

EVALUATION AND ACCREDITATION DOCUMENTS

MATERIALS SCIENCES AND ENGINEERING (MSE) DOCTORAL PROGRAM

Skoltech
Russia

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EVALUATION REPORT

MATERIALS SCIENCES AND ENGINEERING (MSE) DOCTORAL PROGRAM

Skoltech
Russia

JANUARY 2020



After the evaluation of its *Life Sciences and Computational and Data Science and Engineering* doctoral programs, Skoltech has mandated Hcéres to perform its *Materials Science and Engineering* doctoral program evaluation. The evaluation is based on the "External Evaluation Standards for doctorates out of France", adopted by the Hcéres Board on March 26, 2018. These standards are available on the Hcéres website (hceres.fr).

For the Hcéres¹ :

Nelly Dupin, acting President

On behalf of the experts committee² :

Pr Anne Tanguy, President of the committee

In accordance with the decree n°2014-1365, November 14th, 2014,

¹ The president of Hcéres "contresigne les rapports d'évaluation établis par les comités d'experts et signés par leur président." (Article 8, alinea 5) – « countersigns the assessment reports made by the experts'committees and signed by their president » (article 8, alinea 5)

² The evaluation reports "sont signés par le président du comité". (Article 11, alinea 2) – « are signed by the president of the committee » (article11, alinea 2)

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I. NATIONAL CONTEXT AND INSTITUTION IDENTITY SHEET

GENERAL CONTEXT AND HIGHER EDUCATION

The Russian Federation is located only 1.500 kilometres far from France, and was long regarded as one of its leading cultural partner. It is situated between Europa in its west part (25.3% of its area) and Asia in its east part (74.7% of its area). It spans over 9.000 kilometres from Kaliningrad (close to Finland) to Vladivostok (close to Japan). Its global area is more than 17.000.000 square kilometres, making it the biggest country in the world¹. With about 147 million inhabitants as indicated in the official Russian statistics², it is also the 9th most populated country in the world³, far ahead of the next one. Its Gross Domestic Product (GDP) sums up to 4.349 trillion US\$ (6th in the world), representing 29.642 US\$ per capita (49th in the world)⁴. The country is rich in natural resources and has a long tradition in higher education, culture and research, and figures in current rankings amongst the top countries in the world⁵.

The first university in Russia was founded in 1687 and the Lomonosov Moscow State University was established in 1755. Currently, there are 766 universities spread over 82 regions of the Russian Federation, hiring 245.100 faculty members, and covering the whole scope of hard and soft sciences (including Engineering, Life Sciences, Technology or Medical studies)⁶. In 2018, 4.246 million students were studying in one of these universities (among them 260.100 foreign students). Several of the Russian Universities occupied top places in the 2019 QS BRICS University Rankings (Lomonosov Moscow State University rank 6; Saint-Petersburg State University rank 11; Novosibirsk State University rank 12)⁷. The 2019 World University Ranking of Shanghai University ranked the Lomonosov Moscow State University at position 87, Moscow Institute of Physics and Technology amongst the best 401-500 (3rd rank in Russia) together with Novosibirsk State University, while St Petersburg State University (2^d rank) is amongst the best 301-400⁸.

Higher education in the Russian Federation is mostly provided by public universities and institutions. In recent years the offer has been extended by the advent of private higher educational Institutions⁹. In order to offer the right of issuing state-recognized degrees, they need to possess (i) a license for educational activity and (ii) a national accreditation certificate. The license for educational activity allows the institution to train specialists in fields of higher vocational education. The national accreditation certificate guarantees that a state-recognized degree certificate is obtained¹⁰. In 2017, Skolkovo Institute of Science and Technology (Skoltech) has obtained both the "License for educational activity" as well as the "State accreditation" by the Federal Service for Supervision in Education and Science. The PhD degree is, however, not yet formally recognized in the Russian Federation, even if it is very close to the traditional Candidate of Sciences degree awarded by the central state-wide board called Higher Attestation Commission¹¹.

Since 2011, Russian universities organize their curriculum similar to what was agreed on in the Bologna treaties. A Bachelor's degree (4 years) is followed by a Master's degree (2 years). After obtaining a Master's degree, Russian students can enter postgraduate courses and obtain a Candidate of Sciences degree within 3-4 years¹². International students have to demonstrate at least a B1 level in the Test of Russian as a Foreign Language (TORFL)¹³. Since 2015 the equivalence between French and Russian degrees are set formally¹⁴.

SKOLKOVO INSTITUTE OF SCIENCE AND TECHNOLOGY

The Skolkovo Institute of Science and Technology (Skoltech)¹⁵ is a private non-profit institution for higher education (research university) that was founded in 2011 in partnership with the Massachusetts Institute of Technology (MIT) and the Skolkovo Foundation as an essential part of the Skolkovo Innovation Center, the last one being somehow similar to a French "Pôle de Compétitivité". The Founders of Skoltech represent ten

¹ <https://en.wikipedia.org/wiki/Russia>

² <https://www.gks.ru/>

³ https://fr.wikipedia.org/wiki/Liste_des_pays_par_population

⁴ <https://www.imf.org/en/Countries/RUS>

⁵ <https://www.master-and-more.eu/en/top-40-education-systems-in-the-world/>

⁶ Statistical Year book of Russia 2018. Moscow, Rosstat (2018)

⁷ <https://www.topuniversities.com/university-rankings/brics-rankings/2019>

⁸ <http://www.shanghai ranking.com/arwu2019.html>

⁹ <https://studyinrussia.ru/en/why-russia/russian-education-in-figures/>

¹⁰ http://www.obrnadzor.gov.ru/en/higher_education/

¹¹ https://en.wikipedia.org/wiki/Candidate_of_Sciences

¹² <https://studyinrussia.ru/en/study-in-russia/info/levels-of-education/>

¹³ <http://english.spbu.ru/torfl>

¹⁴ <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031978476&categorieLien=id>

¹⁵ <https://www.skoltech.ru/en/>

Russian universities and organizations¹⁶ including recently joined Sberbank¹⁷. The aim is to create a new model of education in Russia and abroad, with international adaptability, very high technical level, and producing research near the market, encouraging a rapid transfer of technology with the creation of start-ups that will join Skolkovo's incubators.

Skoltech offers programs for master and PhD studies in the following domains: Data Science & Artificial Intelligence, Information Science and technology, Life Sciences and Health, Advanced Materials & Engineering, Energy Efficiency, Photonics and Quantum Technologies, Mathematical and Theoretical Physics.

The PhD studies¹⁸ are organized in 7 PhD Programs (Life Science, Computational and Data Science and Engineering, Engineering Systems, Materials Science and Engineering, Petroleum Engineering, Physics, Mathematics and Mechanics) for a total of 383 students in 2018.

Research is organized in 10 Centers for Research Education and Innovation (CREIs)¹⁹ covering the various domains of Materials Science (including materials synthesis, energy storage, quantum materials), Advanced Engineering (like robotics, photonics, complex systems, strategic thinking), Biology (including neurobiology or agro-science), Geology (combining hydrocarbon recovery with geomechanics, geochemistry and high performance computing), Informatics (including Data Science and Artificial Intelligence) and Mathematics (when applied to Theoretical Physics). The Skoltech Center for Energy Science and Technology (CEST) for example, is a CREI consolidating resources around the Energy efficiency target domains. It hosts two PhD programs ("*Materials Science and Engineering*", and "*Engineering Systems*").

KEY FIGURES

Skoltech has been conceived as a small university that will enroll 1,200 graduate students (MSc and PhD) and employ 200 faculty members by 2024²⁰. Currently²¹, 136 professors, 143 postdocs and researchers, 202 engineers and technicians, and over 1,000 students are working at Skoltech. Amongst the students, 383 PhD students (of which 56 are students of the *Materials Science and Engineering* doctoral program) are working in one of the 7 state-of-the-art labs with a total area of 3,300 square meters. Since 2017 Skoltech has seen its number of students to increase by 40% and its number of faculty members by 30%, thus becoming very close to its 2024 target. The academic and engineering staff, as well as the attracted funding followed an exponential growth¹⁸ to reach respectively 492 people and 1,112 million rubles in 2018.

SKOLTECH GOVERNANCE

Skoltech's governance²² is based on the Assembly of Founders, the Board of Trustees, the Academic Council and its President. The Assembly of Founders (with a representation of 10 institutions in 2019) is the highest collegial body that approves the charter, appoints the Board of Trustees, the Academic Council and the President, as well as makes decisions on Skoltech membership in associations and legal entities. The Board of Trustees (including 17 members from academia, economics and politics, including representatives from the Massachusetts Institute of Technology and from the King Abdullah University of Science and technology) conducts general oversight of the Institute's activities. It approves the Strategic Action Plan, the Financial Plan, related reporting, and reviews proposals on major structural changes (like the opening or reorganization of the Centers for Research Education and Innovation -CREIs). The Academic Council is appointed by the decision of the Skoltech Board of Trustees. It oversees the Institute's educational, scientific, R&D and Innovation activities. Its 19 members are from Skoltech senior faculty or management as well as invited members. The President of Skoltech heads the leadership board of Skoltech. Vice presidents have been designated for Industrial Cooperation, International Business Affairs and Intellectual Property, Community Development and Communication, Finance and Operations as well as Real Estate and Facilities. Three deans of Faculty, of Research and of Education and a Provost complete the leadership board. They are responsible for the strategic issues of the Institute, supervising educational programs as well as research strategies.

¹⁶ Moscow Institute of Physics and Technology; Tomsk Polytechnic University; Moscow School of Management Skolkovo; New Economic School; Rusnano; Russian Venture Company (RVC); Bank for Development and Foreign Economic Affairs (Vnesheconombank); Foundation for the Assistance to Small Innovative Enterprises in Science and Technology; RAS Scientific Center in Chernogolovka. Sberbank joint the board of the founders 11th December 2019.

¹⁷ <https://www.skoltech.ru/en/2019/12/sberbank-becomes-a-founding-member-of-skoltech/> (12 December 2019)

¹⁸ Skoltech Annual Report (2018) <https://www.skoltech.ru/app/data/uploads/2019/04/Annual-report-2018.pdf>

¹⁹ <https://www.skoltech.ru/research/en>

²⁰ https://www.skoltech.ru/app/data/uploads/2019/10/Strategic-plan-2019-2021_september-2019_mailing-small.pdf

²¹ <https://www.skoltech.ru/en/about/key-facts/>

²² <https://www.skoltech.ru/en/about/governance/>

POSITIONING, STRATEGY AND CHALLENGES

Skolkovo Institute of Sciences and Technology has been created for becoming the leading university in the Russian Federation and one of the top institutes worldwide. Goals of Skoltech include performing cutting-edge fundamental and applied research and fostering academic excellence.

Educational and research programs have been implemented for providing exceptional intellectual and material environment, allowing to educate the next generation of leaders in science, technology and business.

Challenges include establishing successful research programs in a rapidly evolving international competition. These programs are predominantly dependent on optimal financial resources and access to highly qualified persons at each level of the hierarchy. The leadership of Skoltech and the association with its collaborative partner, the Skolkovo Foundation, have been organized for facing these challenges.

II. EVALUATION PROCEDURE

PRESENTATION OF THE INSTITUTION'S SELF-EVALUATION APPROACH

The PhD program of the Skoltech Center of Life Sciences has submitted a clearly organized self-evaluation report which follows the structuration into four areas of the Hcéres PhD evaluation framework:

- Area 1 – The positioning of the doctorate;
- Area 2 – Organization and management of the doctorate;
- Area 3 – Supervision and training for doctoral students;
- Area 4 – Integration of doctors into the job market.

Each of these four items has been concisely described on 30 pages that were supported by extensive appendices, providing additional information on individual points, often represented in form of tables. The self-evaluation report is accompanied by a SWOT analysis.

COMPOSITION OF THE COMMITTEE

- Ms Anne Tanguy, Professor of Mechanics and Materials Sciences at INSA-Lyon, former vice-Director of the Doctoral School of Mechanics, Energetics, Civil Engineering and Acoustics, University of Lyon, France, chair of the committee,
- Mr François Henn, Professor of Physical-Chemistry, Faculty of Sciences, University of Montpellier, France. Head of the bidisciplinary Physics-Chemistry bachelor. Former Vice President for International Affairs of the University of Montpellier (2012-2018)
- Mr Philippe Lecoœur, Professor of Materials science at Paris-Saclay University, vice-Director of the Materials department from Center for Nanoscience and Nanotechnology (C2N) research laboratory, head of the Master Training in Materials science from Paris-Saclay University, France.
- Mr Benjamin Ourri, PhD student in organic chemistry, UCB Pharma and University of Lyon, France.

The committee was accompanied by Prof. Pierre Sebban, science advisor at the Hcéres.

ON-SITE VISIT DESCRIPTION

The committee visited Skoltech from December 9 to 11, 2019.

On day one of the visit, President Prof. Alexander Kuleshov received the committee in the presence of dean of education Prof. Anna Derevnina, with the director of the Materials Science and Engineering doctoral program Prof. Alexey Buchachenko, and the director of the CEST Prof. Artem Abakumov. They provided a general presentation of the Institute, introducing the importance of Skoltech in the Russian Federation, and the importance of innovative research and the doctoral programs in Skoltech. This meeting was followed by a more detailed presentation of the Materials Science and Engineering doctoral program by its director Prof. Alexey Buchachenko in the presence of the pedagogical and administrative team. After this presentation, Prof. Buchachenko answered to questions of the committee.

The whole Evaluation committee met different representatives of stakeholders: Mr. Lyssenko from the Lomonosov Moscow State University, Mr. Grimaud from College de France (France), Ms. Kallio from Aalto University (Finland), Ms. Hadermann from University of Antwerp (Belgium), Mr. Antipov from RusTor, Ms. Katorova from the start-up K-plus, Mr. Kashin from InEnergy Ltd., and Mr. Nedoluzhko from LG Technology center.

The committee was then divided into 2 half-committees who met separately a representative panel of the research supervisors and a representative panel of lead instructors.

The first day was concluded by a visit of the general structures in the new building of Skoltech, and especially of the FabLab and the recently installed research laboratory, based on advanced techniques in electron microscopy.

On the second day, the half-committees met representative members of the Doctoral Program Committee, representative members of Individual Doctoral Committee, a representative panel of PhD students (2 working students/year of study including 1 foreign student and one student working in partnership with industry), a representative panel from Skoltech students council, representative members from the Department of Education, representative members from the Doctoral Study office and from the staff in charge of communication and marketing, the staff in charge of the Quality Assurance framework, Staff in charge ITCs facilities, representative staff from the doctoral program involved into integration of Doctors into the jobs market, representative panel of Alumni Association, representative panel of recently recruited junior faculty, and finally a representative panel of doctors having already defended their thesis. In addition, the whole committee met M. Arkady Dvorkovitch, President of the Skolkovo Foundation to exchange about the Skoltech strategy and its evolution. The second day ended with the visit of the research facilities for solar cells and batteries currently located in a different building and which should be transferred in a near future to the new building to be constructed next to Skoltech.

On the last day of the on-site visit, the whole committee discussed one hour with the Program Director of the Materials Science and Engineering PhD program (Prof. M. Buchachenko) for clarifying the points that came to its attention during the two days of interviews and campus visits. After the interview, the committee was invited to attend a thesis defense from the Computer Science department.

The committee acknowledges the efficient, reliable and active organization of the visit by Skoltech.

III. EVALUATION REPORT

AREA 1 – THE POSITIONING OF THE DOCTORATE

1-1: The doctorate's distinct features and objectives are clearly defined

Skoltech Materials Science and Engineering PhD program is a cross-disciplinary program aiming at implementing the fundamental principles of physico-chemical design, synthesis and advanced characterization of materials, for applications in various technologies like energy sources, conversion and storage. The committee thinks that its objectives are clearly defined and are sufficiently large to be adaptable to long-term evolutions, thus guaranteeing its scientific sustainability. Its distinct features, like an ambitious cross-disciplinary research project management, are well integrated in the Skolkovo local environment and supported by the stakeholders.

The Materials Science and Engineering (MSE) doctoral program of Skoltech was launched in 2014, as a research-based cross-disciplinary program, aiming to cover the competences at the junction of fundamental physics, chemistry, chemical and mechanical engineering²³. Currently, it mainly focuses on relating the fundamental principles of physico-chemical design, synthesis and advanced characterizations of materials for applications in energy conversion and storage. Among its goal promotion of innovative start-ups is encouraged considering this potentially highly application oriented field. For example, despite its recent start, a Start-up ("K-pus") aiming at the commercialization of potassium-ion based battery is currently under development by one of the PhD students²⁴ of the program.

The content of the doctoral program is thus easily identified and perfectly integrated in its local environment. It is one of the seven doctoral programs at Skoltech, each of them having approximately the same number of students. Like other doctoral programs at Skoltech, the MSE doctoral program starts after the second year of Master's degree (as defined in the Bologna process²⁵) and it covers a large scientific area from fundamentals to applications. Its research orientation is mainly based on the themes of the Center of Research for Energy Science and Technology²⁶ (CEST, dir. Prof. A. Abakumov), but its cross-disciplinary character allows interactions with other Centers of Research in Skoltech (especially the Center for Photonics and Quantum Materials - CPQM²⁷, the Center for Design, Manufacturing and Materials - CDMM²⁸, the Center for Life Sciences - CLS²⁹ and the Center for Computational and Data-Intensive Science and Engineering - CDISE³⁰). Following the current interests of the actual CEST leader, the MSE doctoral program focuses mainly on the development of new pathways for efficient synthesis coupled with ultimate atomic level investigations by advanced electron microscopy and spectroscopy techniques. Doctoral lectures range from computational chemistry and materials modeling to aerosol science and technology, electrochemistry, structure characterization methods or chemical and geophysical challenges.

Moreover, the MSE program benefits from interactions with different stakeholders as the Massachusetts Institute of Technology or the Lomonosov Moscow State University, through efficient collaborations³¹. It is well supported financially by external stakeholders³² like the Russian Science Foundation and the Russian Foundation for Basic research (16 grants), with Skoltech specific programs (11 internal grants).

The selection of the applicants by the doctoral committee is based on their scientific background in materials science, and on their adaptability to evolve in an international environment. The audience is well identified, with a well-targeted background.

Noteworthy the topic initially identified is sufficiently large to be adaptable to long-term evolutions, thus guaranteeing its scientific sustainability. Finally, it must be outlined that the organization of the MSE is based rather on projects (energy conversion and storage for example) than on disciplines (physics, chemistry or mechanics). This yields a very pragmatic approach facilitating the transfer of fundamental knowledge to applications.

²³ Skoltech Materials Science and Engineering doctoral program, self-evaluation report (2019)

²⁴ <https://crei.skoltech.ru/cest/people/nataliakatorova>

²⁵ https://en.wikipedia.org/wiki/Bologna_Process

²⁶ <https://crei.skoltech.ru/cest>

²⁷ <https://crei.skoltech.ru/cpgm>

²⁸ <https://crei.skoltech.ru/cdmm>

²⁹ <https://crei.skoltech.ru/cls>

³⁰ <https://crei.skoltech.ru/cdise>

³¹ see Appendix F in the self-evaluation report

³² see Appendix I of the self-evaluation report

1-2: The positioning of the doctorate is consistent with its environment

The Skoltech Materials Science and Engineering PhD program is part of a coherent ecosystem based on the general Skoltech strategy of scientific and intellectual excellence within the Skolkovo environment, but it is mainly turned to international collaborations. The committee recommends strengthening the connections with the local industrial sector.

The MSE doctoral program is one of two programs associated with the Center for Energy Science and Technology (CEST), which is one of the key units of Skoltech with a focus on materials and systems in the fast-growing international context of renewable energy and energy storage.

It is indisputable that this program, which scientific level is particularly high, its research themes very well defined, its focus on innovation important and its pedagogical methodology geared towards the rapid empowerment/responsibility of students, has no equivalent in the Russian Federation. It therefore offers a unique opportunity for its students to develop their knowledge, skills and adaptability, particularly in the field of sciences applied to high technology. The environment of the MSE doctoral program can be analysed at four levels: Skoltech, Skolkovo Innovation Center (Skolkovo), Russia and International. While there is no doubt that it fits perfectly into the Skoltech, Skolkovo and International environments (for example, cooperation with other doctoral programs, student involvement / awareness of innovation and start-up developments, publications co-signed with researchers from foreign laboratories), it is less prominent at national level. Indeed, there is very little effective cooperation with the Russian socio-economic world on certain subjects such as batteries, despite its undoubted interest. However, it appears to the committee that the authorities in Skoltech and Skolkovo are sensitive to this issue and that efforts are being made, to strengthen the links with the national socio-economic world³³.

The committee recommends to boost the cooperation with the Russian socio-economic environment in order to offer local/national job opportunities for the newly graduated PhDs or for junior PhDs after a few years of international postdoctoral experience. This will help limiting brain drain whose risk is high. One way could be to develop PhDs funded jointly by Skoltech and national-local companies, during which the student will spend a significant part of her/his research in the company site(s). Another way could be to hire the best students in local decision centers or public administrations.

AREA 2 – ORGANIZATION AND MANAGEMENT OF THE DOCTORATE

2-1: Effective organization and management is in place for the doctorate

The management of the MSE doctoral program is based on a collegial program committee promoting proximity management, supported by an efficient administration. This organization guarantees a very high quality of management at the top of standard international levels. It is very well adapted to the actual size of the program, but it could be threatened in case of a significant change of scale. The committee strongly encourages maintaining proximity management from highly qualified supervisors.

The MSE doctoral program is managed at the administrative and scientific levels, with clearly identified respective roles. The administrative part is taken care by the Doctoral Study office (DSO) which is part of the Education Department. The DSO is responsible for the administrative management from registration, follow-up and assistance for doctoral students during their four years of study. This is done with dedicated staff to the program. Centralized digital management tools and information systems are currently under improvement for more efficient exchanges between the different services. At the level of scientific organization, the Materials Science and Engineering Program Committee (MSEPC) is composed of seven members from the Skoltech plus a chair member being the coordinator of the program. It represents more than 60% of permanent staff from this department. This large ratio relates to the fact that the program is designed as a small unit, in accordance with the Strategic Action Plan³⁴, which targets within 2024 Skoltech with 1200 graduates (MSc and PhD) and 200 faculty members. Every permanent researcher is thus allowed to take part in the MSEPC. The MSEPC is in charge of the general governance for the development of the doctoral program: it leads its strategy; it ensures and centralizes the follow-up of the doctoral students enrolled in the program; it covers admission of the students, agreement of the supervisor, qualifying exams and annual progress reviews. In practice, the

³³ see for example <https://startupbrics.com/russie-cisco-skolkovo-centre-tech/>

³⁴ https://www.skoltech.ru/app/data/uploads/2019/10/Strategic-plan-2019-2021_september-2019_mailing-small.pdf

MSEPC interacts with the Individual Doctoral Committee (IDC). The IDC individually follows and accompanies a doctoral student throughout his doctoral studies. It is composed of three members including the official thesis supervisor and experts in the respective fields of the (cross-disciplinary) themes addressed in the thesis work. These experts may belong to external universities from the Russian Federation or other Skoltech programs. They are chosen by the student together with its supervisor at the beginning of the PhD. They guarantee the smooth running of the thesis.

The action plan for the research work is established upon the doctoral student's arrival and within three months after the recruitment interview. The thesis subject is then defined and the four years of the study are projected. All along the duration of the PhD, a yearly progress review is organized based on student individual report and interview.

When needed, the MSEPC interacts with the "Disciplinary board". This disciplinary board decides issues concerning "academic integrity", "student attendance" and "student academic performance". Depending on the situation, it may decide to suspend the student stipend for a specific period of time. This body was set up to guarantee students integrity and active participation.

In summary, the academic and administrative organization of the PhD program in MSE at Skoltech is executed in accordance with the highest international standards. During the interviews on site, the committee was able to assess the strong interest and support provided by the trainers to the young doctoral students on the academic as well as scientific and personal levels.

2-2: There is an explicit policy for recruiting and funding doctoral students, which is adapted to the PhD program

The MSE doctoral program recruitment procedure is very well organized and integrated in a long-term strategy of the Skolkovo foundation. The recruitment is based on the quality of the candidates and is highly competitive. No tuition fees are requested and good level scholarships and leave fellowships are provided to PhD students of the MSE doctoral program. The committee recommends to spread more homogeneously the distribution of PhD students on the panel of supervisors.

The recruitment methodology of is implemented in two stages, based first on the student CV and then on an interview (by videoconference if necessary). The enrolment of doctoral candidates is characterised by a sufficiently low selection rate (~10%) guaranteeing the high scientific level and motivation of the candidates. Once selected, the candidates choose their supervisor (who can refuse) and the theme of their future work. The precise thesis subject will be refined during the first year of the doctorate. This process ensures a close connection and cohesion between the student and his/her supervisor.

The policy for funding doctoral students is very clear since it is based on a given number of grants, the amounts of which are known in advance (75,000 rubles to start with)³⁵. The funds come from the Skolkovo Foundation and are approved by contract with Skoltech for a period of 5 years, thus ensuring sufficient sustainability and visibility for program managers. The students do not pay any tuition fee during their scholarship. Depending on the performance of the student, PhD scholarships can also be supplemented after the first year. In addition to these financial resources, the students benefit from an excellent environment to prepare their doctorate (research facilities, level/experience of supervisors).

The most concrete results of this policy are i) a capacity for rapid adaptation under conditions of encouraged autonomy, ii) the very good (international) level of research conducted by doctoral candidates very quickly after their integration and ii) a relatively low failure/abandonment rate (<10%).

Knowing the levels of scientific excellence, of scholarship and of the unique working/education conditions, it is thus surprising that the number of applicants (~133 in 2019) remains low, given the potential number of students in the Russian Federation, even if only in Moscow and its metropolitan area (>12 million inhabitants). 25% of doctoral students in the MSE program are foreigners, but it is worth noting that they come mainly from former USSR republics or countries with which political and economic cooperation has always been strong (i.e. Algeria, India, Ukraine, Kazakhstan, Pakistan, Tajikistan, Belarus, Venezuela, China and Iran).

These two points (relatively low number of candidates and still limited geographical origins) are probably due to cultural and linguistic barriers that psychologically incline many students not to consider mobility opportunity, as well as long-term scientific studies. This is a widespread phenomenon in all countries^{36,37}. That said, given the very high level of international recognition that Skoltech wishes to achieve, a broader/stronger recruitment strategy in terms of both national and international targets could be envisioned.

³⁵ <https://www.skoltech.ru/en/apply/faq/>

³⁶ <https://www.campusfrance.org/fr/mobilite-internationale-des-etudiants-toutes-les-tendances-sont-dans-les-chiffres-cles-2019-de>

³⁷ https://www.ccomptes.fr/system/files/2019-09/20190916-synthese-mobilite-internationale-etudiants_0.pdf

The committee recommends to develop a more aggressive international "marketing" policy aimed at countries in European and American continents (including North and South America), with the support, if necessary, of the main founding partner, i.e. the MIT, the Skolkovo Foundation and the Government of the Russian Federation. Skoltech could also propose to some foreign partners to implement joint supervision theses; insofar promoting double diploma was proven to be an effective way of making scientific cooperation more attractive, and strengthening it over the long term. Furthermore, Skoltech's image and attractiveness could also benefit from the advertising done by its Alumni network.

Last, although the freedom left to the freshly recruited PhDs shows many advantages in terms of education and motivation, it does not guarantee, however, a homogeneous distribution of students among the different supervisors and that may unbalance the scientific and education strategy of the institution.

AREA 3 – SUPERVISION AND TRAINING FOR DOCTORAL STUDENTS

3-1: The doctorate applies a strict doctoral student supervision and follow-up policy

The Skoltech Materials Sciences PhD program applies a strict doctoral student supervision and follow-up policy at the highest international level. Attractive fellowships facilitate international leave of students for completing their training. The collegial organization of the program helps in a general goodwill.

Since 2017, the right to supervise PhD students within the MSE program is granted by the Doctoral Program Committee. Over the last 5 years, the number of Skoltech faculty involved in the PhD supervision within the program has almost doubled due to the arrival of new CEST faculty members and engagement of faculty from other CREIs. Currently, 12 faculty members (among 19 members in CEST) are involved in the supervision of 1 to 11 doctoral students per faculty³⁸. The average number of students per official supervisor is 4. The quality of the supervision is guaranteed by the corresponding IDC. The student is allowed to change his supervisor if needed. Team based challenges are encouraged. The use of open space offices promotes exchanges between students and researchers of different programs.

As employees of the Institute, the doctoral students and their supervisors must comply with the Code of Ethics³⁹ (including integrity, responsibility, professionalism, respect and transparency principles). Concerning the financing of the studies, each student receives a scholarship of at least 75 000 rubles/month (approx. 1 072 euros/month) that can raise 105 000 rubles/month based on the students' performance.

Year 1 of the PhD is devoted to the submission of the individual study plan and thesis proposal. Each year, the Doctoral Program Committee supervises the Annual Progress review allowing the student to continue or not his PhD based on his academic results, number and level of publications (60 ECTS have to be completed each year, including 42 to 54 ECTS for research completion). During Year 4, the students apply for the Thesis Final Review (see Area 3-3). All along their PhD, the students have free access to material resources in Skoltech, including very high-resolution transmission microscopes, Fablab and synthesis platforms from different CREIs.

The general quality insurance framework is performed by the Department of Education for the academic performance, academic integrity, quality of teaching and research service evaluation as well. A disciplinary board chaired by the dean of education and composed of 2 students, 2 faculty members, 1 legal representative, and 1 invited person if needed, was established to address issues related to student misconduct, due to conflicts between students, bad academic performance, or based on the advice of the research supervisor, CREI director or other faculty members. The disciplinary board can take the decision to decrease or even to suspend the scholarship of the student.

The Students Council represents the student rights at the institutional level and centralizes common leisure activities. They are invited to participate at the Academic Council. Note that there is no strict formalization in case of conflicts resolution, maybe due to the importance and current efficiency of the collegial management.

The detailed Skoltech policy on PhD program and PhD thesis defense, as well as on Student scholarship, Academic integrity and Disciplinary board, can be found on the website.⁴⁰

³⁸ see self-evaluation report, Table 10 p. 21

³⁹ Order n°680 of the President of Skoltech, dated 21st October 2019 accounting the decision of the Academic Council

⁴⁰ <https://skoltech.instructure.com/courses/2017/files/folder/Policies>

To conclude, the procedures of the follow-up of doctoral students are clearly defined, coherent and transparent. It ensures very high quality conditions of work including free access to state of the art experimental platforms. The organization is based on a collective mentorship. The doctoral student is responsible for the quality of his work. The limited number of students allows a close connection between staff and students who are encouraged to form a welded community.

3-2: The doctorate offers diverse teaching and organizes supplementary events

The program of lectures provided during the MSE PhD is very well structured and complete. Students can choose a tailored panel of lectures out of a rich disciplinary and transversal program. A variety of supplementary events are also organized, such as workshops with industrial partners. Students can also choose their own courses abroad for a short period of time, or even propose their own lectures. The committee thinks that the program could now benefit from a wider involvement of external lecturers from the socio-economic world or from external universities. This contribution is still very marginal.

Students must choose and follow 4 disciplinary advanced courses, 7 optional courses and 10 doctoral courses during their 4 years of study. Each validated course results in ECTS. The courses are organized in 2-month sessions. At each session term, students apply for the courses of their choice. The students benefit from this flexible organization, which eases the planning of their research activities. A variety of courses⁴¹ are offered, covering the field of material sciences and engineering (for instance: computational methods, organic materials, electrochemistry). Thanks to these courses, the students can develop a tailored knowledge for their own research projects and a general scientific culture. Written and oral communication skills in English are developed thanks to dedicated training (for instance: master thesis in English). Professional training offered by the program relies on specific courses which cover innovation, entrepreneurship, pedagogy and intellectual property (for instance: technology commercialization, leadership for innovations). There are no courses specifically dedicated to the job search. Research seminars complete the offer. The courses can be at master (classes common with MSc students) or PhD level. The accessibility and the validation of the courses are clearly defined and communicated. The teachings provide a complete and tailored profile to the student that is adapted to their career plans. The training is often project oriented. The lectures are given by instructors from the research units. Instructors also aware students about ethics and scientific integrity. Moreover, scientific and professional events are proposed to the students, for instance the presentation of the main outcomes of the PhD work to industrial partners as well as additional seminars that can be proposed and organized by students. However, there is no socio-economic partner directly involved in the courses. The committee think that the program would benefit from the involvement of socio-economic partners in teaching, because such involvement induces a diversification of the teaching methods and expertise. Finally, the committee regrets that the mandatory course on pedagogy suffers from a lack of available places.

3-3: The doctorate is based on explicit rules for thesis duration and defense

The committee considers that the rules established within the Skoltech MSE doctoral program are very well structured, coherent and carried out at a high level of excellence, which is in line with the highest international requirements for doctoral programs.

The timing of the thesis is clearly established and follows a very clear pattern. The academic year starts on November 1st. The first step consists in building with the supervisor and with the help of the IDPC a realistic work plan including the courses to be taken, as well as the scientific expectations of the thesis based on a literature review. The work plan is validated by the Doctoral Program Committee within the first three months. This may be refined all along the first year.

As already mentioned (see Area 3-1), the PhD student must submit each year in September, a report to the Doctoral Program Committee, which makes collegial recommendations during an interview. This annual progress review is used to identify scientific as well as personal problems. If problems are identified, the doctoral student, his/her supervisor, the Individual Doctoral committee and also the head of the students - if requested - systematically endeavor to find amicable solution. If the doctoral student is proven to be responsible of the situation, the Disciplinary board may decide to reduce the grant for a fixed period or to interrupt the thesis. So far less than 10% of PhD students have faced such situation.

In the final year of the thesis, the work of the PhD student is examined by the Doctoral Program Committee, joined by an independent external member from a national university (currently Prof. K. Lyssenko⁴² from Lomonosov Moscow State University). This Thesis Final review consists in examining thesis manuscript's draft and

⁴¹ <https://www.skoltech.ru/en/education/course-catalog/#>

⁴² https://www.researchgate.net/profile/Konstantin_Lyssenko

validating all the criteria required for the thesis defense. The thesis work must contain significant advances in the field of research addressed. To complete the doctoral program and defend the thesis, the student must have completed his or her doctoral studies, be the first author of two articles in international peer-reviewed journals indexed in WoS, and have made two oral presentations at international conferences. Candidates are responsible for compliance with the rules on plagiarism. Any failure to comply with this rule found during the final examination of the thesis may result in an exclusion from the program.

Once all the criteria have been validated, the Doctoral Program Committee and the Individual Doctoral Committee define the appropriate format for the thesis, including the composition of the thesis jury. The thesis defense can then be organized within 4 months, affront of a jury composed of 5 to 9 experts in the relevant research area with no conflicts of interest. The jury includes one chair from Skoltech and at least 2 internationally recognized members. The defense is public, it consists of a 40 minutes presentation summarizing the work followed by a series of questions addressed by the jury members. Any person from the audience is also authorized to ask questions.

The HCERES committee considers that all the applied rules for the duration and defense strictly meet the criteria defined and implemented in the most renowned international universities.

AREA 4 – INTEGRATION OF DOCTORS INTO THE JOB MARKET

4-1: The doctorate includes mechanisms to promote the integration of doctors into the job market

The MSE program contributes to the integration of doctors into the job market. The creation of start-ups is encouraged thanks to Skoltech environment as well as courses and innovative projects. The students are in close contact with the industrial world thanks to dedicated events, but the actual national market is still very tight which threatens the employability of the doctors. The committee recommends preparing the students not only for academic careers, but also encouraging them to leave Skoltech for foreign countries and for jobs in local/national industries or highly qualified administrations.

The program targets the integration of the students in the job market thanks to an important number of events that involve the industrial partners. As far as possible, the research projects are carried out in collaboration with industrial partners. The integration into the job market is encouraged for example through research grants and industrials contracts (with Huawei, Gasprom, LG Chem, Procatom, Qunit Tech, Inergy group...), local support to entrepreneurship-related activities (through E&I center and Skolkovo Foundation), as well as regular events like the Skolkovo Innovation Center events⁴³ and specific Skoltech conferences to meet industry and academic representatives. A faculty member (currently Dr D. Pogozev) has the specific role of Industry project manager, to boost the connection with industrial partners and survey the related events. However, the industrial sector related to MSE program is poorly developed in Russia, especially regarding research and development⁴⁴. As already mentioned in Area 1-2, it must be noted that there is a notable mismatch between the formation of highly qualified junior researchers and the lack of opportunities at the national level. In addition, there is not dedicated staff specifically in charge of helping individually students to apply for industrial position and defining its personal and professional project. Finally, after completion of their thesis defense, the doctoral students interested to apply for assistant professor positions in universities belonging to the Russian Federation need formally to get the equivalence of the *candidate of science* title. This title is considered as an equivalent to an international PhD degree but not yet officially to the PhD degree delivered at Skoltech. The authorities in Skoltech and Skolkovo are already aware of this issue and efforts are being made to improve the situation.

Nevertheless, the doctors seem to be qualified to find industrial positions abroad, where the market is more developed regarding R&D on the targeted domains of materials design and energy conversion and storage. The program and its environment (Skolkovo center) highly contribute to the creation of start-ups by providing funds and facilities and thanks to dedicated courses (Intellectual property, technology commercialization, innovation). This helps job finding, but this is not a long-term solution to the lack of national opportunities (regarding industry). Finally, the students are highly qualified to find postdoctoral positions abroad, thanks to their publications and recognized supervisors. Surprisingly, many students wish to stay at Skoltech for their post-doctoral studies despite the Skoltech strategy of promoting international in and out-going mobility.

⁴³ <https://www.skoltech.ru/en/events/>

⁴⁴ https://www.ersi.eu/repec/ers/papers/17_1_p6.pdf

The committee recommends informing the students not only about academic opportunities, but also about non-scientific positions requiring a PhD (high-level public services, management). The committee recommends also encouraging the international mobility of the students that are interested in an academic career, for two reasons: 1) the benefit of students who should avoid staying in the same institution and who should learn from abroad experiences; 2) improving the program's reputation on the largest possible scale. Finally, the committee recommends motivating the supervisors to closely contribute to the professional project of their students.

4-2: The doctorate has effective monitoring of the integration of doctors into the job market

Technically, the structures for monitoring the development of integration of Materials Sciences Skoltech graduates are in place, but due to the recent set up of the program, it is too early to draw conclusions.

The MSE doctoral program began in 2014. Two students graduated in 2018 and one in 2019. Two of these students are currently under contract with Skoltech and one has joined a research center abroad. Given the youthfulness of the program, it is difficult to identify a clear trend of student's integration in relation to the program's objectives.

More generally, Skoltech has not yet set up an active monitoring system for graduates in their first years of employment. Indeed, the individual follow-up (MSs and PhDs) ends at the graduation. The committee recommend to extend this individual follow-up. It must be noted that graduates keep their email box forever: this should help to maintain a permanent link with them.

An Alumni association exists and includes all the cohorts of students since they entered Skoltech. However, this association neither has a clear role, neither has its own budget. This does not provide the resources to organize significant events with former students.

The committee recommends that the Alumni association participates to the creation of a network of former students, with dedicated financial support, which will help to promote Skoltech's reputation and student's attractiveness. This association should also set up events between post-graduated and students in order to help them apprehending job market.

4-3: The data collected is analyzed, communicated and used

Every service stores its own statistics with a close follow-up of the students. Annual reports are published in the website of Skoltech. The committee recommends combining the data for recruitment, academic results and integration into the job's market, to demonstrate the added value of the program, as well as to identify the most appropriate undergraduate trainings. The committee recommends also the early implementation of a close follow-up of the students after graduation, because it is an efficient way to promote the cohesion and the role of Alumni.

At the moment, the data for recruitment, academic results and integration into the job's market are stored in different services in Skoltech and are not combined together. As mentioned previously, due to the low number of graduated students, it is too early to evaluate the efficiency of the follow-up of the students in a statistically significant way, especially concerning their integration into the job's market.

IV. CONCLUSION

PAST ACHIEVEMENTS

The Skolkovo Institute of Science and Technology (Skoltech) was founded in 2011 under the supervision of the Ministry of finance. Since then, the attracted funding (R&D contracts, grants from the Skolkovo foundation, consulting services, professional training) is growing exponentially, reaching 1,112 million rubles in 2018. Skoltech is the unique formation in the Russian Federation completely given in English language. Student's recruitment is highly selective and students do not pay any tuition fee. The Institute includes 10 master degrees and 7 doctoral programs accredited in the Russian Federation (one of them, the Life Science doctoral program, was already accredited internationally by HCERES). The minimum scholarship of doctoral students is 1.5 times the average salary in the Russian Federation, and the working conditions are one of the best, since Skoltech moved into a new recently built spacious place last year. This place is adapted to welcome state of the art equipment, as for instance the most recent and performant electron microscopes. A second building should be built in the coming years where all labs will be integrated. In 2019, Skoltech has obtained good international visibility in research, since it was listed in Top-100 Nature Index Young University Ranking, thus confirming its world-class reputation.

The Materials Science and Engineering doctoral program was created in 2014. In 2019, 56 students and 13 faculty supervisors of outstanding scientific quality are associated with the MSE (7 full professors, 1 associate professor and 5 assistant professors). The scientific excellence of the faculty members is documented by strong publication records in top journals, including Science, Nature, Physical Review Letters, Journal of Chemical Physics and many others, resulting in high h-indices (>20 for full professors). Half of them did their PhD in foreign countries, resulting in important international contacts. The number of new doctoral students increased continuously from 3 in 2014 (having defended their PhD in 2018-2019), to 23 in 2019. Note that the same amount of publications per student was maintained despite the growth of the program. Thus, the establishment of Skoltech as a functioning university with high visibility, and the successful implementation of the MSE doctoral program within this Institute in a very short period of time are impressive.

An enriched cross-disciplinary teaching program completes the research activity, with a strict quality process. Initiatives from the students are strongly encouraged. The policies of doctoral supervision and follow-up of the students are clearly elaborated and combine individual excellence with encouragement for collective work, in a spirit of close mentorship promoting the progressive empowerment of the students. The students become very quickly responsible for their work. The administrative support meets the highest international standards. Current improvement of the centralized digital management tools and information system is a proof of quality and the condition of adaptability to the increasing number of students and faculty members. Taken together, the implementation of the Skoltech MSE PhD program during these first five years has yielded convincing results with respect to the organization and management of the doctorate, as well as for the supervision and training of the doctoral students.

TODAY'S CHALLENGES

Today's development of Skoltech and of the MSE doctoral program will continue to face international competition. In particular, the PhD program needs to obtain a sharper international visibility that will be required to increase the percentage of incoming students from abroad, and especially from western countries. As for all universities competing for academically excellent students and outstanding research, the program needs to continuously adapt to its international environment and to face new societal challenges. Its international visibility would definitely be reinforced by strong agreements with western universities (like double diploma or financial investments for example). The efficient integration of the freshly graduated students into the highly qualified local and international job market (in private or public companies and administrations) is also a condition to strengthen the attractiveness of the program.

OUTLOOK TO THE FUTURE

Overall, the information provided in the self-evaluation report has been confirmed during the interviews carried out by the committee. The achievements since the creation of Skoltech and more specifically of the MSE PhD program are remarkable. The performance of the program meets the highest international standards. One of the most remarkable potential of the program is its ability to connect cross-disciplinary fundamental research and engineering applications for newly designed materials. Students have access to the state of the art equipment for synthesis and characterization of materials. It is important to maintain a permanent adaptability to new research challenges. The topic of the MSE program is sufficiently large to remain open to new research directions.

In order to maintain the effectiveness of this training, it does not seem favorable to envisage significant diversification. It is therefore important to maintain a strong focus (currently linked to materials for energy storage and conversion). However, it is also important to effectively integrate the newly recruited researchers, both scientifically and in the decision-making committee of the program's strategic orientations, in order to benefit from their dynamism, creativity and thematic contributions.

In conclusion, the implementation of the Skoltech Materials Science and Engineering PhD program has been carried out following highest international standards. Everything is in place to ensure the success of this project. The faculty and the students are highly motivated and of outstanding quality. They have access to very high performance characterization tools. In view of the achievements to date, the committee is fully confident in the capability of Skoltech and of the MSE PhD program governance to take appropriate decisions to reach the initial and ambitious objectives that are to make Skoltech an important player in the Russian higher education and research environment as well as at the international scale.

STRENGTHS:

- Excellent technical infrastructures
- Very high scientific level of supervisors with international experience and recognition
- Excellent international recognition for scientific collaborations and publications
- Effective and efficient cross-disciplinarity
- Willingness to integrate the socio-economic environment
- Very positive management based on individual mentorship system
- Excellent follow-up of the students all along the timing of the PhD
- Well controlled autonomy and progressive empowerment of students
- Trust in PhD's capability and work
- Very good pedagogical organization with high proximity to the students
- Willingness and efficiency to integrate international criteria of excellence
- Flexibility and adaptability of the organization as well as of the content of the formation
- Collegial organization seemingly fluid, with high freedom accorded to the supervisors and to the teachers in a spirit of excellence

WEAKNESSES:

- The sustainability of the economic model is very dependent on public funds (95% of total funding) but on a fixed term. The collaborations with external institutions and stakeholders are not strongly supported, especially with regards to their financial participation
- There is a risk in the future that the growth of the model involves too much bureaucracy and a loss of proximity
- The excellent working conditions must not preclude from maintaining the structure alive, with a good adaptability and regular change of governance
- The high selection of students combined with internal recruitment after the completion of their thesis induces a serious risk of endogamy
- The economical support is currently very expansive. In case of diversification of funding sources, it must be able to preserve both the fundamental research path to applications and the reverse.
- There is no specific and systematic politics of support for recently recruited junior assistant professors.
- Absence of statutory representation of students in decision-making bodies (Doctoral committee, Education committees)
- The relatively low number of PhD candidates indicates the still weak recognition of Skoltech in Russia, that is in contradiction to its very high potential of attractiveness

RECOMMENDATIONS:

- Maintain the competitiveness of the structure, through a good adaptability and regular change of governance to foster the rapid emergence of a new generation of supervisors and managers
- The efficient management based on positive methods and individual mentorship system must be preserved despite the structure growth
- Make sure of the good integration into the job market, especially at the local /national scale, to maintain a permanent exit flow and powerful network (an attractive training serving as an efficient springboard for the carrier)
- Maintain and pursue a high level of fundamental research
- Continue irrigating applications and maintain the adaptability of students
- Diversify hiring opportunities
- Boost the recently recruited junior assistant professors to allow them to make the system benefit from their dynamism and creativity.

V. COMMENTS OF THE INSTITUTION

Skoltech

СКОЛКОВСКИЙ ИНСТИТУТ НАУКИ И ТЕХНОЛОГИЙ

Autonomous Non-Profit Organization for Higher
Education
«Skolkovo Institute of Science and Technology»
Russian Federation, 121205, Moscow,
Territory of Innovation Center Skolkovo,
Bolshoy Boulevard 30, building 1
OGRN 1115000005922
INN/KPP 5032998454/773101001
Tel.: +7 (495) 280-14-81

Professor François Pernot,
Directeur/Director
Département Europe et International
Europe and International Department
2 rue Albert Einstein - 75013 Paris

March 04, 2020

Dear Professor Pernot,

I am writing to you regarding the HCERES Expert Committee's evaluation of the Skoltech PhD program in Materials Science and Engineering. In my opinion, the entire evaluation process, including the on-site visit by the Expert Committee, met the highest academic standards, and we found it fair, efficient and thorough. We appreciate the time and attention so obviously given.

The resulting Evaluation report provides a comprehensive analysis of the program, which we find extremely useful for our further improvement and development, thus ensuring continuing compliance with the high Standards and Guidelines for Quality Assurance in the European Higher Education Area.

We agree with all the conclusions made by the Expert Committee. We also accept its recommendations, with the understanding that some of them require time and dedicated work to implement fully. On the other hand, we are glad to share that some measures have already been initiated in response to the critical comments provided in the Evaluation report. For example, we have expanded the capacity of the mandatory course on pedagogy, increased support of young assistant professors, and worked to improve Skoltech's recruitment strategy.

On behalf of Skoltech, I respectfully request that the Council of HCERES approve the accreditation of the Skoltech PhD program in Materials Science and Engineering on the basis of the Evaluation report by the Expert Committee. We are grateful for your kind consideration and attention to this matter.



Sincerely yours,
Anna Derevnina

Associate Provost, Dean of Education

International evaluation and accreditation

ACCREDITATION DECISION

MATERIALS SCIENCE AND ENGINEERING (MSE) DOCTORAL PROGRAM

Skolkovo Institute of Science and Technology
(Skoltech)

Russia

APRIL 2020

SCOPE OF THE ACCREDITATION GRANTED BY HCERES

HCERES has built its evaluation process based on a set of objectives that higher education institution study programmes must pursue to ensure recognised quality within France and Europe. These objectives are divided up into four fields among which are the accreditation criteria.

As for the “External Evaluation Standards”, the accreditation criteria have been specifically designed for foreign programmes. The accreditation criteria were adopted by the Board on June 2016 and are available on the HCERES website (hceres.fr).

The accreditation committee, meeting his accreditation decision, has wholly taken into account the final evaluation report of the study programme. This accreditation decision is the result of a collegial and reasoned process.

The accreditation decision issued by HCERES shall not grant any rights whatsoever, whether in France or abroad. The decision on training programme accreditation confers an accreditation label and does not infer recognition of the accredited qualifications. The HCERES accreditation process therefore has no impact on the qualifications recognition process in France.

THE HCERES CRITERIA FOR DOCTORATE ACCREDITATION

HCERES has built its doctorate evaluation and accreditation process on a set of values and objectives that doctorates must pursue to ensure a certain level of quality.

These objectives are organised around four areas:

- Area 1: Positioning of the doctorate
- Area 2: Organisation and management of the doctorate
- Area 3: Supervision and training of doctoral students
- Area 4: Integration of doctors into the job market.

AREA 1: POSITIONING OF THE DOCTORATE

Accreditation criteria

The positioning, the content and the objectives of the doctorate are clearly defined. Its interactions with the stakeholders (lead institution(s), foreign partners, socio-economic environment) are formally set out and effective. Its links with the research units and the institution's scientific policy are effective.

Criterion assessment

The content and the objectives of the Materials Science and Engineering (MSE) Doctoral Program of Skoltech (started in 2014) are clearly defined. They are moreover sufficiently large to be adaptable to long-term evolutions, thus guaranteeing undoubtedly its scientific sustainability. Its distinct features, like an ambitious cross-disciplinary research project management, are well integrated in the local Skolkovo environment and supported by the stakeholders.

The MSE Doctoral Program is part of a coherent ecosystem based on the general Skoltech strategy of scientific and intellectual excellence within the Skolkovo environment, but it is mainly turned to international collaborations. The committee recommends to strengthen the connections with the local industrial sector.

AREA 2: ORGANISATION AND MANAGEMENT OF THE DOCTORATE

Accreditation criteria

The doctorate's organisation and management are clearly defined and rely on material and human resources adapted to the requirements of programmes at ISCED level 8. Internal quality assurance mechanisms are in place and effectively used in order to improve the doctorate continuously. The doctoral students recruiting is formally set out, their funding is fair and sustainable.

Criterion assessment

The management of the MSE Doctoral Program is based on a collegial program committee promoting proximity management, supported by an efficient administration. This organization guarantees a very high quality of management at the top of standards international levels. It is very well adapted to the actual size of the program. Internal quality assurance mechanisms are in place and centralized in the Doctoral study office. They are used in order to improve the doctorate continuously, especially the quality of the lectures proposed to the students. The committee observes that, this organization may need to be adapted in case of a significant change of scale, especially to maintain the flow of incoming highly qualified supervisors. The MSE Doctoral Program recruitment procedure is very well organized and integrated in the long-term strategy of the Skolkovo foundation. The recruitment is based on the quality of the candidates and is highly competitive. No tuition fees are requested and good level scholarships and mobility fellowships are provided to PhD students of the MSE Doctoral Program. The committee recommends to take special care to increase the homogeneity of the spreading of the PhD candidates on the panel of supervisors.

AREA 3: SUPERVISION AND TRAINING FOR DOCTORAL STUDENT

Accreditation criteria

A strict policy of supervising and follow-up of doctoral students is set. Doctoral students have access to various teaching and professional trainings and take part in scientific/professional actions. Explicit rules are defined concerning the thesis duration and defense. Measures to combat fraud, plagiarism and corruption are applied within the doctorate.

Criterion assessment

The Skoltech MSE Doctoral Program applies a strict doctoral student supervision and follow-up policy at the highest international level. Attractive fellowships facilitate international leave of students for completing their training. The collegial organization of the program helps in a general goodwill. The rules established within the Skoltech MSE Doctoral Program concerning thesis duration and defense are very well structured, coherent and carried out at a high level of excellence, which is in line with the highest international requirements for doctoral programs.

The program of lectures provided during the MSE PhD is very well structured and complete. Students can choose a tailored panel of lectures out of a rich disciplinary and transversal program. Various supplementary events are also organized, such as workshops with industrial partners. Students can also choose their own courses abroad for a short period of time, or even propose their own lectures. The committee thinks that the program could now benefit from a wider involvement of external lecturers from the socio-economic world or from external universities. Indeed, these two last contributions are currently still very marginal.

AREA 4: INTEGRATION OF DOCTORS INTO THE JOB MARKET

Accreditation criteria

The doctorate implements systems to promote the doctorate and the integration of doctors into the job market. The integration monitoring and analysis are effective and used to perform the continuous improvement of the doctorate.

Criterion assessment

Technically the structures for monitoring the development of integration of the Materials Sciences Skoltech graduates are in place, but due to the recent set up of the program, it is too early to draw conclusions.

Every service stores its own statistics with a close follow-up of students. The data for recruitment, academic results and integration into the job's market, should be combined. The committee recommends to prepare the students not only for academic careers, but also for jobs in local / national / international industries or highly qualified administrations. Finally, the committee recommends the establishment of close follow-up of students after graduation, strengthening the role of Alumni in order to promote long-term cohesion.

FINAL DECISION

Considering the accreditation criteria analysis detailed above, the accreditation committee issues the following decision:

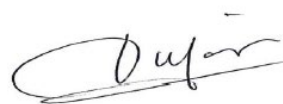
“Five-year unreserved accreditation decision”

and draws attention to the following points:

- Maintain the competitiveness of the structure, through a good adaptability and regular change of governance to foster the rapid emergence of a new generation of supervisors and managers
- The efficient management based on positive methods and individual mentorship system must be preserved despite the structure growth
- Make sure of the good integration into the job market, especially at the local /national scale, to maintain a permanent exit flow and powerful network (an attractive training serving as an efficient springboard for the carrier)
- Maintain and pursue a high level of fundamental research
- Continue irrigating applications and maintain the adaptability of students
- Diversify hiring opportunities
- Boost the recently recruited junior assistant professors to allow them to make the system benefit from their dynamism and creativity.

SIGNATURE

For HCERES and on behalf of



Nelly DUPIN
Secrétaire générale
nelly.dupin@hceres.fr
T. 33 (0)1 55 55 62 55
2 rue Albert Einstein - 75013 Paris

Nelly DUPIN,

Acting President

Date: Paris, April 15th, 2020

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Evaluation of clusters of higher education and research institutions
Evaluation of higher education and research institutions
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International evaluation and accreditation



2 rue Albert Einstein
75013 Paris, France
T. 33 (0)1 55 55 60 10

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