



**Report on the evaluation of the  
Materials Research and  
Technology department (MRT) at  
the Luxembourg Institute of  
Science and Technology (LIST)**

**Based on a peer review as commissioned by the Ministry of  
Higher Education and Research of Luxembourg**

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# 1. Introduction

The Ministry of Higher Education and Research (MESR) of Luxembourg mandated *Interface Policy studies Research Consulting*, Switzerland, to organise and lead a research evaluation of the Centres de Recherche Publics (CRP).

The Grand Duchy of Luxembourg operates three non-university public research and technology institutions. They are the Luxembourg Institute of Science and Technology (LIST), the Luxembourg Institute of Health (LIH) and the Luxembourg Institute of Socio-Economic Research (LISER). The three CRPs include departments linked to different scientific disciplines. The evaluation focused on the performance of the CRPs' departments.

The evaluation was conducted in 2022 and followed two earlier evaluations carried out in 2012 and 2018. This report presents the evaluation of the department of Material Research and Technology (MRT) of LIST.<sup>1</sup>

The observations and recommendations presented in this report are based on a peer review by the following four experts working in the departments' research fields:

- Prof. Dr. Paul Hartmann, Institute for Surface Technologies and Photonics, Joanneum Research, Austria
- Prof. em. Dr. Louis Schlapbach, Empa & ETH Zürich, Switzerland
- Prof. Dr. Peter Schurtenberger, Department of Chemistry, Lund University, Sweden
- Dr. Tessa ten Cate, Brightlands Materials Center, The Netherlands

The peer review consisted of a self-assessment report written by MRT and a hearing at the department that took place in September 2022. The assessment period runs from 2018 to 2021. The hearing, which was organised and moderated by Interface, comprised a presentation by the department, a group discussion of the self-assessment report and several individual and group interviews. These included interviews with the Head of department, research team leaders, members of the wider research staff and PhD students as well as clients and business partners. The report was finalised by Stefan Rieder and Chiara Büchler of Interface.

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<sup>1</sup> Between 2010 and 2012, evaluations of selected departments of the former CRPs were carried out. The first full evaluation of the CRPs, which included all departments, was carried out in 2018.

The overall results of all departmental evaluations are summarised in an institute report for each CRP<sup>2</sup> and a synthesis report<sup>3</sup>. The institute report includes an assessment of the CRPs as whole. It also summarises the findings from additional governance interviews with representatives of the management teams at the CRPs as well as a comparison between the CRPs and a foreign benchmark institute.

The report is structured into two parts: the first part discusses in detail the observations gathered by the expert team during the evaluation process. This part will focus on the input, output and outcome/impact of the department:

- *Input* includes the preconditions for the research conducted, such as strategies, financial and human resources, infrastructure, organisation and external research, industry and other collaborations.
- *Output* includes the performance of the department, exemplified through research and innovation results and their dissemination.
- *Outcome and impact* refer to the medium- and long-term effects as well as the relevance of the output on science, society, economy, and public administration/politics.

The second part presents the expert team's overall assessment and recommendations for further developing existing strengths and overcoming observed weaknesses.

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<sup>2</sup> Rieder, Stefan; Grosjean, Nicolas; Büchler Chiara (2023): Report on the evaluation of the Luxembourg Institute of Science and Technology (LIST), Interface Policy studies Research Consulting, Lucerne and Lausanne.

<sup>3</sup> Rieder, Stefan; Balthasar, Andreas; Haefeli, Ueli; Grosjean, Nicolas; Büchler, Chiara; Essig, Stefan; Thorshaug, Kristin (2023): Synthesis report on the evaluation of the Centres de Recherche Publics (CRP) in Luxembourg, Interface Policy studies Research Consulting, Lucerne and Lausanne.

## 2. Detailed results of the evaluation

### 2.1 Description of the Department

MRT was created in 2015 as a part of the merger of CRP Gabriel Lippman and CRP Henri Tudor into LIST. The department aims to become a leading Research and Technology department in selected material domains and processing technologies in the long-term. According to LIST's overall strategy, MRT contributes to the Research and Technology Organisation (RTO) vision by providing research and technology development for process and product innovations through enabling technologies in advanced materials and manufacturing as well as nanotechnology. Based on this vision, MRT's strategy has three dimensions. Firstly, MRT wants to achieve and maintain research excellence in its core areas. Secondly, the department focuses on visionary core technology which addresses societal challenges. Thirdly, MRT aims for the provision of impactful research-based innovation for industry partners and customers. With its extensive infrastructure and multi-purpose equipment at MRT's facilities, the department is an attractive partner for the industry.

During the evaluation period, MRT implemented the concept of core technologies (also Innovation Lines). The core technologies define disruptive technologies corresponding to innovations that rely on material sciences and technology developments. The research activities and technology developments within the department are built around four areas: Clean Technologies, Materials-enabled Digital Technology, Sustainable Materials and Processing and Manufacturing. With the establishment of the European Space Resources Centre (ESRIC) as the fourth LIST department in 2020, activities related to space resources have been transferred to ESRIC.

MRT's target groups are the scientific community and the industry inside and outside Luxembourg. In 2021, MRT had a total of 197 full-time equivalents. Third-party funding amounted to approximately 13.5 million Euros in 2021, with 50 per cent thereof originating from competitive grants and 50 per cent from contract research (45 per cent collaborative research, 5 per cent paid services and others).

### 2.2 Input

#### 2.2.1 Strategy of the department

The experts note that MRT has a clearly outlined strategy that works well in practice. During the evaluation period, the department implemented several core strategical elements such as the reorganisation of MRT into five research development and innovation (RDI) units and the creation of a science, technology, and partnership office. Furthermore, the management concentrated on developing and implementing the new concept of core technologies.

In general, the concept of core technologies is rated very positively by the expert team: on the one hand, they foster synergies between the research units, and on the other, they provide guidance for the staff in working towards a common goal. MRT has a very structured approach in selecting infrastructure and projects that enable the alignment of a large proportion of projects with the overall strategy and particularly the core technologies. The expert group rates this as a very positive status quo and a clear illustration of the department's excellent management. They also conclude that the

strength of the Core Technologies could be further improved by enhancing external input, such as scientific advice.

Despite the overall positive assessment, the experts identify two shortcomings in this development:

- Firstly, the experts observed posteriority regarding the selection of research topics within MRT. With MRT's current growth strategy and difficulties regarding recruiting highly skilled staff (see section 2.2.2), it remains unclear to the experts whether the department is able to handle all of its research topics. For the further development of MRT, the experts encourage the management to review research topics and, if necessary, withdraw posteriorities from certain research areas. This will allow the department to create an even clearer and narrower research catalogue with a strong emphasis on the core technologies and their application.
- Secondly, from a historical point of view, LIST's visibility has grown. However, the experts have gained the impression that the international visibility of the department and the institute is still not in line with the department's abilities and competences. Hence, the expert group encourages the management of LIST and MRT to plan a coordinated effort to improve the visibility of the institute and department at the international level, possibly in coordination with the UL.

Overall, the balance between capacities for use inspired basic research versus technology development remains an important matter, which needs to be taken into account in the department's strategic development. While MRT's various competencies and well-documented track record seem not to be of significance in the attractiveness of the department for SMEs, this is clearly different for large companies and their willingness to engage in strategic partnerships and programs. The expert group sees this as a strategic challenge for the future of MRT.

Accordingly, the experts note the need for a high-level decision to clarify the relationship and balance in scientific excellence and technology development within LIST, not only MRT. In this context, and in agreement with the experts of the 2018 evaluation, the 2022 experts strongly suggest establishing an external Science and Innovation Advisory Board to support the department's management in handling these strategic challenges. In the experts' opinion, MRT's management team would profit from external support especially in the reassessment of strategic issues and crucial recruitment processes.

### **2.2.2 Human and financial resources, infrastructure, and equipment**

#### **I Human Resources**

The management team and the staff of MRT are highly motivated. In the expert's opinion, the department's management is doing an excellent job and has a clear vision for the development of MRT. The experts find that MRT has a positive working environment and conditions, with highly qualified staff members who are motivated to conduct high-quality research. Access to infrastructure and equipment as well as the leadership provided by the Head of the department is assessed as excellent. Overall, staff at all levels seem to be dedicated to MRT's vision and mission.

This overall positive assessment also holds true for the PhD students. The experts note that the PhD students benefit from excellent working conditions as regards infrastructure and equipment as well as continuous education including communication skills. The department's spirit allows them to informally explore existing competencies outside their research group. Overall, the experts are of the impression that the doctoral students are satisfied with their on-site supervision.

As regards human resources, the experts identified three shortcomings:

- The number of female employees in this department is low. In particular, no women are working in management positions in the research units or groups. Despite the recognised difficulties in recruiting women for technical fields, this situation is unsatisfactory in the view of the experts.
- During the evaluation period, there were no structures or processes in place to enable and/or support career development activities for PhD students. Thus, the experts note some deficits in more formalised career development activities. The expert team encourages MRT to create and implement a formalised career development process for PhD students.
- In addition, the experts note a lack of possibilities for the PhD students to participate in topical educational activities with the UL and especially foreign partner universities. Hence, large joint doctoral schools between the UL and LIST such as the FNR funded Massena should be maintained as they provide additional topical educational activities that otherwise are difficult to find in Luxembourg due to the limited size of the UL and LIST.

Furthermore, the experts observed that talent attraction is an increasing challenge for MRT and more generally LIST. The recruitment of PhD students in particular is difficult, because a) the pool of potential PhD students at the UL is small and b) neither MRT nor LIST can offer attractive academic career paths for young researchers. However, the experts identify two possible approaches to address the problems mentioned during the next evaluation period:

- Firstly, MRT has established cooperations with universities in France and Belgium such as the University of Lorraine and the Université catholique de Louvain. However, during the evaluation period, the department mainly organised affiliated professor positions based on staff interest in teaching. According to the experts, MRT should use the creation of joint positions and groups with universities as an element of strategic recruitment for highly skilled researchers especially in research areas where the UL is not as active, such as the field of chemistry. Therefore, the experts advise MRT to seek more formal links (e.g. joint positions, joint research groups) with other universities offering high-quality education and research in strategically important research areas.
- Secondly, the experts note that a major mechanism for the successful recruitment of PhD students is the possibility of performing project work and internships at MRT/LIST during their Bachelors and Masters education. MRT offered these positions during the evaluation period. The experts believe this to be a very effective approach and encourage MRT to increase contact with universities in order to reach more potential PhD students.

The expert group has discussed the current permanent scientific staff ratio (research and technology staff, 40 per cent). The experts acknowledge that permanent positions can, on the one hand, have positive effects such as (a) that the perspective of a permanent position may attract more high-level scientists, who otherwise have to jump from one post-doc position to the other or prefer to go to industry, and (b) that the knowledge drain of scientists leaving after some years is lower when using more permanent staff. However, on the other hand, the experts conclude that a lower percentage or even reduction of permanent scientific staff would enhance the knowledge transfer through the movement of highly trained young researchers from MRT to industry and other research institutions as an essential contribution to society with a significant impact. This argument goes hand in hand with redefining the balance between scientific excellence and technology development, which should be reflected at the institute level (see section 2.2.1). Given the



positive and negative effects a high ratio of permanent staff members can have on MRT, the experts advise the department to review its current policy regarding the staff composition carefully.

#### I Financial resources

The experts find that MRT's financial situation is very sound. The facilities and the possibility to work on selected topics in the broad range from basic research to technology development are strong assets for MRT that the experts trace back to the excellent financial situation and the high block grant. MRT received the highest share of third-party funding within LIST (see also section 2.2.4). However, the department's management and staff mentioned the high overheads as a threat during the hearing. The experts acknowledge a sensible trade-off between overheads and the highly dedicated staff and agree that major efforts should be made to decrease overheads. They also emphasise reducing administrative costs, especially at the institute level. Nevertheless, the experts are under the impression that this appears to primarily be a problem for service contracts. In contrast, using internal block grant money for co-funding competitive grants and collaborative projects can reduce the cost issue. Additionally, the experts state that reducing overhead costs is also beneficial for competitive grants and collaborative projects, since more block grant will remain available if less is needed for co-funding.

MRT's infrastructure and equipment provide excellent conditions for conducting research and attracting talent. Nevertheless, the further growth of MRT appears to be slowed down by delays in the move into the "maison des matériaux" as well as in equipping. The fact that building management is not the responsibility of MRT or LIST seems to aggravate this problem.

### 2.2.3 Organisation

MRT is a well-organised department with clearly defined processes and structures supporting the research and technology development done at the research units. The organisation allowed the implementation of the Core Technology Lines and provided the necessary structures. Based on the hearing, the experts note that the structure works.

Nevertheless, the structure is demanding and can cause coordination problems for example. The matrix organisation with the superordinate Core Technology Lines and various support structures (e.g. platforms, pilot line management, technology line management) is demanding, and the staff needs time to learn how to work within the structure. Therefore, the expert team expresses doubts about the efficiency of this structure.

The experts observed that collaborations between research units are taking place frequently. Nevertheless, MRT could enhance internal cooperation even further to break down walls between different research units or groups. This is especially important if MRT aims to continue its excellent work, combining expertise to solve complex problems, and to be attractive to industry and other stakeholders. Hence, the department should encourage this, for example, through measures like joint presentations of projects.

The Materials & Manufacturing and Technology Infrastructure (MM-TI) incorporates MRT's three platforms: the prototyping and testing platform, the material characterisation platform and the composites manufacturing platform. According to the experts, the MM-TI is not sufficiently incorporated into the development and planning of new projects. The experts formed the impression that the platforms are not a priority for the principal investigators and project managers. This can create problems as regards the planning of resources and the availability of equipment and personnel. In order to further work along

the Core Technology lines, the early inclusion of the available platforms in project definitions will be crucial. Thus, the experts suggest carefully reviewing the role and position of the platforms.

#### **2.2.4 External research and industry collaboration and service provision**

The experts consider the department's industry cooperation and services to be very successful. Following the recommendation of the 2018 experts, MRT has made a substantial and successful effort to increase the number of national and international industry cooperations during the evaluation period. Moreover, strategic partners like Goodyear are considering renewing their relationship. MRT's ability to form collaborations and strategic partnerships with the private sector is assessed as a main strength of the department. Therefore, the experts see the development of MRT's industry collaborations very positively and are impressed by the proactive role of partnership development. They advise MRT to continue strengthening the cooperative approach. The experts propose three measures that build on the excellent foundations the department has created:

- Firstly, identifying the strengths and weaknesses of MRT's contribution to collaborative projects will be crucial for further developing the department's strategy. Thus, the experts suggest introducing a lean and concise formal debriefing process that applies to all industry cooperation projects. A debriefing process should include, for example, a short debriefing survey to assess the company's satisfaction with the cooperation and handling of intellectual property rights. MRT could also use the results of this survey to make the outcomes of certain cooperations more publicly visible when used in marketing material and initiatives for the industry both at the national and the international level.
- Secondly, MRT's partnership development has done very well in developing collaborations with industry. However, the experts recommend carefully checking whether the handling of partnerships is efficient.
- Thirdly, the experts expressed concern about the explicit definition of TRL-levels in describing the LIST partnership models for collaborative projects and strategic partnerships. The definition of TRLs is appropriate for emergency activities, not for R&D work for innovation typically based on unexpected results. Thus, the explicit definition of TRL-levels could unnecessarily constrain future collaborations for MRT. Hence, the experts advise that MRT should push for reconsideration at the corporate level.

In general, the relationship between MRT, and more generally LIST, and the UL should be strengthened. The experts find it striking that the UL does not appear more prominently e.g. in the 2021 LIST Annual Report and in the Self-Assessment Report provided by LIST. In general, the effort to brand Luxembourg as a place of science should be given more prominence. Luxembourg is too small to duplicate research and dissemination activities of different institutions such as the UL and LIST; they need to be coordinated and aligned with a national viewpoint. MRT has good cooperation with the department of Physics and Materials Science (DPhyMS) at UL, however, collaborative work with the Department of Engineering (DoE) is less clear. MRT should develop its collaboration with the UL and elaborate a stronger strategic alignment as a priority for future evaluations (see section 2.2.1).

### **2.3 Research and innovation performance (Output)**

#### **2.3.1 Quality of the output**

The quantity and quality of the publications are rated as excellent. The bibliometric analyses conducted by the evaluation team show two developments:

- Firstly, the bibliometric analysis shows that the output quality during the evaluation period has been high. The department’s average Field-Weighted Citation Index (FWCI) of 1.17 indicates a research impact above field average. With the decrease of the FWCI after 2019, a downward trend can be identified for the rest of the evaluation period. Overall, the bibliometric analysis therefore shows that while the number of publications increased during the evaluation period, the FWCI decreased at the same time. This negative development and the increasing publication intensity per researcher, which peaked at almost one publication per FTE of scientific staff in 2021, indicates that more publications of lower quality have been produced. The experts recommend monitoring this development.
- Nevertheless, within LIST, MRT is the department with the strongest focus on publications in high-quality journals, with 50.5 per cent of publications in the top ten journals by CiteScore.
- Furthermore, to better assess the quality of the department’s outputs in the future, the experts advise MRT to add a list of the most important invited speaker presentations at international meetings to the next self-assessment report.

The experts find that the quantity and quality of MRT’s performance is also visible in the department’s financial results. The department’s third-party funds originating from competitive funding as well as collaborative funding with the public and private sector and the Fonds National de la Recherche (FNR) steadily increased during the evaluation period. Moreover, third-party funding continuously covered 60 per cent of the department’s expenditures during the evaluation period. This very stable ratio is evaluated as excellent.

The experts consider the number of patents and licenses to be appropriate. By contrast, the number of start-ups and spin-offs is low. MRT created one spin-off in 2018. Even though the department contributes 25 per cent to LIST’s KPI target of four spin-offs, given the size and resources of the department, the expert’s identify potential for the creation of more spin-offs. However, during the evaluation period there was no spin-off policy in place for LIST. Thus, besides the effort needed from MRT, the experts see a need for to develop a clear spin-off policy at the institute level.

### **2.3.2 Quality of the output**

The experts note that the capability to assemble multiple competencies within the department is a strength for the department’s research activities and technology development. The high quality of research indicated by the bibliometric analysis is assessed as a strong asset for creating long-term strategic partnerships with large national and, especially, international companies.

The experts note that MRT has a good number of external project-partners and, more generally, an appropriate output of patents and publications. Moreover, when assessing the quality of the outputs, the experts state that MRT’s IP-strategy is sufficient. The monthly organised IP-committee within the department, in particular, is regarded as a valuable structure for developing IP.

The newly implemented Testing and Prototype Engineering Platform and the Pilot line Management are critical success factors for developing industrial projects and innovation. The experts rate these structures as good preconditions for technology and knowledge transfer to the industry. Irrespective of this positive evaluation, they share the opinion that MRT’s Knowledge and Technology Transfer (KTT) strategy is not yet clearly outlined. Additions to the strategy should include regularly organised seminars on KTT, possibly in collaboration with specialists from the UL.

This assessment is in line with the recommendation from the experts of the 2018 evaluation about promoting the entrepreneurial spirit within the department. They pointed out in particular that the MRT staff should actively consider what MRT can offer to industry and society and then consider initiating this by creating spin-offs. The 2022 experts support this recommendation and encourage the department's leadership to create a vibrant entrepreneurial spirit among its PhD students and experienced Post-Doctoral researchers. This development could lead to an increasing track record of Start-ups and Spin-offs created by MRT.

#### **2.4 Outcome and Impact**

Based on the documentation made available and the interviews during the hearing, the experts have formed the impression that in general the cooperation between MRT and industry is appropriate and that a national economic impact is generated. The contract research MRT is providing for industry satisfies the needs of industry. This is clearly illustrated by the increasing revenues generated.

Discussions with selected industry partners during the hearings revealed that MRT's partners are satisfied with the services provided and the development and handling of the partnerships. The long-standing collaboration with industrial partners is an additional indication that MRT's services have a positive impact on companies.

Furthermore, the experts believe that MRT is active in key areas that are of great importance for the economy of Luxembourg. MRT has also made efforts to strengthen the transfer to the economy by creating internal structures (science, technology and partnerships office). The degree of success of these structures still remains to be seen at the end of the evaluation period.

Overall, the impacts of MRT's activities on the economy and society are difficult to assess. It is therefore important from the experts' point of view to systematically record stakeholders' satisfaction with MRT's services (see section 2.2.4). Surveys and other instruments could be used to better record the effectiveness of MRT.

## 3. Overall assessment and recommendations

### 3.1 Overall assessment of the department

The experts assess the development of MRT over the evaluation period as very positive with respect to quality and quantity of knowledge generation for both scientific and industrial worlds. Moreover, the expert team acknowledges the leadership provided by the department's management. The definition and implementation of the core technologies focused the department's research and innovation agenda. The working conditions at MRT are assessed as very good with highly qualified staff members working on the defined core technologies. MRT's impressive infrastructure contributes to this. A high level of cooperation with national and international industry assures MRT's current very sound financial situation.

Curiosity-driven research and technology development are both relevant for innovation. MRT's current balance is evaluated as appropriate. This balance, combined with the excellent organisation and resourcing of the department, has resulted in a high quality and quantity of outputs which are assessed very positively. In order to strive for scientific excellence in the future, closer collaboration with the University of Luxembourg (UL) is necessary for LIST and MRT.

The evaluation identified three areas of improvement to ensure MRT's positive development during the next evaluation period: Firstly, MRT's relationship with the UL is excellent in certain areas but is not a priority for the department. With the research landscape in Luxembourg evolving, MRT, and more generally LIST, needs to seek closer collaboration with the UL and other universities. A second set of issues is centred on the strategic challenges that MRT will face during the next evaluation period. MRT's strategy will need to be reassessed during the next evaluation period, particularly emphasising the balance of scientific excellence (basic research) and technology development (transfer to industry); both pillars for innovation. A third area of improvement concerns MRT's growth expectations for the future. To ensure a smooth growth process, various strategic and organisational issues will need to be addressed, such as HR management and talent attraction. Furthermore, delays in the move into the new building for MRT are negatively affecting the department's development. Special attention should be paid to this aspect in future.

### 3.2 Recommendations

Based on the observations stated above and in the previous chapters, the expert team formulates the following recommendations (any aspects which concern LIST as well as MRT are also reported in the institute report for LIST):

#### I Recommendation 1: Continue with the current strategy

The experts assess the department's current strategy positively. The focus on research excellence, core technologies and research-based innovation for the industry is compelling. Its implementation has progressed well during the evaluation period.

The experts recommend continuing with the overall strategy over the next four years. Nevertheless, they also see a need to modify certain elements of the strategy in the next evaluation period. Recommendations two to four address the modifications necessary in the coming years.

**I Recommendation 2: Foster the creation of joint positions with universities**

In general, recruitment at all levels is crucial for the success of an RTO. This is particularly true for the recruitment positions of high-profile researchers and well-trained PhD students. Therefore, the expert group recommends creating formal links in the form of joint positions between MRT and the UL as well as other universities, for two reasons:

- Firstly, joint positions with universities for high-profile researchers and well-trained PhD students will create attractive career opportunities and therefore strengthen MRT's appeal in the academic labour market. Moreover, joint positions will improve MRT's international visibility.
- Secondly, joint positions with universities outside Luxembourg can be used to rectify the problems caused by the missing chemistry activities at the UL that are particularly important for the research activities at MRT. Closer contact with universities could help to overcome the current difficulties in recruiting PhD students, not only those with chemistry backgrounds, but to counteract the low number of students at the UL in other subjects.

These formal links should also be used to provide training opportunities for Bachelors and Masters students. The announcement and employment of trainees is evaluated as an efficient mechanism to attract PhD students in the coming years.

**I Recommendation 3: Align research activities between the UL and LIST**

Given the size of Luxembourg's research and innovation landscape, competition between the UL and MRT or between the UL and LIST on the same research topics is not advisable. MRT has established excellent collaborations with the UL's DPhyMS and a joint doctoral school, the Massena Doctoral Training Unit, has been established. However, cooperation between MRT and the UL is not equally well developed in all areas (e.g. engineering).

The experts therefore recommend making an effort to align research activities between the UL, MRT and LIST in all relevant research areas. They particularly recommend that this effort should not be left to the individual research groups or the department but rather be made at a higher level such as LIST and UL management as well as at a ministerial level.

**I Recommendation 4: Further development of the strategy regarding the positioning of MRT between research and industry**

The experts acknowledge the success that MRT has in collaboration with industry. The expert group recommends continuing with these collaborations. At the same time, the experts recommend further developing the strategy with particular emphasis on the balance between scientific excellence and technology development. Systematic feedback processes between industry partners and MRT are helpful in this context.

The nature of the research activities at MRT (from curiosity driven to use-inspired research and development) remains an important matter for MRT, which needs to be clearly defined. While MRT's academic track record is important for large companies and their participation in joint projects, this does not seem to be the case to the same extent for SMEs. The expert group sees this as a strategic challenge for the future of MRT. Overall, the experts note that there is a need for a high-level decision clarifying the relationship/balance between scientific excellence and technology development within LIST.

**I Recommendation 5: Reflect on effects of growth strategy**

The experts recognise that MRT is pursuing a growth strategy involving increasing research topics, staff, and infrastructure. The experts suggest that this should not lead to a fragmentation of research topics within the department.

In addition, the experts state that the delay in the new building hinders the development of MRT. The current infrastructure situation is therefore not supporting the growth strategy. Thus, the experts strongly recommend reassessing the department's long-term strategy with respect to the building infrastructure. An improvement in the building infrastructure will not only allow the further development of research areas but will also facilitate internal collaborations between research groups as well as MRT's ability to interact with the other departments of LIST and with the UL.

**I Recommendation 6: Appoint a Science and Innovation Advisory Board**

Key strategic decisions such as growth, balance between basic research and technology development or the recruitment of key personnel should be discussed with competent external stakeholders. Therefore, the experts recommend appointing a Science and Innovation Advisory Board (SIAB). The SIAB should include:

- Representatives of the University of Luxembourg
- Representatives of other universities and research institutions outside Luxembourg
- Representatives of industry

A Science and Innovation Advisory Board can then function as a sounding board and should be established in the short-term.

**I Recommendation 7: Address overhead and organisational issues**

By comparison with benchmark institutions, MRT's overhead costs are rather high. This is seen as a threat to the competitiveness of MRT for service contracts and industry project collaborations. The experts strongly recommend making a real effort to reduce its administrative cost considerably, especially at the institute level, in order to decrease the overhead costs for the department.

The expert group further recommends that MRT reconsiders how efficiently the organisational structures and processes in place function and if the overheads are adequate in comparison with the outcome of the administrative quality provided. MRT is additionally advised to form small teams of administrative and research employees to develop more efficient and lean processes. Two exemplary measures are highlighted by the experts:

- In view of the complicated organisational structure including the overarching organizational element, such as the Innovation Lines, Innovation Centres or the Core Technologies, the experts see a need for a review of the effectiveness of the fixed positions.
- According to the experts, MRT has a tradition of very detailed project descriptions in long internal reports. The expert group recommends writing more concise publications (or patents) first and then using the products as internal reports in order to avoid process duplication.

**I Recommendation 8: Improve international visibility including industrial as well as societal impact**

From a historical point of view, LIST's visibility has grown substantially since 2015. However, the experts are of the impression that the visibility of LIST and of MRT is not

yet in line with their abilities and competencies. The expert group recommends making a substantial and coordinated effort to improve the visibility of MRT and LIST at an international level. A coordinated effort should include the following:

- Regularly and collaboratively identifying top results of MRT and the University of Luxembourg. The publication and communication of top results should be complemented by a proposal for potential speakers to be invited to program committees of international conferences.
- Organising international meetings on hot topics reflecting its own competencies in Luxembourg, preferably together with the UL.
- Partnerships with universities and research organisations to submit proposals for European Infrastructure Projects, where transnational access to experimental infrastructure is funded for users from academia and industry.

#### **I Recommendation 9: Develop a diversity policy**

The MRT needs to improve diversity at the management level. The representation of women in leadership positions is especially concerning. The experts recommend developing and implementing a clear diversity policy. The diversity policy could be based on LISTs “Diversity and Inclusion Charter”.

Furthermore, the diversity policy should include measures such as selection criteria for all positions, application management (e.g. actively inviting women to apply for leadership positions), enhancing the compatibility of working conditions with requirements of families (e.g. part-time positions, teleworking), inclusion of diversity aspects in employee satisfaction surveys, facilitating networks of female employees, career planning and coaching/mentoring guidelines. Additionally, the experts suggest providing childcare options at LIST.

#### **I Recommendation 10: Develop and implement spin-off/start-up strategy within LIST and MRT**

The department shows clear strengths as regards the quality and quantity of research and innovation outputs with high numbers of top publications, patents, and industry cooperation projects. However, the current track record in creating spin-offs and start-ups is not impressive. The experts recommend developing a vibrant entrepreneurial spirit among PhD students and Postdocs to motivate and support the creation of spin-offs and start-ups. For example, by introducing a bi-annual competitive spin-off or start-up award, granting a one- or two-year salary for postdoctoral research (50,000 to 100,000 Euros) or specific training or courses, possibly in collaboration with the UL.

Furthermore, the experts assess the proposed “Jump Start” program as promising and recommend that LIST adopt the program, possibly using MRT as a testbed with the objective of generating a start-up ecosystem around LIST.



## Appendix: Agenda of hearing

Wednesday, 14 September 2022		
<b>1   15:45 – 16:45   Welcome address by the Ministry of Higher Education and Research (MESR)</b>		MESR
16:45 – 17:00 <i>Break</i>		MRT Evaluation team
<b>2   17:00 – 18:00   Presentation by the Department of Environmental Science and Innovation (MRT)</b>		MRT Evaluation team
Time	#	Function/institution of participants
17:00 – 18:00	1	Head of the Department
	2	Expert scientist fellow
	3	Core Technology Manager
	4	Head of the FP unit & Head of SC unit ad interim
	5	Head of SIPT unit
18:00 – 20:00	Discussion of self-assessment report and preparation of interviews	
Evaluation team		
Thursday, 15 September 2022		
<b>3   8:00 – 9:30   Questions and discussion on the self-assessment report</b>		MRT Evaluation team
Time	#	Function/institution of participants
8:00 – 9:30	1	Head of MRT department
	2	Head of NN unit
	3	Head of director office
	4	Head of the FP unit & Head of SC unit ad interim
	5	Head of SIPT unit
10:00 – 10:30 <i>Break</i>		
<b>4   10:00 – 12:15, 13:30 – 15:10   Individual interviews</b>		MRT Evaluation team
Time	#	Function/institution of participants
10:00 – 10:30	1	Head of the Department
10:35– 11:05	2	Programme Manager, LIST-Goodyear Partnership
11:10 – 11:40	3	Senior Researcher

11:45 – 12:15	Junior Researcher	
12:15 – 13:30 <i>Lunch Break</i>		
13:30 – 14:00	4 Senior Researcher	
14:05 – 14:35	5 MM-TI Advanced Characterization Platform Pole leader	
14:40 – 15:10	6 Head of the FP unit & Head of SC unit ad interim	
15:10 – 15:30 <i>Break</i>		
<b>5   15:30 – 17:15   Group discussions with clients/business partners (group 1) and PhD students (group 2)</b>		MRT
		Evaluation team
<b>Time</b>	<b>#</b>	<b>Function/institution of participants</b>
15:30 – 16:15	1	Manager R&D Grant and Partnership, Goodyear
	2	Managing Director, GRADEL
	3	R&D Director, ST Microelectronics
16:15 – 16:30 <i>Break</i>		
16:30 – 17:15	1	PhD
	2	PhD
	3	Post-doc
From 17:15	Discussion of results and report writing	Evaluation team
<b>6   17:30 – 18:15   Visit to laboratories and other infrastructure</b>		Evaluation team MRT
<b>Friday, 16. September 2022</b>		
<b>7   8:30 – 12:30   Discussion of results and report writing</b>		Evaluation team
<b>8   12:30 – 13:00   Presentation of results</b>		MESR MRT Evaluation team