniques for preservation, restoration, and expansion of cognitive functions.

The Center will focus on the following main goals:

- Become a key center of expertise, development, and transfer of emerging technologies in the field of Neurobiology and Brain Restoration in Russia.
- Perform cutting-edge fundamental and applied research in selected critical areas of the most prospective research streams in the Neurobiology and Brain Restoration field to generate new tools and techniques for diagnosis, therapy, and prevention of most common, economically and socially valuable cognitive disorders as well as for expansion of cognitive functions.
- Educate next-generation researchers and specialists required to support the development and implementation of new technologies, methods, and applications in Neurobiology and Brain Restoration field.

To achieve these goals, we set the following critical tasks on Center development for years 2019-2021:

A. Establish an Analytical center, to function as a think tank gathering, organizing, and analyzing scientific and clinical information on human cognitive mechanisms, existing technological barriers, and emerging technologies and applications.

B. Set up Research Laboratories to conduct research and development in the critical nodes of research streams identified among the most prospective emerging directions of the Neurobiology and Brain Restoration field. Based on the current assessment, we identified the following four perspective streams that will work synergistically:

   - small molecules in neuromodulation;
   - brain stimulation;
   - brain metabolism;
   - neuroimaging.

C. Establish a base for training and education of researchers and specialists required to support the development and implementation of new technologies, methods, and applications in the area of Neurobiology and Brain Restoration. This effort will be accomplished by:

   a. Setting up multidisciplinary MSc and PhD educational programs, including an MD-PhD track, graduating leaders of research and development tracks;
   b. Additional professional education designed to train specialists for mass implementation of perspective emerging technologies, methods, and applications.

D. Strengthen a national and global partnership network with research, clinical and industrial communities; develop

and enhance sustainable cooperation with national and international industrial corporations and clinics.

Analytical Center

Will focus on the following tasks:

(1) Facilitate Foresight Research and formulate a Strategic Road map summarizing:
- evaluation of existing and emerging trends in the development of technologies, methods, and applications in the area of Neurobiology and Brain Restoration;
- evaluation of the capabilities and limitations of clinical and industrial organizations in implementing novel methods and applications in the area of Neurobiology and Brain Restoration;
- evaluation of legal and ethical trends affecting the application of technologies, methods, and applications in the area of Neurobiology and Brain Restoration.

(2) Select, based on a systematic evaluation of a Strategic Road map, the most prospective research streams for development of emerging technologies on global and national levels.
(3) Identify key nodes of such priorities to conduct research and development with the direct involvement of CNBR.

Will generate:

- *Strategic Road map* of Neurobiology and Brain Restoration existing and emerging directions and trends. The first version will be released in 2020, updated every six months, and systematically revised every three years;
- *Analytical repor*t on the most prospective research streams based on the systematic evaluation of the Strategic Road map.

Perspective Customers: CNBR, state and municipal government bodies (Ministry of Science, Ministry of Health, Labor and Social Policies Ministry, Ministry of Industry, and relevant departments of municipal governments), state development institutions, and pharmaceutical companies, producers of medical materials and equipment, medical organizations and their consortia, business consulting and investment companies.
- *Internal Analytical report* on the most prospective priorities to conduct research and development with the direct involvement of CNBR faculty and research teams.

Research Laboratories

Will focus on cutting-edge fundamental and applied research to generate prototypes of new tools and techniques for diagnosis, therapy, and prevention in selected most common, economically, and socially valuable nosologies.

Research laboratories, working synergistically in four perspective streams set forth above, will generate the following deliverables addressed to selected nosologies:

- *Schizophrenia and other cognitive disorders (bipolar disorders, major depression disorders):*
  - A prototype of the biochemical test system for objective diagnostics of cognitive disorders: released in 2021-2022. Clinical partners: Psychiatric Clinics #1 named by Alekseev, clinics of Russian Rail Ways; Prospective customers: affiliated companies of Russian Rail Ways and Transmashholding; producers of diagnostic test systems or diagnostics laboratories (SPP Diagnostic systems, Ecolab, Invitro).
  - TMS treatment application protocols for Major Depressive Disorder:

released and implemented at several clinical test sites in 2021-2022. Clinical partners and Perspective Customers: the Mental Health Research Center of Russian Academy of Medical Sciences (MHRC), Research Institute of Emergency Pediatric Surgery and Traumatology, Moscow Department of Health.

- *Ischemia in stroke and brain aging:*
  - TMS treatment application protocols: released and implemented at several clinical test sites in 2021-2022. Clinical partner and Prospective Customer: the Mental Health Research Center (MHRC).
  - Synthetic RNA and AAV vectors for gene therapy technology prototypes: released in 2022-2024. Clinical partner: Institute of gene biology. Prospective customers: BIOCAD.

- *Tumors:*
  - Algorithms for improved digital brain mapping and tumor identification and tracking: released in 2020-2021. Clinical partners: Burdenko Clinical center; Prospective customers: BrainLab, MRT-Expert.

- *Autism:*
  - TMS treatment application protocols: released and implemented at several clinical test sites in 2021-2022. Clinical partners and Perspective Customers: The Mental Health Research Center (MHRC), National medical child health research center.

- *Cerebral palsy:*
  - Early diagnostics methods based on biomarker detection: released in 2022-2024. Clinical partners and Prospective customers: The Mental Health Research Center (MHRC), National medical child health research center.
  - Algorithms for efficiency evaluation of physiotherapy-based treatment procedures: released in 2022-2024. Clinical partners and Prospective customers: The Mental Health Research Center (MHRC), National medical child health research center.

- *Alzheimer, Parkinson Disease:*
  - Preventive non-pharmacological therapeutic applications (e.g., specific and ad hoc developed TMS treatments): prototypes released in 2022-2024. Clinical partners and Prospective customers: MHRC, SibGMU
  - Synthetic RNA and AAV vectors for gene therapy: prototype methods released in 2024-2026. Clinical partner: Institute of gene biology. Prospective customers: BIOCAD

The list of deliverables will be expanded systematically based on the selection of prospective priorities according to the Strategic Road map and established cooperation with national and international industrial corporations and clinics.

Educational Program

As first steps, the CNBR educational activities will coordinate efforts with the Center for Life Sciences and Center of Computational and Data-Intensive Science within the framework of established MS and PhD programs.

The educational goals of CNBR include:

- within MS program framework: release up to 20 science, technology, and innovation leaders in Neurobiology with MS degree per year at the Center's full capacity, with the first few graduates released in 2022;
- within PhD program framework: release up of 10 PhD graduates per year at the Center's full capacity, with a particular focus on education of future clinical research leaders though MD-

PhD track, with the first few graduates released in 2024;
- additional professional education courses:
  - courses and lectures for clinicians, health care professionals, and medical companies' representatives, starting from 2020;
  - online courses, starting from 2021;
- popular science lectures and events monthly.

Strengthen a national and global partnerships network

CNBR has already developed the partner clinical network based on long-term agreements or realized projects with team in Clinics the University of South California, Psychiatric Clinics #1, The Mental Health Research Center (MHRC), Research Institute of emergency pediatric surgery and traumatology, Federal Scientific center of child health, National medical child health research center, Scientific neurology center, National medical research center of psychiatry and narcology, National medical research center of neurosurgery named by Burdenko.

Leading faculties and researches of the Center are involved or have already conducted projects with startups and industrial companies: Marlin biotech, BIOCAD, BrainLab (Germany). Some prospective cooperation models are under discussions with the Russian Rail Way group (RRW), Chemrar group. The Center will enhance cooperation with R-Pharm, Pharmstandard and Skolkovo ecosystem: startups like Generium (have R&D and pipeline in Multiple sclerosis), and industrial pharm and medical partners such as AstraZeneca, Sanofi, J&J, Philips innovations Labs, INVITRO, Medci.

CNBR proceeds as an active member of international brain research consortia with BRICS countries, Germany, USA, and others.

Organizational aspect

In 2019-2020, the initial efforts in organizational aspect relate to the development of essential research infrastructure and expansion of faculty and research team.

The Center has established at Skoltech a research base of the small molecules in neuromodulation, brain metabolism, and neuroimaging research streams. Further expertise at these and other streams will be added by recruiting faculty and researchers, as well as through close cooperation with Russian and foreign scientific, clinical, and industrial partners. The planned structure of the Centre in its final configuration will include 11 laboratories: five experimental and six computational. Of them, three currently exist and additional 4-5 are planned to be established before the end of 2021. According to Skoltech relocation schedule CNBR, including existing laboratories located on-premises on 1, Nobel street, will move to the new Campus in Q1 of 2021. There is a space of 1250 sq.m allocated for laboratories and 650 sq.m for office facilities, currently being prepared for design and construction.

The launch of MS, PhD programs, and additional professional education courses for medical personnel is planned for 2020. These require an increase in the number of faculty to a total of at least seven by June of 2021.


thermoscientific
Helios G4 PFIB UXe

Digital Agriculture Laboratory Program

Russian agro segment has made a considerable breakthrough over past twenty years. It is being driven by dozen of major domestic agro-companies in key segments of crop and livestock production. However, the technological underdevelopment of Russian agriculture is a key barrier for further development. The main factors driving the growth of the agro markets are progress in genetics of industrial plant hybrids and animal crosses, feeding and processing optimization and smart irrigation and precise farming and total automation of plant growing and husbandry. The growing importance of data analysis and digital farming tools may ultimately change the business model of seed companies, of animal breeders and meat processing companies, opening new opportunities for R&D in Russia. Skoltech Digital Agro laboratory permits Russian agricultural industry to provide a systemic response to the challenges and emerging technological needs in the most strategical areas as dairy and meat production (beef and pork), cereals and oilseeds production. In the future, it is planned, that the Agrolaboratory will be converted into full CREI in the sphere of agrotechnology with all corresponding transformations.

The Laboratory will focus on the main goals:

- Become a leading expert in Russia in applied multi faced agro technologies and big data on global and national levels.
- Perform cutting-edge applied research in the most prospective cross functional areas – soil, microbiome, plant and animals, technologies for collecting and analyzing agro data, food processing
- Educate specialists in animal and plant breeding with modern molecular and genomic breeding and cell technologies to support the development new genetic resources and technologies

To achieve these goals, we set the following

Key tasks on Lab for a period of 2019-2021:

A. Establish an Analytical agro data center, function for gathering, organizing, and analyzing genetics, biochemical and management information on agro-technology, breeding and poorly structured data for searching. Develop algorithms and analytical tools. Additional direction is a multi-level database for collecting digital information from genetic collections.
B. Set up Research Laboratories to conduct research and development in identified among the most prospective emerging directions of agro technology and agro breeding that will work synergistically:

    - Soil-microbiome- plants models
    - Molecular phenotyping and metabolomics researches
    - Modern molecular and genomic selection in plant and animals
    - Cell and molecular biotechnology studies for plants

C. Establish educational base for training and additional professional education of researchers and specialists required to support the development and implementation of new technologies, methods, and applications in the area of molecular and genomic selection.
D. Strengthen a national partnerships network with commercial breeding companies, research Universities and agro genetic collections, industrial communities.

Analytical agro data center can be organized in collaboration with CDISE. It will focus on the following tasks: identify and formulating Strategic directions for data collection; develop methods and approaches for selection and collection data from different areas and in different manners and formats; development of analytical tools for data processing, data mining and

compilation of breeding indexes and optimal plant crossing patterns; elaborate strategically oriented partnership with global commercial companies and government agencies.

Research Laboratories will focus on cutting-edge applied agro research in different cross-functional areas.

- *Molecucular phenotyping and metabolomics researches*; The direction is proposed to use wide range of precise methods: mass-spectrometry, chromatography, MALDI. Potential industrial partners: Agroplazma, Rusagro
- *Modern molecular and genomic selection in plant and animals*. The direction will conduct all the range of molecular methods. Automatized phenotyping systems will complement researches on base of video analytics and sensors for automative collecting of data. Biotechnology plant part will use different modern protocols for the main agro cultures – soybean, wheat, corn, sunflower. Potential industrial partners EcoNiva, Agroholding Kuban.
  Animal breeding technologies will combine marker-associate and whole-genome sequencing methods, genome evaluation system and development breeding indexes for cattle (including 2 subdivisions – dairy and meat). Potential partners: Miratorg, EkoNiva, Agroholding Kuban.
- *Cell and molecular plant biotechnology laboratory*. Will use the best open sourced protocols and methods – dihaploids, callus culture and protoplast modification. The laboratory will support breeding projects of the Laboratory.
- *Complex soil-microbiome- plants interactions laboratory*. The laboratory will use precise climate greenhouse for combine researches and interactions between soil microbiome and plant. Potential partner: Uralchem – leading producer of agro fertilizers.

Educational Program will be organized with supporting of global Multinational partners (Bayer or Syngenta) and provides organization of regional hubs with local agro universities and research institutes. The program will be structured on three levels from basic biotechnology to advanced methods of genome editing. Will generate the following deliverables:

- *Advanced specialist program: up to 20 specialists a year since 2020, middle level course up to 40 specialists and basic biotechnology program – up to 100 specialists a year.*
- *Partner regional hubs will be localized in main agro macro regions: Siberia, Central Area, South Area and Volga region. Four technology areas planned for trainings: molecular associated selection, genomic technologies, cell technologies, molecular biotechnology and bioinformatics.*

Strengthen a national and global partnerships network

Digital Agro laboratory plans to have a wide partner network with recognized research and educational universities for collaborative purposes. Laboratory already has developed the partner research network with All-Russian Research Institute of Oil crops, All-Russia Rice Research Institute, Stavropol State Agrarian University. Researches of the laboratory are involved or have already conducted projects with startups and industrial companies: “Agroplazma”, “Soybean Complex”, EFKO.

Organizational aspect

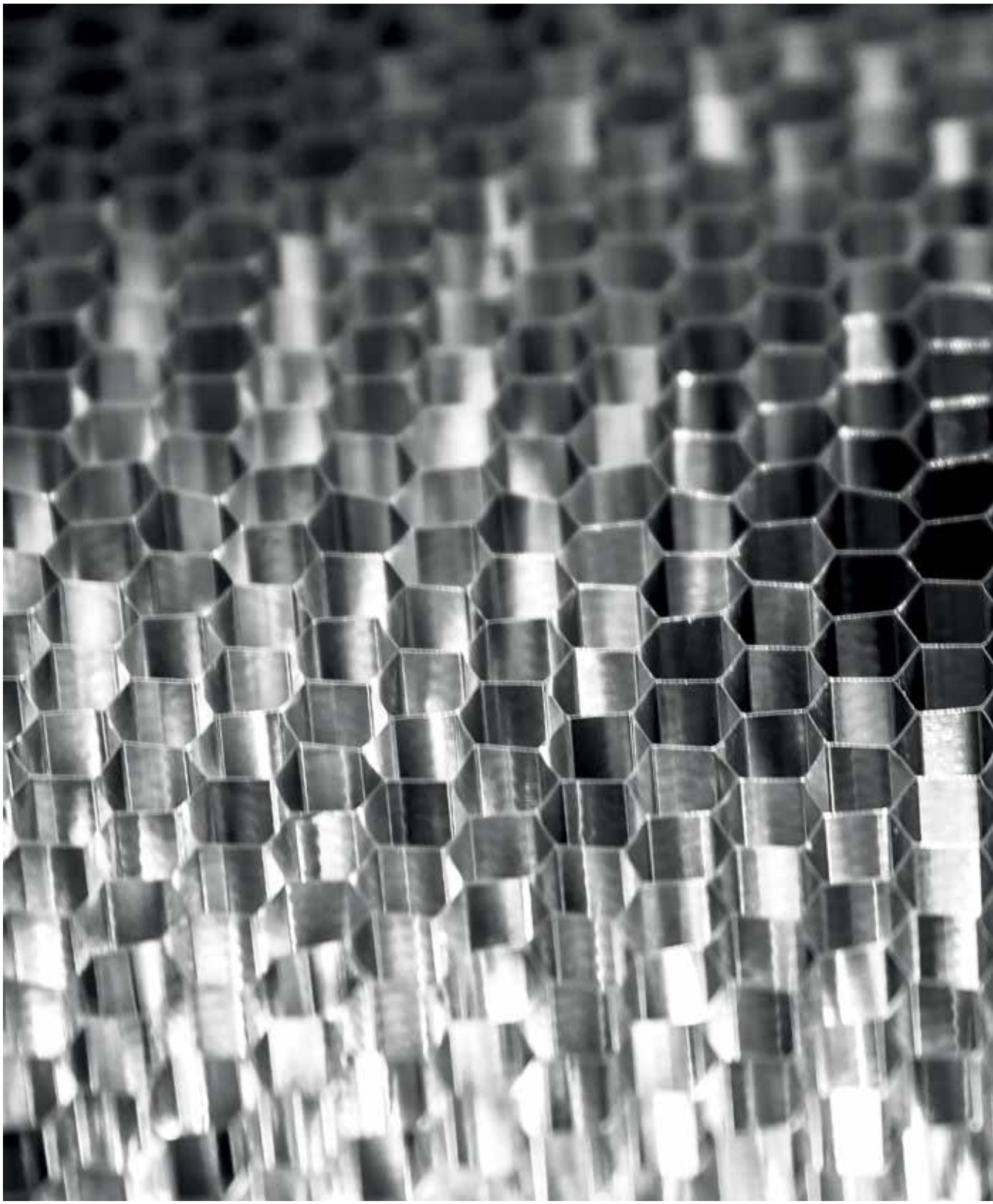
In 2019 – 2020 the main efforts will be concentrated in organizing the core team. According to the expected scenario, the laboratory will hire 5-7 professors in the next 6 months (1-2 professors on animal husbandry, 2-3 on crop production, 1 on digital technologies). This allows Skoltech to generate revenue at level of 60-90 million rubles a year. The external funding is expected to grow by 25-30% over the next

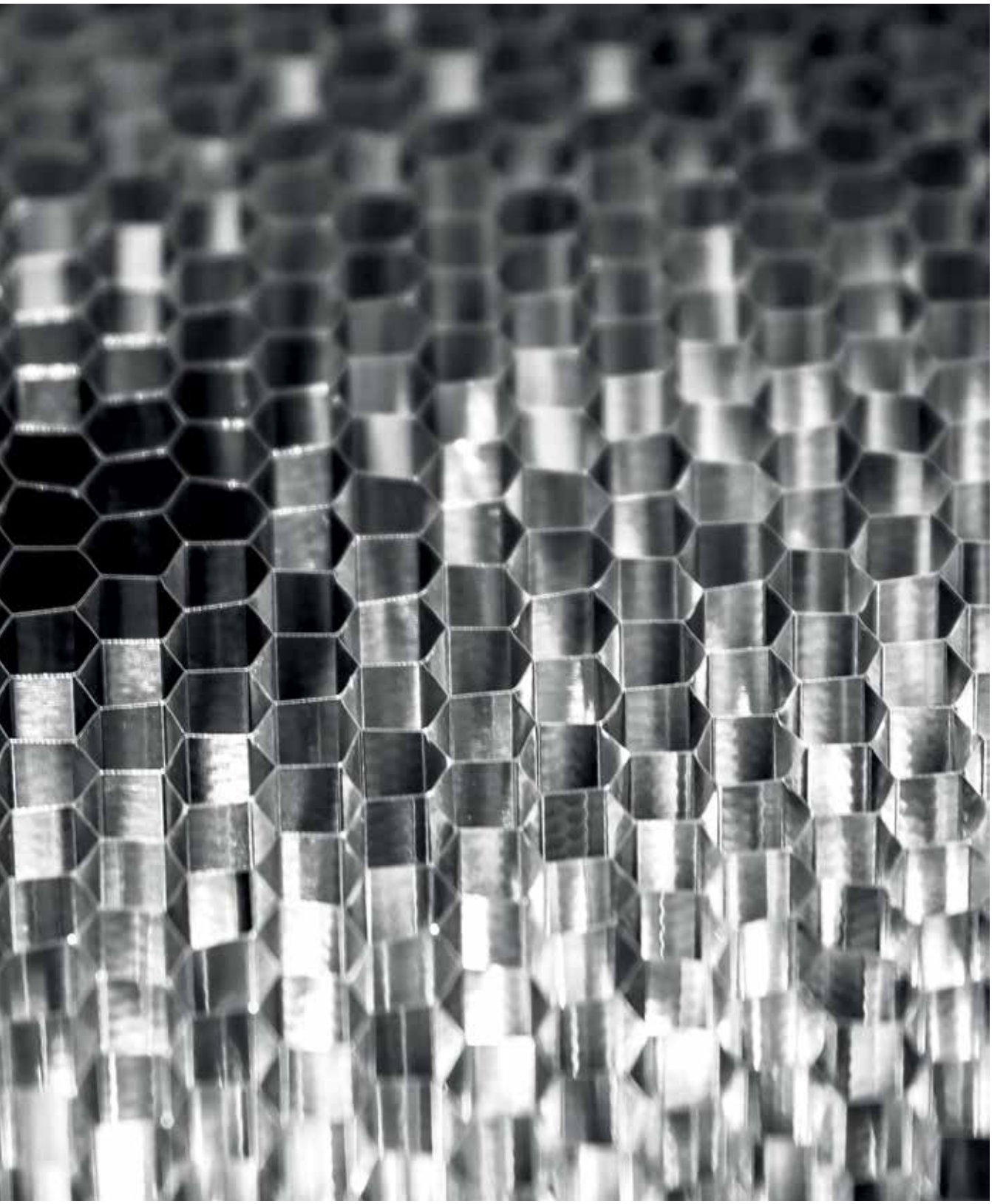
2 years – mainly due to the growth of direct industrial contracts, participation in the FSTP.

Additional external funding will come from the Ministry of Agriculture (in 2-3 Federal research programs subprograms from 12) and the Federal R&D Program of the Ministry of Science in a consortium with industrial partners. The additional expertise as well as sharing equipment is planned within collaborating projects with the CDISE.

The planned structure of the Centre includes 4 laboratories. According to Skoltech construction schedule Laboratory will be located in new Campus. Starting of the own research laboratories plan to be realized by the mid of 2020. There is a space of 550 sq.m allocated for laboratories and 750 sq.m for office facilities, currently being prepared for design and construction. The launch of programs for additional professional education for breeders and specialists is planned in 2020.

CUTTING-EDGE ENGINEERING & ADVANCED MATERIALS





Center for Design, Manufacturing and Materials

The Center for Design, Manufacturing and Materials (CDMM) sets as its primary goals research, education and innovation aimed at selected **key strategic directions** of advanced manufacturing (materials, technologies, processes, digital engineering and management): Polymer-based Composite Materials, 3D-Printing Technologies, Thermal Spray Processes, Digital Design and Manufacturing, and Product Lifecycle Management.

The following **main goals** have been set:

- Research: perform cutting-edge basic and applied research in the key strategic directions of advanced manufacturing.
- Education: educate the next generation of researchers, engineers, and practitioners to assume a role of technical leadership in research and innovation of high-tech sector.
- Innovation and Value Generation: create business opportunities in the key strategic directions of advanced manufacturing in the form of advisory services, shared facilities services, industry-funded research, and new enterprises.

Since the inception of CDMM in 2015, its main efforts were to develop research infrastructure essential to building successful research, education, and innovation program in the key strategic directions of advanced manufacturing.

Five main research laboratories have already been established: Composite Materials and Structures Laboratory, Additive Manufacturing Laboratory, Mechanical Testing and Materials Characterization Laboratory, Information Technologies for Advanced Manufacturing Laboratory, and Micro- and Nano-Mechanics Laboratory.

In addition to these facilities, two new lab modules are planned to be opened in the New Campus. Thermal Spray Lab empowered with Industrial Robots and Advanced Prototyping Lab Module to perform manufacturing process simulation, to conduct material testing and evaluation, and to finally prototype the product. The design for Thermal Spray Laboratory is ready, and the equipment for the laboratory is purchased. The Advanced Prototyping Lab Module will be combined with Information Technologies for Advanced Manufacturing Lab giving rise to a Digital Design and Prototyping Laboratory. Upon completion of these laboratories, the CDMM will become a unique research, education and innovation entity that is not present anywhere in the world.

The next challenge is to attract talented, ambitious junior faculty and postdocs. Over the three years, the plan is to double CDMM faculty, postdocs and researchers, MSc and PhD students and to increase the research productivity. The CDMM is strongly positioned to make this leap, mainly because the key infrastructure and facilities are essentially in place. In particular, the following targets are set:

1. Recruit world-class senior faculty to lead the laboratories for Composite Materials and Structures, Additive Manufacturing, and Thermal Spray.
2. Develop and implement outreach and recruitment strategies that include:
    - engagement of Russian diaspora to identify top junior faculty and researchers
    - establishment of CDMM as a center of excellence with noticeable research and educational programs and highly desirable place of employment
    - targeting top international experts in the CDMM key strategic directions.
3. Strengthen international cooperation.
4. Increase the number of funded research projects.
5. Closely work on targeted national and international image and visibility campaign to promote CDMM, its importance and unique positioning for what is commonly referred to as

Industry 4.0, both internationally and within Russia.

Educational Targets:

1. Increase the number as well as the quality of incoming MSc and PhD students.
2. Make both MSc and PhD programs highly visible, recognized nationally and internationally, significantly demanded.

The following activities are planned:

1. Actively participate in student outreach and recruitment campaign by:
   - extending outreach coverage,
   - continuously improving quality of the educational program, variety of courses emphasizing the interdisciplinary nature of the CDMM educational and research programs
   - continuing outreach activities with active participation in Skoltech events such as Open Doors and recruiting campaign.
2. Expand the interdisciplinary Master's program in Advanced Manufacturing Technologies from three modules to three independent educational tracks in Advanced Manufacturing, Digital Engineering Technologies, Mechanics and Physics of Advanced Manufacturing with each track having synergistic, coordinated, comprehensive curricula, hands-on innovation, research, and industry experiences.
3. Increase the size of the incoming Master's students body to ten in each educational track.
4. Improve the industrial immersion program for Master's students regarding better alignment with the CDMM key strategic directions of research and educational tracks.
5. Increase the size of incoming PhD students to eight each academic year while improving their quality.
6. Expand PhD program in Mechanics to include Thermo-Fluid Sciences and Solid Mechanics.

With the further development of research laboratories, increase in the number and variety of laboratory classes with hands-on experience using state-of-the-art facilities, substantial growth of the number of faculty and researchers, the improvement in course offerings and Master's thesis research opportunities, the initiatives identified above are highly feasible and achievable for the period 2019 – 2021.

Value Generation Targets: With the completion of the state-of-the-art research facilities and the targeted increase of the number of faculty, researchers, MSc and PhD students, the CDMM will have positioned itself to take on the next challenge to become an internationally recognized center of excellence in advanced manufacturing that attracts researchers and industry from all over the world and bridges the gap between fundamental/applied research and industry. To achieve this objective, the following strategic value-generating initiatives are planned:

1. Form partnerships with industrial companies by utilizing unique research facilities and faculty expertise.
2. Develop self-sustaining mechanisms to provide measurement and simulation-based certification, high-tech standardization services to government agencies, institutes, and industries by utilizing unique facilities and technologies available in the CDMM laboratories.
3. Become a leading expert in Russia in the areas of Advanced Manufacturing, Industry 4.0, including cutting-edge technologies within National Technology Initiative.
4. Develop policies, tariffs, budget recovery mechanisms for Mechanical Testing and Materials Characterization Laboratory to be used as a shared facility.
5. Increase the number of industry-funded research projects.
6. Increase participation in research projects in collaboration with industrial partners.
7. Strengthen international cooperation.

Center for Hydrocarbon Recovery

The Center for Hydrocarbon Recovery (CHR) has been created by the decision of the Skoltech Board of Trustees in 2014. Primary goal of the CHR is to provide world-class research, education, and innovations in the area of exploration and production of unconventional and hard-to-recover hydrocarbons. The Center's aim is to establish Skoltech as a leader in education and technology development and Russia's future needs in the area of exploration and production of hydrocarbons.

Main areas of the CHR activity in research, education, and innovation are geomechanics, enhanced oil recovery, geophysics and petrophysics of unconventional reservoirs, gas hydrates and permafrost, advanced reservoir simulations and data science in application to oil and gas industry. The research efforts are focused on the development of new technological solutions in exploration and production of hydrocarbons at such geological objects as brownfields, tight oil, heavy oil, shale oil, oil fields in polar regions and Arctic shelf.

Following Skoltech strategy, the CHR develops collaboration with world-leading universities including University of Calgary (Canada), Heriot-Watt University (Scotland) and others. Among our university partners are famous Russian universities such as Lomonosov Moscow State University, Bashkir State University, Gubkin Russian State University of Oil and Gas, and the Institutes of Russian Academy of Sciences.

MSc education program has been developed in collaboration with university partners, and was adapted for the needs of Russian industry and accredited in accordance to the Russian Federation legal procedures.

Research facilities of the CHR, which are unique not only for Russia, include experimental laboratories focused on research in the areas of advanced petrophysics and geochemistry, geomechanics, enhanced oil recovery gas hydrates, and permafrost.

The Center actively develops collaboration with industry in different forms, including R&D and service contracts, research consortia, joint grants with government and other. The industry partners are leaders in Russian oil and gas sector, including Gazprom Neft, Gazprom, Lukoil, Rosneft, Tatneft, Novatek and other oil and gas producers and service companies. A considerable part of the CHR budget comes from collaboration with industry. It is expected that in 2019-2021, depending on research direction, from 20% to 90% of operational costs of research subdivisions of the center will be financed from external sources (50% in average).

Space Center

Space Center research supports space exploration efforts to address current societal challenges and changing nature of today's complex systems. One of the challenges is to provide knowledge and capabilities for the new digital economy, while addressing issues in autonomous systems, artificial intelligence and increased levels of interconnectivity.

The Center focuses on exploring new approaches for system concepts, implementation and operating of complex systems through their lifecycle. The activities are divided into three main directions:

1. Strategic thinking (technology design and management)
2. Advanced engineering (space hardware and robotic systems)
3. Complex systems applications (commercial applications and scientific exploration)

The goal of *the strategic thinking* direction is to design space systems, products and services using comprehensive and rigorous systems engineering methodologies and tools. Domain neutral themes include systems engineering, concurrent engineering, and technology planning and roadmapping methodologies that are applicable to complex engineering systems across various disciplines. Domain specific themes encompass the development of federated space systems and new space instrumentation for telecommunications and remote sensing.

The goal of the *advanced engineering* direction of the Space Center is development of advanced methods and tools for design of aerospace systems to reduce costs and shorten development time, as well as implementation of terrestrial and space robotic systems. The Center is focusing on interactions and interfaces between space, atmospheric (HAPS) and near-ground (UAV) systems. The Center plans to develop technologies with a relatively high risk on small satellite platforms. In the long run, applications of complex system will drive strategic thinking and new developments, therefore closing the loop.

The goal of the *complex system applications* direction is to develop space-data driven applications and services fostering the synergies and interdependencies between space science, engineering and industry. To achieve the goal, advanced methods to exploit space data derived from various space systems and application fields are developed, including satellite imagery and communications, satellite navigation, remote sensing and in-situ data of space weather and its effects on space-borne and ground-based technological systems.

In Education, we aim to create highly competitive program in Systems Engineering with specializations in space and robotics systems. Core classes are built around the concept of Model Based Systems Engineering with an intense project-based practical component. Courses start with Fundamentals of Systems Engineering, then basics are applied during Spacecraft and Mission Design class and finally new projects can be created during the Space Sector class, where students are asked to create their own value generation projects.

The Space Center will continue to actively work with two sources of industrial funding – NTI and large industries, including RosCosmos, United Aircraft Corp and others. To initiate partnerships with large Russian industry, we're developing a set of continuing education courses, to promote our approach. In the long term, we plan that our services will be needed in large industrial projects.

ENERGY EFFICIENCY

Center for Energy Science and Technology

Research within CEST consists of five main thrusts (see below) and a cross-cutting thrust on computational materials that parallel key areas of global trends, market forecasts, anticipated industry size, expected growth, and targeted opportunities by 2025-2040.

The factors driving the growth of the energy conversion and storage markets are progress in renewable energy power generation, rapidly increasing grid scale energy storage market, drop in prices of metal-ion and redox flow batteries; and the growing applications of energy conversion and storage technologies in various end-user industries.

As of 2015, over 120 nations worldwide have undertaken the initiative of generating power through renewable energy sources and its storage in a cost-efficient manner. In terms of leveled cost basis, renewable energy sources such as solar and wind is expected to contribute significantly in the coming years in comparison to conventional energy sources such as coal, nuclear or gas. This trend is expected to continue in the long term as the cost for renewable energy sources would continue to fall.

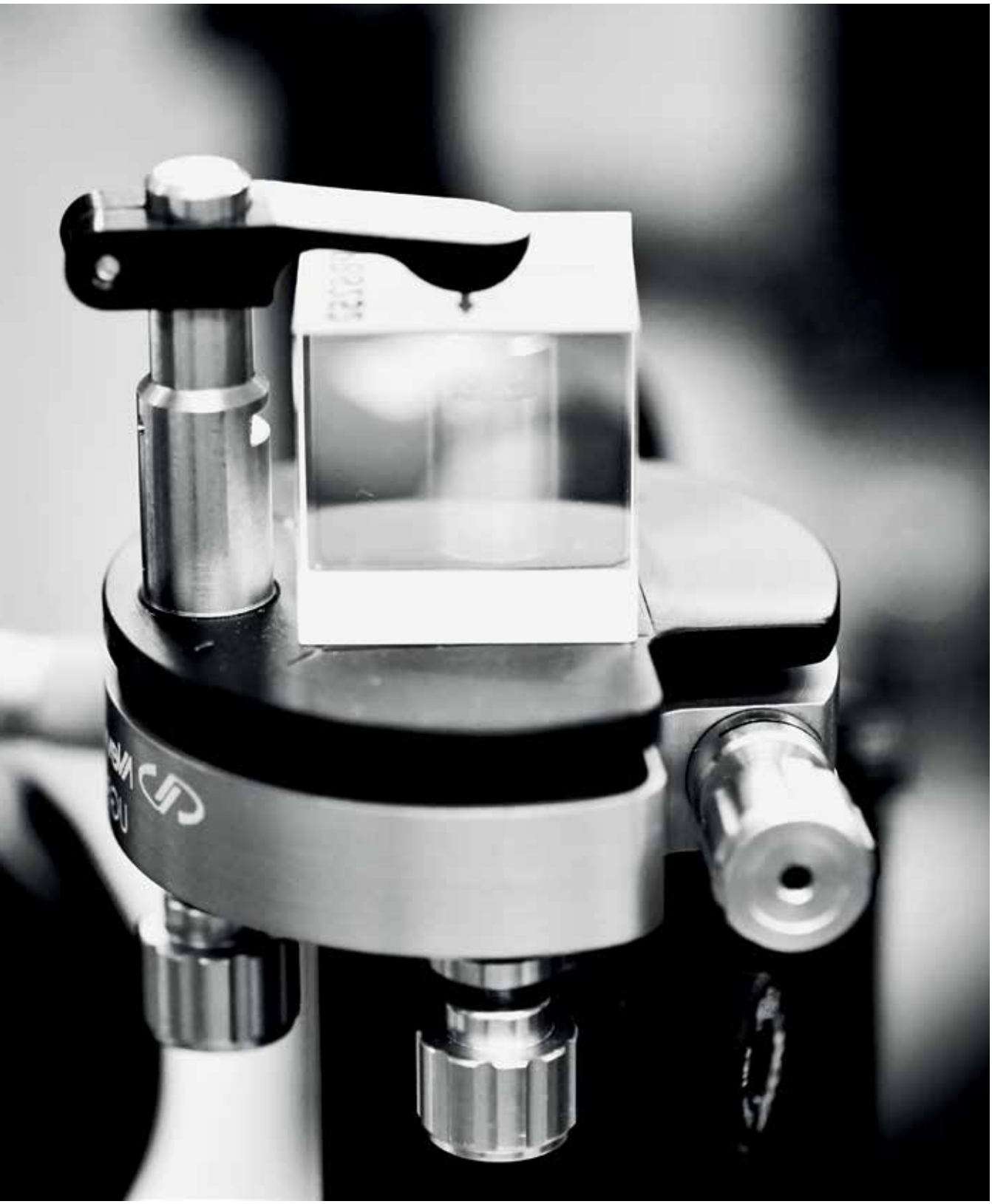
Energy conversion and energy storage help in lowering the cost of a power system infrastructure such as transformers, distribution and transmission lines through load levelling during peak time. Both Solar Energy Conversion and Electrochemical Energy Storage, are essential components of integrated and diversified energy systems including smart micro-grids; A diversified energy system is a key driver for the growth of energy conversion and storage markets and can also be used to enhance frequency control capability and market regulation.

In energy systems area, the main drivers for research are a strong trend towards distributed (and renewable) energy sources, radically changed characteristics of the power system due to replacement of traditional power stations by renewable ones, increased engagement of consumers who become prosumers (producers or consumers, depending on energy price), interactions between power, heat and gas networks and increased penetration of energy storage and microgrids. Accommodating those changes can be made easier by significant advances in sensing (mainly Phasor Measurement Units (PMUs) enabling fast, accurate and GPS-synchronized measurements of power, current and phase and power system communications. The dramatically changing characteristics of energy systems require development of new methods for energy system analysis and control while expansion of microgrids requires advances in power electronics (new generation of inverters) and in analysis and control. While energy markets are becoming more mature, new technologies potentially more suitable to distributed energy markets are being tested such as blockchain. The trend towards creating regional grids requires new tools for optimizing connections (transmission expansion) and for allocation of costs and benefits between the countries participating in regional grids.

With a keen focus on emerging areas the CEST concentrates on the following:

Thrust 1. Electrochemical Energy Storage (Stevenson, Abakumov, Antipov, Korsunsky, Troshin, Zhugayevych)
Thrust 2. Electrochemical Energy Conversion (Stevenson, Abakumov, Antipov, Troshin)
Thrust 3. Solar Energy Conversion and Storage (Troshin, Stevenson, Zhugayevych, Tretiak)
Thrust 4. Smart Energy Grids: Systems and Devices (Bialek, Bischi, Ouerdane, Dymarsky, Vorobev, Gryazina, Pozo, Ibanez)
Thrust 5. Energy Markets and Regulation (Pozo, Bialek, Gryazina)
Cross-cutting Thrust. Computational Energy Materials (Oganov, Zhugayevych, Buchachenko, Tretiak, Shapeev, Levchenko)

PHOTONICS & QUANTUM TECHNOLOGIES



Center for Photonics and Quantum Materials

CPQM is the only physics-oriented Skoltech CREI responsible for the Target Domain *Photonics & Quantum Technologies*. The Center carries out fundamental and applied research aiming to foster transition from current electronic paradigm of signal processing and computations to new promising approaches based on integrated optic/optoelectronic components and disruptive quantum technologies. This technological challenge is understood throughout the World, with an increasing funding of research in the fields of Photonic Technologies, Quantum Materials and Quantum Technologies. CPQM research in Quantum Materials (2D materials, superconductors, semiconductors, quantum-coherent systems) is mainly of fundamental nature, whereas the photonics agenda of the CREI is focused on applications. Such a structure of the Center is intimately dictated by the logic of technology development when a new achievement is often based on the use of a new class of materials whose physical properties are to be described and understood.

Considering existing demands on high-tech technologies, CPQM focuses on the following principal research streams:

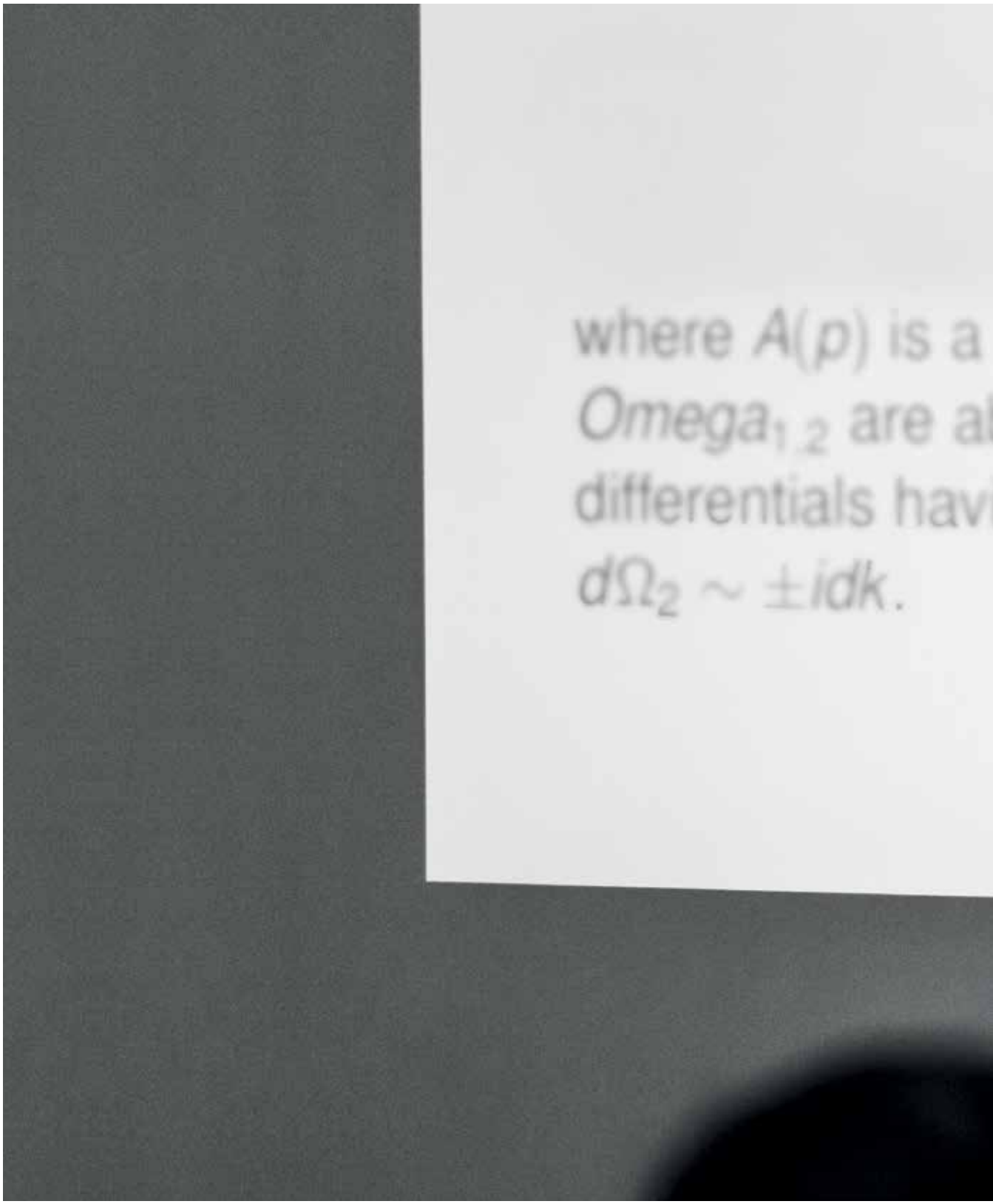
- Novel quantum materials (V. Antonov, A. Nasibulin, V. Perebeinos)
- Superconducting quantum technologies (V. Antonov, O. Astafiev, M. Skvortsov)
- Complex quantum systems (B. Fine, M. Skvortsov)
- Information and communication technologies (I. Gabitov, F. Kueppers, A. Shipulin)
- Sensing and metrology (O. Astafiev, V. Drachev, A. Shipulin, F. Kueppers)
- Nano- and biophotonics (V. Drachev, N. Gippius, D. Gorin)
- Hybrid photonics (N. Berloff, P. Lagoudakis, S. Mailis)

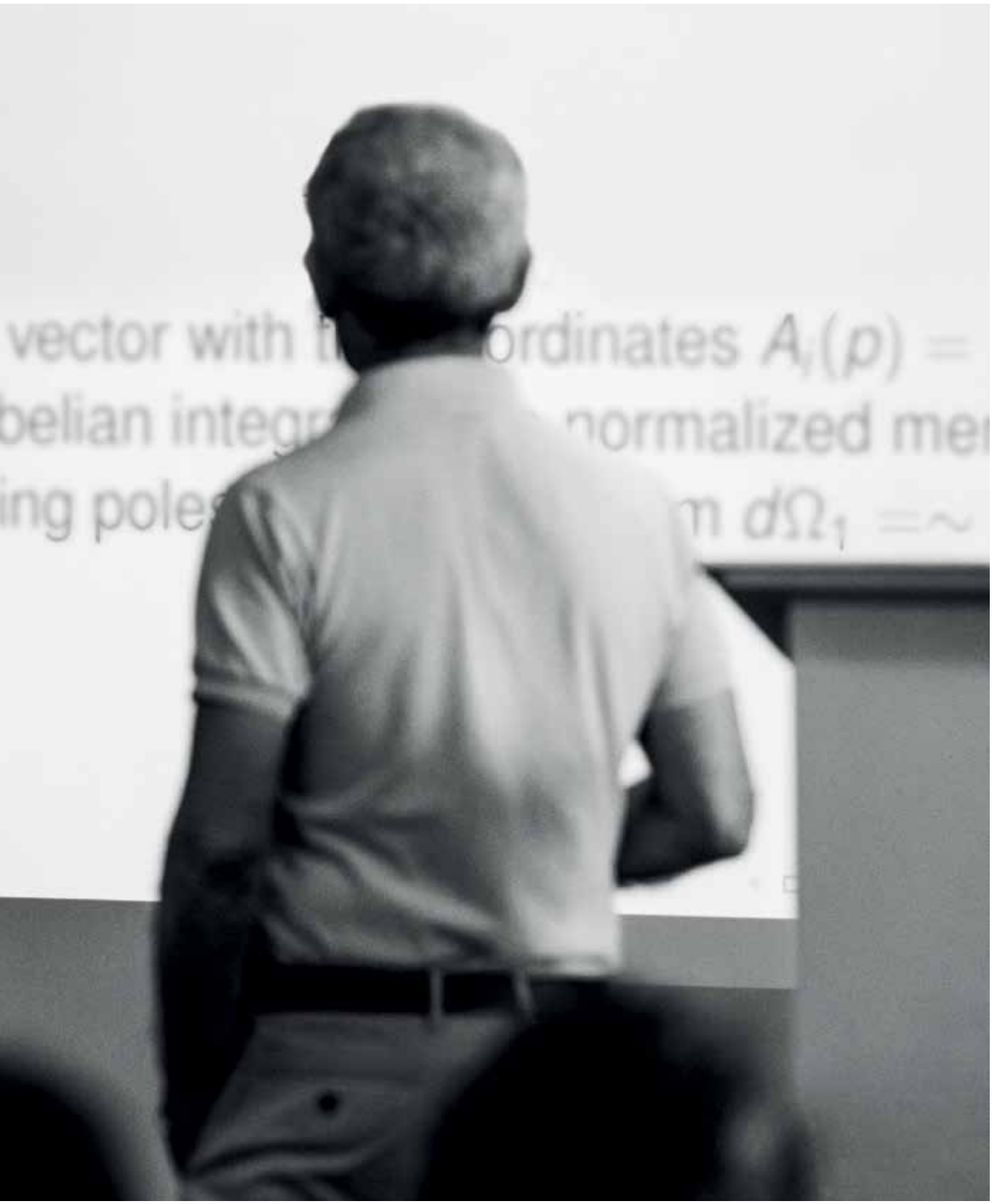
CPQM has established several R&D directions in the field of applied photonics as a response to the respective top-rank federal programs. Two major industry-oriented projects are currently being implemented (Integrated radiophotonics and Space atomic clock), and several projects are in the planning and/or negotiation phase. A start-up company CryptoChemistry Ltd. was established in 2017 as a Nanomaterials Laboratory spin-off. In order to strengthen the CREI agenda in Quantum technologies, CPQM is planning to establish Superconducting Quantum Technology laboratory that will conduct fundamental and applied research in quantum information processing and related applications. The low-temperature lab will provide scientific and engineering support for physics-related MSc and PhD programs in the field of Photonics & Quantum Materials. Several new R&D laboratories will address the emerging needs in applied photonics technologies.

At the education side, CPQM has developed the MSc program in Photonics and Quantum Materials and PhD program in Physics, which are licensed and accredited by the Russian Federation. The MSc program is realized in the network form with the Moscow Institute of Physics and Technology and Saint Petersburg Academic University. The core curriculum of the educational programs will be further modified to meet the needs of both research (quantum technologies) and innovation (applied photonics) components of the Center.

In order to attract the best-motivated MSc students, the concept of the Undergraduate Research Opportunity Program (UROP) has been developed and approved by the Academic Council. The goal of the Program is to select talented and ambitious undergraduate students from partner organizations, nurture curiosity and provide access to advanced courses and multidisciplinary research environment, extend enthusiasm for conducting research in different fields, thus shaping the pipeline to Skoltech MSc programs. The launch of the pilot UROP in Physics is planned for 2019.

ADVANCED STUDIES





Center for Advanced Studies

The strategic goal of the Center is the implementation of its stated mission: to develop the tradition of worldwide excellence of Soviet and Russian mathematics and theoretical physics schools, and foster new generation of scientists by integrating education and research, and creating an innovative model of education, which will allow to include Russian and international leading scientists into educational process.

Research within CAS CREI is focused mainly on the areas of geometric representation theory, string theory, conformal and gauge field theory, integrable models, combinatorics and singularity theory, symplectic geometry, topology, statistical physics, dynamical systems, hyperbolic geometry.

The composition of CAS consists of 12 professors, 5 visiting professors (E. Arbarello, University "La Sapienza", Rome; A. Braverman, Toronto University and Perimeter Institute; A. Okounkov, Columbia University, New York; S. Smirnov, Geneva University and A.Zorich, Paris), who contribute to research and educational activity of the Center. In addition, the composition of the Center includes one senior research scientist and four research scientists. At present, the composition of the Center is well balanced in terms of age distribution. In coming years, the Center's goal is to be opened for "targets of opportunity", but at the same time- to increase efforts for attracting "rising stars".

In 2015-2018, over 40 publications indexed in Web of Science, Scopus were published in high impact factor journals or appeared in the press. The CAS faculty are highly visible organisers and participants in international conferences.

Excellence in research is a key for success in the realisation of the second component of the Center's mission – *educational program*. The program has started in September 2017. Currently, the program offers 19 courses. As a part of its 'pilot' elements, the first Master and PhD students were transferred to the program during the academic year 2016/2017. Their choice proved to be extremely successful: 3 out of 6 PhD students were awarded "Young Mathematics of Russia" prize. That achievement is a benchmark for a further generation of students which the Center would like to see.

However, competition for such students is tough because the Center competes not only with Russian institutions but with the best US and European Universities.

In short terms, any competition with Harvard, MIT, Princeton, Columbia and their peers might seem hopeless, but in the long run, it might turn beneficial for all sides. A possible strategy is to create joint programs between Skoltech and western partners. Currently, the Master program of the Center is a joint program with the MA program "Mathematics and Mathematical Physics" at HSE, and in coming years it will extend towards MA programs of MPTU. An attempt to create a joint program with any of above-listed Universities is not an extension it is a *quantum leap* in the organisation of education. At this moment it is hard to predict if such an ambitious goal can be achieved but arguments, which prove its partial success, do exist.

The first and the most important argument is close scientific relations of the current Center members with their Russian speaking partners in the best US Universities. For example, the Center team – Prof. Olshansky, Prof. Braverman, Prof. Finkelberg, Prof. Shlosman, Prof. Krichever might form a joint program with MIT team – Prof. Borodin, Prof. Etingof, Prof. Bezrukavnikov, Prof. Gorin (+ Prof. Gaitsgory, Harvard and Prof. Corvin, Columbia).

An essential step towards this goal was 2019 Summer School in Mathematical Physics where Andrey Okounkov, Nikita Nekrasov, Roman Bezrukavnikov, Alexander Braverman will gave courses. The School attracted students from the best Universities over the world.

Among the long-term objectives of the Center, there is an extension of the research areas to include some closely related fields in condensed matter: the theory of topological

insulators and other topologically nontrivial structures. Another direction is algebraic geometry with all its diversity and discrete geometry with emphasis on integrable models.

Internal Skoltech goal and prospective development of the Center is to become a full-scale partner for all other CREI's responsible for a mathematical component of their Educational programs. That includes the creation and delivery of new courses upon requests of these programs.

The steady state of the Center needed for the achievement of all these goals is seen as 15 senior members + 10 postdoc level positions + 5-7 associated international members.

Research Excellence

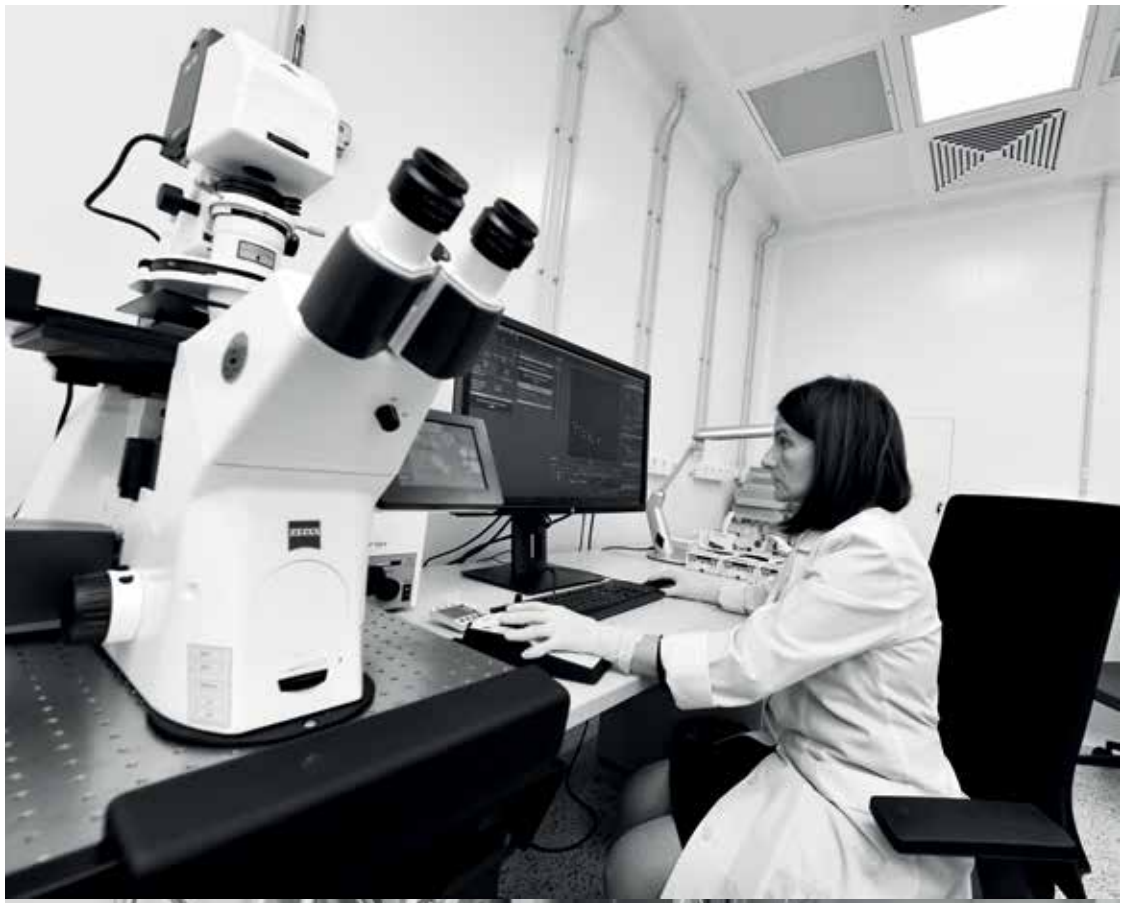
Responsibility Provost
Units involved Research Department

OPERATIONAL KPIs	2019	2020	2021
ATTRACTED GRANTS, MLN RUB (CONTRACTED)	240	270	305
FUNDS ATTRACTED BY SHARED FACILITIES (MLN RUB)	36	62	100
INTERNAL (SKOLTECH)[4]	20	29	43
EXTERNAL (NON-SKOLTECH)	16	33	57
SHARED FACILITIES IN OPERATION:			
GENOMICS CORE FACILITY	+	+	+
FABLAB AND MACHINE SHOP	+	+	+
ADVANCED IMAGING CORE FACILITY	+	+	+
MICRO- AND NANOFABRICATION CLEANROOM (INTEGRATED PHOTONICS)			+[5]
BIOIMAGING AND SPECTROSCOPY CORE FACILITY	+	+	+
ADVANCED MASS SPECTROMETRY CORE FACILITY	+	+	+
DATA STORAGE AND PROCESSING CLUSTER	+	+	+
STRATEGIC PARTNERSHIP PROGRAMS	+	+	+

	TIMELINE
Task 1: facilitate attraction of research grants from national and foreign agencies	**annually**
Actions: 1. Monitor national and international grant programs, inform academic personnel on the possibilities for applying. 2. Provide support on preparing and submitting grant applications. 3. Oversee grant projects, maintain database, provide data on ongoing and past projects.	

[4] Attracted to CREIs and reflecting the amount of shared facilities contribution
[5] Subject to allocating budget for lab construction in 2020.

	TIMELINE
Task 2: facilitate research infrastructure development, incl. shared facilities	**annually**
Actions: 1. Coordinate development of Skoltech research infrastructure. 2. Plan purchasing and facilitate installation of shared equipment. 3. Develop policies, tariffs and budget recovery mechanisms as part of shared facilities financial model. 4. Deploy core facilities management software. 5. Promote services of shared facilities externally.	2019 2019–2020
Task 3: organize and manage strategic partnership programs	**annually**
Actions: 1. Support design and implementation of strategic partnership programs with MIT, Technical University of Munich, other partners; ensure duly selection of topics and proposals for support (e.g. Calls for Ideas, Call for White Paper etc). 2. Maintain ongoing programs, ensure regular assessment.	

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Teaching & Learning

Responsibility Dean of Education
Units involved Education Department, CREIs, CEI

OPERATIONAL INDICATORS	2019	2020	2021
MSC AND PHD STATE ACCREDITED PROGRAMS, NUMBER	15	15	15
PHD PROGRAMS WITH INTERNATIONAL ACCREDITATION, NUMBER	1	3	3
PHD GRADUATES RECEIVING A PHD DEGREE, %	80	85	85
HIGH-TECH COMPANIES INVOLVED IN STUDENTS TRAINING (INDUSTRIAL IMMERSION, PROJECTS, GUEST LECTURES, ETC.), NUMBER	120	150	150
EDUCATIONAL ELEMENTS (INCL. EXTRA-CURRICULAR) FOR SOFT SKILLS DEVELOPMENT INCLUDING IN COLLABORATION WITH PARTNERS IN THE FRAMEWORK OF SKOLKOVO EDUCATION HUB, NUMBER	15	20	20
EDUCATIONAL ELEMENTS FOR ENTREPRENEURIAL SKILLS DEVELOPMENT, NUMBER	15	20	20
COURSES ACTIVELY SCAFFOLDING BY LMS, %	75	80	80
STUDENTS PARTICIPATING IN COURSE SURVEY, %	85	90	90
LIBRARY RESOURCES: BOOKS AND E-BOOKS / FULL-TEXT DOCUMENTS' DOWNLOADS FROM LIBRARY DATABASES, NUMBER	1 800 / 36 500	2 500 / 50 000	2 700 / 64 000

	TIMELINE
Task 1: develop globally competitive academic programs	**annually**
Actions: 1. In collaboration with the High Council for Evaluation of Research and Higher Education implement procedure of international accreditation of academic programs and Skoltech as an institution. 2. Finalize Skoltech PhD programs' development. Contribute towards official recognition of Skoltech PhD degree within Russian legal framework. 3. Implement education quality assurance system including self-assessment of academic programs, regular students' surveys. 4. Design and implement pilot undergraduate programs in Science, Technology and Engineering.	

	TIMELINE
Task 2: implement new technologies and practices to educate centennials	**annually**
Actions: 1. Increase active teaching methods and technologies to substitute traditional passive lecturing. Integrate “Learning by Doing” and “Learning by Teaching” to provide more personalized educational trajectory for each student. 2. Encourage students’ team projects under mentorship of junior research staff, PhD students and postdocs.	
Task 3: create a unique student favorable educational environment	**annually**
Actions: 1. Maintain Learning Commons. 2. Develop e-library and virtual resources, digital tools, eLearning to encourage Digital Learning Commons. 3. Implement a Learning Management System.	
Task 4: foster students’ success	**annually**
Actions: 1. Expand and enhance entrepreneurial skills to secure students’ career development, driven by entrepreneurial spirit. 2. Support soft skills development via curriculum and extra-curriculum activities. 3. Activate student academic mobility in world’s leading universities and research centers.	

Integrating Innovation

Skoltech graduates will each follow different paths in life. Whichever they choose and in addition to their technical skills, all will require a similar set of basic foundational skills to be successful innovation and technology leaders set forth in Skoltech's mission.

The Center for Entrepreneurship and Innovation (CEI) was created to support Skoltech in accomplishing its mission "… to have …economic impact in the Russian Federation and around the world by accelerating innovation: building integrated research and innovation programs to effectively meet the needs of industry and society and educating graduate students to be leaders in translating knowledge from science to innovation".

The CEI has a goal to support Skoltech to become a catalyst in Skolkovo ecosystem, an engine of economic growth by teaching students and faculty knowledge, skills and developing attitudes, necessary in entrepreneurship and innovation, engaging them in E&I activities, building links between Skoltech and E&I ecosystem in Skolkovo, Russia and internationally, and by accelerating research outcomes toward commercialization and broader social impact.

The CEI track should provide a cross-section of basic "core" skills in the 6 key success areas. Electives then add depth in areas of specific interest. Each thesis contains an innovation component, to be signed off by a CEI professor. Successfully restructuring CEI depends on clarifying what role it should take at Skoltech in light of Skoltech's innovation mission. At a minimum, CEI should be a mandatory "track" for all Skoltech students (differentiator!). As capabilities increase over time, degree minors and (dual-) degrees could be considered.

Responsibility	Vice President for International Business Affairs, IP Vice President for Industrial Cooperation
Units involved	CEI, CREIs, Industrial Programs Department

OPERATIONAL INDICATORS	2019	2020	2021
INNOVATION WORKSHOP	+	+	+
% OF GRADUATES INVOLVED IN INNOVATION ACTIVITIES, INCL. SKOLKOVO STARTUPS	–	+5%	+5%
TRANSLATIONAL RESEARCH PROGRAM	+	+	+
COOPERATE WITH THE SK FOUNDATION VIA SELECT PROGRAMS	+	+	+
DEVELOP AND IMPLEMENT EARLY STAGE ACCELERATOR WITH OUTSIDE PARTNERS	+	+	+
INCREASE IN NUMBER OF NEW STRIP PROJECTS*	7	10	13

* subject to the future budget availability.

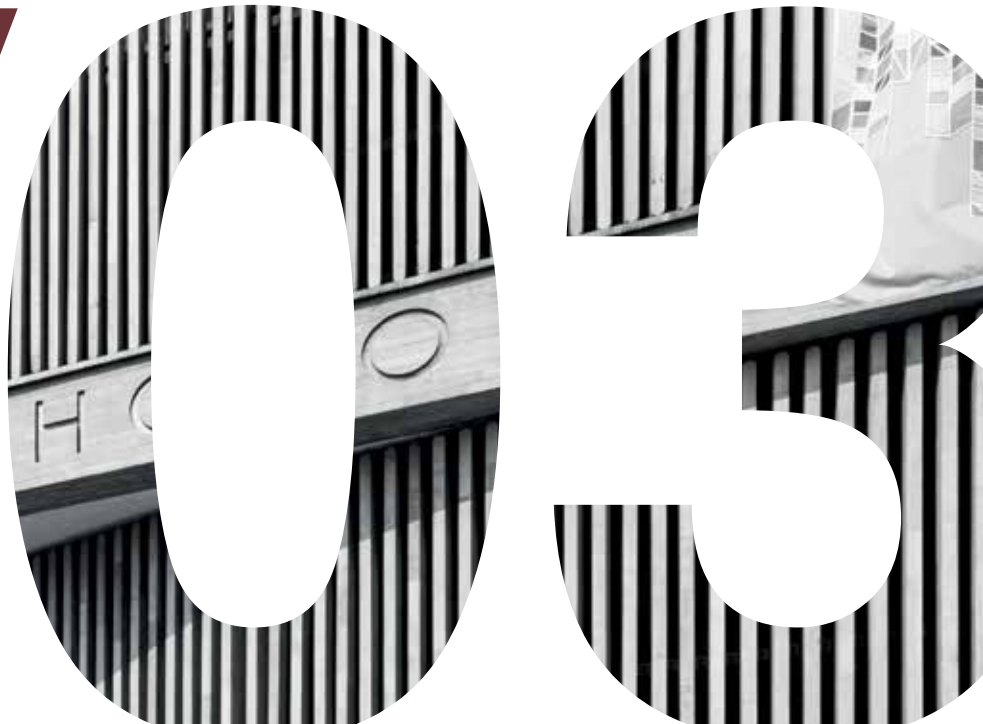
	TIMELINE
Task 1: develop and deliver E&I educational component	**annually**
Actions: 1. Expand and diversify Innovation Workshop program. 2. Develop E&I thesis component in the MSc and PhD curriculum. 3. Restructure and expand CEI curriculum. 4. Integrate selective components of Skolkovo education-hub.	
Task 2: implement Institute's translational research program	**annually**
Actions: 1. Conduct competitive selection of projects. 2. Develop operational plan for all STRIP projects. 3. Organize and manage mentor support from global representatives of companies, institutions and academic partners.	

	TIMELINE
Task 3: arrange and provide regular support to students' entrepreneurial activities	**annually**
Actions: 1. Active support, development and expansion of student entrepreneurial club. 2. Develop follow-on support program to start-up concepts created at the Innovation Workshop. 3. Develop and implement early stage accelerator with outside partner and SK Foundation.	
Task 4: provide support for involving graduates' in innovation activities	**annually**
Actions: 1. Collect standardized for industry student profiles, interested in placement. 2. Identify companies that are interesting for students. Deliver students' profiles. Support students in organizing interviews. 3. Provide support through the CEI, including mentoring students to turn their research projects towards applied research with business perspectives.	


2018
INNOVATION
WORKSHOP

Value Generation

//03



Professional Training

Responsibility Vice President for Industrial Cooperation
Units involved CREIs, Industrial Programs Department

OPERATIONAL INDICATORS	2019	2020	2021
FUNDING ATTRACTED UNDER PROFESSIONAL TRAINING PROGRAMS, MLN.RUB	50	55	60
NUMBER OF PROGRAMS / SEMINARS FOR INDUSTRY, INSTITUTES OF DEVELOPMENT AND OTHER CLIENTS	10	12	14

	TIMELINE
Task 1: coordinate professional training programs	**annually**
Actions: 1. Monitor demand for professional courses industry, institutes of development and other clients. 2. Develop and keep updated marketing materials, ensure active promotion. 3. Facilitate portfolio update and delivery of courses by the CREIs, ensure follow-up with clients.	

Advisory Services

Responsibility Vice President for Industrial Cooperation
Units involved CREIs, CEI, Analytical Department of Science & Technology Development

OPERATIONAL INDICATORS	2019	2020	2021
ANALYTICAL DIGESTS AND REPORTS ON SCIENCE, TECHNOLOGY, AND INNOVATION POLICY SUBMITTED	20	25	25
WORKING GROUPS / EXPERT PANELS WITH THE INSTITUTE'S PRESENCE	10	12	15

	TIMELINE
Task 1: provide advice in science & technology intense areas to regulatory bodies, high-tech companies, institutes for development	**annually**
Actions: 1. Leveraging faculty competencies analyze emerging areas in science and technology and develop analytical digests and reports. 2. Analyze regulations in science, technology and innovation, participate in working groups, expert panels, etc. Contribute to development of state policies, programs and standards in the area of science and technology. 3. Disseminate analytical work within expert community (conferences, round tables etc.), publish research results.	


ИСАНИЕ СОГЛАШЕНИЯ
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Industry Funded Research

Responsibility Vice President for Industrial Cooperation
Units involved CREIs, Industrial Programs Department

OPERATIONAL INDICATORS	2019	2020	2021
ATTRACTED FUNDING UNDER R&D CONTRACTS, SUBSIDIES (CONTRACTED), MLN. RUB	920	975	1030

	TIMELINE
Task 1: organize and facilitate R&D activities in CREIs under contracts with high-tech companies / State subsidies	**annually**
Actions: 1. Support the CREIs in setting up R&D projects with high-tech companies. 2. Coordinate the Institute's participation in State competitive funding programs (monitor opportunities, liaison with funding agencies, coordinate proposals preparation and submission). 3. Monitor R&D projects' implementation for meeting contractual obligations, maintain statistics on the Institute's contracts portfolio.	
Task 2: coordinate the Institute's participation in scientific and technological State initiatives	**annually**
Actions: 1. Coordinate launch and implementation of large complex projects in the framework of National Technological Initiative roadmaps. 2. Coordinate implementation of intergovernmental program on Photonics under the Strategy of Scientific and Technological Development of Russia. 3. Coordinate implementation of intergovernmental BRICS activities related to R&D projects.	

Technology Licensing

Skoltech was created with the mission of educating students, advancing knowledge, and fostering innovation in order to address critical scientific, technological, and innovation challenges and gaps facing Russia and the world. This mission requires careful nurturing of the results of the creative work of Skoltech's faculty, students and other researchers. It also requires diligent and wise management of Skoltech's intellectual property (IP). The KTO objective is to facilitate identification, assessment, protection and transfer processes for technology developed at Skoltech.

Technology protection, IP management and commercialization services, and other support services, are provided by the staff of Skoltech's Knowledge Transfer Office, which is part of the Center for Entrepreneurship and Innovation.

Motivation and engagement of a researcher is a primary factor of successful technology transfer. Skoltech therefore seeks to cooperate with, and incentivize, its faculty, students and other researchers to engage actively in inventive activities, and to work with the Knowledge Transfer Office to successfully commercialize the results, whether through the vehicle of a Skoltech start-up company or through licensing to established enterprises.

Responsibility Vice President for International Business Affairs, IP
Units involved Knowledge Transfer Office, CREIs

OPERATIONAL INDICATORS	2019	2020	2021
PATENT APPLICATIONS	0,3	0,5	0,6
TECHNOLOGY LICENSING (ROYALTY AND IP SALE)	5	10	15

	TIMELINE
Task 1: Educate faculty / researchers / students on IP policy and technology licensing	**annually**
Actions: 1. Develop and implement special course for non-IP professionals 2. Develop and implement sustained IP/licensing visibility program across Skoltechs 3. License CIPHER IP software for use by all Skoltech faculty/ students/researchers 4. Train Skoltech faculty/students/researchers on the use of IP information and IP analytics as part of their research activity and innovation processes	

	TIMELINE
Task 2: IP patent application process and alignment with Skolkovo Foundation	**annually**
Actions: 1. Creation of fast-moving working group to evaluate potential patent applications. 2. Determine and align select IP and licensing operations with Skolkovo Foundation IP department (IP Center Skolkovo). 3. Select appropriate software for management of in-house IP operations, and train IP / TL staff in its proper use. 4. Develop protocols and capability for negotiation of joint invention management agreements with external research partners (universities and institutes) internationally and in Russia.	
Task 3: process for the development and management of licenses	**2019**
Actions: 1. Develop mapping of licensing development and sales process (with KPMG). 2. Determine clear roles and responsibilities for the entire transaction cycle for the development and execution of licenses. 3. Develop in-house human capability for identifying appropriate potential licensees (i.e., for market research for technology licensing). 4. Develop appropriate in-house capability for the negotiation of license agreements with potential licensees. 5. Develop in-house capability for determining appropriate license fees, and royalty rates and terms, for license agreements. 6. Develop internal system for monitoring Skoltech's obligations under license agreements. 7. Develop protocols for the management of jointly held license agreements with partner universities and research institutes.	
Task 4: payment of royalties and monitoring	**annually**
Actions: 1. In conjunction with legal department, develop and implement process that follows royalty payment and monitoring	

	TIMELINE
2. Implement quarterly review of outstanding related licensing sales and payments. 3. Develop capability for identifying and managing potential infringements of Skoltech's IP. 4. Develop and implement standardized reporting for licensing results.	
Task 5: protection, management and licensing of software inventions	**annually**
Actions: 1. Develop protocol for ensuring that computer software developed by Skoltech faculty / researchers / students is appropriately identified, protected and managed. 2. Developing protocol for ensuring that software developed by Skoltech faculty / researchers / students and licensed-out by Skoltech does not violate the copyright and other IP rights associated with software owned by external parties. 3. Develop protocol for situations where open-source licensing of Skoltech-developed software is preferred by Skoltech faculty / researchers / students.	

New Enterprises

More than ever, a student-led entrepreneurial culture and Skoltech identity is evolving through managed CEI programs like the Innovation Workshop; the world-class professors of Skoltech; expanding CEI course selection; and, attendance to real-world events like Start-up village, Open Innovations and SLUSH. Some of the key guiding principles of the CEI educational program remain aligned and reflect the learning at MIT, at other leading institutions and, more recently, at Skoltech itself.

One of the overall 'spin-off' objectives is that Skoltech, as part of the Skolkovo eco-system, creates an environment where students feel entirely free and empowered to begin the journey of entrepreneurship. Since Skoltech's inception in 2011, students have established over 30 start-up companies with many at continued stages of development.

In order to continue to foster this development, the continued re-structuring of CEI will consist of the development of expanded mentorship, coaching and peer-reviewed advice. Secondly, there will be greater and more seamless access to basic back-office services including organizational planning, finance, sales and marketing, legal and professional skills training. Thirdly, at the appropriate time in CEI's renaissance in the coming two-three years, the establishment of an incubator, accelerator or creative destruction lab will be launched when the appropriate organizational and operational benchmarks are achieved.

Responsibility Vice President for International Business Affairs, IP
Units involved CREIs, CEI

OPERATIONAL INDICATORS	2019	2020	2021
REVENUES FROM NEW ENTERPRISES (MLN RUB)	3	5	10
NEW ENTERPRISES ESTABLISHED (PER YEAR)	8	12	15
ENTERPRISES WITH SKOLKOVO RESIDENT STATUS (CUMULATIVE)	40	55	70

	TIMELINE
Task 1: effectively engage faculty, staff and students and alumni to increase pipeline development and efficiency of new enterprises	**Q1 2019**
Actions: 1. Engage all internal stakeholders in the new enterprise functional strategy. 2. Align functional strategy with department of education.	

	TIMELINE
Task 2: develop and manage sustained professional 'coaching model' for every new enterprise	**annually**
Actions: 1. Develop and launch new enterprise coaching model whereby each enterprise is assigned an 'entrepreneur in residence' (EiR) to support new enterprise operational activity. 2. Search and interview wide-ranging number of candidates that could support new enterprise in new coaching model. 3. Database all reviewed and approved 'coaches'. 4. Assign 'coaches' to select new enterprises.	
Task 3: Expand relationships with international entrepreneurs and VCs	**annually**
Actions: 1. Review current list of international entrepreneurs who have or are actively supported new enterprises at Skoltech. 2. Expand list of international entrepreneurs and identify possible list of VCs inside/outside Russia – with select number of focused geographic areas.	
Task 4: Expand visibility opportunities for Skoltech new enterprises at key global events – jointly with Skolkovo Foundation	**annually**
Actions: 1. Align with Foundation: determine top international events where Foundation will be present and where new enterprises could also participate. 2. Ensure that Skoltech new enterprises compete for the opportunity to be present at Tier-A innovation and business conferences.	


KARFIDOV LAB
1000000 ₽
В БЛАГОДАРНОСТЬ ОТ ВЫПУСКНИКОВ
ЗА НАВЫКИ, ПРИОБРЕТЕННЫЕ В СКОЛТЕХЕ
Skoltech
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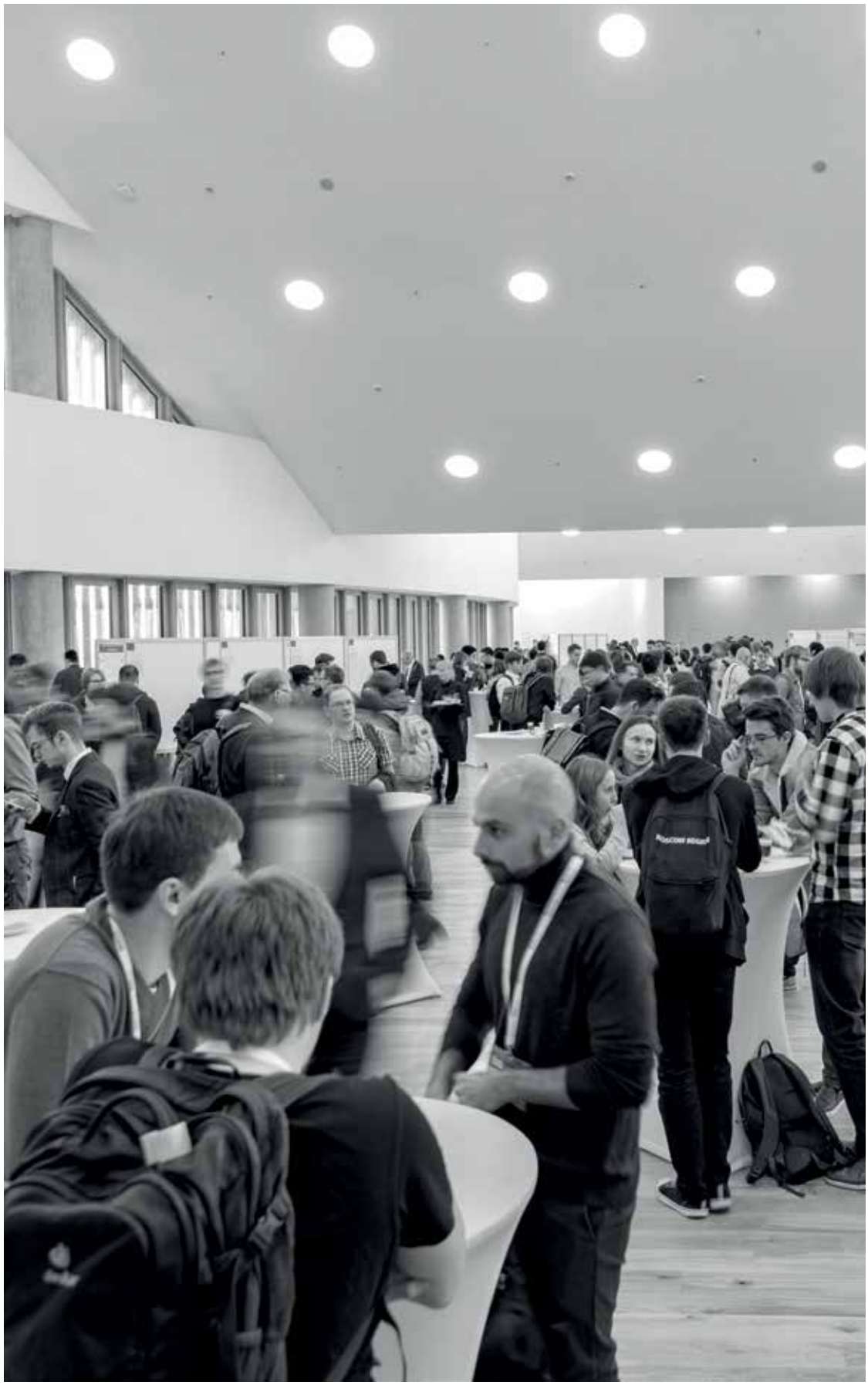
Operational Management & Campus



Responsibility	Vice President for Finance & Operations
Units involved	Finance Department
	HR Department
	IT Department
	Legal Department
	Procurement Department
	Campus Planning and Construction Department

OPERATIONAL INDICATORS	2019	2020	2021
TIME REQUIRED FOR DOCUMENTS' APPROVAL IN FINANCE & OPERATIONS	5 days	4 days	4 days
TREASURY FUNCTIONS TO MEET THE INSTITUTE'S OPERATIONAL AND FINANCIAL NEEDS PERFORMED	sufficient liquidity exists	sufficient liquidity exists	sufficient liquidity exists
DEPLOYMENT OF MONTHLY/QUARTERLY/ANNUAL REPORTING AND ANALYTICS AVAILABLE TO INTERNAL AND EXTERNAL STAKEHOLDERS	reporting deployed	according to approved schedule	according to approved schedule
TARGETED USE OF SK GRANT FUNDS ALLOCATED	amount of SK grant returned to the Foundation < 1%	amount of SK grant returned to the Foundation < 1%	amount of SK grant returned to the Foundation < 1%
% OF INFLUENCEABLE[6] SPENT ACTIVELY (INFLUENCED BY PROCUREMENT)	±85%	±90%	±90%
TOTAL ANNUAL SAVINGS EQUIVALENT (DIRECT SAVINGS) BY IMPLEMENTING TENDERING PROCEDURES[7]	10% achieved saving	10% achieved saving	10% achieved saving
DEVELOP AND IMPLEMENT SALARY SAVING APPROACH FOR EXTERNALLY FUNDED PROJECTS	% salary saving	% salary saving	% salary saving
CARRYING OUT PROJECTS FOR AUTOMATION / REENGINEERING OF BUSINESS PROCESSES	system implementa-tion according to approved schedule	system implementa-tion according to approved schedule	systems and applications implemented and operational
BUSINESS AND IT PROCESSES FORMALIZED, ASSUMED INTERNAL CONTROLS PRINCIPALS	30%	50%	80%
NET SQM OF SPACE IN OPERATION	95 400	103 000	106 000
RECORDABLE INCIDENT RATE	5%	2%	2%
WORK ORDER CLOSURE	95%	95%	95%
PREVENTATIVE WORK ORDER RATE	20%	30%	30%
CAPITAL PROJECT CASH FLOW EXECUTION	±5%	±2%	±2%

[6] Scholarships, payments to other institutions, charities, schools, payments to banks, interest charges; payments to individuals (e.g., staff costs), payments on research grants, training, research bodies; provisions relating to vacation allowance and bad debts, depreciation & amortization, membership and affiliation fees (including payments to professional bodies), conference fees, rent and rates and planning fees to local authority, student life expenses.
[7] Annual procurement savings as a % of influenceable spent.

	TIMELINE
Task 1: provide financial and operational resources for maintaining Institute's capacities	**annually**
Actions:	
1. Ensure financial planning, budgeting, forecasting of resources.	
2. Diversify revenue, specifically to increase a share of external funding.	
3. Increase income from investment in the Institute's infrastructure.	
4. Provide reporting to internal and external stakeholders, also according to International Financial Reporting Standards.	
5. Provide legal support on research, education, operational activities; ensure support to startups established by faculty, researchers and students.	
6. Support implementation of tuition fee model (legal, financial functions), provide adjustments if necessary.	
7. Employ sustainable procurement policies and procedures.	
8. Implement a salary saving approach on external research projects.	Q4 2019
9. Ensure efficient travel services, also by migration to a new travel management system, implementing Intranet Travel & Expense Page.	2020
10. Create KPIs dashboard.	2020
11. Ensure continuous cost efficiency with regards to operational services.	
12. Introduce measurable SLAs, ensure internal customer satisfaction: Directum; ERP-Travel, Procurement.	2019
Task 2: provide effective information systems to support business processes, ensure IT infrastructure development	
Actions:	
1. Ensure process automation, implementation of IT instruments for research, educational, operational activities, facilities management.	ongoing
2. Increase IT support, ensure centralized research software management, increase IT security posture.	2019

	TIMELINE
3. Maintain archive (digital and hard-copy).	regular operation since Q1 2019
4. Develop and implement a “personal cabinet” as a one-window for end-user into the management system.	2020
5. Carry out ERP project (stage 2), incl. project management module, RFID, warehousing module.	2019
6. Support implementation of Student Information System (SIS). Ensure integration with other information systems.	2020
7. Implement and monitor information security framework, policy and IT related risk management strategy.	2020
8. Support implementing shared facilities management and control system.	2020
9. Identifying requirement for CRM for CREIs and other Skoltech divisions Implementation of CRM.	2019 2020
10. Revise IT policies and procedures to comply with new processes.	ongoing
Task 3: develop operational support of the CREIs while maintaining the current number of staff	
Actions:	
1. Assign Finance Business Partners to CREIs.	2019
2. Assign HR Business Partners and Procurement Account Managers to CREIs.	2020
Task 4: develop and foster a culture of proactive risk evaluation. Develop and maintain Internal Control System (ICS)	
Actions:	
1. Perform an annual risk assessment, identifying operational risks to the Institute. Provide mitigation strategies, ensure control systems are in place and working effectively.	annually
2. Implement and regularly update Risk & Control Matrices.	annually
3. Implement and monitor control procedures, ensure automation where possible.	ongoing
4. Implement self-assessment / external assessment mechanisms.	2020

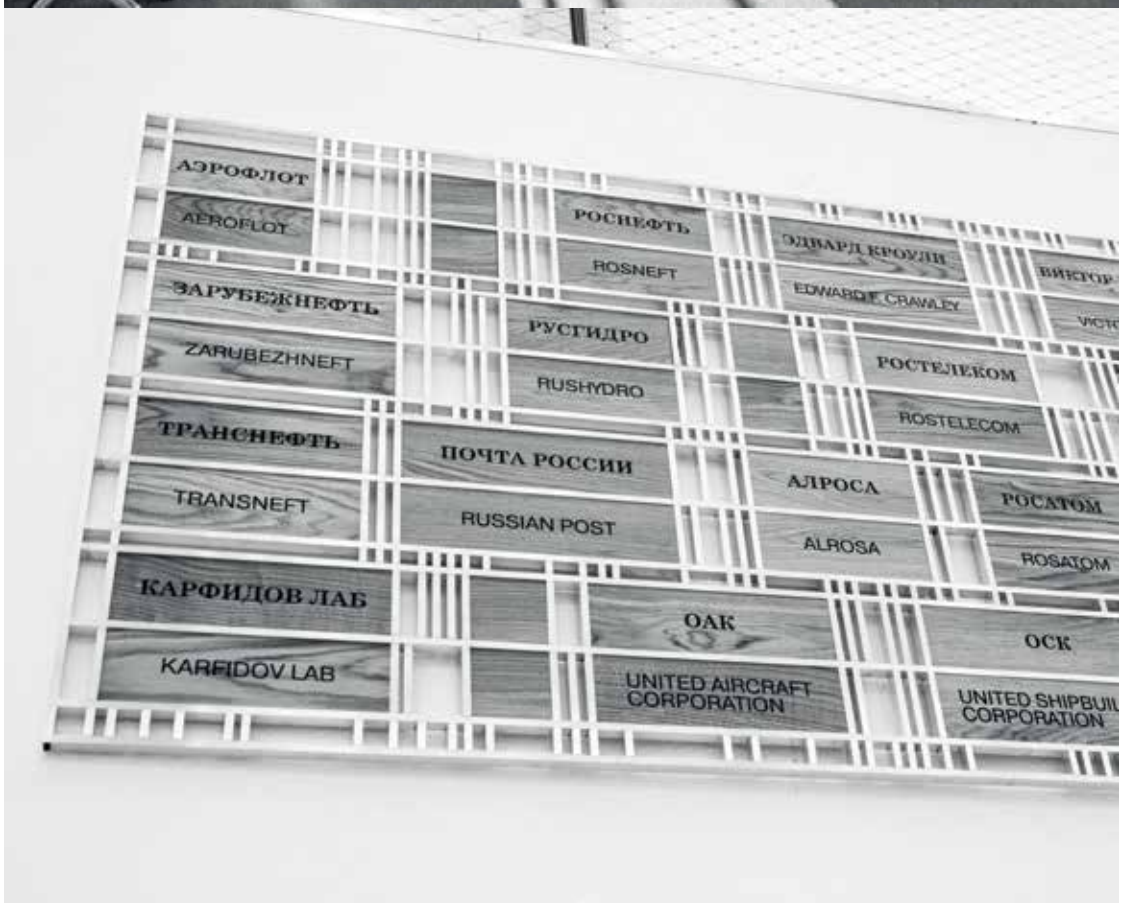
	TIMELINE
5. Provide expertise of Internal Control function including Training Program for new employees.	2020
6. Maintain policies and procedures, relating to operational processes.	ongoing
Task 5: develop service level agreements	
Actions:	
1. Identify elemental services, their internal customers, and specify operating procedures for their provision.	Q1 2020
2. Establish, approve and implement Service Level Agreements Institute-wide.	Q4 2020
3. Conduct annual review of SLA and Head Policies to identify areas for better efficiency and take corrective action.	2021
4. Revise SLA and Policies.	2021
Task 6: commission and deliver Institute and laboratory complex	
Actions:	
1. Deliver and stand-up East Ring campus and infrastructure.	Current – 06/20
2. Deliver Group 1 Labs (CDMM, Advanced Imaging, Masterskie).	Current –02/20
3. Deliver Group 2.1 (partial) Labs (CDISE, CEI).	Current – 03/20
4. Deliver Group 2.1 (remaining) Labs (CLS labs, Bio Core Facilities).	3/21
5. Deliver Group 2.2 Labs (CEE, CES, CSR, CPQM).	12/21
6. Deliver Group 3 Labs (Data Storage and Processing Cluster, Micro- and Nanofabrication Cleanroom).	TBD[8]
Task 7: ensure dormitory for Skoltech students	**by 2022**
Actions:	
1. Development and approval of the project construction documentation.	2020

[8] Subject to allocating budget for lab construction in 2020.

	TIMELINE
2. Find and provide temporary accommodation ensuring best options available (Skolkovo territory or nearby locations).	by time dormitory is commissioned
3. Deliver dormitory.	by 2022
Task 8: execute leasing and amenities program	
Actions:	
1. Attract users and execute operating model.	Q4 2020
Task 9: execute Institute space planning program	
Actions:	
1. Implement a project documentation archive that allows public access to the most current Institute allocation plans and area counts, Space Governance Policies, Navigation system and procedures. Study an opportunity to implement Space management platform that simplify operational procedures between different department in the Institute.	Q4 2020
2. Develop and deploy a space information and management system that maintains complete and accurate records of current space utilization metrics and performance indicators.	Q4 2020
3. Together with contractors finalize design documentation for Laboratory buildings.	Q4 2020
Task 10: start-up space, facilities management and engineering operation	
Actions:	
1. Review current and initiate new policies for operational management of space, facilities and infrastructure.	Q1 – Q4 2020
2. Develop and implement furniture relocation Policies and procedures during different types of Events.	
3. Finalize fixed and loose furniture purchasing according to the budget plan.	
4. Finalize minor design projects (music studio, library, gym etc.)	
Task 11: relocate the Institute to the new campus	
Actions:	
1. Relocate general Institute operations and administration, relocate labs in accordance with lab complex construction delivery schedule.	by Q2 2020

	TIMELINE
Task 12: establish a system of competitive evaluation of facilities operations	
Actions:	
1. Identify space and facilities metrics, their current and desired performance levels.	Q1 2019
2. Establish system of benchmarks against which to measure the performance of Skoltech facilities.	Q1 2019
3. Establish and implement a system of regular evaluation, reporting and corrective action.	Q2 2019
Task 13: create business plans to generate income for the Institute from excess space and facilities capacity	
Actions:	
1. Identify areas of excess capacity in the Institute and establish concept for their use.	Q4 2019
2. Develop business plans and financial models for the use of this capacity.	Q1 2020
3. Attract users to excess capacity and provide income-generating tenant services.	2020
Task 14: develop and implement space and facility management and information systems	
Actions:	
1. Establish data points to monitor, inventory and control.	Q1 2020
2. Develop and implement policies for collection of life-cycle data, analysis and reporting on established data points and their cost indicators.	Q2 2020
3. Search and procure appropriate system.	Q3 2020
4. Implement system.	2021
Task 15: develop and implement materials management, inventory and internal order systems	
Actions:	
1. Implement automation solutions (in accordance with phased implementation plan).	2019-2020

	TIMELINE
Task 16: cultivate and promote a culture of occupational safety	
Actions: 1. Establish EHS Committee to set standards, determine audit and control programs, and implement system of continuous safety improvement and deployment.	Q1 2020


АЭРОФЛОТ
AEROFLOT
РОСНЕФТЬ
ROSNEFT
ЭДВАРД КРОУЛИ
EDWARD CRAWLEY
ВИКТОР
ЗАРУБЕЖНЕФТЬ
ZARUBEZHNEFT
РУСГИДРО
RUSHYDRO
РОСТЕЛЕКОМ
ROSTELECOM
ТРАНСНЕФТЬ
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ПОЧТА РОССИИ
RUSSIAN POST
АЛРОСА
ALROSA
РОСАТОМ
ROSATOM
КАРФИДОВ ЛАБ
KARFIDOV LAB
ОАК
UNITED AIRCRAFT CORPORATION
ОСК
UNITED SHIPBUIL
CORPORATION


НАУКИ И ТЕХНОЛОГИИ

Key Performance Indicators

//05

The Strategic KPIs reflecting Institutional performance will serve as a tool for measuring effectiveness of the Plan execution.

Figure 4. Strategic KPIs

KPIS	UNITS	2019	2020	2021
ACADEMIC EXCELLENCE				
Publications indexed in WoS, Scopus	No./faculty	4.1	4.2	4.3
Graduates[9]	Persons	240	360	360
Graduates involved in innovation activities	%	70	70	70
VALUE GENERATION				
Attracted funding	mln.Rub	1250	1370	1550
Patents applications	No./faculty	0.3	0.5	0.6
Skolkovo enterprises (cum.)	Units	40	55	70
OTHER				
External financing	%	25	26	27

Distribution of responsibilities between the Institute's top-management (senior administration and CREI Directors) for Strategic KPIs is defined by the KPIs maps.

[9] ±5% in 2020, 2021.

KPIs annotation

PUBLICATIONS INDEXED IN WoS, SCOPUS
ratio of faculty publications affiliated with Skoltech, indexed in WoS and/or Scopus, to the average number of faculty during the reporting period

GRADUATES
total number of students that graduated from MSc and PhD programs during the reporting year

GRADUATES INVOLVED IN INNOVATION ACTIVITIES
% of MSc and PhD graduates who (i) are employed in industrial or research organizations in Russia, (ii) have established startups or are employed in the Skolkovo companies, (iii) are doing internships in the abovementioned organizations; or (iv) continue at Skoltech to complete PhD programs (MSc graduates), from the total number of MSc and PhD graduates during the reporting period; this indicator is calculated based on alumni survey

ATTRACTED FUNDING
contracted funds for the reporting year within grants, R&D contracts, subsidies, agreements for providing services (shared facilities, advisory services, professional training courses and programs), technology licensing (royalty and IP sales), income from new enterprises established by Skoltech faculty, researchers, students, alumni.

SKOLKOVO ENTERPRISES (CUM.)
(1) companies established by:
- a. Skoltech personnel, students or alumni,
- b. former Skoltech personnel during the period of their employment in Skoltech,
- c. Skoltech personnel prior their employment in Skoltech with a provision that the company uses results of Skoltech research activities or Skoltech resources

(2) companies:
- a. where Skoltech academic personnel have an option,
- b. with which Skoltech has investments agreements,
- c. where Skoltech is included as a participant

ATTRACTED FUNDING
ratio of total number of Skoltech patent applications to the average number of faculty during the reporting period

EXTERNAL FINANCING
% of external financing, i.e. excl. Skolkovo Foundation grant, to the total Institute's expenses (excl. investments into development of the Institute's infrastructure) during the year

Glossary

BOARD OF TRUSTEES
Board of Trustees of the Autonomous Non-Profit Organization for Higher Education "Skolkovo Institute of Science and Technology"

GRANT AGREEMENT
Agreement between the Institute and Non-commercial organization "Foundation for Development of the Center for Elaboration and Commercialization of New Technologies" (Skolkovo Foundation)

CAS
Center for Advanced Studies

CDISE
Center for Computational and Data-Intensive Science and Engineering

CDMM
Center for Design, Manufacturing and Materials

CEI
Center for Entrepreneurship and Innovation

CEST
Center for Energy Science and Technology

CHR
Center for Hydrocarbon Recovery

CLS
Center for Life Sciences

CNBR
Center for Neurobiology and Brain Restoration

CPQM
Center for Photonics and Quantum Materials

UNIT
Institute's structural unit performing specific tasks and activities established in the SAP

CREI (CENTER)
Institute's structural unit implementing a long-term (at least three years) development program, aimed at integration of research and education activities, value generation (Centers for Research, Education and Innovation (CREIs), Space Center, Center for Advanced Studies)

UNIT
Institute's administrative structural unit performing tasks and activities established in the SAP

SKOLKOVO FOUNDATION
Non-Commercial Organization "Foundation for Development of the Center for Elaboration and Commercialization of New Technologies"

KPI
key performance indicator of the Institute's development

LEARNING COMMONS
special Campus spaces that integrate computing and library services, makerspaces, equipment, tools, shared for tutoring, reading, team-work, aimed at stimulating active learning (available 24/7)

MIT
Massachusetts Institute of Technology

OPERATIONAL INDICATOR
measures interim results of completing tasks set by the SAP

SC
Space Center

SKOLTECH, INSTITUTE
Autonomous Non-Profit Organization for Higher Education "Skolkovo Institute of Science and Technology"

STRATEGIC ACTION PLAN (SAP)
Institutional Plan for Development which sets vision, strategic goals and initiatives, KPIs, tasks and actions, responsibilities. The SAP is developed for a three years' cycle, annually updated and approved by the Board of Trustees. It serves a basis for the Grant Agreement, reporting to the stakeholders

STRATEGIC KPI
Institutional key performance indicator, established in the Subprogram and / or Grant Agreement

SUBPROGRAM
Subprogram "Establishment and Development of the Skolkovo Innovation Center" in the frames of the State Program of the Russian Federation "Economic Development and Innovative Economy"

TARGET DOMAIN
strategic focus area of the Institute's education, scientific, R&D (or) innovation activities. Approved by the Board of Trustees within the SAP

Skoltech. Gateway to the World

SKOLKOVO INSTITUTE OF SCIENCE AND TECHNOLOGY (Skoltech)
143026, Moscow, Bolshoy boulevard 30, build. 1. Tel. +7 (495) 280 14 81
www.skoltech.ru