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FOREWORD
FNR STRATEGY
2018-2021
Dear readers,

The present document outlines the FNR strategy for public research in Luxembourg over the next four years (2018-2021). The development of this strategy has taken more than a year and involved most of the agency’s collaborators, the chairs of FNR evaluation panels, the members of its scientific council and board of directors, as well as important stakeholders, such as the University of Luxembourg and the Public Research Centers. It has also drawn input from a large number of important fundamental policy documents and recommendations, a list of which can be found in the appendix.

Within a very short period of time – compared to the many decades or even centuries in other countries – Luxembourg’s public research has already come a very long way. Seeds of excellence are already present, a culture of quality is emerging, impact orientation is gaining momentum and collaboration between institutions is advancing. From a building-up phase that really commenced at the turn of the millennium, public research has now entered its consolidation phase, during which it will have to prove its excellence and quality in a tough worldwide competition. There are still some major challenges ahead, but without any doubt, Luxembourg has very competitive assets for research.

Since its creation back in 1999, the Luxembourg National Research Fund (FNR) has been a leading player in the development of the research ecosystem, driving the national strategy and keeping high the values of excellence in research and socio-economic impact.

For the upcoming four years, we have the firm intention to continue in that direction and the FNR will dedicate a total budget of 341 million Euros to make progress in the realisation of our vision and mission.

In order to make that progress, three strategic objectives have been set, articulated around six key value drivers. The FNR also wants to push forward a competitive and comprehensive culture of excellence and has therefore defined six dimensions that constitute the agency’s understanding of “excellence in research”. Scientific excellence will obviously remain the key criterion throughout the FNR schemes, but it will be coupled to strategic considerations and a greater emphasis on the generation of economic and societal impact through research.

As unambiguously formulated in its mission, the FNR will continue to put all its efforts in setting up a sustainable world-class research system in Luxembourg that will generate societal and economic impact in key strategic areas. Our strategy for 2018-21, outlined in this document, is one further cornerstone to pave the way towards achieving this ultimate goal.

Marc Schiltz, Secretary General and Executive Head
Véronique Hoffeld, Chair of the Board
Thierry Wolter, Vice-Chair of the Board
Yves Fromes, Chair of the Scientific Council

1. Marc Schiltz
2. Véronique Hoffeld
3. Thierry Wolter
4. Yves Fromes
02 RESEARCH IN LUXEMBOURG

Current state of play and challenges
I. THE CURRENT STATE OF PLAY – 2017

The Luxembourg public research system is presently at a crucial stage of its development. The period up to about 2013 was a time of building research institutions and infrastructures and setting up a comprehensive research system in less than twenty years, almost out of nothing.

This was a formidable challenge that was more than successfully met. Public investments in research and development were multiplied more than tenfold during the first decade of this millennium.

Luxembourg research has established itself, benefits from a positive resonance from the Luxembourg society, and has started to become internationally visible in a number of areas.

As far as science and research in Luxembourg is concerned, you are... interested.

Since 2014, a number of substantial reforms in the organisation and governance of the research system were undertaken and a new period of consolidated growth has begun.
As of 2017, the overall state of Luxembourg’s research system can be described as follows (All data pertain to the 2014-17 period):

**A CULTURE OF QUALITY IS EMERGING**
- uni.lu ranked in top 200 in THE ranking, in the top 20 young universities and in the top 60 in the field of computer science.

**IMPACT ORIENTATION IS GAINING MOMENTUM**
- 4 spin-offs and 36 patents generated from FNR projects;
- 50% of AFR-PPP PhD fellows still in Luxembourg;
- 40% are employed by industry;
- FNR funded projects HuMiX and Fieldspec have gained substantial international visibility.

**COLLABORATION BETWEEN INSTITUTIONS IS ADVANCING**
- LARI (Luxembourg Agency for Research Integrity) founded in 2016;
- A common National Quality Framework for Doctoral Education was elaborated and an institutional agreement was reached regarding the supervision of PhD candidates.

**SEEDS OF EXCELLENCE ARE PRESENT**
- 7 ERC grants awarded to Luxembourg-based researchers, among which one FNR PEARL Chair and 2 FNR ATTRACT Fellows.

**BELVAL RESEARCH & INNOVATION CAMPUS**
- Luxembourg’s campus for research and innovation. It provides high-end facilities and infrastructures, with the University, research centers, business incubators and research and innovation agencies, all on one site. It represents an investment of 1 billion Euro.

**SOME ROAD BLOCKERS STILL EXIST**
- Administrative inertia, hurdles and unnecessary constraints.

**PRIVATE R&D INVESTMENTS ARE DECREASING...**
- ... but public R&D is the driving force of the Luxembourgish research ecosystem;
- public R&D: 0.51% (of GDP in 2010) -> 0.71% (in 2016);
- private R&D: 1% (of GDP in 2010) -> 0.64% (in 2016).

**II. CHALLENGES AHEAD**

In the OECD Innovation Policy Review of Luxembourg (April 2015), the challenges that the Luxembourgish research is facing in this new phase of development, have been very clearly spelled out:

- To **consolidate the progress** Luxembourg made over the past decade, and advance further to become a widely recognised location for research and innovation in Europe;

- To **better link and orient more strategically** the promising initiatives in the area of research and innovation that have been initiated during the recent period of rapid growth and change;

- To **improve governance** and steer the innovation system in away that enhances coordination across ministries and agencies; strengthens linkages between public research centres and the University of Luxembourg, and helps better target long-term funding to the most promising research areas and groups.

*These key recommendations form the backbone of the FNR strategy 2018-2021.*
III. LUXEMBOURG’S KEY ASSETS FOR RESEARCH

In defining a strategy for public research, it is important to take stock of Luxembourg’s key assets that are relevant for realising the ambition of setting up a world-class research system.

Luxembourg is an open and international country, an attractive place for talents from all over the world and it has an innovative and competitive economy in key sectors, such as ICT, finance and new materials.

Luxembourg: A Competitive International Business Landscape

- Ranked n°1 worldwide for technological readiness (source: Global Competitiveness Report, Word Economic Forum 2016-2017 edition);
- Top 10 of the most innovative countries in the world (source: Global innovation index 2015);
- Only two countries in the world have a more globalised economy than Luxembourg (source: 2017 KOF Index of Globalisation);
- Luxembourg is in the top 3 when it comes to talent attraction and retaining (source: INSEAD Global Talent Competitiveness Index 2017);
- Luxembourg is ranked 7th in the overall Global Talent Competitiveness Index 2017;
- Luxembourg is in the top 4 of most liveable locations in the world (source: ECA international location rankings);
- Luxembourg has the most competitive economy of all countries in the EU (source: IMD World Competitiveness Ranking 2015).

There is a sustained and overarching political will to further invest in public research, reflected by the substantial budgetary means that have been made available as well as by the provision of world-class government-funded research infrastructures (most notably the Belval Research and Innovation Campus).

Furthermore, societal support for research and for further public investments in research remains strong. The Luxembourg government has developed major strategic plans for the long-term development of the country.

The «digital luxembourg» initiative promotes the development of a national infrastructure and business environment in support of the ICT sector and sustains the digital transformation in the public sector.

The «Third Industrial Revolution for Luxembourg» is the government’s major initiative to elaborate and implement a long-term economic model for the country in which three technologies converge (the digital transformation, new sources of energy, and new modes of mobility) to usher in a smart green digital society.

More sector-specific initiatives are the «space resources.lu» project which aims to position Luxembourg as an international hub for the exploration and use of space resources, and the national cancer plan «Plan National Cancer 2014-18» (which contains a chapter on research actions and goals).
03 LUXEMBOURG NATIONAL RESEARCH FUND (FNR)
The Luxembourg National Research Fund (FNR) is the main funder of research activities in Luxembourg. We invest public funds and private donations into research projects in various branches of science and the humanities, with an emphasis on selected core strategic areas.

Furthermore, we support and coordinate activities to strengthen the link between science and society and to raise awareness for research.

We also advise the Luxembourg government on research policy and strategy.

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### Our vision

To establish Luxembourg as a leading knowledge-based society through science, research and innovation, thereby contributing to the country’s economic diversification and future prosperity.

### Our mission

To set up a sustainable world-class research system in Luxembourg that will generate societal and economic impact in key strategic areas.
To set up a sustainable world-class research system in Luxembourg that will generate societal and economic impact in key strategic areas

FOUR IMPORTANT ELEMENTS APPEAR IN OUR MISSION STATEMENT:

1. The notion of a **world-class** research system, which is reflected in our strong focus on scientific quality and international visibility.

2. The notion of a **sustainable** research system, which is reflected in our focus on capacity building. The emphasis on sustainability arises from the fact that our research system is still very young and in a process of rapid development.

3. The notion of **societal and economic impact**, which has gained more importance over the past years and which will become central in the future.

4. The notion of **key strategic areas**, which obliges us to set research priorities and to choose them so that there is an alignment with the strategy of the societal and economic development for the country. The need for selecting a limited number of research priorities is quite naturally dictated by the constraint of being a small country, with very limited capacities (in absolute terms).

HOW WE WORK

The FNR’s most highly valued criteria are excellence and quality in research. To identify the most promising and most excellent projects and researchers, we systematically submit funding requests to an assessment by independent international experts.

We implement the « Principles for Scientific Merit Review » (issued by the 2012 « Global Summit on Merit Review »), which embody the highest international standards of expert assessment, transparency, impartiality, confidentiality and integrity.

We commit to conduct our operations through a Quality Management System (QMS) certified by the ISO 9001: 2015 standard.

OUR CORE VALUES

- **Towards researchers and research institutions:** We implement a fair and transparent process in our decision-making and nurture an open dialogue with the scientific community;

- **Towards the government, tax-payers and donors:** We are accountable for the usage of funds that we are entrusted with and we strive for efficiency in our operations;

- **Towards the general public:** We care for the long-term interest of the country and consider engagement with society as a constitutive part of science;

- **Towards our collaborators:** We aim to stimulate talent-development and competence building of our staff, which translate FNR’s vision, mission and core values into action.
II. AN OVERVIEW OF FNR’S FUNDING INSTRUMENTS

NATIONAL RESEARCH PRIORITIES

• Were defined and approved by the Government, following a comprehensive foresight study conducted by the FNR in 2007
• FNR has been mandated by the Government to propose a revision of the national research priorities by 2019

NATIONAL RESEARCH PRIORITIES AS DEFINED IN THE FNR FORESIGHT REPORT IN 2007

**Innovation in Services (IS)**
- Development and Performance of the Financial Systems
- Business Service Design
- Information, Security and Trust Management
- Telecommunication and Multimedia

**Sustainable Resource Management in Luxembourg (SR)**
- Water Resources under Change
- Sustainable Management and Valorisation of Bioresources
- Sustainable Building and Bioenergie
- Spatial and Urban Development

**New Functional and Intelligent Materials and Surfaces and New Sensing Applications (MS)**
- New Functional and Intelligent Materials and Surfaces

**Biomedical and Health Sciences (BM)**
- Regenerative Medicine in Age-related Diseases
- Translational Biomedical Research
- Public Health

**Societal Challenges (SC)**
- Social and Economic Cohesion
- Education and Learning
- Identities, Diversity and Interaction

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III. YOUR TABLE CONTENTS

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FNR’s vision and mission
2018 - 2021

Innovation in Research management

Shaping a shift in Luxembourg

Anchor Science in Society

Stimulate Knowledge Transfer

Become an Innovative Research Agency
Strengthening the foundations

FOSTER INTERNATIONAL COOPERATION

ATTRACT AND NURTURE TALENTS

RESEARCH PRIORITIES STRATEGIC ALIGNMENT
04 FNR’S STRATEGIC OBJECTIVES FOR 2018-2021
I. STRATEGIC OBJECTIVES

The strategy for 2018-21 has been designed to make progress in the realisation of FNR’s vision and mission, by duly taking into consideration the current state of play of public research and at the same time making maximal use of Luxembourg’s key assets.

I. STRENGTHENING THE FOUNDATIONS

• We will reinforce the development of a sustainable research system and human resource base, founded on a comprehensive culture of excellence;
• We will build up critical mass with the ambition to attain scientific leadership in key areas.

II. SHAPING A SHIFT IN LUXEMBOURG

• By developing research priorities that are in line with the long-term strategic plans for the country, we ambition to fuel innovation in the business, health and public sectors and support the digital and societal transformation;
• We intend to anchor science in society by reinforcing an active exchange between research and society including the mobilisation and involvement of citizens.

III. PROMOTING INNOVATION IN STRATEGIC RESEARCH MANAGEMENT

• We will develop the know-how and infrastructures to implement an evidence-based approach in the design, monitoring and assessment of research strategies and programmes;
• We will position the FNR at the forefront of national and international debates on research policy and strategy;
• We will explore new ways of assessing and evaluating projects and programmes, enabled through digital technology and based on the latest evidence available from research.
II. A COMPREHENSIVE CULTURE OF EXCELLENCE IN RESEARCH

The six dimensions of “Excellence in Research”:
The FNR formulates Excellence in Research along six dimensions, as the contributions that research institutions, research groups and the individual researcher make towards:

1. **SCIENTIFIC QUALITY**
   by making significant and international visible scientific advances (in terms of understanding, method, theory and application), across and within disciplines.

2. **PUBLIC OUTREACH**
   by helping the development of a research culture in Luxembourg through public engagement actions, improving scientific literacy, raising awareness of the added value of research in tackling societal challenges and stimulating a critical mind-set within society.

3. **TEACHING AND TRAINING**
   by making innovative contributions in graduate and postgraduate teaching and by educating a critical mindset and training highly skilled people with career opportunities within and outside academia.

4. **SOCIAL IMPACT**
   by informing policy debate and decisions in Luxembourg by research evidence and close interaction with societal stakeholders and by providing solutions to the needs of society.

5. **ECONOMIC IMPACT**
   by strengthening industry/private sector through collaborative efforts between the public research organisations and industry; by enabling the transfer of research findings and know-how to the private sector and by stimulating entrepreneurial activities within the public research institutions.

6. **SHAPING THE RESEARCH SYSTEM**
   through innovating in research management, and by creating an institutional environment that nurtures talents, stimulates outstanding research and fosters entrepreneurial spirit.

All of these dimensions are equally important and should be supported and be rewarded. Individual researchers, teams and units should be assessed and evaluated along these dimensions. Of course, no single researcher, team or unit can be excellent in all of them.

However, there should be a common understanding that excellence at the individual level and at the level of teams and units, should be achieved in more than just one of these dimensions.

The dimensions of excellence will be reflected to varying degrees in the criteria of FNR’s support instruments.
05 ACTION PLAN
THE VALUE DRIVERS FOR OUR STRATEGY
THE VALUE DRIVERS FOR OUR STRATEGY

To design an action plan for the implementation of this strategy for public research in Luxembourg, the FNR has identified the six most important value drivers:

I. FOCUS ON RESEARCH PRIORITIES AND ENSURE STRATEGIC ALIGNMENT

II. ATTRACT AND NURTURE TALENTS

III. FOSTER INTERNATIONAL COOPERATION

IV. STIMULATE KNOWLEDGE TRANSFER AND ENTREPRENEURSHIP THROUGH COOPERATION WITH ECONOMIC AND SOCIETAL ACTORS

V. ANCHOR SCIENCE IN SOCIETY

VI. BECOME AN INNOVATIVE RESEARCH AGENCY

In the following sections, we will further develop the content of these pillars and line out specific actions that are planned for the period 2018-21.
I. FOCUS ON RESEARCH PRIORITIES AND ENSURE STRATEGIC ALIGNMENT

Scientific excellence of high international visibility has been identified as one of the key impacts to be pursued by the FNR. Given the limited research capacities of a small country, it is clear that high international visibility can only be achieved in a restricted number of research fields, which have to be carefully selected.

The selection of such priorities will have to consider the existing seeds of research leadership as well as the ability of Luxembourg to forge a distinct profile in these domains.

Regarding this last point, the central recommendation in the 2015 OECD report reads:

“Luxembourg would benefit from a full-fledged national STI strategy that articulates the links between research investments and their likely impacts on the government’s economic diversification, social well-being, and sustainability goals.”

In this context, over the past two years, the Luxembourg government has launched the “Third Industrial Revolution for Luxembourg” initiative that aims to elaborate and implement a long-term economic model for the country, in which three technologies converge (the digital transformation, new sources of energy, and new modes of mobility) to usher in a smart green digital society. Some complementary strategic initiatives have also been taken by the government, most notably the Digital Lëtzebuerg, the Plan Cancer and the Space Resources initiatives.

Following OECD’s recommendation, the FNR believes that the key research areas should be chosen such as to maximise the possibilities for alignment with the societal and economic development strategy.

STRATEGIC OBJECTIVE 1
STRENGTHENING THE FOUNDATIONS:

▷ We will reinforce the development of a sustainable research system and human resource base, founded on a comprehensive culture of excellence.

▷ We will build up critical mass with the ambition to attain scientific leadership in key areas.
While it will be important to focus on a limited number of research topics related to the different pillars of the Third Industrial Revolution (ICT Innovations, Smart City including Mobility and Energy, Smart Space, Fintech and Smart Manufacturing including Composite Materials and 3D Printing), the FNR will also need to account for the fact that it takes time, and efforts to develop scientific expertise and critical mass whereas the political, economic and societal agendas may change more rapidly.

The FNR’s portfolio of instruments will, therefore, need to provide the means to strengthen disciplinary scientific excellence, but also comprise tools that allow channeling the existing scientific expertise in a cross-disciplinary nature to solving the questions that are posed by the future societal and economic challenges.

**PROPOSED ACTIONS:**

- The reformulation and revision of the national research priorities.
- Implementation of the comprehensive view of excellence in research in existing funding instruments;
- Expanding the centre of excellence programme NCER with the clear aim to reinforce existing niches of excellence in areas where there is a demonstrated potential to gain a leading international position;
- Exploring the opportunity of strategic interdisciplinary programmes to build research capacity in topics of national relevance.

As can be seen in the example of the Digital transformation challenge (also called Smart Economy in the 3rd Industrial Revolution report), various scientific disciplines (e.g. ICT, biomedicine, education, history, sociology, economics, ethics) can make contributions to questions of cybersecurity, digital health, digital ethics, new models for labour organisation (Work 4.0), wellbeing and education, all of which are relevant topics for this particular challenge.

How can research contribute to the development of strategic priorities?

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<th>Strategic priority</th>
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<td>- Social &amp; Humanities</td>
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<td>- Mathematics</td>
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<td>- Law</td>
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II. ATTRACT AND NURTURE TALENTS

Talented people drive high scientific output and serve as the vehicle to transfer knowledge from research into society and the economy. Being able to attract top talent in key areas and support the best researchers in a sustainable way is therefore crucial for building an excellent research system.

There is an increasing difficulty in attracting and retaining highly skilled workers in the face of mounting global competition – in particular for ICT & Engineering.

In its 2015 report, the OECD recommended to support research careers at all stages and to develop research career routes to improve Luxembourg’s attractiveness to the most promising researchers. Recent FNR evaluations (e.g. INTERFACE impact analysis 2016 and CORE Evaluation 2015) reiterate the OECD recommendation to provide career track opportunities for the most promising young researchers to conduct their research projects.

Instruments encouraging early independence of excellent researchers, tenure-track opportunities and job opportunities beyond academia, as well as dual career considerations and gender aspects are elements that make for an attractive research system.

However, given that the system has only limited absorption capacities, the FNR will need to analyse together with the institutions where the focus should lie in terms of funding for the various career stages and in providing tenure track or tenured positions.

The findings of the Impact assessment of CORE, INTER, ATTRACT and PEARL (INTERFACE, 2016) show that the contribution to the research system has been highest in the past for the advanced career stage schemes (PEARL and ATTRACT), where the FNR managed to attract junior and senior group leaders with international renown.

These researchers have substantially contributed to developing the maturity and research excellence in the relatively young Luxembourg research system.

PROPOSED ACTIONS:

• Re-design the CORE junior programme as a scheme that supports early independence of postdoctoral level researchers;

• Improve the gender balance of researchers in Luxembourg, by initiating a national initiative to promote more women in science.
III. FOSTER INTERNATIONAL COOPERATION

Luxembourg is a small and relatively new player in the global research landscape; international cooperation is of vital importance. By teaming up with the best teams from all over the world, Luxembourg researchers can expand and multiply their impact and have access to expertise in multiple fields that are unavailable here.

Also, a strong international exposure acts as an external quality gauge for the national teams. International collaboration also plays an important role to increase the visibility of Luxembourg research and to promote Luxembourg as an innovation centre. The emerging concept of « Science diplomacy » even advocates the use of research cooperation between nations to build international partnerships beyond science.

International collaborations also provide opportunities to identify new research axes and offer the possibility for Luxembourg researchers to take part in the worldwide and interdisciplinary efforts addressing global challenges that are not national priorities per se (e.g. climate change, sustainable agriculture, food security).

In the past, FNR has strongly built on comprehensive bilateral cooperation agreements with partner research funding agencies. Such agreements (often build on the lead agency principle) are now in place with the most important countries in Europe and Luxembourg researchers have greatly benefitted from these funding opportunities. Multilateral international cooperation was mainly enabled through FNR’s participation in ERA-nets, Joint programmes and art. 185 cooperation.

More recently, person-based funding instruments have been added to our portfolio. These comprise the INTER-Mobility scheme and the earmarking of AFR PhD and PostDoc grants for specific international co-operations.

In the future, the FNR plans to expand its support for international cooperation in a much more specific and targeted fashion, by selecting partner countries or organisations/universities abroad that provide specific expertise complementing those of Luxembourg’s national champions.

PROPOSED ACTIONS:

- The existing bi- and multilateral instruments will be further exploited and new funding mechanisms for tri- or multilateral projects will be identified;
- Continue the strategy of focused bilateral collaborations with selected international partners (countries or individual institutions/universities) with emphasize on specific research topics and explore joint funding mechanisms;
- The participation in a small number of multilateral INTER initiatives addressing global challenges will be considered.
In recent years, the Luxembourg government has placed increasing emphasis on the need for evidence of economic and societal returns from its investment in research. Greater attention is given to the so-called “third mission” activities of public research. Universities and research and technology organisations are adopting more business-minded approaches and giving more attention to the impact of the public investments they receive.

Given the FNR’s vision to contribute to the country’s economic diversity, social well-being and future prosperity, FNR-funded research should aim to generate the biggest possible impact on policy behaviour and practice in Luxembourg economy and society.

This is only possible if FNR provides funding for innovative research, with a high potential for (long-term) socio-economic benefits, i.e. creating jobs and increasing wealth; sharing knowledge and expertise, and increasing human capital; increasing the effectiveness of public services and policy; enhancing quality of life, health and creative output; and ensuring environmental sustainability.

The FNR has designed and put in place, over the last two years, successful vehicles to promote impact on the economy through its PPP and PoC/KITS programmes. However, the notion of “Impact on Society”, embracing a broader concept of valorisation, has so far only been reflected marginally in the activities of the FNR.

In the future, the FNR will explore in greater depth how far the mechanisms put in place to enhance economic impact can be emulated in the societal context. In addition, support for research actors on the interface of science and society (e.g. Clinician-Scientists) should allow bridging the gap between research and practice.

STRATEGIC OBJECTIVE 2
SHAPING A SHIFT IN LUXEMBOURG:

▷ By developing research priorities that are in line with the long-term strategic plans for the country, we ambition to fuel innovation in the business, health and public sectors and support the digital and societal transformation.

▷ We intend to anchor science in society by reinforcing an active exchange between research and society including the mobilisation and involvement of citizens.

IV. STIMULATE KNOWLEDGE TRANSFER AND ENTREPRENEURSHIP THROUGH COOPERATION WITH ECONOMIC AND SOCIETAL ACTORS

In recent years, the Luxembourg government has placed increasing emphasis on the need for evidence of economic and societal returns from its investment in research. Greater attention is given to the so-called “third mission” activities of public research. Universities and research and technology organisations are adopting more business-minded approaches and giving more attention to the impact of the public investments they receive.

Given the FNR’s vision to contribute to the country’s economic diversity, social well-being and future prosperity, FNR-funded research should aim to generate the biggest possible impact on policy behaviour and practice in Luxembourg economy and society.
V. ANCHOR SCIENCE IN SOCIETY

On the way to establishing Luxembourg as a leading knowledge-based society, the FNR has set itself the objectives to foster the impact of research on the Luxembourg society and to anchor science in society. Ensuring public engagement in science and/or improving scientific literacy can be considered as impacts in their own right. Indeed, engaging the public with research can improve the quality of research and its impact, raise the profile of researchers, and develop researchers’ skills. It also enables members of the public to act as informed citizens and can inspire the next generation of researchers.

The FNR considers public engagement and science communication as an integral part of research and a joint responsibility of research institutions and funders. It works closely together with research actors, as well as with the educational and associative sectors to support joint initiatives to promote science nationally (among the general public and in schools) as well as internationally.

In the future, the FNR will continue to promote high-quality science communication and provide engagement platforms for researchers and society. Special attention will be given to

• further incentivise public engagement for researchers and research institutions, and help increase the quantity and quality of their public engagement and science communication activities,

• further develop digital communication, and to

• set up further inclusive communication actions with research actors in view of a joint corporate communication effort for Luxembourg research.

PROPOSED ACTIONS:

• Consolidation and refinement of existing tools to support public-private collaborations and the economic exploitation of research results;

• Exploring the opportunities for a funding instrument to support short- to mid-term collaborative research projects between public researchers and public institutions after the Public2 pilot call in 2017;

• Reinforcing the promotion of the JUMP (former Proof-of-Concept (POC)) programme to researchers and institutions in all scientific areas in order to further encourage societal impact.

PROPOSED ACTIONS:

• Continuation of the following Science in Society activities, with proven “multiplier effects”: Researchers’ Days; Chercheurs à l’école; Pairing Scheme – Politics Meets Research; Science Week (jointly with SCRIPT and others); Science Festival (jointly with MNHN); science.lu; Mr Science; training programme for researchers, science communicators and educational personnel; PSP funding programme (PSP-Classic and PSP-Flagship);

• Extending the PSP programme to specifically compensate the researchers’ time spent on public engagement activities and thus to help increase the quantity and quality of such efforts;

• Earmarking PSP grants for priority domains i.e. for participatory projects to encourage researchers to involve the public in the design and implementation of research studies/projects (e.g. citizen science); for projects promoting STEM to girls/young women; for science communication training for researchers; or in any other area considered of strategic importance over the next years.
VI. BECOME AN INNOVATIVE AGENCY

By all means, the FNR has evolved into a research agency that satisfies the highest quality standards in its operations, policies and governance. An external evaluation conducted by the The Evaluation Center of the University of Western Michigan in 2016 concluded:

“The FNR’s procedures allow the FNR to efficiently, effectively and systematically select and fund the highest quality, most excellent, and potentially highest impact research in Luxembourg”.

“The FNR does so by successfully implementing what are currently considered ‘best practices’ in peer review internationally”.

Further, FNR’s quality management system has been certified in 2017 to satisfy the requirements of the ISO 9001:2015 standard.

The FNR has also become an active and recognised contributor in science policy debates in international fora and organisations such as the Global Research Council and Science Europe – the European association of all major national Research Funding and Research Performing Organisations.

Within Science Europe, the FNR has taken up important roles in a number of working groups and committees (notably in the following areas: Open Access, Research Integrity, Researcher’s Careers).

In 2017, the Secretary General of the FNR was elected President of Science Europe.

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STRATEGIC OBJECTIVE 3
PROMOTING INNOVATION IN STRATEGIC RESEARCH

▷ We will develop the know-how and infrastructures to implement an evidencebased approach in the design, monitoring and assessment of research strategies and programmes.

▷ We will position the FNR at the forefront of national and international debates on research policy and strategy.

▷ We will explore new ways of assessing and evaluating projects and programmes, enabled through digital technology and based on the latest evidence available from research.
On the national level, the FNR has led a number of national initiatives involving all major actors (FNR, University, Research Centres) to consolidate the science and research system in Luxembourg, among which:

- The creation of the Luxembourg Agency for Research Integrity (LARI)
- The creation of the first National Centre of Excellence in Research, focusing on Parkinson’s disease and involving all national actors in biomedical research, clinicians and patient association;
- The definition of a national policy for Open Access to Scientific Publications;
- The elaboration of a National Quality Framework for Doctoral Education;
- The brokering of an agreement between the University of Luxembourg and the Public Research Centres regarding doctoral education and the supervision of doctoral candidates;
- The brokering of an agreement between the University of Luxembourg, the LIH and the Centre Hospitalier to providing an adequate contractual framework for clinicianscientists undergoing specialist training (MD-PhD).

In summary, the FNR has become a state-of-the-art research agency that is fully respected by its international partners and whose leading role in shaping national research policies is unanimously recognised. However, the FNR believes that it can further evolve to become a driver for innovative research management, strategy and policy implementation.

The major global trends that can be observed in research, such as digitalisation, big data and artificial intelligence, as well as the move towards democratisation and open science will have a profound impact on the way research is organised and conducted.

Equally, these developments will also bring about major changes in the way that research projects will be reviewed, monitored and how their outcomes will be measured in the future. To keep pace with these global developments, it is vital that the FNR develops the capacities to follow and absorb them, and learns how to apply them in the Luxembourg context.

**Impact assessment for research strategy and policy formulation.** While the FNR does monitor the progress of individual projects that it funds, and evaluates the final reports for each project, the FNR is currently not sufficiently well armed when it comes to condensing the sum of many individual project evaluations into an assessment of the programme as a whole.

The agency is also fairly unprepared to monitor outcomes and impact in a longitudinal fashion (i.e. over time) and exploit them for programme evaluation and future policy development.

It is, therefore, necessary that the FNR acquires expertise on scientifically rigorous models of the research process that allow a more rational assessment of the impact of science (a field called « Science on Science Policy »).
Digitalisation and democratisation of research and « Open Science ». At the international level, there is currently a lot of research and debate taking place around questions on how to open up the evaluation and assessment of research funding and research policies. « Open Science », mainly enabled through digitalisation, allows for increased reach and visibility of science as well as greater transparency of the research process in all its phases. Examples of new approaches include:

- crowd vs expert evaluation, open evaluation;
- the use of dedicated impact evaluation panels (comprising non-scientists);
- using data analytics and artificial intelligence in the assessment and evaluation of research projects and proposals;
- engagement of citizens in the development of research agendas.

The FNR needs to keep itself updated about these developments. However, much better: it could take an active part at the forefront of them. Being a small and agile agency, the FNR can explore new methods and test new approaches in a relatively uncomplicated way. In brief, the FNR could be an innovative research agency.

Research policy intelligence. With the development of the necessary know-how, both inhouse and through international networks and cooperations, it will become possible to achieve a more sophisticated monitoring of the outcomes and impacts of the national research strategy. In turn, this can form the foundation for a more evidence-based design of national research policies.

With the particular configuration of the FNR, which comprises international scientists (in the CS), national stakeholders (in the CA) and research management experts (in the executive office), the FNR would be ideally positioned as a centre of national research policy intelligence.

PROPOSED ACTIONS:

- A strategy to (a) build-up in-house expertise in Science of Science Policy through training and collaboration, and to (b) determine the infrastructure and analytical tools required to perform a more rigorous and quantitative monitoring and assessment of the outcomes and impact of Luxembourg’s research efforts, will developed;
- In collaboration with expert teams, exploratory projects to assess the possible implementation of new technological solutions in the evaluation processes of the FNR will be undertaken;
- The Science Europe recommendations on Research Information Systems will be implemented;
- The existing Open Access policy of the FNR will be expanded and a data management policy in accordance with the findings of Science Europe’s Working Group on Research Data will be developed;
- FNR’s participation in international debates and discussions on research policy topics, most notably within Science Europe and in the Global Research Council, will be intensified.
**APPENDIX I**

**MULTIANNUAL BUDGET - EXPENSES**

The annual data shown below are indicative. The budgets will be adopted annually by the FNR’s Board of Directors.

The ceilings for multi-annual commitments have contractual value, in accordance with Article 4 of this agreement.

<table>
<thead>
<tr>
<th>STRATEGIC OBJECTIVE 1</th>
<th>Programmes and Priority Actions</th>
<th>2018-2021 Annual Average</th>
<th>Multiannual Maximum Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengthening the foundations</td>
<td>CORE, OPEN, INTER, RESCOM, OPEN ACCESS, scientific integrity, AFR, “Junior careers”</td>
<td>€36,962,500</td>
<td>€232,410,000</td>
</tr>
<tr>
<td></td>
<td>PEARL, ATTRACT, NCER, PRIDE</td>
<td>€21,140,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRATEGIC OBJECTIVE 2</th>
<th>Programmes and Priority Actions</th>
<th>2018-2021 Annual Average</th>
<th>Multiannual Maximum Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaping a shift in Luxembourg</td>
<td>JUMP, KITS, Industrial Fellowships, BRIDGES, IPBG, PUBLIC2, transversal programmes, Clinnova</td>
<td>€18,725,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSP, SIS, FNR Awards, Communication, “Belval Branding”, Subvention art. 3.5</td>
<td>€3,300,000</td>
<td>€88,100,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRATEGIC OBJECTIVE 3</th>
<th>Programmes and Priority Actions</th>
<th>2018-2021 Annual Average</th>
<th>Multiannual Maximum Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting innovation in strategic research management</td>
<td>Innovative agency, operating costs</td>
<td>€5,072,500</td>
<td>€20,290,000</td>
</tr>
</tbody>
</table>

**TOTAL** | **€85,200,000** | **€340,800,000**
ORGANISATION

The FNR is a public institution created by statute (Law of 31 May, 1999) and enjoys legal capacity and full administrative and financial autonomy. Our overall strategy is laid down in a 4-year contract with the Luxembourg Government, which also defines our budget appropriation.

The Executive Office is composed of more than 26 committed collaborators, who are experienced and highly qualified professionals with a strong track record in science and research management or in the field of science communication.

www.fnr.lu/our-team/

OUR LEADERSHIP: EXECUTIVE HEAD

The Secretary General of the FNR is the chief executive of the organisation. He heads the Executive Office, implements the strategy, oversees programme development and manages all running activities. He is appointed by the Board of the FNR, subject to approval from the government.

BOARD OF THE FNR

Our Board supervises the organisation and approves the overall policies and strategic priorities of the FNR. It is appointed by the government and is composed of nine independent directors active in industry, business and the civil society. The members of the Board act in full autonomy.

SCIENTIFIC COUNCIL OF THE FNR

Our Scientific Council acts as an advisory body to the FNR. Appointed by the Government, it is composed of international experts. The current scientific council was appointed by ministerial decree in June 2015.

www.fnr.lu/organisation/
The present document defines FNR’s strategy for public research in Luxembourg over the next four years (2018-21). The development of the strategy has drawn input from a number of important fundamental policy documents and recommendations formulated therein:

- OECD Innovation Policy Review of Luxembourg – April 2015;
- « Luxembourg 2020 » Programme national de réforme du Grand-Duché de Luxembourg dans le cadre du semestre européen 2017;
- Luxembourg National ERA Roadmap 2020, version actualisée 2017;

The feedback provided by various evaluations, assessments and self-assessments that have been conducted over the past three years by the FNR and by others have also provided important input:

- Self-assessment report 2014-17 of the Luxembourg National Research Fund (FNR);
- An evaluation of the Luxembourg National Research Fund CORE selection procedure (2016). Conducted by The Evaluation Center of the Western Michigan University;
- Impact Assessment of the FNR funding programmes CORE, INTER, ATTRACT and PEARL (2017). Conducted by INTERFACE Politikstudien, Forschung, Beratung (Luzern, CH);
- Impact of POC and AFR-PPP funded projects 2014-17. Summary report (2017);
- Opinion Poll on the recognition and perception of science and scientific research in Luxembourg (2017). Conducted by QUEST;
- Recommendations from the CORE panel Chairs, as discussed in FNR’s Scientific Council;
- Evaluation of the University of Luxembourg (2017). Conducted by INTERFACE Politikstudien, Forschung, Beratung (Luzern, CH).