

RESEARCH CENTER CONCEPT

Skolkovo Tech

Skolkovo Institute of Science and Technology

SkTech/MIT

INITIATIVE

RESEARCH CENTER CONCEPT¹

OVERVIEW

As a key part of the Russian Skolkovo Initiative, the Skolkovo Foundation, MIT, and others are assisting in the creation of the Skolkovo Institute of Science and Technology (SkTech) as a novel international graduate university integrating advanced research, education, and entrepreneurship, all based on academic excellence and the spirit of innovation. Research Centers are a key element in the creation and ongoing operation of SkTech. A number of collaborative multi-university Research Centers will be created as part of, and associated with, this independent university. These Research Centers will be funded through SkTech. A key element of the implementation plan is to couple the recruitment of SkTech faculty and growth of educational programs with the activities and growth of SkTech Research Centers. The Research Centers will initially be started with existing international and Russian institutions and investigators. As SkTech faculty begin their appointments at SkTech and in new SkTech research facilities, they will join Research Centers such that at the end of the ramp period, SkTech will be an equal participant in all (approximately fifteen) of these ongoing multi-university international SkTech Research Centers. SkTech faculty members will join and teach in one of the SkTech topical educational programs, once the SkTech faculty member begins his or her tenure on the SkTech campus. They will also participate as investigators, guiding their students and research staff, in one of the Research Centers. A defining attribute of SkTech will be the creation and integration of innovation and entrepreneurship components, embodied in a Center for Entrepreneurship and Innovation (CEI). This vision and approach, with the support of the Skolkovo Foundation and others, will place SkTech on the international stage as a unique research university, leading and participating in on-going collaborative international research centers, educating a new breed of students, and having a signature emphasis on integration of advanced research, education, innovation and entrepreneurship.

This document summarizes the guiding principles and goals for SkTech, the role of Research Centers in the establishment and on-going mission of SkTech, and additional context for Research Center interaction with the SkTech education and innovation components.

GUIDING PRINCIPLES AND GOALS

The mission² of SkTech will be to educate students, advance knowledge, and foster innovation in order to address critical scientific, technological, and innovation challenges and gaps facing Russia and the world. SkTech will be a new university model for Russia built on a number of guiding principles, and contributing to several goals:

¹ This is a subset and adaptation of the “Concept and Implementation Overview – Skolkovo Institute of Science and Technology (SkTech)” dated November 5, 2011, for the purposes of providing background information to SkTech Research Center proposers.

² The vision, mission, guiding principles, and design of SkTech is evolving further based on this initial statement.

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- Create a university environment of innovation: SkTech will bring together research and education across a broad spectrum of science, engineering, and innovation areas in order to foster multidisciplinary discoveries and inventions that arise through the mixing of students, faculty and researchers across traditional disciplinary boundaries.
 - Integrate education and research: in addition to course work, graduate students will participate in research throughout their education; each SkTech faculty member will both teach and engage in research, in order to foster excellence and creativity in both.
 - Develop and embed university components of an innovation and entrepreneurship ecosystem within Skolkovo. These university components include formal and informal education in innovation and entrepreneurship, as well as university policies and structures for interfacing with industrial commercialization and venture opportunities as they develop at Skolkovo and elsewhere.
 - Lay the foundation for a world-class research university that will help attract, create, and retain both Russian and international talent to Skolkovo and Russia.

Many of these principles, goals and approaches are familiar to and consistent with the recent evolution of Western universities and economies. These goals are based on recognition of the increasingly important role that research universities play as part of a vibrant innovation ecosystem. While Russian science is known to be very strong, substantial gaps in the Russian innovation system also exist. New paradigms and new perspective are needed to bridge these gaps. The foundational goals and the corresponding organization to be created and embodied in SkTech present an important new stage for Russian academia. SkTech will be built on the best traditions of Russian education and research structures and practices but with a new focus on entrepreneurship and innovation.

The integration of education and research is one important innovation, consistent with but seeking to accelerate nascent trends within Russian science. Traditionally, Russian science has been spread across three different types of institutions: universities, Academy of Science research institutes, and specialized research institutes. Universities typically focus on education and do relatively little research; they report to the Ministry of Education and Science. Research institutes reporting to the Russian Academy of Sciences do mostly fundamental research and relatively

little education. In addition, there are research institutions founded by various industrial and governmental organizations, each with a narrow focus on a specific area of applied research and reporting to their respective funders. SkTech will strive for a different model – one that seeks to integrate education and research, while bridging fundamental scientific and engineering research across disciplinary boundaries and interfacing with a broader industrial and entrepreneurial ecosystem to foster high impact research and generate innovative flows to the economy.

SkTECH ORGANIZATION AND EDUCATIONAL PROGRAMS

SkTech will be organized as a permanent, modern, international university as pictured in Figure 1, with a physical campus for research and education in Skolkovo. SkTech will initially have five primary education and research programs, corresponding to priority areas as defined by Russia: these will be programs in Information Science and Technology, Energy Science and Technology, Biomedical Science and Technology, Space Science and Technology, and civilian Nuclear Science and Technology. Each of these Programs will provide Master's and Ph.D. degrees to be granted by SkTech. A Center for Entrepreneurship and Innovation (CEI) within SkTech will provide education, research, and administrative functions related to the practice of entrepreneurship and innovation, spanning across and coupled to the degree-granting programs. Fifteen Research Centers will be associated with SkTech, each residing under one or more of the programs. Each Research Center will have a thematic research mission carried out through a distributed collaborative research program between SkTech, international, and Russian institutions, and will have both physical and virtual components. As the SkTech campus and research laboratories are constructed and equipped, SkTech faculty, staff and students will conduct their research under each Research Center in new physical laboratories at SkTech. In addition, each Research Center will have a virtual component, comprised of ongoing research collaborations with and between the Research Center partner institutions in which each institution's researchers conduct their research primarily at their home facilities, but in thematic and intellectual collaboration across and within Research Center areas and projects. Finally, SkTech will have central administration that provides the educational and research facilities and services of a modern research university.



Figure 1: Conceptual Architecture of SkTech

As a founding institutional partner with SkTech, MIT will play a lead role in fostering creation of Research Centers, in developing and establishing the initial educational programs, in recruiting and developing the initial SkTech faculty, and in creating the Center for Entrepreneurship and Innovation at SkTech. A select number of newly hired faculty will spend up to one year at MIT in a Faculty Development Program. The faculty will be hosted by an MIT faculty member (in some cases, that MIT faculty member will be participating in a Research Center), propose and begin a joint research program with their host faculty member, sit in on classes that they will eventually teach at SkTech, and engage in other faculty development activities, including those related to the practice of entrepreneurship and innovation. Upon their return to SkTech, they will begin teaching the classes associated with the graduate programs, and engage in research with their SkTech students and research staff, in newly created SkTech facilities and laboratories. They will also join a Research Center, as described below.

RESEARCH CENTERS

The second major component of the SkTech concept is the establishment of Research Centers (RCs); the simplified Research Center conceptual structure is shown in Figure 3. SkTech Research Centers embody the increasingly important collaborative and multi-university research partnerships required for multidisciplinary advanced research. Each Research Center will have SkTech as the lead university (reflecting the flow of funding for these Centers through SkTech), and have two or more major university or research institution partners, bringing SkTech faculty and researchers into collaboration with researchers from both international and Russian institutions. Each Research Center will have at least one Russian and one non-Russian institutional participant, enabling these Research Centers to foster international collaborations. The faculty, post-docs, students, and other researchers participating in the Research Center will primarily conduct their research at their home institutions and in existing facilities at their home institutions, but work collaboratively at the project and Center levels to achieve the thematic and intellectual research goals of the Center. Each Research Center will also work closely with one or more SkTech educational programs, to develop and deepen new graduate degree tracks at SkTech that support, leverage, and advance education and research in the Research Center focus area.

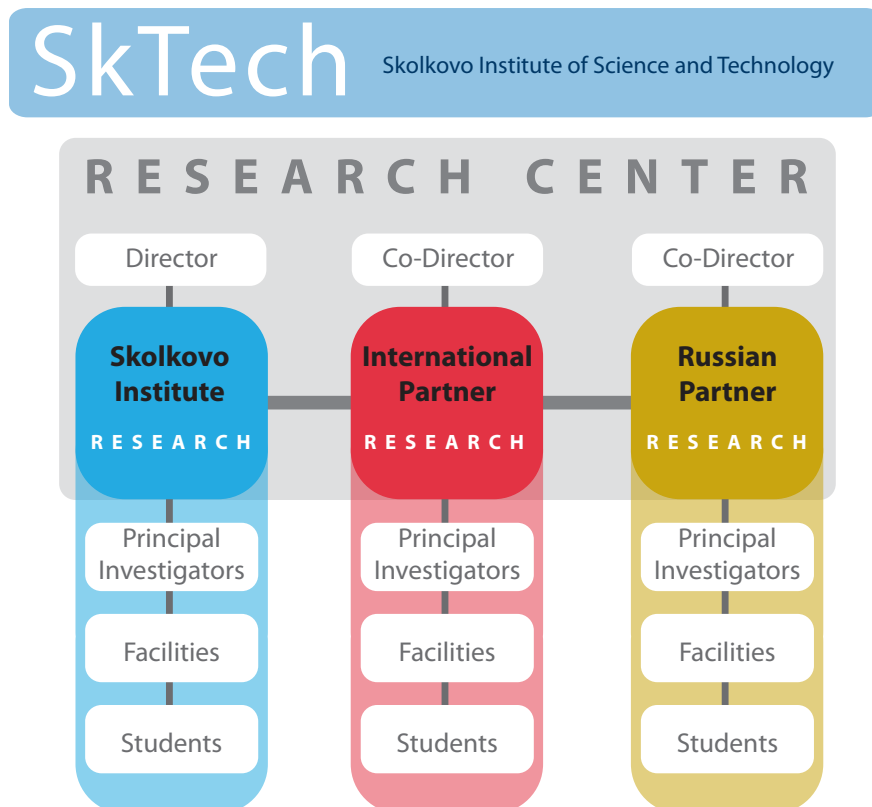


Figure 3: Multi-university collaborative structure of an SkTech Research Center

A more detailed common framework for the organizational structure of a Research Center is pictured in Figure 4. This common framework is required in order to establish the relationship of the Research Center to SkTech, and the contractual relationship of other partners in the Research Center to SkTech. Within or in addition to this basic framework, each Research Center may propose customized governance structures appropriate to the research/education mission of the Center. In the common or basic framework, a Research Center is an “SkTech Research Center” in that the funding for the Center flows first to SkTech (from the Skolkovo Foundation in the initial stages of the university), and then (a) from SkTech to its own researchers (who are employees, students, or otherwise direct appointees of SkTech), and (b) from SkTech to the other institutional participants by way of a multiparty research grant or contractual agreement. Thus, the non-SkTech Russian and/or international investigators, researchers and students are not SkTech employees but rather remain employees, students or appointees of their contracting home institution.

The division and flow of Center funding, both initial and evolving over the initial period (e.g., 5 years) of the Center will be part of the Center proposal, and will be defined and set as part of the resulting research contract. Similarly, the ownership of intellectual property generated individually or jointly by participants under the Research Center funding and collaborations, and the sharing of revenue resulting from licensing of this intellectual property, will be established through the Research Center contract. The ultimate responsibility for the Research Center resides with SkTech, thus the Center Director will be an SkTech faculty member. In the initial stages, this responsibility may be an *ex officio* role filled by the SkTech Vice-President for Research, an SkTech Program Director, or other designee of SkTech; at a later point an appropriate SkTech faculty hire will take on the role as responsible SkTech Center Director.

The Research Center Director will work closely with the Research Center Co-Directors from the other participating institutions to guide the functioning of the Center. These duties include administrative functions; the annual (or agreed upon) reporting of expenditures by each institutional participant; the reporting of research results (publications, presentations, student theses, invention disclosures and patent filings, etc.); the fostering of research collaboration through Center annual meetings, strategic planning, symposia, and workshops; the execution of internal processes for identifying new research needs and opportunities, as well as proposing, evaluating, and selecting new research projects to be conducted within the Center; the execution of internal processes for evaluating and appropriate sunset or completion of projects within the Center; the on-going evolution and development of the Center including seeking additional sources of funding; and coordination of educational program interface with SkTech.

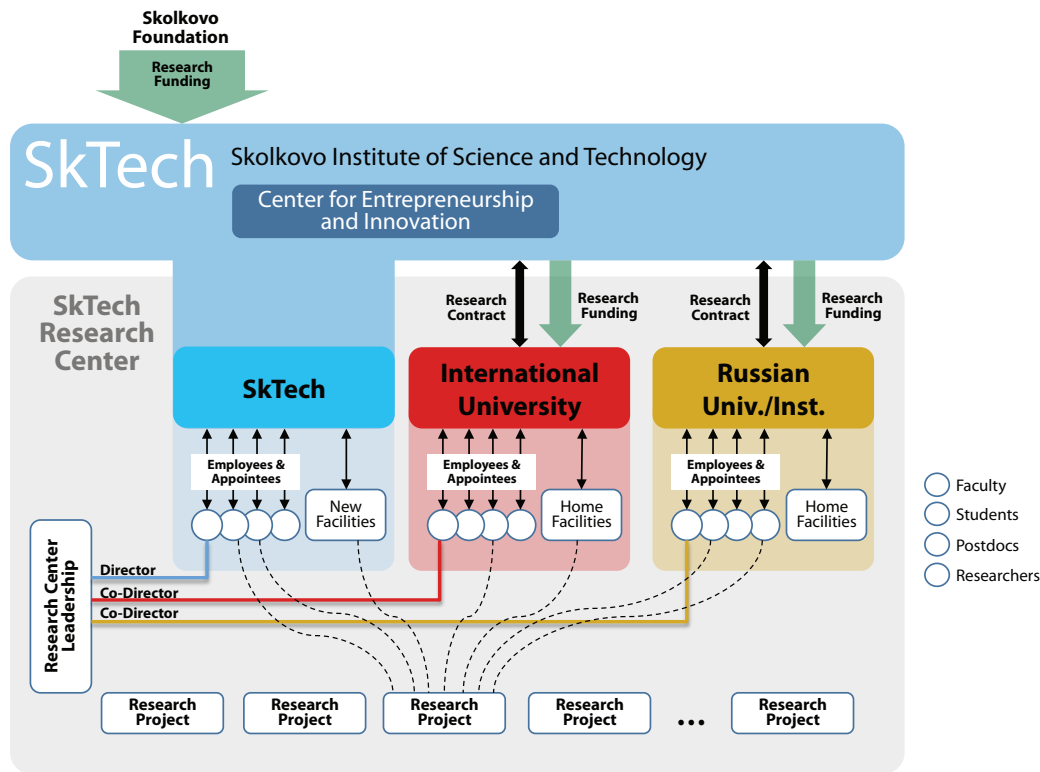


Figure 4: Organizational structure of an SkTech Research Center

Consistent with the organizational structure of Figure 4, guidelines for the operation and administration of research by the Research Center participants, including those in Russia, will be developed as part of the Research Center request for proposals and research contract procedures. These are expected to include guidelines for grant and contract administration; expected or allowable research expenditures (faculty, student, postdoc, and researcher salaries; equipment; travel; materials and services, etc.); management of salary costs; reporting requirements (technical, fiscal, equipment and property, intellectual property); and financial review and control requirements. Such models and procedures are contemplated to be part of one or more workshops focused on university research and innovation management to be held in Russia.

RESEARCH CENTER CREATION

A crucial element of the SkTech implementation plan is the parallel ramp of SkTech faculty hiring and development, with the creation of the Research Centers and the development and startup of the SkTech educational programs. This coupling is

illustrated in Figure 5. Successive numbers of SkTech faculty arrive on the SkTech campus and participate in Research Centers, such that SkTech becomes a full participant and equal partner in each of the multi-university Research Centers by the end of a ramp-up period. Initially, a Research Center will be created as a collaboration between SkTech, an international university, and one or more other Russian research institutes or universities, although the initial number of faculty or researchers at SkTech in the Research Center may be small or nominal at launch of the Research Center. Nevertheless, Research Centers need to be built early, for several reasons. They enable SkTech to rapidly establish a research presence in key research areas, to build industrial connections, to attract and create relationships with the leading researchers and universities in the world, and drive development and creation of SkTech's coupled research, education and innovation model from the very beginning. Research Centers need to exist when the SkTech faculty arrive, outfit their labs, and launch their research at SkTech after their time at MIT: the Research Center provides an essential intellectual home and set of further research project opportunities to enable and launch the careers of the SkTech faculty.

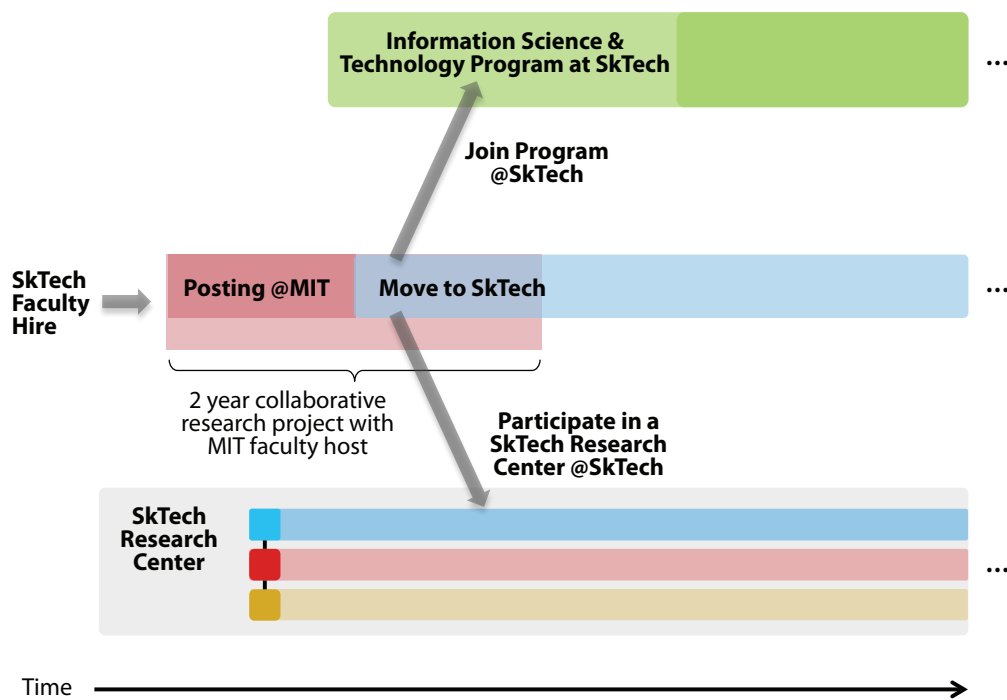


Figure 5: SkTech faculty hire and development, feeding into SkTech Educational Program and SkTech Research Center ramp up

To build these Research Centers, MIT will assist in the design of a Research Center creation process that operates through SkTech, consisting of exploration of research needs and priorities, workshops to identify research opportunities based in part on these and on Skolkovo cluster directions and to foster awareness of potential partners, a preliminary white paper step with feedback to enable strong proposals, a proposal submission mechanism, a process for peer-review by international experts in the program area, and a decision making process and body within SkTech that selects and recommends winning proposals for approval of funding and launch of Research Centers. The Scientific Advisory Council of the Foundation is expected to play an important role in involving prominent researchers and institutions into the proposal process, including fostering participation in the workshops. In many cases, early Research Centers will not initially have participating SkTech faculty (as they will not have yet been hired by SkTech), but these Research Centers must agree to and plan for (as part of their proposal and contract) the incorporation of new SkTech faculty into the intellectual theme and research collaborations of the Center as those SkTech faculty begin their research activities at SkTech. Each Research Center will thus grow as the SkTech faculty are hired, culminating in SkTech being a full partner in each Center, and cementing the visibility and identity of each Center as an SkTech Research Center.

Each Research Center can propose a structure appropriate to its own targeted research and education challenge, specializing or consistent with the basic framework discussed above. For example, some centers may elect and propose to have researchers from three institutions (SkTech, Russian, non-Russian) as pictured in Figure 4, while other centers may establish a sub-contract mechanism by which they could recruit and engage additional individual researchers from other universities or institutions that bring crucial or unique capability to the center. Similarly, some centers may expand their participation by establishing a mechanism for the engagement of industrial participants.

Each Research Center is expected to be of substantial scale in terms of funding and researcher participation in order to achieve four related goals. First, the Center should be of sufficient size to attack important and high impact research themes and problems through multiple collaborative projects. Second, the Center must be sufficiently broad to inspire and develop an educational track within a corresponding SkTech educational Program. Third, the Center must generate a thematic research activity at SkTech sufficient to attain a leadership position and provide an intellectual home and network of colleagues and collaborators for the required number of new

SkTech faculty. And fourth, the Center should seek to integrate (though with different degrees or weightings appropriate to the research challenge) aspects of science, engineering, and industrial application or impact.

These multiple purposes and needs for SkTech Research Centers, coupled with their multi-university and international collaborative scope, dictate a sufficiently large and robust funding requirement. Specifically, funding at a level of approximately \$6M to \$12M USD per year (inclusive of overhead) divided among the envisioned major institutional partners (including SkTech as it hires its faculty) would enable the substantial and focused participation of at least four to eight primary faculty with research staff and students at each institution (i.e., at least four to eight faculty from an international institution to interact with at least four to eight faculty in Russia in addition to the new SkTech faculty members hired over time and subsequently participating in each SkTech Research Center). An example model would be for each of the primary faculty associated with a Research Center to have three to four graduate students and one to two postdocs under their guidance participating in Center research, perhaps augmented by additional researchers; the mix of students and postdocs would be expected to vary by faculty member and leading research practice in different research areas (for example, some research areas are graduate student intensive with relatively few postdocs, while the reverse may be true in other research areas). Of course, the specific funding required will vary depending on research area and proposed research and education program, as well as the proposed growth or ramp rate of the Research Center, but this scale of funding is essential in order to launch SkTech and create a vibrant set of SkTech Research Centers forming a network of world-class, multi-university, international research collaborations sufficient to impact an innovative and entrepreneurial ecosystem in Skolkovo and Russia.

The Research Centers will be an important mechanism for SkTech to learn from, and collaborate with, multiple leading international research universities in addition to MIT, as well as build strong linkages to multiple leading Russian research institutes and universities. In particular, the multi-university structure, as well as the size or scale, of the Research Centers pictured in Figure 4 are meant to create and foster deeply collaborative research efforts within the Center. As indicated at the bottom of Figure 4, joint research between faculty, students, postdocs, and researchers across more than one of the participating institutions are desired at not just the Center level, but at the individual research project level. The Research Centers can also play an important human capacity development role: one criteria of a Research

Center proposal will be a plan for the sharing of some number of postdocs, and for the exchange of students, among the Research Center participants. This, together with other research visits and exchanges, will also be important in fostering deeply collaborative research, and could develop candidates for future SkTech and other Russian university faculty hires.

As with US National Science Foundation STC (Science and Technology Center) and ERC (Engineering Research Center) models that couple research to education, the Research Centers will also couple to the SkTech educational programs. The Research Centers will be expected to contribute to generation of new course materials, or to new educational “tracks” or degree specializations within the SkTech Master’s and PhD degree programs. Well thought-out plans for educational as well as research contributions and collaborations will be key criteria for selection of winning Research Center proposals.

Finally, the SkTech Research Center participants will be expected to benefit from, and develop strong linkages with, the SkTech Center for Entrepreneurship and Innovation. These linkages include creation of industrial interfaces and participation models, research project identification and development mechanisms (e.g. Innovation Grants), as well as research contracting and intellectual property licensing standards and models.

In order to provide an initial strong linkage between the educational programs and the Research Centers, to attract the participation of MIT faculty in all of these research program areas, and to create the models for Research Center formation and administration, five of the projected fifteen Research Centers will be reserved for MIT to Co-Direct with SkTech as the non-Russian institution. MIT and MIT principal investigators may also participate in open proposals and competitions for other SkTech Research Centers. Consistent with an ambitious three year timetable, the implementation plan will include mechanisms to rapidly prototype and launch early SkTech/MIT research center generation and seed research activities, enable identification of initial Russian research collaborators, create workshops to identify priority research needs and opportunities, and implement coupled SkTech educational programs.

THE CENTER FOR ENTREPRENEURSHIP AND INNOVATION

The third core element of SkTech will be an integral structure to foster and link research and education with innovation and entrepreneurship. The overarching goal is to instill a culture of innovation and entrepreneurship in the education and scientific activities of SkTech. Like the Research Center model, the CEI will be developed through a collaboration between MIT, SkTech and possibly other institutions. MIT will assist SkTech in establishing this new model through the creation of a Center for Entrepreneurship and Innovation at SkTech (CEI@SkTech). The CEI will be based on fundamental principles for success in academic innovation and derived from experience at MIT and elsewhere and will integrate the three pillars for entrepreneurship and innovation (E&I): Education, Research, and Commercialization. Interaction of the CEI@SkTech with the Skolkovo School of Management could provide an opportunity to build on a current collaboration between the MIT Sloan School of Management and the Moscow School of Management in Skolkovo. In addition, linkages with other institutions in Russia offer additional opportunities for collaboration in both education and research. Thus, one can view the structure of CEI in a manner analogous to the Research Centers (see Figure 4) in which there are activities at SkTech, MIT and other institutions with collaboration in research and education amongst the partners.

The vision for CEI@SkTech and its integration into the university is summarized in Figure 6. It will provide not only the internal infrastructure for education in innovation and entrepreneurship, and for the funding of innovation grants and E&I research, but also the interface for external relationships with industry and international institutions in support of external research contracts, technology transfer to both new and existing companies including: the Technopark, investors and entrepreneurs. CEI@SkTech will oversee course offerings to students in all of the Programs, provide knowledge assistance to all of the SkTech Research Centers and maintain a liaison with all the SkTech Research Centers to identify IP, support technology transfer and facilitate where appropriate external industrial interaction. These activities of CEI@SkTech, the CEI@MIT and interaction with other institutions are described in more detail below.

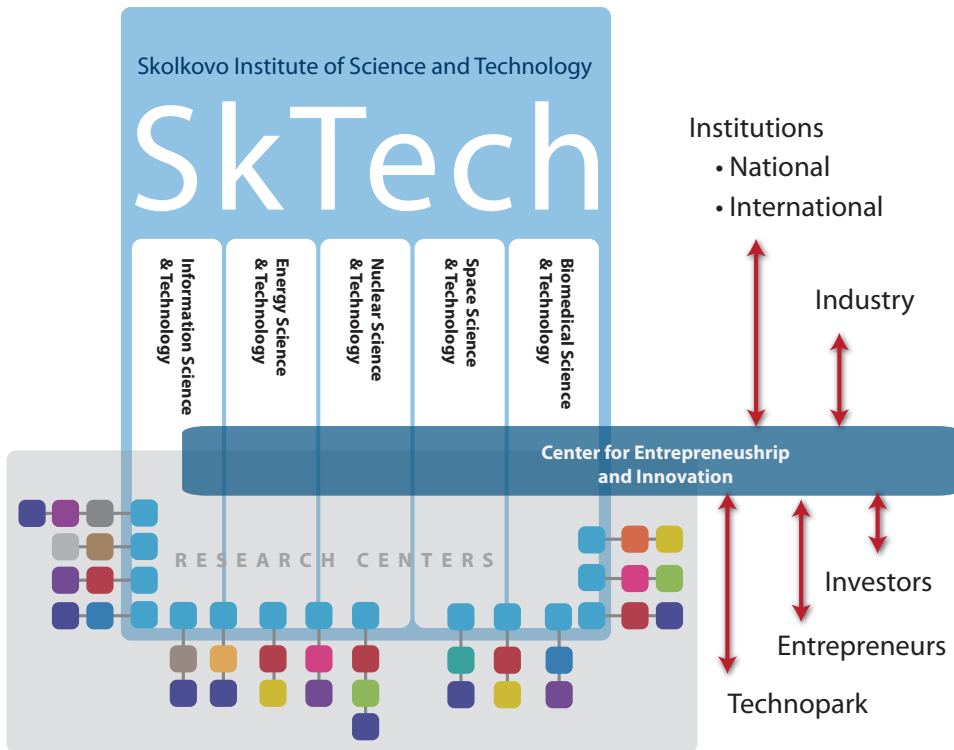


Figure 6: CEI Functional Model – External Interface

The framework for the organizational structure of CEI@SkTech is based on three pillars, each of which embraces several short and long term goals. The organizational architecture, capability and capacity for CEI@SkTech will be developed in collaboration with CEI@MIT and will be designed to meet the unique needs of the Russian innovation ecosystem.

The Education Pillar is based on the principle that “the informed eye can see the opportunity.” Educational activities along with an integrated curriculum in innovation and entrepreneurship provide a means to assure that all students and post docs understand the potential and processes for commercialization of science and technology. These activities build: strength in disciplinary scientific and engineering knowledge which provide the platform for a knowledge economy; familiarity and comfort with cross-disciplinary initiatives; worldly knowledge to understand the societal context of science and technology; systems thinking to address complex and dynamic problems; and innovation and entrepreneurship education to connect science, technology and business. Formal subjects in innovation and entrepreneurship will be available as both required material as

well as additional elective subjects for greater depth and disciplinary focus. In addition activities such as student/staff clubs, business and plan and new venture competitions, and mentoring by entrepreneurs bring opportunity to create a culture of innovation in the university.

The Research Pillar has several components. First, strong basic research in science and engineering is essential, as it provides the ideas and observations from which innovation emerges; basic research is the engine for innovation and the Research Centers provide this engine. These RCs will each have an on the ground activity at SkTech as well as at international institutions (like MIT) and other Russian institutions. Second, there must be an opportunity for strategic cross-disciplinary research as is proposed and enabled by the educational programs associated with the five science and technology theme areas. Third, this basic research must be translated to address specific market opportunities such that, if successful, it may have commercial impact; we envision the use of Innovation Grants supporting translational research as practiced by the MIT Deshpande Center as an essential model to develop and capture value from basic research. Finally, the research pillar must also include research on the management and practice of innovation and entrepreneurship, especially in the Russian context. This is essential to assure continuous improvement and understanding of the unique regional business and social dynamics of entrepreneurship.

The Commercialization Pillar provides the administrative framework and processes to capture and create value arising from research. There must be an organization with processes, policies and procedures to: write and execute contracts for sponsored research with outside parties; identify, create and protect intellectual property; implement best practices in technology transfer to both new and existing companies that are fair and transparent in defining the legal agreements that link funding, research and commercialization; provide transparency and guidelines for preventing conflict of interests; provide mentoring across the entire value chain from idea to commercialization; and promote and nurture connections and build networks both within and external to the university. Since we envision that research contract administration and intellectual property licensing will report within the same organization, care must be taken to balance the interests of research sponsors and spin-outs with the correlate interest of inventors and SkTech in designing a process that is transparent, auditable, and consistent with university licensing best practices. The use of a template research contract and a template intellectual property license will provide a common origin for negotiations and consistency in terms and conditions, yet preserve the ability to customize agreements. A number of mechanisms based on accumulated experience at MIT and elsewhere are important

to achieving these goals. These include: industrial liaison and venture finance networks; student clubs and activities; internal and public events; publication through journals, web blogs, etc.; administration of competitions and rewards; competitions for venture creation, business plans and solving “grand challenges”; and reward and celebration of achievement. One of the features of Skolkovo is the inclusion of a Technopark, technology cluster and research centers of established companies; these provide the opportunity for forming and incubating early stage technology spinout companies as well as tech transfer to established companies. While these external entities are not directly connected to SkTech and are not part of this Agreement, nurturing the local innovation ecosystem is important to SkTech. The industrial liaison office established at SkTech will be charged with the responsibility to develop, nurture and sustain these relationships as part of the greater SkTech innovation ecosystem.

These three pillars will be architected, created and implemented at SkTech through CEI@SkTech. The model for organizing the CEI@ SkTech will develop through a joint design exercise between MIT and SkTech and utilize the infrastructure of CEI@ MIT to develop E&I courses, model all the functional activities described above, and learn from shared MIT/SkTech administration of innovation grants for translational research derived from joint MIT and SkTech, Research Center, or Skolkovo research projects. We can identify certain functional aspects of the collaboration that bring together the various SkTech entrepreneurship and innovation (E&I) ecosystem elements to support ideas that will emerge from SkTech research conducted in the research centers and affiliated institutions:

- An education and research function, led by SkTech appointed faculty of Entrepreneurship and Innovation, to develop and deliver E&I curricula in support of degree fulfillment of SkTech degree candidates, to engage in research into the management and practice of innovation and entrepreneurship, and to guide and integrate the commercialization functions of the CEI into the fabric of SkTech's research and education objectives.
- An Innovation Fund @SkTech to support translational research that will foster connections between SkTech researchers and the Russian E&I ecosystem through the grant selection and management process. In the near term, such a model and awarding of grants may be implemented in collaboration with partner Russian institutions with which SkTech would like to establish connections.

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- A technology transfer and intellectual property (IP) office that can manage the lifecycle of an idea: including an outreach function to attract non-governmental research support for SkTech researchers' ideas; a research contracts drafting, negotiation, and compliance management function; and an IP identification and management function, including publication of a transparent and simple Conflict of Interest (COI) Guideline.
 - A mentorship function to provide guidance for faculty, researchers, and students that would include developing go-to-market strategies for Innovation Grants, venture mentoring, and Entrepreneurs-in-Residence.
 - An E&I programming function that links E&I education curriculum to incentives, rewards and celebrations of achievement with a particular focus to develop and administer competitions and incentives for venture creation, business plans, and solving “grand challenges” that will foster connections – through programming and networking – between SkTech faculty, researchers and students with the external Russian and International E&I community, and will provide an important programming link and house Student clubs. Activities will include events to showcase to international communities the research results of SkTech and its Research Centers. There is an opportunity to showcase selected research at MIT's annual IdeaStream event which is directed to a venture capital audience. Such events will be organized in Russia as well.