

Evaluation of the University of Luxembourg

Based on 13 peer reviews of the research units and interdisciplinary centres and interviews with the management of the University of Luxembourg, commissioned by the Ministry of Higher Education and Research of Luxembourg

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COMPANY INFORMATION

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SUMMARY AND RECOMMENDATIONS

The Ministry of Higher Education and Research of Luxembourg (MESR) mandated *Interface Policy Studies, Research, Consulting*, Switzerland, to organize and lead an external evaluation of the University of Luxembourg. The focus of the evaluation was the research performance of the research units and interdisciplinary centres¹ at the University. The evaluation was conducted in 2016 and focused on the period 2012 to 2015. Thirteen evaluations² were carried out, consisting in peer reviews in the research units, semi-structured personal interviews with the University management, and exchange with an institutional evaluation conducted in parallel with this evaluation.

This section summarizes the results of the evaluations in an overall assessment and then presents recommendations addressed to the research units, the Faculties, the management of the University, and the MESR.

INPUT – CONDITIONS FOR RESEARCH

Central conditions for research of high quality and quantity are, among others, a clear research strategy, sufficient human and financial resources, adequate infrastructure, a well-functioning organization, the presence of a quality assurance system, and productive and long-term contact with stakeholders.

Overall, the University exhibits good conditions for research. We find that especially the following features promote research of high quality and quantity:

- Favourable working conditions (wage level, block grants, and other financial resources; facilities, laboratories, and other infrastructure);
- Highly skilled and motivated researchers in all positions;
- Sensible research priorities at the University and unit level;
- Flourishing cooperation within the University, with local stakeholders, and with partners abroad.

However, the evaluation has also identified room for improvement in the following areas:

- Research strategies for the evaluation period and the future within some of the research units;

¹ In the following, for the sake of simplicity and easier reading of this report, only the term 'research units' is used for 'research units and/or interdisciplinary centres'. In situations concerning only the research units or only the interdisciplinary centres, we specify this as follows: 'research units in the faculties' or 'interdisciplinary centres'.

² Two research units were evaluated at a joint hearing.

- Human resources management, career development plans, and employment restrictions;
- Management of infrastructure, connected to the new Campus Belval, renewal of existing or purchase of additional expensive equipment, and access to electronic databases, libraries, and journals;
- Quality assurance and monitoring systems in some research units;
- Relationship between the Faculties and the interdisciplinary centres, connected to perspectives on obligations and responsibilities in the areas of research, strategy, management, and teaching;
- University-central support functions (e.g. support in human resources management and finances, external communication, and knowledge and technology transfer);
- Number of management bodies at the central University level;
- Relationship between the University and the ministries, where the role and influence of the government is a point of discussion.

OUTPUT – RESEARCH PERFORMANCE

When assessing the output of the research units, central indicators included research results, publications, external and competitive funding, innovation, activities for editorial boards and funding agencies, organization of and participation at scientific and public events, and recognition.

Quality and quantity of output

Based on the indicators mentioned just above, the experts conclude that the University demonstrates output of high quality and quantity. Regarding the different research units, the assessments are as follows:

- Nine research units produce output of very high to excellent quality and quantity. The performance is, among other things, illustrated through regular publications in well-reputed international journals, participations at international conferences and in editorial boards, innovative and interdisciplinary research, and the use of novel methodologies.
- In four research units, the output is assessed as medium to good. The performance is negatively affected by relatively low numbers of publications in higher profile journals and/or per full-time equivalent. Furthermore, the performance of the sub-units in these research units varies considerably, ranging from excellent to below average.

Third party funding

The performance of the research units in the acquisition of third party funding is somewhat difficult to compare. Two tendencies can be identified:

- According to the experts, a majority of the research units have secured high shares of third party funding, in particular from the Luxembourg National Research

Fund (FNR) and the European Union (EU), including European Research Council (ERC) grants, allowing them to expand their own structures.

- A minority of the research units display medium to low levels of third party funding. There are several reasons for this: Some of these units have high internal block grants that may reduce the ambitions for external funding. Furthermore, the experts identify a lack of culture of regularly writing proposals in some units. Lastly, some units are reluctant to invest in acquisition, as it is associated with risks and administrative burdens.

Patents and spin-offs

Filed or granted patents and spin-offs are only present in a few research units. The experts see the establishment of decentralized technology transfer offices as important to secure the handling of intellectual property. Because this type of output is only relevant in some research domains, it is not a good indicator for the research performance of the University. A comparison of the research units is therefore not constructive.

Development of research priority areas

The University has formulated six areas of preferential but not exclusive focus for the period 2014 to 2017. In addition, four further priority areas have been defined. Based on the statements provided in the interviews and supported by findings in the peer reviews, performance in these priority areas is assessed as follows:

- Performance is considered to be especially positive in the priority areas ICT Security, Systems Biomedicine, and Law. This is also largely the case for Computational Sciences and for Physics and Material Science.
- In the areas Educational Sciences, Multilingualism and Intercultural Studies, and Entrepreneurship and Innovation/Audit, performance is assessed as partly positive.
- In the areas International Finance and Sustainable Development, performance has developed but has not reached the envisioned level.

The experts see the University's focus on a limited number of priority areas and the incentives available to boost research within these areas as beneficial to achieving excellence in research. However, some of the research units operate outside of the national priority domains and the priority areas of the University and thus may experience difficulties in obtaining funding.

IMPACT – VISIBILITY AND TRANSFER OF KNOWLEDGE

The assessment of the research units' impact is based on their international scientific recognition as well as their national and international public recognition. Of interest are their influence on research communities and their effect and relevance for society (including the economy and politics).

Impact on research communities

Overall, the University enjoys quite high visibility in the international research communities.

- According to the experts' reviews, seven research units can compete at an international level, are internationally well known, and have clear scientific impact in their respective domains.
- In six research units, scientific impact is identified, but there is potential for increased international visibility. In some of these units, varying performance in the subunits affects the overall reputation and visibility of the units.

Impact on society

The research units demonstrate clear impact on Luxembourg society. Transfer of knowledge occurs through one or more of the following ways:

- Through cooperation with industry: Some research units secure mutual transfer of knowledge through extensive collaboration with industry partners.
- Through service provision to the public sector: Several research units provide research and services to the public sector in Luxembourg.
- Through training of students and PhD candidates: Most research units are able to attract highly qualified researchers from abroad. A large share of the PhD candidates who come to Luxembourg later take up work in the national industry, academia, or the public sector.
- Through public outreach: Several of the research units have direct influence on politics and society through public events and communication via media.

RECOMMENDATIONS TO THE RESEARCH UNITS AND THE UNIVERSITY MANAGEMENT

Based on the findings presented in the summary and the detailed presentations in the subsequent sections of this report, the following recommendations are addressed to the research units and the University management.

R1 Further develop research strategies

The hearings have revealed potential for further development of the research strategies in some of the research units. Whereas some research units could profit from a sharpening of their research strategies or a redefinition of their focus areas, other research units need to develop a more distinct focus or stronger links between research areas, recruitment, and external funding. We recommend that the research strategies include measures to address identified challenges, for example variations in the performance of subunits or insufficient third party funding. Where necessary, the development of research strategies should be followed by the Rectorate and the Faculties of the University and supported by international advisory boards.

R2 Implement quality assurance and monitoring systems

According to the experts, many of the research units could benefit from implementation or strengthening of quality assurance and monitoring systems. Monitoring of the quality and quantity of output could be used as an indicator for the success of the

units' research strategies. It could also provide directions for the distribution of individual incentives at the unit level. We recommend that the University develop coherent guidelines to support the procedures in the research units. The University and the units should make sure that these systems do not cause negative effects on the scientific work and academic freedom of the units' researchers.

R3 Develop career-planning instruments, including gender and family policies

The research units and the University are recommended to develop career-planning instruments that include career development plans for researchers (particularly PhD candidates and postdoctoral researchers), a gender policy, and a concept to reconcile work and family life.

RECOMMENDATIONS TO THE FACULTIES AND THE UNIVERSITY MANAGEMENT

The following recommendations are addressed to the Faculties and the University management.

R4 Improve relationship between Faculties and interdisciplinary centres

The interdisciplinary centres demonstrate outstanding output and have high national and international impact on research and society. However, the Faculties and centres have in part different perspectives on the obligations and responsibilities of the centres in the areas of research, strategy, management, and teaching obligations. The University is recommended to develop, in collaboration with the Faculties and interdisciplinary centres, a set of core guidelines on the role, rights, and responsibilities of the interdisciplinary centres.

R5 Increase support resources at the University level and support technology transfer

The research units are in need of support from the University, for example in the acquisition of third party funding, in human resources management, finances, and external communication, and in the handling of knowledge transfer, including intellectual property rights (patents, licences, and spin-offs). To offer optimal services, the University is recommended to secure efficient support of the research units by the central University administration. Further, the University should strengthen its technology and knowledge transfer, in particular through the development of decentralized technology transfer offices (where appropriate).

R6 Examine management structure at the University level

We recommend that the University examine the role and number of management bodies at the central University level and assess whether it is possible to streamline the structures. This entails considering whether some processes could be delegated to the Faculties and/or the research units (followed by a necessary increase in resources).

R7 Review research priorities and strategic positioning of research units

In future assessments of its research priorities, the University is recommended to assess the strategic positioning of the research units, including what type of research the units should provide in what research areas. Here, Ruttan's³ adaptation of Stokes' quadrant model could serve as a framework. The model distinguishes four types of research: curiosity-driven basic research; applied research and industry-sponsored technology development; use-inspired basic research; government-sponsored applied research and technology development. The type of research provides directions for goals with respect to motivation, form of control, and performance.

RECOMMENDATIONS TO THE UNIVERSITY MANAGEMENT AND THE MESR

This last section presents recommendations addressed to the University management and the MESR.

R8 Develop 'masterplan' for Campus Belval

We recommend that the University develop a 'masterplan' for Campus Belval. Up to now, decisions on distribution of laboratory and office space, and regulations on the utilization of facilities and available equipment have led to tensions. The plan should secure a basis for optimal synergies between the research units and national public research institutions.

R9 Examine ways to improve framework conditions for career development

The University and the MESR are recommended to examine whether the national labour law could be adapted, specifically with regard to the strict handling of the five-year contract limitation for non-professorial staff. This would be beneficial for the development of career plans within the research units, especially for PhD candidates and postdoctoral researchers (see recommendation 3 above).

R10 Secure clear communication on the collaboration between the University and the national government

The interviews at management level and the hearings revealed concerns regarding the role of the national government, where there is a fear that the government has too much influence on the management and the research priorities of the University. Furthermore, there are concerns that the ministries affect the freedom of research through financing new research institutions. As the evaluation did not examine these processes in detail, we cannot determine whether the concerns are justified. However, because they may affect the research performance of the units, we recommend that the University and the MESR examine these issues and, if necessary, secure clear communication on the role and potential influence of the ministries, for example in the creation of new research institutions and in the decision-making processes of the Board of Governors.

³ Ruttan, Vernon Wesley (2001): *Technology, growth, and development: An induced innovation perspective*, Oxford University Press, New York (see Chapter 13: "Science and technology policy", pp. 534-599). The terminology in Ruttan's model differs somewhat from the terminology used by the University (see section 3.3 below).

I INTRODUCTION

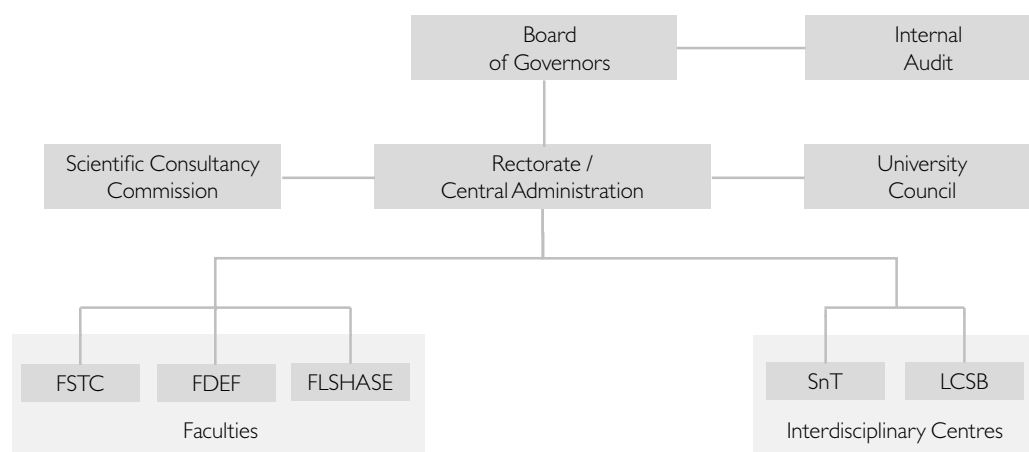
The Luxembourg University Law⁴ stipulates that the University of Luxembourg be evaluated by an external party every four years. The University, founded in 2003, was evaluated for the first time in 2008 and for the second time in 2012. The Ministry of Higher Education and Research of Luxembourg mandated *Interface Policy Studies, Research, Consulting*, Switzerland, to organize and lead the third external evaluation of the University in 2016. The focus of the evaluation was the research performance of the various research units and interdisciplinary centres⁵ at the University.

This synthesis report provides an overall assessment of the research performance of the research units at the University. It points out the similarities and differences in the input, the output, and the impact of the evaluated research units. The overall conclusions and recommendations are presented above in ‘Summary and recommendations’.

1.1 UNIVERSITY OF LUXEMBOURG

The University has three Faculties with research units in different scientific disciplines. In addition, there are three interdisciplinary centres⁶ (see Figure 1.1).

Figure 1.1: Organization Chart, University of Luxembourg



Source: Website of the University of Luxembourg (<www.uni.lu>). FSTC = Faculty of Science, Technology and Communication; FDEF = Faculty of Law, Economics and Finance; FLSHASE = Faculty of Language and Literature, Humanities, Arts and Education. The figure depicts the situation in the evaluation period 2012 to 2015.

⁴ *Loi du 12 août 2003 portant création de l'Université du Luxembourg* (<www.uni.lu/university/official_documents>).

⁵ In the following, for the sake of simplicity and easier reading, the report uses the term ‘research units’ for research units and/or interdisciplinary centres. In situations concerning only the research units or only the interdisciplinary centres, the report uses the following specific terms: ‘research units in the faculties’ or ‘interdisciplinary centres’.

⁶ The Interdisciplinary Centre for Contemporary and Digital History was established in 2016. It is not part of the evaluation, as the assessed period is 2012 to 2015.

The University has nearly 6,200 students and 1,500 staff.⁷ It is largely funded through government block grants and competitive research funds from the Luxembourg National Research Fund (FNR) (see key figures in Table 1.2).

Table 1.2: Key Figures, 2012-2015, University of Luxembourg

	2012	2013	2014	2015
Human resources [full-time equivalent]				
Total number of employed persons	1126.0	1312.0	1414.0	1504.0
- Researchers	809.0	957.0	1043.0	1100.0
Financial resources (including HR costs) [EUR in millions]				
Government contribution	122.9	144.2	150.3	159.5
Financial resources (excluding fixed costs) [EUR in millions]				
Total annual budget	39.7	54.2	60.4	72.2
- Government contribution (block grant) ¹⁾	12.9	20.6	22.0	29.1
- Government contribution (IRP) ²⁾	5.2	5.5	5.6	5.8
- Competitive research (FNR)	15.5	20.4	24.5	27.7
- Competitive research (EU)	2.8	2.7	3.3	4.0
- Other	3.3	5.1	5.1	5.7
Financial resources (excluding fixed costs) [share of annual budget]				
Government contribution (block grant) ¹⁾	32.5%	38.1%	36.5%	40.3%
Government contribution (IRP) ²⁾	13.2%	10.1%	9.3%	8.0%
Competitive research (FNR)	39.0%	37.6%	40.5%	38.3%
Competitive research (EU)	7.0%	4.9%	5.4%	5.5%
Other	8.3%	9.4%	8.4%	8.0%

¹⁾ Excluding fix costs; ²⁾ IRP = competitive internal research projects.

Source: Documentation from the University of Luxembourg and the MESR.

1.2 EVALUATION OBJECTIVE AND FOCUS

The objective of the evaluation was twofold:

- *Address legitimization of the University (summative evaluation):* The evaluation should examine the research performance of the University that has been made possible through the funding invested by the government. This addresses the legitimization of the University.
- *Create learning effects (formative evaluation):* The evaluation should trigger learning effects by assessing the research performance of the University. The formative evaluation should show the strengths and weaknesses of the research units in the field of research, both retrospectively and prospectively.

⁷ This information was provided in the self-assessment report of the University of Luxembourg.

To achieve the stated objectives, the evaluation focused on three elements:

- *Input* includes the preconditions for the research conducted, such as research strategy, financial and human resources, infrastructure and equipment, organization, and quality assurance systems.
- *Output* includes the performance of the research units, exemplified through research results and the dissemination thereof (e.g. research results, scientific publications, third party funding, patents, licenses, and spin-offs).
- *Impact* refers to the national and international medium- and long-term effects and the relevance of the output on science (e.g. reputation, visibility, and influence) and on society, economy, and politics (e.g. service provision, transfer of knowledge, visibility in the public, and cooperation projects with stakeholders).

The evaluation focused on the performance of the research units listed in the table below (Table 1.3).⁸

Table 1.3: Research Units and Interdisciplinary Centres, University of Luxembourg

Faculty	Research unit
Faculty of Science, Technology and Communication (FSTC)	1 Computer Science and Communications Research Unit (CSC)
	2 Research Unit in Engineering Science (RUES)
	3 Mathematics Research Unit (RMATH)
	4 Physics and Materials Science Research Unit (PHYMS)
	5 Life Science Research Unit (LSRU)
Faculty of Law, Economics and Finance (FDEF)	6 Research Unit in Law (RUL)
	7 Centre for Research in Economics and Management (CREA)
	8 Luxembourg School of Finance (LSF)
Faculty of Language and Literature, Humanities, Arts and Education (FLSHASE)	9 Education, Culture, Cognition and Society (ECCS) and Luxembourg Centre for Educational Testing (LUCET)
	10 Integrative Research Unit on Social and Individual Development (INSIDE)
	11 Identités. Politiques, Sociétés, Espaces (IPSE)
Interdisciplinary centres	12 Interdisciplinary Centre for Security, Reliability and Trust (SnT)
	13 Luxembourg Centre for Systems Biomedicine (LCSB)

Source: Website of the University of Luxembourg (<www.uni.lu>).

1.3 METHODOLOGY

The evaluation was conducted in 2016 and assessed the period 2012 to 2015. It consisted of peer reviews in the research units, interviews with the University management, and exchange with an institutional evaluation that was conducted in parallel.

⁸ The research units ECCS and LUCET were evaluated at a joint hearing.

Peer reviews

The evaluation was based mainly on peer reviews by experts working in the same fields as the evaluated research units. A group of at least three experts was put together for each research unit.⁹

1. In a first step of the evaluation, using a standardized self-assessment report, the research units and the University carried out self-evaluations in spring 2016. Subsequently, the expert teams received the self-assessment reports of their respective research units.
2. In a second and main step of the evaluation, hearings were conducted with the expert teams onsite in Luxembourg in September 2016. The hearings, which were organized and moderated by Interface, were composed of a self-presentation by the research unit, a group discussion on the self-assessment report, demonstrations of facilities and ongoing projects, and several individual and group interviews. The hearings resulted in unit-specific evaluation reports.¹⁰

Management interviews

In addition to the peer reviews, Interface conducted semi-structured personal interviews with representatives of the University's management team. The interviews were carried out in Luxembourg in September and October 2016.¹¹

Institutional Evaluation Programme

In parallel to this evaluation, the Institutional Evaluation Programme (IEP) of the European University Association carried out an institutional evaluation of the University of Luxembourg in the fall of 2016. The aim of the evaluation was to support the University in the development of its strategic leadership, capacity to manage change, and internal quality culture, with recommendations in the context of the aims and objectives of the University.¹² The results of the IEP evaluation are published in a separate report.

Interface had the opportunity to attend the IEP evaluation during two days in Luxembourg in October 2016. Where relevant, the results of the observations have been included in the assessment of the conditions for research and the research performance.

1.4 INFORMATION ON CATEGORIZATION

In some of the chapters of this synthesis report, the research units are categorized into groups based on the unit-specific evaluations. We would like to point out that the categorization is based on the experts' overall assessments. As discussed below, in some research units the performance of the subunits varies considerably concerning conditions for research, research performance, and impact. These variations in the

⁹ List of experts in appendix A1.

¹⁰ The individual research unit evaluation reports are listed in appendix A2.

¹¹ Interview list in appendix A3.

¹² IEP (2015): Institutional Evaluation Programme: Guidelines for institutions. EUA – Institutional Evaluation Programme.

performance of the subunits are not visible in the categorization. As such, the unit-specific evaluation reports give a more detailed and nuanced picture of each unit. We encourage the reader to take this into consideration when reading the synthesis report.

1.5 ACKNOWLEDGEMENTS

We would like to thank everyone who assisted us in the evaluation of the University. The MESR and the University provided valuable feedback and helped optimize the instruments used in the evaluation. The responsible staff at the University actively supported us with the organization of the self-assessments and the hearings. We extend our sincere thanks to the individuals in the research units as well as in the University management who agreed to take part in the interviews. Finally, we would like to thank the experts, who with their active and engaged participation made a successful evaluation process possible.

This section presents the evaluation findings in the areas: research strategy, financial and human resources, infrastructure and equipment, organization, and quality assurance systems. Information on these areas is necessary to evaluate to what extent the input available creates the necessary conditions for output of high quality and quantity. As such, enhancements in these areas may improve the research performance of the research units. In addition to the unit level, we discuss organizational aspects on the University and Ministry level, because they were addressed in the peer reviews and the interviews as potential factors in the research performance of the University. Lastly, the future research strategies of the research units are assessed.

2.1 RESEARCH STRATEGIES

The evaluations found that there are variations in the research strategies of the research units. The research units can be divided into three groups:

- The first group, consisting of five research units (INSIDE, IPSE, LCSB, RMATH, SnT), demonstrates research strategies with clear objectives that have been pursued with success over several years. These research units may improve their strategies further through the development of new research areas.
- In the second group, encompassing two research units (PHYMS, RUL), research strategies have been developed, but they could be improved, for example in terms of defining a more distinct strategy or securing internal synergies.
- In the third and last group, we find six research units (CREA, CSC, ECCS/LUCET, LSF, LSRU, RUES) with a lack of or with underdeveloped research strategies. The lack of a research strategy can often be traced back to organizational changes or leadership issues. Here, the research strategies may be improved considerably through the development of an overarching approach that sets clear goals concerning research areas, recruitment, and output.

The evaluations reveal a clear connection between the research strategies and the performance of the research units. Whereas units with a clear research strategy generally demonstrate very high research performance, the units with below average or heterogeneous performance also have an underdeveloped or lacking research strategy. As such, optimization of the research strategies and objectives at the research unit level may improve the output and impact of the University.

2.2 HUMAN AND FINANCIAL RESOURCES, INFRASTRUCTURE, AND EQUIPMENT

In general, the research units exhibit very good conditions in terms of the human and financial resources available. Also the existing infrastructure in terms of laboratory, office space, and equipment is generally found satisfactory in most research units, in

some even excellent. A group of research units is able to keep up with the internationally most renowned universities in terms of available resources. The new Campus Belval offers great potential for the future research activities of the University. The researchers within the research units are generally highly qualified and demonstrate strong commitment to securing excellent research performance and high impact.

Despite these positive results, the following six issues are identified:

- Academic exchange is not used to its full potential. Existing tools of the FNR and the University, such as sabbatical leaves and visiting researcher positions, should be used fully and developed further.
- Concerns identified in some research units are a lack of resources for renewal of existing or purchase of additional expensive equipment, and inadequate access to electronic databases, libraries, and journals.
- Several research units lack or have unclear career development plans for their collaborators. There is a need for support from the University level in developing clear standards and criteria for promotion. Further, the strict handling of the five-year contract limitation for non-professorial staff, regulated by the Luxembourg labour law, is mentioned as a central hampering element in the promotion possibilities of the University's employees, especially PhD candidates and postdoctoral researchers.
- The hearings have revealed some issues concerning the new Campus Belval. The collaboration with Fonds Belval has been challenging. Issues include regulations on utilization and distribution of facilities, lacking equipment such as blackboards or whiteboards, and delayed installation of library facilities.
- Some research units report insufficient internal administrative support at the research unit and University levels. At the unit level, this poses a certain threat to the productivity of the units, as the research staff members need to take on time-consuming administrative tasks. At the central University level, it leads to lengthy procedures (e.g. in external communication, recruitment processes, and approval of proposals).
- A final issue concerns the insufficient gender diversity in some research units (especially at the professor/senior scientist level) and the general lack of gender policies and support for the reconciliation of work and family life through measures such as child care and a dual career model.

2.3 ORGANIZATION

In this section, organizational structures on three levels are addressed: the research unit level, the University management level, and the Ministry level. Central questions are whether the research units' organizational structures are suitable for providing optimal performance and whether the overall structure of the University and the cooperation with the ministries provide optimal conditions for research.

Research unit level

The two interdisciplinary centres operate with a top-down governance and management structure. The experts find that this organization is clear and successful, with a positive effect on the working conditions as well as on the produced output and impact of the centres. The organization of the research units in the Faculties is somewhat more heterogeneous. Overall, there appears to be a lack of formal leadership structures combined with a strong focus on academic freedom. In some research units, informal governance structures work well due to historic reasons or personal traits. In other units, the absence of clear structures results in a lack of leadership. In part, this can be traced back to the additional work that management positions entail and the lack of incentives and sanctions available to leaders at the research unit and subunit levels, which make these positions unpopular.

Faculty level

The hearings and the interviews at the management level revealed some issues in the relationship between the Faculties and the interdisciplinary centres. This is not so much a problem of cooperation between the research units. Rather, the issue is linked to the question of what rights the interdisciplinary centres should be granted (e.g. decision power in the centres and in decision-making processes at Faculty level, and supervision rights) and what services the centres should provide to the Faculties (e.g. teaching obligations).

University level

The interviews with the University management and participation in the IEP meetings showed that there are a large number of management bodies at the central University level (e.g. the Scientific Consultancy Commission, the University Council, the Management Team, the Executive Team, and the Rectorate itself). In the interviews with representatives of the University management, doubts were expressed as to whether the multitude of committees secures an efficient organization and transparent decision-making processes. Through a development of leaner administrative processes, there is potential for more efficient management of the University.

Ministry level

In the management interviews and the hearings, the growth in as well as the current available funds of the University are assessed very positively. The commitment to and support of the University at the political level in Luxembourg has clearly increased since its foundation in 2003. However, some potential conflicts are identified:

- A first issue is the influence of the MESR on the Board of Governors, which is seen as too strong by a number of interviewees. There is concern that the government has too much influence on the management of the University.
- A second issue is linked to the creation of new research institutions, such as the planned Luxembourg Centre for School Development, the Luxembourg Centre for Logistics, and the newly created Interdisciplinary Centre for Contemporary and Digital History. Some researchers see this as an opportunity for establishing new research areas. However, it has also triggered defensive reactions among some re-

searchers, because they see earmarked investments as a threat to the freedom of research.

As we did not evaluate the processes in the management bodies and did not analyse the creation processes of new research institutions, it is not possible to assess whether these voiced concerns are justified. However, because these issues may affect the research performance of the research units, the University and the MESR should examine them more closely.

2.4 EXTERNAL RESEARCH COLLABORATIONS AND SERVICE PROVISION

The evaluations show that all research units demonstrate a good range of national and/or international collaborations with industry, government, and research institutions, which is very beneficial to their research. However, most research units could broaden their scope further, for example through increased collaboration with local industry and service provision to public administrations. There is also potential for closer collaboration with public research institutions such as the Luxembourg Institute of Health (LIH) and the Luxembourg Institute of Science and Technology (LIST). Furthermore, collaboration with international partners could be strengthened.

2.5 QUALITY ASSURANCE SYSTEMS

According to the experts, six research units (IPSE, LCSB, LSRU, PHYMS, RMATH, SnT) have appropriate quality assurance systems, albeit with different content, that allow for quality control of their performance. In seven research units (CREA, CSC, ECCS/LUCET, INSIDE, LSF, RUES, RUL), there is no clear or insufficient monitoring of the quality of output. In some of these units, although a formal quality assurance system is lacking, informal procedures partly provide some form of monitoring. The supervision of PhD projects is positively assessed and represents a clear strength of the University.

In general, an improvement of the quality assurance systems is beneficial, as it may promote output of high quality and act as a basis for awarding individual incentives. As such, all research units should make explicit and formalize their quality assurance and monitoring systems of activities such as publications, awards, and active collaborations, including exchange of researchers and successful competitive funding. Coherent guidelines at the University level may support the research units in developing procedures at the unit level. However, the University and the research units should make sure that the systems do not cause negative effects on the scientific work and academic freedom of the units' researchers.

2.6 FUTURE RESEARCH STRATEGIES

Overall, the research units that have insufficiently developed research strategies also demonstrate weaker research strategies for the future. However, also research units

with established research strategies in the evaluation period could benefit from a further development of their future objectives. The research units are encouraged by the experts to develop their research strategies for the future through more detailed and concrete objectives and to include a clear and coherent strategy on research areas, recruitment, and funding. To secure success in the priority areas of the University and Luxembourg, the research strategies of the research units should be developed within the framework of the priorities of the University and at national level.

This section provides a synthesis of the main area of focus of the evaluation: the output. In addition to the scientific output, third party funding and the development of patents and spin-offs are addressed. Lastly, we examine the performance in the priority areas of the University.

3.1 QUALITY AND QUANTITY OF OUTPUT

Overall, the research units demonstrate output of high quality and quantity, especially given the relatively young age of the University.

- Nine research units (CREA, CSC, INSIDE, IPSE, LCSC, PHYMS, RMATH, RUL, SnT) display output of very high to excellent quality and quantity. Most of these units publish regularly in well-reputed international publications and are active participants at international conferences and on editorial boards. In general, these research units can compete with comparable international research institutions in their domains. Some of them enjoy a leading international role, delivering outstanding research and publications with very high scientific relevance. Furthermore, there are several examples of innovative and interdisciplinary projects as well as research of high practical value to policy development in Luxembourg. Several units have also developed novel methodologies. In view of the resources available, the research activities are assessed as satisfactory in terms of both quality and quantity.
- In four research units (ECCS/LUCET, LSF, LSRU, RUES), the output is assessed as medium to good. However, the following issues are identified: Although the quality of output is predominantly assessed positively, there are relatively few papers in higher profile journals, and/or rather low numbers of publications per full-time equivalent. Furthermore, the output of the subunits is very heterogeneous, with some subunits exhibiting excellent results but others showing far below average results. A lack of a clear research strategy, a historical focus on education, or organizational issues and prior conflicts are prominent reasons for the insufficient and/or varying output.

3.2 THIRD PARTY FUNDING, PATENTS, AND SPIN-OFFS

The performance of the research units in the acquisition of third party funding is somewhat difficult to compare. First, because of research collaboration between units, it is difficult to distinguish between the acquisitions of the respective units. Second, some experts were reluctant to assess the units based on the information available, as a number of factors affect the level of third party funding. Due to this, we abstain from categorizing the research units based on their performance. However, two tendencies can be identified:

- According to the evaluations, a majority of the research units demonstrate high to very high performance levels in the acquisition of third party funding, predominantly from the FNR (including ATTRACT¹³ and PEARL¹⁴ grants) and the EU (including European Research Council (ERC) grants). These are also largely the research units with the best output in terms of quality and quantity.
- According to the experts, a minority of the research units have medium to low levels of third party funding. In some of these units, the internal block grant offers sufficient funding, and as such, the incentives for the researchers to secure additional funding are rather low. The experts also identify a lack of culture of regularly writing proposals within some units. Furthermore, some of the units are reluctant to invest in acquisition, as it entails risks and administrative burdens. Here, insufficient capacities of the research facilitators responsible for application support at the Faculty level are raised as an issue.

Filed or granted patents and spin-offs are present in only a few research units. In the case of spin-offs, the results are even more limited, as only five spin-offs were launched during the evaluation period, four of them at the interdisciplinary centres. As such, the evaluations identify clear potential in the area of patents, licences, and spin-offs. The establishment of technology transfer offices (where appropriate) is seen by the experts as beneficial to secure the handling of intellectual property. Because such output is only relevant in some research domains, it is not seen as a useful indicator for the research performance at the University level. A comparison of the research units is therefore not constructive.

3.3 RESEARCH PRIORITIES OF THE UNIVERSITY

In the self-assessment report developed as a part of this evaluation, the University states that it focuses on both basic (curiosity-driven) and applied (mission-driven) research. Its main objective since 2005 has been to achieve international academic (research) excellence. As a framework for research at the University, a set of focus areas has been developed. In the current plan for the years 2014 to 2017, the following areas are listed:

- *Central Priorities at the Faculty level:* Computational Sciences (new since 2014); Law, stressing European Law; International Finance; Educational Sciences
- *Research priorities at the Interdisciplinary Research Centres:* ICT Security; Systems Biomedicine

¹³ The ATTRACT programme of the FNR is designed for researchers not yet established in Luxembourg who demonstrate the potential to become leaders in their field of research. The funding scheme offers promising junior researchers the opportunity to set up their own research team within one of the country's research institutions (see <www.fnr.lu>).

¹⁴ The PEARL programme is directed at public research institutions in Luxembourg and leading research professionals abroad. The goals of the programme are to recruit internationally leading researchers with outstanding track records and thereby to strengthen the research areas that are of strategic importance to Luxembourg. PEARL projects have a lifespan of five years with a financial contribution of between three to four million euros by the FNR (see <www.fnr.lu>).

- *Other Priorities:* Physics and Material Science; Entrepreneurship and Innovation/Audit; Multilingualism and Intercultural Studies; Sustainable Development

In the interviews with the University management, the research output in the priority areas was addressed. Based on the statements provided in the interviews and supported by findings at the research unit level, the performance is considered to be especially positive in the priority areas ICT Security, Systems Biomedicine, and Law. This is also largely the case for Computational Sciences and for Physics and Material Science. In the areas Educational Sciences, Multilingualism and Intercultural Studies, and Entrepreneurship and Innovation/Audit, the performance is assessed as partly positive. In the areas International Finance and Sustainable Development, the performance has developed but has not reached the envisioned level.

The experts and the interviewed representatives of the University management see the focus on a limited number of priority areas and the linked incentives available (e.g. competitive funding) to boost research within these areas as beneficial. Due to the small size of the country and the University, the goal should be to excel in a few chosen areas instead of developing an identity as a ‘generalist’ university. However, the vision and research objectives are rather vague, and the University could benefit from clearer specification and concretizations of its research strategy and measures to reach its objectives. This includes an assessment of the strategic positioning of the research units, i.e. what type of research the units should provide in what research areas. As the situation is today, some research units operate outside of the national priority domains and the priority areas of the University, and they may thus experience difficulties in obtaining funding.

This section focuses on the effects and the relevance, i.e. the impact, of the research units' output. This includes the national and international scientific reputation and visibility of the research units compared to similar research institutions abroad as well as the benefits for and the impact on Luxembourg society, including the economy and politics.

4.1 IMPACT ON RESEARCH COMMUNITIES

Concerning impact on research communities, the evaluations have found that the research units that exhibit output of high quality and quantity also have the highest scientific impact.

- Seven research units (INSIDE, IPSE, LCSB, PHYMS, RMATH, RUL, SnT) can be described as internationally visible and well known, with a high impact on the research in their respective domains.
- In six research units (CREA, CSC, ECCS/LUCET, LSF, LSRU, RUES), the scientific impact is overall high, but varying performance among the subunits affects the overall reputation and visibility. Some of these research units enjoy a high international reputation; however, their reputation is linked mainly to some subunits or individual researchers. In these units, there is potential for increased visibility on the broader European and international levels.

4.2 IMPACT ON SOCIETY

Concerning impact on society, the results are generally promising, as most of the research units have pronounced cooperation with national stakeholders and thus make a positive contribution to Luxembourg society. The contributions are found mainly in four areas:

- A number of research units have strong links to the economy through projects with industry partners. Where mutual and lasting cooperation exists, the companies benefit from the collaboration with the University and its provided services. Here, research within computational sciences offers numerous examples.
- Several research units provide research and services to the public sector. For instance in the areas education, social work, and law, there are a large number of examples of transfer and services.
- There is an important transfer of knowledge via the education and training of students and PhD candidates who are later employed in the national labour market.
- Several of the research units have direct influence on politics and society through public outreach, for example through public events and communication via media.

APPENDICES

The appendices provide the following information:

- A1 Evaluation teams
- A2 List of evaluation reports
- A3 Interviews with the management team

A I EVALUATION TEAMS

Unit	Experts and their affiliations
CSC	<ul style="list-style-type: none"> - Andreas Dengel, professor and chair of Knowledge Based Systems at TU Kaiserslautern, and member of the Management Board and scientific director at the German Research Centre for Artificial Intelligence (DFKI GmbH), Germany - Colette Rolland-Benci, professor of information sciences at Panthéon Sorbonne University - Paris I, France - Burkhard Stiller, professor, Department of Informatics, University of Zurich, Switzerland
RUES	<ul style="list-style-type: none"> - Jeffrey Packer, professor of civil engineering at the University of Toronto, Canada - Stefanie Reese, professor and head of the Institute for Applied Mechanics at RWTH Aachen University, Germany - Kurt Stockman, professor of electromechanics at Ghent University, Belgium - Martin Vermeer, professor of geodesy at Aalto University, Finland
RMATH	<ul style="list-style-type: none"> - Uwe Jannsen, professor of mathematics at the University of Regensburg, Germany - Giovanni Felder, professor of mathematics at the Swiss Federal Institute of Technology in Zurich (ETH Zurich), Switzerland - Jan Obloj, professor of mathematics at the University of Oxford, United Kingdom
PHYMS	<ul style="list-style-type: none"> - Leticia Cugliandolo, professor of theoretical physics and high energy physics at the University Pierre et Marie Curie – Paris VI, and director of Ecole de Physique des Houches, France - Helmuth Möhwald, professor of physics and physical chemistry and emeritus director at the Max-Planck-Institute of Colloids and Interfaces, Potsdam, Germany - Christian Wetzel, professor of physics, applied physics, and astronomy and professor of materials science and engineering at the Rensselaer Polytechnic Institute, Troy, NY, United States
LSRU	<ul style="list-style-type: none"> - Rudi Beyaert, professor, associate department director and leader of the Unit of Molecular Signal Transduction in Inflammation at the VIB Inflammation Research Centre and the University of Ghent, Belgium - Thomas Decker, professor of immunobiology and leader of the group Host Responses and Innate Immunity to Bacteria at the University of Vienna, Austria - Yves Muller, professor, leader of the research group Protein Structure and Protein Design at Friedrich-Alexander-Universität Erlangen-Nuremberg (FAU), Germany
RUL	<ul style="list-style-type: none"> - Estella Baker, professor of European criminal law and justice at De Montfort University Leicester, United Kingdom - Vito Roberto, professor of private, commercial and business law at the University of St. Gallen, Switzerland - Hans-Heinrich Trute, professor of public law, media and telecommunications law at the University of Hamburg, Germany
CREA	<ul style="list-style-type: none"> - Robert Elliott, director of admissions and recruitment in the Department of Economics at the University of Birmingham, United Kingdom - Beat Hotz-Hart, professor emeritus, member of the Board of the University of Zurich, expert at the Swiss National Science Foundation, Switzerland - Berthold Wigger, professor, head of the Chair of Public Finance and Public Management at the Karlsruhe Institute of Technology, Germany

Unit	Experts and their affiliations
LSF	<ul style="list-style-type: none"> - Bruno Gerard, professor of finance at BI Norwegian Business School, Norway - Thorsten Hens, professor of financial economics at the University of Zurich, Switzerland - Ania Zalewska, professor of finance at the University of Bath, United Kingdom
ECCS / LUCET	<ul style="list-style-type: none"> - Jean-Claude Beacco, professor of French educational linguistics at Sorbonne Nouvelle University – Paris III, France - Mariette Huizinga, associate professor of developmental psychology at the Free University of Amsterdam, Netherlands - Hans Anand Pant, professor and chair of Research Methods in Education at Humboldt-Universität zu Berlin, Germany - Klaus Willmes-von Hinckeldey, professor of neuropsychology at University Hospital Aachen of RWTH Aachen University, Germany
INSIDE	<ul style="list-style-type: none"> - Bea Cantillon, professor of social policy and director of the Herman Deleeck Centre for Social Policy at the University of Antwerp, Belgium - Marie Johnston, emeritus professor of health psychology at the University of Aberdeen, Scotland - Brendan Whelan, former director of the Economic and Social Research Institute Dublin and former research director of the Irish Longitudinal Study on Ageing Trinity College Dublin, Ireland
IPSE	<ul style="list-style-type: none"> - Desmond Dinan, professor of public policy at George Mason University, Arlington, VA, United States - Elvira Glaser, professor of Germanic philology at the University of Zurich, Switzerland - Stefan Gosepath, professor of philosophy and political theory at Freie Universität Berlin, Germany - Olivier Graefe, professor of human geography at the University of Fribourg, Switzerland - Jakob Vogel, professor of European history (19th & 20th century) at Sciences Po, Paris, France
SnT	<ul style="list-style-type: none"> - Bart De Moor, professor at Dept. Electrical Engineering, KU Leuven, Belgium - Christer Norström, working chairman of WeMeMove AB and adjunct professor at KTH Royal Institute of Technology, Sweden - Colette Rolland-Benci, professor of information sciences at Panthéon Sorbonne University - Paris I, France - Burkhard Stiller, professor, Department of Informatics, University of Zurich, Switzerland
LCSB	<ul style="list-style-type: none"> - Rolf Apweiler, director of the European Bioinformatics Institute of the European Molecular Biology Laboratory (EMBL-EBI) and senior scientist, United Kingdom - Rudi Beyaert, professor, associate department director and leader of the Unit of Molecular Signal Transduction in Inflammation at the VIB Inflammation Research Centre and the University of Ghent, Belgium - Michael Hastings, head of the Neurobiology Division at the MRC Laboratory of Molecular Biology, United Kingdom - Ulf Landegren, professor, head of the Advanced Molecular Techniques in Genomics, Proteomics and Medicine research group at the Department of Immunology, Genetics and Pathology, University of Uppsala, Sweden

A2 LIST OF EVALUATION REPORTS

Balthasar, Andreas; Thorshaug, Kristin (2017): Report on the evaluation of the Integrative Research Unit on Social and Individual Development (INSIDE) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Balthasar, Andreas; Thorshaug, Kristin (2017): Report on the evaluation of the Research Unit in Law (RUL) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Haefeli, Ueli; Dolder, Olivier (2017): Report on the evaluation of the Identités. Politiques, Sociétés, Espaces (IPSE) Research Unit at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Haefeli, Ueli; Dolder, Olivier (2017): Report on the evaluation of the Mathematics Research Unit (RMATH) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Haefeli, Ueli; Dolder, Olivier (2017): Report on the evaluation of the Research Unit in Engineering Science (RUES) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Rieder, Stefan; Iselin, Milena (2017): Report on the evaluation of the Centre for Research in Economics and Management (CREA) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Rieder, Stefan; Roose, Zilla (2017): Report on the evaluation of the Computer Science and Communications Research Unit (CSC) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Rieder, Stefan; Roose, Zilla (2017): Report on the evaluation of the Education, Culture, Cognition and Society (ECCS) and of the Luxembourg Centre for Educational Testing (LUCET) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Rieder, Stefan; Roose, Zilla (2017): Report on the evaluation of the Luxembourg School of Finance (LSF) at the University of Luxembourg, Policy Studies, Research, Consulting, Lucerne.

Rieder, Stefan; Thorshaug, Kristin (2017): Report on the evaluation of the Interdisciplinary Centre for Security, Reliability and Trust (SnT) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Schlapbach, Louis; Dolder, Olivier (2017): Report on the evaluation of the Physics and Materials Science Research Unit (PHYMS) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Schlapbach, Louis; Roose, Zilla (2017): Report on the evaluation of the Luxembourg Centre for Systems Biomedicine (LCSB) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

Schlapbach, Louis; Roose, Zilla (2017): Report on the evaluation of the Life Science Research Unit (LSRU) at the University of Luxembourg, Interface Policy Studies, Research, Consulting, Lucerne.

A 3 INTERVIEWS WITH THE MANAGEMENT TEAM

The following representatives of the University management team were interviewed:

- Prof. Dr. Rainer Klump
(President of the University of Luxembourg)
- Prof. Dr. Ludwig Neyses
(Vice-president for Research)
- Prof. Dr. Romain Martin
(Vice-president for Academic Affairs)
- Prof. Dr. Eric Tschirhart
(Vice-president for Technology Transfer and Fundraising until 2016, from 2017 *Chargé de Mission* for Technology Transfer and Fundraising)
- Prof. Dr. Tonie van Dam
(Vice-president for Doctoral Education and Training, Gender, and International Relations from 2017)
- Alfred Funk
(Director of Administration)
- Prof. Dr. Paul Heuschling
(Dean of the Faculty of Science, Technology and Communication)
- Prof. Dr. Stefan Braum
(Dean of the Faculty of Law, Economics and Finance)
- Prof. Dr. Georg Mein
(Dean of the Faculty of Language and Literature, Humanities, Arts and Education)
- Prof. Dr. Björn Ottersten
(Director of the Interdisciplinary Centre for Security, Reliability and Trust)
- Prof. Dr. Rudi Balling
(Director of the Luxembourg Centre for Systems Biomedicine)
- Prof. Dr. Massimo Malvetti
(Secretary General of the Board of Governors)