

Strategic Development Document of IST Austria for the period 2018–2020

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1 Preamble

This strategic development document describes the strategic outlook of the Institute of Science and Technology Austria (IST Austria) for the coming years. As laid out in the framework agreement between the Federal Republic of Austria and the Institute it serves as a basis for the negotiations on the performance agreement for the period 2018 to 2020 between IST Austria and the Federal Ministry of Science, Research and Economy.

2 The Role of IST Austria in the National Research Landscape

The Institute of Science and Technology Austria (IST Austria) was founded to add a globally visible beacon of frontier research to the Austrian science system. This document reviews the purpose and goals of the Institute, and the conditions that are necessary for its success.

2.1 Is there a recipe for institutional success in science?

Science turns human curiosity about nature – i.e., curiosity about our environment and ourselves – into a systematic effort. While a world without science would see little change in our living conditions, human curiosity brought about and science has accelerated the perpetual change we call progress. Science is the long-term driver behind new technologies, whether in healthcare, agriculture, energy, transportation, communication, manufacturing, or defense. Net science production is therefore the only sustainable way for a nation to profit from human progress and create wealth; nations that are net science consumers will fall behind in the long run. This insight lies at the root of most national efforts to participate in the world-wide scientific enterprise.

Successful participation in science is tough. Science is not just international, competitive, collaborative, expensive, and constantly changing – science exhibits all of these attributes *in the extreme*.

The markets for ideas and for scientists are global. Whether the goal is to publish or to patent, there is neither fame nor fortune for second place in science. Scientific progress often requires teamwork and the cooperation of experts from different fields. Some areas of science need infrastructures that individual institutions or even countries cannot afford. New insights and new methods can change the scientific landscape from one day to the next. Above all, science is serendipitous. Scientific breakthroughs are rarely expected; if they could be foreseen or brought about with certainty, they would not be science. Successful participation in science therefore cannot be decreed by a master plan about strategic directions and concentrated

expenditures; it requires a far more extensive and less guided approach to create an eco-system in which science can thrive.

The only reliable way of safeguarding a nation's investment in science is to create and maintain a comprehensive national education system that lays the groundwork through substantive science education in school, produces the professionals needed by industry and society through effective tertiary science education, and competes in the world-wide scientific enterprise through competitive doctoral and postdoctoral science education. Primary and secondary school science education is substantive if it not only imbues all pupils with the importance of science and prepares them for life in a high-tech world; it must also rouse and foster scientific talents. Tertiary science education is effective if it produces sufficiently many graduates that are sufficiently broadly prepared for the professional needs and job markets of the future. Finally, most scientific progress is based on research performed by doctoral students, postdocs, and young independent scientists; it will happen at the institutions that are able to attract the best doctoral, postdoctoral, and faculty candidates from around the world.

Just as science itself is international, competitive, collaborative, expensive, constantly changing, and serendipitous, the spearheads of a successful national science system must be open to the world, highly selective in their recruitment multi-disciplinary and, well-funded, dynamic and non-bureaucratic, and fully autonomous. In order to attract ambitious scientists from all over the world, an institution must also be permeated by a special spirit. The most successful international examples form pockets of “restless bliss” for scientists in a noisy world – quietly busy islands whose inhabitants are driven by the common sense of purpose to expand the frontiers of human knowledge. A scientific institution forms a pocket of restless bliss if it is steeped not only in scholarship and individualism but also in community and respect for each other; if it values creativity and originality but also hard work and tenacity; if it is well-funded but rewards only performance and achievement; if it is open to all but thrives on constant competition; if it disdains limits and hierarchies but embraces evidence and reason; if it perpetually reinvents itself and yet maintains as its most valuable asset its long-term brand and reputation.

The leading American research universities form such pockets of restless bliss. They are magnets that attract scientific high performers at all levels – from the apprentice (doctoral student) to the assistant (postdoc) and independent scientist (a.k.a. principal investigator) – from all corners of the world. The unique value of a Princeton or Stanford lies not in the total cost of their buildings and scientific instruments, nor in the accumulated brain power of their Nobel laureates and other human resources, not even in the expected value of their inventions and spin-offs, but in the atmosphere that permeates their campuses, classrooms, research labs, and nearby coffee shops. The infrastructures and the salaries of Princeton or Stanford are easy to match and top for rich nations like the Gulf Emirates or Singapore, yet a campus atmosphere that stimulates intense intellectual inquiry and discourse is difficult to recreate. For a small country like Austria it is fortunate that not all conditions for the success of a scientific institution can be bought and decreed. Despite enormous investments, serendipity is unlikely to strike in closed, restrictive, or hierarchical societies.

2.2 The purpose of IST Austria

IST Austria is the result of a conscious effort to create in Austria an internationally oriented apex of its national science system. The Institute was founded in 2006, started operating in 2009, comprises 45 research groups in 2017, and will double in size till 2026. The two core missions of IST Austria are to perform world-class research and to provide world-class doctoral and postdoctoral education in science. In order to accomplish these missions, IST Austria must attract top scientists from the entire world, i.e., it must compete successfully for doctoral students, postdocs, and faculty (professors) against the leading scientific institutions in the world. Every decision in the design and development of IST Austria, no matter how large or small, has been guided by this principal goal. This applies equally to the construction of the campus and scientific infrastructure, to the recruitment of scientific and support personnel, and especially to the creation of internal structures and a scientific culture that, over time, shall enable the emergence of an internationally known pocket of restless bliss for scientists in Austria.

Two of the most important early design decisions at IST Austria were the creation of a professorial tenure track and an institutional doctoral school, both common around the world but, in their uncompromising versions, new in Austria. The professorial tenure track offers regular professorships to young scientists, first for a multi-year trial period after which their scientific performance is evaluated rigorously. It is these offers which allow IST Austria to compete for faculty candidates with the leading institutions around the world. The institutional doctoral school requires all doctoral students to pass a selective admissions process and complete a rigorous structured curriculum, while offering full-time employment in return. It is these offers which allow IST Austria to compete for doctoral candidates with the leading institutions around the world.

IST Austria can succeed only as part of a strong national science system and, by succeeding in its core missions of world-class research and doctoral training, will further strengthen this system. The Institute relies on national research funding agencies that are financed generously and distribute their grants strictly competitively, on doctoral candidates from the Austrian universities whose education prepares them to compete successfully with their international peers, on a national science infrastructure that keeps up with the state-of-the-art, on a scientific establishment that is open to new administrative structures, and on a public that understands the value of science for society. The Institute collaborates with scientists across the nation and the world; it produces graduates for research and leadership positions within the nation and the world, it contributes to the scientific infrastructure that is available to all Austrian scientists; it introduces to Austria successful international models for science administration such as the professorial tenure track and the institutional doctoral school; it gives an impetus to the Austrian start-up scene and enhances the attractiveness of Austria for research-intensive international companies. Above all, IST Austria increases the amount and raises the level of the engagement of Austria within the international scientific enterprise, by bringing top performers, their ideas, and ultimately economic and public value to Austria.

IST Austria sees itself as vanguard of Austrian science – a nimble spearhead that can react quickly to international developments and new challenges; more advance guard than heavy flagship; more bold prototype than safe product: always looking out for and probing new directions in science, in science infrastructure, and in science management. By constantly moving with the unpredictable leading edge of international science and by adapting quickly to new trends, the Institute can play a central role in keeping the entire national science system competitive. As the forces that drive international science are extreme, so must be the principles that govern IST Austria.

2.3 The conditions for the success of IST Austria

As science itself is extremely international, competitive, collaborative, expensive, dynamic, and serendipitous, IST Austria can fulfill the spearhead role within the Austrian science system only by creating and maintaining extreme conditions that will not guarantee but facilitate success in science. The Institute would not add value by duplicating other parts of the Austrian science system. Instead, the Institute has set up and strives to maintain the following conditions:

Extremely international The majority of scientists at all levels (doctoral students, postdocs, professors) are international. The language spoken on campus is English.

Extremely open There must be no in-house careers: all professors are recruited from outside the Institute, preferably from abroad to bring new scientific strengths to Austria. For every scientific position, IST Austria recruits world-wide. The Institute evaluates each applicant individually, looking for unique experiences and outstanding accomplishments rather than specific degrees or titles. Doctoral students can be hired without Master's degree, professors without habilitation.

Extremely selective For all positions, scientists are chosen from the largest possible pool of candidates. Doctoral and professorial candidates apply to the Institute, usually in the thousands, not to a research group or search committee. Students and postdocs are not recruited for specific research projects, nor professors for specific research topics.

Extremely opportunistic IST Austria always tries to hire the best available scientists, independent of their research interests. Whenever the opportunity to hire a world-leading scientist arises, in any field of science, the Institute must seek to attract that person. It is the availability of outstanding candidates, rather than strategic planning or stakeholders' wishes, which will determine the research portfolio of the Institute.

Diverse IST Austria values differences in scientific approaches and views, as well as differences in scientific and personal backgrounds.

Undirected IST Austria is an academic institution. All scientists are free to choose their scientific projects and their scientific collaborators – within the Institute, within Austria, and abroad.

Extremely competitive Half of IST Austria's budget depends on performance criteria such as the successful acquisition of competitive external research funds. Also, a significant fraction of the Institute's internal resources is distributed to the research groups on a competitive and time-limited basis. A successful research group is funded in three ways: by winning external competitions for research grants; by winning internal competitions for research funds; and through a base budget promised by the Institute.

Extremely performance-oriented The base budget of each research group depends on the scientific performance of the group and is promised for five years at a time. After the first five years, junior professors need to undergo an international evaluation of their scientific accomplishments. The outcome of this so-called "tenure evaluation" determines whether or not the professor may stay at the Institute. There are no predefined criteria for successful tenure evaluations, except that the professor must meet the standards of leading international competitors.

Extremely dynamic IST Austria hosts doctoral students and postdocs for one stage of their careers. At the completion of their training, they must leave the Institute. This means that close to 20 percent of all scientists are replaced every year, and that less than 10 percent of all scientists – namely, those professors who pass their tenure evaluation – may stay at the Institute beyond five years. Professors who retire or leave IST Austria for other institutions are not replaced by new hires in the same field.

Extremely young Most professors of IST Austria are hired early in their careers, near their peak of creativity. Every professor, no matter how junior, is independent from day one, with complete control over their base budget and research group, and not subordinate to a more senior professor.

Extremely non-hierarchical IST Austria is, on the scientific side, organized into research groups. Each research group is headed by a professor and consists of a small number of doctoral students and postdocs. All students and postdocs are supervised directly by their group leaders. All professors report directly to the president of the Institute.

Extremely interactive IST Austria is not partitioned into departments or scientific units of any kind, other than the individual research groups. The size of each research group is limited to 15 scientists, including the group leader (professor). This group size limit enables the direct supervision of the group members by the group leader, and fosters the interaction between different groups, even across different scientific disciplines. Small research groups interact with each other more than large groups do.

Multi-disciplinary IST Austria unites all major fields of science on one campus: the life sciences, the physical sciences, and the mathematical sciences. Cross-disciplinary collaborations are supported by the space allocation to research groups, by infrastructure sharing between groups, by an internal competitive fund that is available for multi-group collaborations, and by the institutional doctoral school. IST Austria has a single, multi-disciplinary doctoral program. All doctoral students are required to take courses together with students from other disciplines and to complete research projects with several different groups before choosing a supervisor for their doctoral research.

Well-funded To compete with world-leading institutions, IST Austria must provide its scientists with a state-of-the-art scientific infrastructure and with colleagues that can offer any needed expertise. Hiring strictly the scientists with the greatest potential is one thing, providing them with an environment that supports them to live up to their full potential the other. This requires internationally competitive financing. Otherwise the Institute will attract only second-rate scientists, in which case it would be wiser to save the funds altogether.

Efficient IST Austria pools its lab spaces, scientific equipment, and technical services centrally, whenever feasible, to make them available to all scientists of the Institute. There is an internal market-place for equipment use and technical services in order to guide and control the investments of the Institute into scientific infrastructure. Any unused capacities are made available to other scientists in Austria and abroad.

Extremely independent IST Austria must maintain complete autonomy from all sponsors, public and private. While sponsors have the obligation to demand that their funds be spent economically and the right to ask for any reporting they wish, all Institute decisions regarding research directions, personnel, internal processes, scientific infrastructure, and individual projects must be made on their scientific merits, without external influences.

Extremely flexible All planning processes for the development and operation of IST Austria exhibit large margins of uncertainty, both at the level of individual research groups and at the Institute-wide level. This has scientific, personnel, and financial reasons: neither the results nor the timeline of scientific projects can be predicted, nor the future developments in science; the scientists that the Institute tries to attract and keep are in high demand around the world and may join competitors; the outcomes of all efforts to acquire competitive research grants or private donations are marked by a high degree of variability. It is therefore paramount that individual professors as well as the entire Institute maintain maximal flexibility in spending their funds; that they can always and non-bureaucratically change or postpone expected expenditures due to new developments.

Extremely intense IST Austria employs only full-time scientists: they must be fully committed to the advancement of science, their own scientific career, and the support of the Institute. In return, the Institute must provide a 24/7 work environment that allows dedicated scientists to focus single-mindedly on their scientific success.

Extremely supportive Besides performing world-class research, the training of scientists is the second main priority of IST Austria. The goal of the Institute is to become a world-wide brand for doctoral education. The doctoral students and postdocs of the Institute receive not only close guidance by world-class scientists, but also professional training in the communication and leadership skills necessary to succeed in academia, industry, and the public sector. Much of the reputation of the Institute will depend on the success of its alumni.

Extremely ambitious All evaluations and measurements of IST Austria must compare the Institute and its conditions against the world-leading institutions, both in the direct competition for scientific talent and in the indirect competition for success at the most prestigious international journals, conferences, prizes, fellowships, and funding agencies.

Long-term The success of individual research projects and scientific hires can be measured in years, typically 3-5 years. The impact of research results and scientific careers beyond a narrow community of scientific peers, on other disciplines, on society, and on industry, must be measured in decades. The reputation of a scientific institution therefore requires decades to build.

Valuable IST Austria is built on the premise that wherever world-class scientists are brought together and given the freedom and the means to pursue their interests, driven only by their curiosity, some of the outcomes, while unforeseeable, will benefit society and industry. The Institute is committed to profit, in the long run, also financially from the scientific discoveries that will happen on campus, through the management of intellectual property and through the entrepreneurial training it offers to students and postdocs. If the Institute succeeds in its scientific mission, it will also generate economic value on a scale that is comparable to the leading scientific centers around the world.

2.4 Beyond IST Austria

International science is organized as a network of universities and research centers that are connected through the constant exchange of scientists and ideas, both in competition and in collaboration with each other. The strongest nodes of the network form hubs that, through their gravitational attraction, grow even stronger over time. Unlike natural resources, brain power is distributed equally around the globe. In the global competition for talent it is therefore especially the small countries which must strive to build attractive science hubs in order to be net importers of brain power. The Vienna and Lower Austria region satisfies many prerequisites for becoming a global science hub in the center of Europe: a rich historical legacy, a high quality of life, many diverse universities and research institutions. Nonetheless, this can happen only through a concerted and sustained effort by all stakeholders to build a top-notch, flourishing, and many-faceted eco-system for science in and around Vienna. A successful IST Austria can contribute an essential building block towards that goal.

3 Current Status and Development of IST Austria from 2018 to 2020

3.1 The Status of IST Austria as of December 31, 2016

3.1.1 The two primary missions of IST Austria are (1) to perform basic research in science on a world-class level and (2) to train internationally recruited scientists in doctoral and postdoctoral programs.

3.1.2 IST Austria has hired 45 professors of biology, neuroscience, physics, mathematics, and computer science.

3.1.3 The professors of IST Austria have acquired 31 ERC grants for their research. The doctoral and postdoctoral programs of IST Austria have been funded by EU-COFUND.

3.1.4 IST Austria has graduated 30 PhD students and 130 postdocs, who have left the Institute for their next career steps.

3.1.5 IST Austria has set up the following scientific service units to support its scientists: library, scientific computing, machine shop, nanofabrication, bioimaging, electron microscopy, preclinical, and life sciences.

3.1.6 IST Austria has 264 career employees, including professors, administrative employees, and employees in the scientific service units. IST Austria has 308 non-career employees on temporary contracts, including PhD students and postdocs.

3.1.7 IST Austria will double in size until 2026.

3.2 The Plans of IST Austria for 2018-2020

3.2.1 By December 31, 2020, IST Austria expects to grow to about 355 career employees (FTE).

3.2.2 IST Austria values diversity and is committed to providing equal opportunities and ensuring fairness, in particular with regards to equality of men and women.

IST Austria aims to provide a place where everyone is treated equally and respectfully regardless of age, gender, nationality, ethnicity, religion, sexual orientation, and physical ability.

3.2.3 IST Austria plans two new science buildings: a building that enables chemical research to be completed in 2020, and a building for life science research to be completed in 2023.

3.2.4 IST Austria plans to hire about 5 new professors per year. The actual number will vary from year to year, depending on the availability of candidates. While IST Austria expects to hire in all fields of science, special efforts will be made to hire (1) female professors, (2) users of current and future facilities, (3) chemists, and (4) interdisciplinary scientists.

3.2.5 Depending on which professors will be hired, IST Austria may add NMR, mass-spectroscopy, crystallography, cryo electron microscopy, and/or genomics facilities to its scientific service units.

3.2.6 IST Austria expects to admit about 1 new PhD student per professor per year. The number of postdocs will depend on the success of professors with external grants.

3.2.7 In addition to its two primary missions – basic research and (post)doctoral training – IST Austria plans efforts in four secondary directions:

3.2.7.1 IST Austria will continue its science outreach activities for the general public (IST Lectures, Open Campus, etc.) and increase its science education activities with the goal to improve science education at Austrian schools. This includes the building of a Visitor Center on campus by 2020.

3.2.7.2 IST Austria will continue to develop a comprehensive “eco-system for innovation” around the campus. This includes the management of intellectual property, the support of the technology park IST Park and the planned start-up incubator IST Cube, as well as entrepreneurial training and technology transfer activities such as the TWIST Fellow program and an industrial affiliates program.

3.2.7.3 IST Austria will continue to raise private funds for its endowment.

3.2.7.4 IST Austria is prepared to serve as an advocate for science management and graduate education in Austria.

3.2.8 In fall 2019, IST Austria will be evaluated by an international scientific committee appointed by the Board of Trustees.

3.2.9 IST Austria may introduce scientific departments.

3.3 Measures for the Performance Agreement 2018-2020

3.3.1 IST Austria supports the strategy for research, technology, and innovation (FTI-Strategie¹) of the Austrian government. The goal of excellence in basic research, which is emphasized also in the "Action Plan for a Competitive Research Area²", underlies all decisions regarding the structure and operation of the Institute.

3.3.2 The Action Plan calls for the improvement of career opportunities for scientists at Austrian universities and research institutions – the support of the careers of young scientists being one of the core aims also of the "Development Plan of the Austrian Universities"³. IST Austria has set up its own career model based on international standards. As such, it can serve as a model for the career development plans of Austrian universities and other research institutions.

3.3.3 IST Austria is an active member of the Austrian research area ("Österreichischer Forschungsraum"). The Institute participates in the research infrastructure database of the BMWFW, which facilitates collaborations with other universities, research institutions as well as industry, also in accordance with the "Strategy for the Future of Life Sciences in Austria".

3.3.4 Another goal of the RTI Strategy, to establish more competitive research funding, is one of the core principles of IST Austria, as half of its budget depends on the fulfillment of research-immanent quality criteria, including significant targets on third-party funds. To succeed, the Institute must have equal access to all competitively distributed national research funds.

3.3.5 IST Austria will continue to monitor and collect information on available funding schemes, programs, and organizations. The Institute will actively engage in consultations of the BMWFW for the next EU framework program.

3.3.6 IST Austria will continue to implement and develop further the following concepts, which were introduced during the period 2015-2017:

- Personnel and Career Development Plan
- Alumni Tracking and Networking Concept
- Position paper on Open Access & Open Data

¹ Realising potentials, increasing dynamics, creating the future. Becoming an Innovation Leader. Strategy for research, technology and innovation of the Austrian Federal Government. 2011

² Aktionsplan für einen wettbewerbsfähigen Forschungsraum. Maßnahmen des Bundesministeriums für Wissenschaft, Forschung und Wirtschaft zur verstärkten Umsetzung der FTI-Strategie der Bundesregierung in ausgewählten Themenfeldern. Bundesministerium für Wissenschaft, Forschung und Wirtschaft. 2015

³ Der gesamtösterreichische Universitätsentwicklungsplan 2016-2021. Bundesministerium für Wissenschaft, Forschung und Wirtschaft. 2015

- Science in Society – An outreach concept at IST Austria
- IP and Commercialization Strategy & Industry Cooperation Strategy

3.3.7 IST Austria develops, implements, and evaluates measures to support especially the careers of female scientists. To support the compatibility of a scientific career with family life, the institute aims at obtaining the certificate “audit workandfamily” and will continue to fulfill and improve the measures laid out in the audit plan.

3.3.8 As called for in the Action Plan, IST Austria will continue to enhance the mobility of its staff by supporting the participation of its employees in the Erasmus+ program. The Institute stays in touch with its graduates through an alumni network.

3.3.9 IST Austria is one of the forerunners in Austria regarding open data and open access and is committed to provide unrestricted and cost-free online access to scientific publications. The creation of an online repository and other measures of the Institute’s open-access policy anticipated some of the elements of the Digital Roadmap Austria.

3.3.10 The FTI Strategy, the Action Plan, and the Open Innovation Strategy of the BMWFV and BMVIT all call for increasing the dialogue of science and research with society. The goal of a better public understanding of scientific research is supported by the outreach program of IST Austria, which includes public lectures and the annual SommerCampus for children.

3.3.11 Another focal point of recent Austrian research policy papers is to foster the collaboration of science and industry⁴. IST Austria will continue its diverse efforts in this area, such as its translational TWIST fellowship program, which was referred to in the Open Innovation Strategy⁵. Another important project is the construction of a technology park (“IST Park GmbH”) adjacent to the campus, in cooperation with ecoplus. The technology park attracts companies and encourages entrepreneurship joining basic research with innovative technological or industrial applications and products.

3.4 Major Challenges for IST Austria for 2018-2020

3.4.1 There is an increasing international trend towards “fast-track PhD programs” that admit BS students and award MS degrees “on the way” to the PhD. To stay internationally competitive for the best PhD students, IST Austria must award its PhD students with the equivalent of an

⁴ See e.g. Zukunftsstrategie Life Sciences und Pharmastandort Österreich. Bundesministerium für Wissenschaft, Forschung und Wirtschaft. 2016

⁵ Open Innovation Strategy for Austria. Goals, Measures & Methods. Federal Ministry of Science, Research and Economy and Federal Ministry for Transport, Innovation and Technology. 2016

MS degree after the successful completion of the course and rotation requirements of the PhD program.

3.4.2 The secluded location of IST Austria offers many advantages, but the limitations of the gastronomic, transportation, and childcare infrastructures make it difficult for scientists to work outside standard working hours. IST Austria must make every effort to enable its scientists to work whenever their projects demand it, independent of the time and day of the week.

3.4.3 IST Austria must make every effort to increase the number of female professors. This is a challenge because the international competition for first-rate female scientists is especially fierce.

3.4.4 The financial stability and financial flexibility of IST Austria has been an indispensable condition for its success. To continue that success, IST Austria must continue to rely on 10-year budget stability and on maximal spending flexibility over current and future 10-year budgeting periods.

3.4.5 IST Austria needs to acquire a substantial part of its budget from external competitive sources. This principle enforces performance, but requires that IST Austria must not be disadvantaged in the competition for external competitive funds, be it through programmatic or overhead restrictions.

3.4.6 To guarantee the long-term success of IST Austria, the institute must take full control of its campus.