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Evaluation of LIST-ITIS

Report by the external peer review committee

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Executive summary

This report presents the results of the peer review of the Department of IT for Innovative Services (ITIS) of the Luxemburg Institute of Science and Technology (LIST). The review covers the period 2014-2017 and considers scientific performance, relevance for society including client and partner interaction and the governance and organisation as requirement to sustain the ability and suitability for promoting both scientific performance and interaction with clients and stakholders.

The review was performed by an independent external assessment committee, consisting of five internationally renowned researchers in the field of the research of the Department, Prof. em. Collette Rolland (Chair, France), Prof. Marina Jirotka (UK), Prof. Pericles Loucopoulos (Greece and UK), Prof. Martin Matzner (Germany), and Prof. Günter Schäfer (Germany). Geert van der Veen and Katharina Warta (Technopolis Group) acted as support for the peer review committee.

The experts consider that despite pertubations of the ITIS department following the merger of two research institutes into LIST in 2015, and related significant tension on staff, the department achieved a number of successes in terms of output and impact. The current ITIS organisational structure was set up in April 2017 with a clear internal structure and formalised processes and procedures. ITIS is in the process of acquiring additional expertise in areas of growth. The review took place at a turning point from which the committee sees signs of improvements and growth.

The department has faced significant difficulties to perform in relation to the indicators set out in the performance contract, notably related to competitive income (reaching only 23% against a target of 40%), the number of PhD students and pubication intensity. Indeed, performance according to several KPI was declining during the evaluated period, however, the experts see the potential of a turn of this tendency following the stabilization of the organizational structure in 2017 and based on achievements of recent years. Today, ITIS is mainly in the position of a national player, with some specific research areas where its' results obtain very good international impact. They have the potential to reach this level across the board.

With regard to research impact, ITIS has developed a high number of assets and has a true national socio-economic impact, with good examples of international impact. In the context of Luxembourg and in light of the vision and mission statement of LIST, quality of innovation is more important than traditional measures of research performance. The expert panel appreciates the presentation of projects, and assesses them as innovative, robust and in line with the mission, as well as the creation of spin-off companies and increased awareness of the importance and relevance of IP. ITIS put in place several infrastructures that provide advanced and adequate support for researchers. The participation to EU projects enhances ITIS international anchoring and cooperation.

In terms of governance, discussions at the unit and department levels revealed that some of the institute-wide processes affect negatively the functioning, efficiency, and culture of ITIS. This concerns a lack of transparency of decision making, linked to that, a lack of delegation of responsibility.

The peer review committee has the following recommendations:

1. Keep the focus and the organisational structure while making the strategy more explicit and more coherently presented and implemented
2. Formalize the assetisation process and capitalise on experience in this respect
3. Horizontal programmes should be formally defined and implemented
4. Performance indicators should be more tailored to the mission of ITIS and open to qualitative approaches
5. Define a roadmap to achieve a substantially higher rate of external financing
6. Put additional attention to get FNR projects and PhDs

7. Increase research performance and develop international cooperation
8. Create a structure to facilitate cooperation and foster potential synergies between ITIS and SnT
9. Enhance external visibility and improve communication on skills and competencies toward potential customers and partners
10. In the light of the new director coming in the near future, increase delegation of responsibility at suitable levels, increase transparency and shorten critical decision making processes

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1 Introduction

1.1 Institutional background

This report presents the results of the peer review of the Department of IT for Innovative Services (ITIS) of the Luxemburg Institute of Science and Technology (LIST). LIST was created in 2015 from the merger of two former Public Research Centres, CRP Gabriel Lippmann and CRP Henri Tudor, established in 1987. Since 2008, multi-annual performance contracts between the Ministry and the CRPs have introduced a high degree of strategic and operational autonomy of the CRPs. The evaluation period refers to the performance contract 2014-2017, renewed in 2015 after the merger. In parallel to reorganisation, the mission of the CRPs has been reoriented from service-oriented applied research, to more strategic applied (and occasionally oriented basic) research. At the same time, the new law encouraged the CRPs to engage in technological development to support product development, production processes and services. It therefore gives increased weight to valorisation activities, including patenting / licencing or to spin off firms. Finally, the law explicitly calls on the CRPs to encourage researcher mobility and contribute to train research personnel.

The vision of LIST is to contribute to society by becoming a fully operational research and technology organization (RTO) anchored in Luxembourg, with a strong influence in Europe, positively impacting the country's socio-economic development through its oriented research and technological development activities. LIST undertakes research, development and innovation activities in order to promote the transfer of knowledge and technology and secure scientific and technological cooperation at national and international level. According to LIST's strategic orientation, activities are positioned primarily at levels 3-7 of the technology readiness levels (TRL): experimental proof of concept, technology validation in laboratory, technology validation in relevant environment, demonstration in relevant environment and demonstration in operational environment.

The objective of ITIS is to produce the next generation of decision-making and recommendation solutions, helping organizations become smarter in terms of continuously improving and adapting the execution of their operations to a dynamically changing environment. Improvement of the performance of organizations is considered from three different perspectives: better exploitation of data associated with business processes, more efficient management of the (IT-) infrastructures associated with the execution of processes, and the efficiency of people involved in the realization of processes.

Regarding this objective, ITIS conducts research to develop:

- Data analysis (analytics and optimization methods, artificial intelligence, platform reference architectures, and APIs) and data management architectures with a focus on security and privacy issues
- Human-centred computing (natural and ambient interfaces for interactions between people and computers)
- Knowledge representation: information models, meta-modelling, and ontologies management

The main priority business domains are: Regulated Services and Finance Services, Built Environments, Logistics and Mobility, and Wellbeing.

1.2 Overall setting of the Luxembourg CRP-evaluation

The peer review of LIST-ITIS is part of an evaluation of the three research institutes under the responsibility of the Luxemburg Ministry of Education, Science and Research (MESR). The evaluations cover the period 2014-2017 and take into account scientific performance, relevance for society including client and partner interaction and the governance and organisation as requirement to sustain the ability and suitability for promoting both scientific performance and interaction with clients and stakholders. The evaluation has been assigned to Technopolis Group (www.technopolis-group.com), who designed

the peer review set-up based on the Terms of reference from MESR. It aligns with good practices used in many evaluations.

The results of this peer review feed into the evaluation of LIST as an institute and into the evaluation of the three institutes at national level. For this reason, the chair of the LIST-ITIS peer review also participates in the peer review of LIST at institutional level. The results are intended for MESR to (re)define their relation to the institute; for the institutes to help them to improve their performance further and for other (mainly public) stakeholders to use as they find suitable.

1.3 Composition of the Committee, independence, data provided and procedures followed

1.3.1 Composition of the Committee

The review was performed by an independent external assessment committee, consisting of five internationally renowned researchers in the field of the research of the Department:

- Collette Rolland (Chair) is Professor Emeritus of Computer Science at the University Paris1 Panthéon-Sorbonne.
- Marina Jirotka is Professor of Human Centred Computing, Dept of Computer Science, University of Oxford.
- Pericles Loucopoulos is a Visiting Professor at Harokopio University of Athens (Greece) and at Bournemouth University (UK), he has held full professorship appointments at the University of Manchester (UK) and Loughborough University.
- Martin Matzner is Professor of Information Systems and the Chair of Digital Industrial Service Systems at Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany.
- Günter Schäfer is a Professor of Computer Science working in the areas of telecommunication protocols and network security

Short CV's from all assessment committee members are attached in Appendix A.

Geert van der Veen and Katharina Warta (Technopolis Group) acted as support for the peer review committee.

1.3.2 Independence

Any existing personal or professional relationships between committee members and programmes under review were reported and discussed in the committee meeting to safeguard an independent assessment of the quality of LIST-ITIS and its research programmes in an unbiased and independent way. The Committee concluded that there were no close relations or dependencies and that there was no risk in terms of bias or undue influence.

1.3.3 Data provided to the Committee

In preparation of the review the peers received the following information:

- A self-assessment report of LIST at institute level
- A self-assessment report of LIST-ITIS at department level
- A background report for the peer review of LIST prepared by Technopolis Group, including a.o. an analysis of the participation of LIST in FNR and EC research projects and a bibliometric analysis of the publications of LIST (by ECOOM).

Additional documents as well as the copies of all presentations have been provided during the peer review:

- Erratum of the analysis of the ITIS participation in FNR and EC research programmes in the background report
- Description of the role of the Service Innovation Accelerator Platform (SIA)

- Description of the Technology Transfer Office (TTO)
- Description of the role of the Business Development Office)
- Clarifications from TSS
- Revenues trends of the ITIS entities

The assessment in combination with the discussions of the peer review committee with the research leaders, researchers and stakeholders allowed an objective evaluation of LIST-ITIS.

1.3.4 Procedures followed by the Committee

The final assessments are based on the documentation provided by the Institute and the site visit to LIST-ITIS in Luxembourg on 18-19 September 2018 (programme in Appendix B).

At the beginning of the site visit, the Committee was briefed by Robert Kerger of MESR and Geert van der Veen and Katharina Warta of Technopolis Group about the objectives of the evaluation in general and of the evaluation by the committee in particular. During this meeting, several questions were clarified. The Committee also agreed upon procedural matters and aspects of the assessment.

The peer review itself consisted in presentations and interviews as well as the demonstration of assets and equipment. At the end of the site visit and interviews, the Committee discussed the conclusions and recommendations. Draft conclusions were presented to the participants in the discussions, including the management of ITIS and LIST and representatives of the Ministry of Research.

A first version of this report was drafted by the peers in the week after the site visit to Luxemburg. The report was finalised through email exchanges. The final version was presented to LIST-ITIS mid-October 2018. The reaction of LIST-ITIS was discussed by email by the Committee and led to adjustments of some factual points. The draft final report was then submitted to MESR in December 2018, after a final quality control to assure system wide coherence, the final report was submitted end of February 2019.

For the assessment of the quality of the research, LIST-ITIS was compared at the international level with their peers. Publication and citation records were examined, major achievements were considered and the capacity to attract highly qualified students and collaborators was discussed. For obtaining a view of the relevance for science, elements such as recognition as a knowledge centre, participation in expert groups, editorial boards and professional societies were used.

The relevance of LIST-ITIS was judged at the international and local level. Services and expertise rendered to private and public clients and partners and the impact on the general public served to assess the relevance for society.

The organisation of LIST-ITIS as well as aspects of governance primarily cover observations on the department level, based on the discussion at the level of research units and the department. More global observations, including the positioning of the department within LIST and the positioning of LIST in the research and innovation landscape in Luxembourg, are covered on the institute level by a separate report. Therefore, these findings will feed into the evaluation of LIST at institute level.

2 The positioning of LIST-ITIS research

After the merging of teams coming from different existing entities at CRP Henri Tudor and CRP Gabriel Lippmann, the newly created ITIS department went through a number of significant changes in its orientation that were clearly perturbing the functioning and performance of the department. Despite these challenges, ITIS achieved a number of successes in terms of output and impact. In the experts' view, the review took place at a turning point, from which experts see signs of improvements and growth.

2.1 LIST-ITIS strategy and targets

The mission of ITIS is to develop IT-enabled business solutions and services that support the digital transformation of organizations. Strategy and targets of LIST-ITIS are developed in line with LIST's overall strategy, targets for the evaluation period have been fixed in the performance contract 2015-2017 following the merger. The overall objective to establish LIST as a research and technology organisation (RTO) in Luxembourg is defined as focussing on technology readiness levels (TRL) 3-7. Former activities both in TRL 1-2 (Basic principles observed, technology concepts formulated) and TRL 8-9 (system completed and qualified, successful mission operations) received lower attention, were outsourced or transferred to other organisations. The various reorientations which occurred in the department during the reporting period end up to delimit the RTI activities to design and engineering of IT-enabled services (TRL 3-7), with a focus on the role of Big Data for the improvement of the performance of organizations. A particular attention was given to the acquisition of expertise on TRL 5-7 (development of rapid & robust transferable prototypes) in order to enhance ITIS specificity and to differentiate ITIS from the Interdisciplinary Centre for Security, Reliability and Trust (SnT) at the Luxembourg University (UL), engaging in Computer Sciences and concentrating on TRL 2-4). The focus is now clearly put on valorisation and socio-economic impact (vs. scientific publications).

ITIS places particular emphasis on medium term contractual collaborative research, innovations, technology transfer, and business development with the aim to strengthen Luxembourg's industrial ecosystem. The main driver for ITIS is the socio-economics of its solutions with short delivery lifecycle.

Experts appreciate this orientation, which makes sense, matches the LIST strategy and fits important needs of Luxembourg's economy. The emphasis on "technology" and the focus on big data analytics are pertinent choices.

Experts further approve the decision to address global questions of concern for entrepreneurial sectors and to develop generic lines of technologies that can be transferred and adapted to the specific needs of a single organization or a specific technological/organizational application domain.

Experts noticed that the mission and the vision are shared across the department and that private and public partners and customers participating at the peer review appreciate this mission. The experts' team assesses these facts positively.

Although the new orientation is positive, experts identified possible improvements:

1. Competencies on data analytics need to be shared/developed across the three units.
2. There are some common ideas about a research plan, but a clearly formalized research agenda that would embrace the entire department and thus help with propagating the research ethos of ITIS to the external world is missing.
3. There is a need to develop a common and shared understanding of assetisation trajectories associated with the transformation of scientific and technological solutions into transferable prototypes.
4. There is a need for developing a departmental-wide view on how different units approach external players for partnership and contractual cooperation, so that it does not appear as if there is no cohesion either in the statements made or the efforts for attracting customers.

5. Key performance indicators should be adapted to the mission of the RTO, i.e. including the number of assets generated and/or used or the number of Proof of Concepts shared with industry partners.

2.2 LIST-ITIS clients and stakeholders

Even though an initial consequence of the newly re-focussed overall strategy led to a reduction in the number of clients and cooperating stakeholders, the department still serves a wide range of communities, clients and stakeholders, from artisans to construction workers and – more frequently – to public organisations, institutes and government organisations (see SAR figure 29, p 65), both as partners and end users in their research. They do this, both through addressing a specific need that an organisation may have – for example on risk management or on platforms for companies to measure their compliance to the General Data Protection Regulation (EU) 2016/679 –, and as stakeholders and end users developing requirements for systems to support communities such as Digital Built Environment (DBEM). One further example of the relevance of their competencies is their involvement in the big contract with Goodyear. We believe ITIS can exploit this potential further over the forthcoming years.

Clients and partners participating at the peer review reported that they are very satisfied with their existing relationships with staff at ITIS – some of which have stretched over 4 or more years – and indeed seem to value strongly the scientific knowledge they get access to through their interactions. In addition, some also value the shorter timescales offered by ITIS in addressing their problems, as they could not afford to wait years for a solution that might be offered through supporting a PhD project for example. A critical aspect of the methods employed by ITIS is the strong participation of end users and stakeholders in the co-design of requirements for particular technologies such in the DBEM Group, the TSS Unit with assets like TISRIM, result of a co-design with the regulator (ILR) and the regulated entities (the Telco sector), and many of the projects undertaken by the HCDE Unit. For this they are to be strongly commended. In a sector which is experiencing great change in technological deployment, there is enormous potential for both gaining new partners across Europe, and securing additional funding and potential clients, for smart construction techniques and smart buildings. BART has also, over a very short period of time, built up a rather strong network of customers and has a strong ethos of working closely with the people who have approach them with specific problems.

However, given the above mentioned changes of the ITIS orientation, income from contract research or cooperative projects is below the expected level, and further efforts in developing markets, partners and clients are needed.

3 Assessment of LIST-ITIS

3.1 Research quality

ITIS research program contributes to the development of digital artefacts fitting into their organizational context. In the context of Luxembourg and in light of the vision and mission statement of LIST, quality and innovativeness of these artefacts is more important than traditional measures of research performance. Research quality at ITIS lays for a part on the quality of the assets it produces, their acceptability by end-users and the business value they create. In this respect, ITIS has made valuable contributions to Luxembourgish organisations. The strength lies in innovation of the assets produced by ITIS with particular focus on novel applications as for instance logistics for construction, digital representation of buildings, security etc., in addition to publications.

The fundamental focus of ITIS research is to develop the next generation of decision-making and recommendation solutions, helping organizations to become smarter in terms of improving and adapting the execution of their operations in a changing environment. The view underlying the development of these solutions is the one of an organization as a socio-technical system, which embeds people operating in processes through infrastructures. This view led considering improvement of the performance of organizations from three perspectives, namely processes, infrastructures and people, each perspective being considered by one of the three ITIS research units (BART, TSS and HDCE, respectively). The department is to be commended for this interesting and pertinent perspective to organize ITIS research activities in order to cover the full range of possible improvements of business performance.

While the view underlying the three research units is pertinent, the experts noticed some overlaps across units particularly concerning the smartness dimension of the developed solutions. This is further highlighted by activities of the DBEM group directly involved with the development of smart services in the construction domain. The creation of horizontal programs to foster the synergies between ITIS entities to avoid reduncancies has been planned but not implemented so far.

With respect to traditional research performance evaluation, the peer-committee noticed that the publication intensity (referenced publications) of ITIS has declined (from 0,82 in 2015 to 0.57 in 2017), this is below the value defined in the performance contract (0.77 for 2015, 0,9 for 2017). The total number of referenced publications (Scopus/Web of Science references) has been decreasing during the reporting period, from 80 in 2014 to 34 in 2017. This corresponds to an average of 52 on a three-year window (2015-2017), whereas the bibliometric data show a number of 35. The difference is due to proceedings publications, which are not counted in the bibliometric analysis. It shall be noticed that refereed conference papers correspond to a massively used way to disseminate knowledge in the domain of ITIS; some of these conferences are more selective than journals and publications in those have a high scientific value and impact. A positive sign is the increasing number of publications in 2017. The RCR (0.99) indicator for a three-year window shows that the set of papers published by ITIS in journals attracts just the number of citations expected on the basis of the average citation rate of the publishing journals. Experts recommend taking actions in order to increase the ITIS publication intensity in high impact journals expecting an RCR >1 similar to the one of the preceding Institute Henri Tudor (1.16).

The number of PhD students decreased from 2014 to 2016, but increased in 2017, which is assessed as a positive sign. LIST cannot award academic degrees and therefore, a co-supervision agreement must be defined and formalized through a cooperation protocol with a university. Since many years and thanks to experience at the Henri Tudor Centre, ITIS has a number of universities (Luxembourg university, Université de Lorraine, etc.) ready to collaborate in this respect. However, the nine ITIS professors who are entitled to co-supervise students are not all involved in supervising. The experts' team recommends using the full supervision capacity in order to increase the research culture and augment the visibility of the department. The age pyramid suggests hiring new blood, PhD students and Postdocs particularly.

In the review period, ITIS increased its performance regarding the EU competitive funding, but is under-performing regarding national competitive funding. During the reporting period, ITIS was involved in six H2020 projects (with approximately the same level of intensity for the HDCE and TSS units) and coordinated four HP2020 projects, CrossCult (IA), SUCCESS (RIA), BIMEET (CSA) and GETUI (MSCA-IF). ITIS was also involved in Eureka, Erasmus+ and coordinate three projects in AAL. Whereas the scientific implication in coordinated projects exists but is low, the choice of ITIS as coordinator attests the recognition of its know-how and expertise by EU partners. ITIS gained expertise and networking.

ITIS is clearly under-performing regarding the national competitive funding. ITIS performance regarding FNR funding, especially CORE and INTER is very low. This restricts both its visibility in the Luxembourg context and its recognition as a major player in applied research and IT-based business solutions development. The experts team recommends putting additional attention to get FNR funding, e.g. by explicitly supporting specific internal projects in order to obtain first results that support the preparation of applications in the FNR's various programmes.

Internal cooperation with other LIST departments is weak. There is a clear need to develop interdepartmental activities especially with ERIN. Very few formal frameworks of collaboration are signed with other national R&D institutions (except the Professional Master in Information Security Management). There is clearly a challenge to identify the commonalities and differences in the research profiles of ITIS and the interdisciplinary Center for Security, Reliability and Trust (SnT), a center associated with the university of Luxembourg, and to understand how synergies can be developed. These are serious questions requiring attention and actions.

Regarding external cooperation, ITIS develops collaborations thanks to its participation in two networks, The Enterprise Engineering Network (chaired by E. Proper from ITIS) which is a research & training network and the scientific interest group INTEROP Grande Region focusing on stimulating partnership, technology transfer on enterprise interoperability. The former contributes to the department visibility in EU on topics relevant for ITIS whereas the latter contributes to its influence in the Greater Region. ITIS has strong relationships with the National University of Singapore (NUS) that provided human resources to BART and cooperates to the development of BA activities and with Cardiff University that plays an important role in the DBEM group. The participation to EU projects enhances ITIS international anchoring and cooperation. Experts are in the opinion that ITIS has the potential to develop its European and international cooperation and recommend to take actions in this direction.

The preceding shows that ITIS today is mainly a national player with some areas where the department is good enough to be visible and active at the international level. Experts are of the opinion that ITIS has the potential to reach this level across the board and encourage the department to act in this direction.

3.2 Research quality (at unit level)

3.2.1 Human Dynamics in Cognitive Environments (HDCE)

HDCE is organised in three research groups and one lab: Embedded assessment, Knowledge-based and context aware adaptive systems, and Multi-modal analytics and multi-user natural interaction. It is staffed by 26 members, 3 of whom are researchers with management roles, 15 are researchers, 8 technical experts, 2 PhDs and 1 postdoc. Scientific output in 2017 is 18 referenced publications, 1 of them with an impact factor >= 2. The vast majority of the publications have been directed at conferences and workshops. This is an excellent way of reaching close colleagues in a research field. In terms of wider dissemination, there is evidence HDCE have the potential to disseminate in more general and higher impact research venues e.g. ACM, CHI and CSCW conferences. HDCE has two key projects: the FP7 project "Enhanced Government Learning" (EAGLE) and the H2020 project "Empowering reuse of digital cultural heritage in context aware crosscuts of European cities" (CrossCult). It has produced one Spinoff in 2013 (OAT). They have 6 filed patents, three paying licences.

As the name suggests, this unit focuses on understanding and embedding human dynamics in cognitive environments to build cyber-physical and human centric systems. Projects are all applied rather than

blue skies research and some are more strongly focused on innovation and have companies as partners. They have projects in FP7 and H2020 that are a mix of research and innovation.

The fundamental focus of the research is to develop cognitive environments, examining how physical spaces and objects may be digitally augmented and connected to support and enhance participants' individual and collaborative experiences, work practices and decision-making activities. The Cognitive Environment Lab was officially launched in September 2017 and is hosted by the HCDE unit. The lab is fostering expertise and innovating technologies concerned with connected objects, natural interfaces, 3D printing, sensors and artificial intelligence with the aim of developing new products and services to support group decision-making, complex problem-solving, skills assessment and collaborative design. The lab itself seems very well equipped to explore the types of information the group seeks to analyse.

They have thus focussed on developing expertise in Human-Centred Computing, Ambient Intelligence, Internet of Things (IoT) and multi-user/collaborative natural interaction technology development and testing, as well as user behaviour analysis. These foci fit very well with the sectors for applications in Smart Cities and Smart Manufacturing. in the light of the new focus on TRL projects, this is an appropriate choice. The groups have positioned themselves quite rightly at the heart of the engineering and management activities that the unit undertakes. And on closer interrogation, it became clear that the unit collaborates quite closely with the other units, where expertise is required for user evaluation of systems.

One area of their expertise should be highlighted much more – the human centred computing expertise they bring to projects undertaken in other units. This expertise might be developed and branded as their own. Such an approach might also be useful as they increase their involvement in AI, big data and machine learning, as human centred concerns in this area are highly relevant and need to be addressed; issues such as understanding and mitigating for bias in data sets, fairness in algorithm design, and how data are used and developed in private companies and in government institutions.

The unit is to be commended for its outreach activities which are a key element of responsible innovation. It seems that most of the outreach activities has been undertaken by members of this unit with their interactive technologies, supplemented with some applications from the other units. They have participated in Science festival and Researchers' Days (organized every two years by FNR); other events have been organized in schools by the FNR.

3.2.2 Business Analytics and Regulatory Technologies (BART)

BART is a new unit announced in 2017. It counts 24 persons, including one PhD and 3 PostDocs. It has a considerable number of tools and end-user tested licences, as well as two paying licences. In 2017, the number of referenced publications is 5, one of them with an impact factor of at least 2. It has two income generating projects running (1 FNR and one collaborative).

The BART unit works in the area of Business Analytics and therefore takes a process perspective on data and information models captured in organizations. This methodological approach is likely to enable a multitude of business applications in the near future. The group was established only recently. The current head of unit Jorge Sanz arrived in 2017. The unit comprises the Services and Process Governance (SPG) group and the Business Analytics (BA) group. BA works together with the remaining researchers of the Regulatory Compliance Technology group.

The SPG group continues research they did before the BART unit was established. This group works on (process) model-level, while BA's focus is on process-instance level based on data captured by operational IT systems. These two approaches are very complementary and bear a high potential for synergetic cooperation that has not yet been tapped. The group proved its ability to create innovative assets that are successful in the market. For instance, they created TIPA – an instrument that is often used by business consultants in ITIL business process assessments. TIPA led to the cooperation with commercial partners, and the generation of a total of 106.000 $ Royalty Amount Collected.

BA sets a promising domain-focus to the financial industry and to manufacturing. However, it remained unclear to the peer-review committee in which methodological fields the group intends to specialize, or

if such specialization is intended at all. In its starting phase, BA spent significant effort on suggesting light-weight projects to national companies in order to initiate and sustain first cooperation. Especially against the background of Luxemburg's economic structure, where SME companies play an important role, this approach can be very successful and is likely to increase ITIS total number of industry projects.

Following the arrival of Prof. Sanz, the unit worked also on requirement elicitation related to the Data Analytics Platform. Here, most inter-unit and inter-department cooperation of BART manifests at the moment. Further cooperation with LIST researchers is up to now rather limited.

3.2.3 Trusted Service Systems (TSS)

The TSS unit is organized in 4 RDI groups and one lab to be created in 2019. It is staffed by 31 members of whom 3 are researchers with management roles, 20 are researchers, 8 technical experts, 2 PhDs and 3 post-docs. The publication output of TSS is higher than in other units, with 22 publications in ISI Scopus and 16 others in 2017. TSS as 9 filed patents and 3 paying licences, 8 competitive national and 3 competitive Europan projects, as well as 6 collaborative projects.

The focus of the unit, as stated in their SAR and in the presentation given to experts, is "the design, the security and the optimization of service systems".

The unit is organized into 4 research teams: Data Intensive systems (DAISY); Operations and supply chain optimisation (ORISON); Security, Privacy and Resilient Critical Infrastructures (SECURE); and Informed systems engineering (ISEE). A keyword that is used by the unit for the variety of application areas is "smartness" (e.g. smart cities, smart finance etc). This is something that the experts identified in all units of ITIS.

This unit has been quite successful at attracting external revenues with a steady income, year on year since 2015, of just under 2M€. The unit has also produced some very good assets and the experts were impressed by the demonstrations given during the visit for some of the work already completed

The diversity of research issues addressed by TSS is evidently a good way for attracting external funding, especially in the opportunistic way in which applications for such funding is applied for by the unit.

However, in the opinion of the experts, the unit suffers in terms of research focus. This may be harmful to the unit in the long run, if there is no clear message about the in-depth and specialist expertise offered by the unit in an increasingly competitive research funding environment. Unit leadership is encouraged to reflect on how best to position TSS so that it is the first call for anyone seeking expertise in one or two (at most) areas. This may require a self-examination of the scientific areas being addressed by the unit, the way that the groups are constituted and co-ordinated, and the marketing of the unit.

3.2.4 Digital Built Environment Management

DBEM is a small group (11 persons, including 1 PhD and 2 PostDocs) playing the role of incubator with the perspective of developing a full research unit on the topic of managing digital built environments. In 2017, they have three referenced publications, one of them with impact factor >=2. They also have two filed patents and 2 Beta-Test End-User Licences. Currently the group is working on one FNR project and 3 European projects, as well as 2 collaborative projects.

The experts are of the opinion that the group addresses research questions related to an important industrial sector of Luxembourg, which can potentially generate a large number of collaborative PPPs and assets of international visibility.

Experts acknowledged some success stories (e.g. CRTI-Web generating 100 licenses per year). They appreciated both the research method focusing on the production of a technological line and associated basic blocks, thus conforming to the department's strategy and the quality and innovativeness of the presented projects and outputs. DBEM sets a promising domain-focus to the construction industry. The technological line associated to the digitization of lean management construction methods is promising, with some first demonstrated applications at international level (GTM/Vinci). This should be further enhanced, with a full building information model (BIM) integration.

The experts support the wish to recruit two talents who will spend the next full year in the group in the perspective of leveraging the group activities to an international level. While supporting the DBEM development, experts call attention to the positioning of the future unit in the department structure taking into account the fact that DBEM activities are transversal to those of the three other units.

3.2.5 Service Innovation Accelerator Platform (SIA)

The Service Innovation Accelerator Platform (SIA) team is a unit currently consisting of 10 software engineers whose main mission is to support the development of prototypes associated with transferable software applications. Given LIST's overall strategy to focus on TRLs 3-7, the team fulfills an important role in the process of transforming research results of lower TRLs to the level where they can actually be handed over to external partners and stakeholders for further development and valorization. The principal idea behind organizing this software developing group as a central unit for the whole department is to allow for better resource pooling and sharing, as well as enabling better reuse of developed software components in different application contexts.

While "central service units" in general may potentially lead to inefficient incorporation into research and development activities, due to a certain "detachment" of the actual research groups working on core projects, this does not seem to be the case with this specific group. In individual discussions with all research unit/group leaders, it was discussed how researchers appreciate the support of the central services entities SIA, BDOs (business development officers) and VTOs (valorization transfer officers, mostly dealing with IP and other valorization aspects). In all these discussions, researchers gave concrete examples of the support they had received in their past and present projects from the three service units, so that all in all, these central service units do provide valuable contributions to the department's projects. However, it might be discussed if two persons are really required as VTOs for just the ITIS department, or if it would be more efficient to have one unit at the institute level being responsible for the IP-related matters of all departments.

It became less clear, however, how the decision-making with respect to the use of the central service groups' resources is organized and arbitrated in case of conflicting needs and requests, i.e. which project can receive which amount of support at a particular point in time (see also under section 3.4 management and governance).

3.3 Innovation quality and impacts

ITIS went through a number of changes in its orientation, perturbating the functioning and performance of the department. Despite these challenges, the department still could achieve a number of successes.

ITIS developed a large number of different types of assets including software but also hardware, models and tools. They form ITIS reputation as a mainly national player, with some areas where it is good enough to be visible and active on the international level, e.g. PISA/PIAAC Educational Testing Surveys, TAO/OAT, and TIPA for ITIL, two technologies with a large international impact.

- TIPA is a RDI line to help organizations assess the performance of their processes and check the compliance to regulatory constraints. As an example, one trajectory of the TIPA line, TIPA for ITIL has been transferred to the market, has 280 certified assessors in 25 countries and generated $106K royalty amount.
- TAO is an open source based skills assessment line with two trajectories that both have an international impact. One, OAT is now becoming a spinoff success story, the other one led to a world exposure of TAO for PISA in 65 countries.

ITIS has a good potential to reach this level across the board. ITIS clients expressed in their talks with the committee their appreciation for the assets' high level of end-user acceptance, which further underlines the quality and practical relevance of the department's work, which they find very valuable while recognizing the uniqueness of ITIS role in the Luxembourgish context.

The production of these assets is made in close collaboration with stakeholders and end-users through iterative collaboration cycles in which at low levels (TRL 4-5), the practitioners formulate the

requirements of the assets to be developed and at higher levels (TRL6-7), the prototypes are tested by end-users. This approach is shared across ITIS units, contributes to the development of a base of competencies and skills of ITIS staff and is rated very positively by the customers interviewed during the meeting. It is part of a larger process, the assetisation process, which includes the use of push and pull strategies to identify basic research advances in one hand, and market needs on the other hand, develop the asset and capitalize on its construction through the elicitation of reusable basic blocks. In this way, ITIS creates knowledge and technological bases to address classes of problems for which reusability of ready-made chunks of solutions can be assembled and completed to address a new problem. The assetisation process revealed the need for highly profiled software engineers and the creation of the SIA platform. The robustness of the development method is a pledge of research quality.

Based on the three perspectives (process, people and infrastructure) that underlie their research approach, ITIS units have thus focused on developing expertise and innovative technologies in data analysis (for a better exploitation of data associated to business processes), data management architectures with a focus on security and privacy issues, human centered computing (smart interfaces for people interacting with computerized solutions) and knowledge representation to provide models, meta-models and ontologies. The three units and the DBEM group proved their ability to create innovative assets that are successful in the market. For example, they created TISRIM a framework with several extensions to support the management of risks related to information systems, networks and services security. From January 2015, TISRIM is recommended by the National Regulatory Authority (NRA to TSPs (Telecommunication Service providers)).

ITIS research foci fit very well with the four sectors for application of its expertise in Regulated Services and Finance Services, Built Environments, Logistics and Mobility and Wellbeing. These sectors are identified as four societal challenges for Luxembourg and their targeting allow ITIS to produce assets having a socio-economic as well as societal impact. The experts call attention to the high quality of (a) methods and tools associated with compliance of regulations (assessment of processes against standards like ITIL or against some regulations like GDPR), (b) the technological line associated to the digitization of lean management construction methods having an impact at international level (GTM/Vinci), (c) the human-centred computing expertise and the potential on the big data analysis competencies emerging in the department. These are domains, which put ITIS at the forefront of the development of digital artefacts transferable to companies.

In general, the committee found the projects presented in the peer-review to be innovative, robust and in-line with the mission. Focusing on the impact of the research, ITIS contributes to various technological advances in Luxemburg, with international visibility in some cases. One example for such impact is ITIS contribution to the creation of two spin-off companies in the past, and that it has the potential for creating further spin-offs in the future. The peer-review committee further appreciates the development of a patent culture and the increasing number of patents and licences of the organisation. Even if the total number of patents and licenses is rather low at this early stage, awareness of the importance and relevance of IP has been raised across the department. Outcomes for the period 2014-2017 include 29 invention disclosures, 33 I-Depôts, 32 software disclosures, 17 filed patents, 190 payable licenses and 6 open sources software releases. ITIS has a limited impact on the national labor market, because they educate only a few masters and PhDs currently. It is however worth noting the high level of employability of people who left ITIS during the last three years; most of them are contributing to Luxembourg's economy today and two are Professors at renowned universities.

3.4 Management and governance

ITIS has undergone a difficult transformation process following the merger, with the closing of one of its research units, important reduction in personnel, and the move to a new geographic location. According to updated numbers and further information for the year 2018 and beyond, and given the initiated structural changes (establishment of the new BART unit, hiring of new personnel, further development of the DBEM research group into a fourth research unit etc.), the department currently appears to be at a turning point where it might be wise to give it some time to work according to the recently shaped strategy and structure. The new organization was set up in May 2017 and divides ITIS

into three research units and one research group, incubating Built Environment RDI activities within the context of Smart Cities. The SIA platform supports the development of IT artefacts resulting from RDI projects and provides some operational support to the department.

Due to the massive organizational restructuring during the last three years, recruiting highly skilled researchers and engineers has become more difficult. Especially at the group leader and researcher level, applicants seem to prefer a first "visit" for a year before committing to a permanent change, which might be a sign of worries about future of the department. This is further aggravated by the currently excellent job perspectives of people with respective qualifications in competing companies and organizations, some of which also having more flexibility when negotiating salaries.

In line with national and European experience, the department shows an unbalanced gender balance, in particular at the level of group leaders, with not more than two research groups and the SIA team being led by women. At the level of department and research unit leaders, there are only male leaders. With respect to the overall gender balance in the workforce of the department (25%) however, the situation is comparatively good given the general gender ratio in the IT business world.

The discussion with young researchers and PhD students clearly showed that all of them feel well supported by the department. However, the overall number of PhD students and Post Docs is considered too low in relation to the supervision capacities and general research-oriented mission of the department.

The ITIS department has an excellent and well managed research infrastructure at its disposal. Both the demo session and the lab visit showed that the department is very well equipped with highly innovative technologies well fitted to the department's research subjects. This impression was also supported in all discussions with the research units/groups as well as the PhD students & young researchers. Together with the excellent state of the new building and its geographical location, this clearly contributes to the attractiveness of the department as an employer and institution.

Currently the department has some aspects of Responsible Innovation (RI) embedded informally in their practices. For example, there is a strong orientation to producing research and innovations that protect customers privacy and security, both of which are essential to good research and RI. In addition, the practices of co-design and evaluation of technologies are also a strong aspect of RI. They may wish to develop RI practices more formally in the future to ensure the ethical and societally acceptable production of their technologies. E.g., if a future objective is to focus on Big Data, then the department should also consider the ethical and societal implications underpinning the use of these data sets and the algorithms that make use of them. Issues of bias in data sets and fairness in algorithms are currently rife and the department needs to be able to address and anticipate them.

They have very good outreach activities at the level of the department. But there should also be some mechanism for engaging with citizens in public dialogue when the technologies they develop will impact upon communities. It is critical, for example, that the DBEM technologies and their impacts are developed in collaboration with communities so that communities that will be affected by the outcomes of these technologies have some say in the consequences, understand the issues and perhaps, are given incentives to accept certain situations.

Both the overall management and governance of the department and LIST are in principle well structured. However, the two-days visit revealed that currently the LIST organization's efficiency is suffering from inappropriate repartitioning of responsibilities and decision making – with a strong tendency to micromanagement, i.e. too many decisions are centrally taken at the institute level, and there is insufficient transparency in the decision-making processes. This also affects the decision making with respect to closure of contracts and resource scheduling & allocation, and thus negatively impacts the overall performance in R&D projects as well as the general mood among the workforce.

4 Conclusions

Following the merger, ITIS went through a number of changes in its orientation and organization, perturbating the functioning and performance of the department, notably a change in strategy to focus on TRLs 3-7, the closing of one of its research units, and the move to a new geographic location. Despite these challenges, the department achieved a number of successes in terms of output and impact. The review took place at a turning point from which we see signs of improvements and growth.

The current ITIS organisational structure was set up in April 2017, with a clear internal structure and formalised processes and procedures. The merger process created significant tension on the staff of the department which still continues. ITIS is in the process of acquiring additional expertise in areas of growth. In line with national and European statistics, the gender distribution is unbalanced across the whole organisational structure.

In the period under review, the department has faced significant difficulties to perform in relation to the indicators set out in the performance contract, notably related to competitive income (reaching only 23% against a target of 40%), the number of PhD students and publication intensity. Indeed, performance according to several KPI was declining during the evaluated period, however, the experts see the potential of a turn of this tendency following the stabilization of the organizational structure in 2017 and based on achievements of recent years. Today, ITIS is mainly in the position of a national player, however with some specific research areas where its' results obtain very good international impact. They have the potential to reach this level across the board.

With regard to research impact, ITIS has a true national socio-economic impact, with good examples of international impact that also bears a relevance to society. In the context of Luxembourg and in light of the vision and mission statement of LIST, quality of innovation is more important than traditional measures of research performance. In this respect, ITIS has made valuable contributions to Luxembourgish organisations. ITIS developed a large number of different types of assets with national impact, with very good examples of international impact. A high level of acceptance by end users underlines the quality and relevance of ITIS outputs.

The expert panel appreciates the presentation of projects, and assesses them as innovative, robust and in line with the mission. They contribute to technological advances have contributed to the creation of spin-off companies in the past, and have the potential for creating further spin-offs in the future. The panel also appreciates the development of a patent culture and the increasing number of patents and licences of the organisation. Even if the total number of patents and licences is still low, awareness of the importance and relevance of IP has been raised across the department.

The experts believe that the different units of ITIS and management of LIST should consider how best to coordinate themselves for a whole host of research endeavours that are common across all units. For example, the idea of smartness appears across all units, but there are also other themes such as Big Data, Data Analytics etc. It appeared to the experts that the constitution of the unit was influenced not entirely by scientific arguments. Projects to introduce transversal programs have not been implemented so far.

Experts noticed that ITIS put in place several infrastructures (Cognitive Environment Lab, vehicular Lab, SIA platform, Data Analytics Platform) that provide advanced and adequate support for researchers to be effective in their activities. Further, ITIS enables companies in Luxembourg and the Greater Region to gain access to the cutting-edge Data Analytics Platform, which is internationally competitive. ITIS develops long-term external collaborations thanks to its participation in two networks, The Enterprise Engineering Network and the scientific interest group INTEROP Grande Region. The participation to EU projects enhances ITIS international anchoring and cooperation.

In terms of governance, discussions at the unit and department levels revealed that some of the institute wide processes affect negatively the functioning, efficiency, and culture of ITIS. This concerns a lack of transparency of decision making, linked to that a lack of delegation of responsibility. Despite the broadly recognised comfortable financial situation, due to administrative rules, access to resources can be

limited. Two further points that raise questions to be treated at the institute level relate to the service culture of the HR and the finance functions on the overall LIST level. Finally, existing rules of attributing projects to units and departments include imbalances in the recognition of success when various units are involved.

5 Recommendations

1. **Keep the focus and the organisational structure while making the strategy more explicit and more coherently presented and implemented**

Experts are of the opinion that given the definition of its new research strategy and corresponding initiated structural changes, ITIS currently appears to be at a turning point where it might be wise to give it some time to work according to the recently shaped strategy and structure.

2. **Formalize the assetisation process and capitalise on experience in this respect**

The main driver of ITIS is the production of assets that bring business value to organizations. The experts could see that there are some common ideas about the assetisation process but recommend formalizing an asset value creation model based on a cycle "assetise, deploy and learn". In this cycle, capitalization on experience requires a systematic approach to develop technological building blocks that can be reused to speed up the trajectories bringing the technological assets to higher TRLs. Experts recommend systematizing such capitalization approach, which they noticed is present but not formalized in the current ITIS assetisation process and suggest to consider the 'product line' paradigm as a source of inspiration.

3. **Horizontal programmes should be formally defined and implemented**

Experts became aware of a number of common themes shared by all units with ITIS. However, there is no overarching vision, strategy or plan with the result that work on these common themes are occasionally ad-hoc, whereas it occurs that a unit does not take into due consideration the expertise available in other units. The area of 'smart cities' is an example, which cuts across all units. Experts recommend formally defining and implementing horizontal programmes, which will provide a framework for a greater degree of specialisation and savings in expenditure.

4. **Performance indicators should be more tailored to the mission of ITIS and open to qualitative approaches**

Experts are of the opinion that due to its nature and specific missions, ITIS needs additional indicators to the traditional measures of research performance, such as the satisfaction of customers groups and partners or the use of outputs in practice. Experts recommend identifying qualitative dimensions in addition to quantitative dimensions of interest, to evaluate among others, partnership satisfaction, patenting and licensing effects, spin-off creations and entrepreneurship development. The Cavano and McCall framework based on the three levels, <factors, criteria and metrics> might be useful to define a performance evaluation system tailored to the ITIS mission.

5. **Define a roadmap to achieve a substantially higher rate of external financing**

ITIS shows a very low performance in external funding, with only 23% coming from external resources. In order to catch up with the overall objective of 40% financing from competitive resources and contract research in the coming years, ITIS needs to define a roadmap how to achieve this goal, including a realistic timeframe and portfolio analysis including all units and research groups.

6. **Put additional attention to get FNR projects, PhDs**

ITIS raised more EU funding than FNR funding during the reporting period. While recognizing the performance of the department on very competitive EU funding, the experts' team regrets the underperformance of ITIS on FNR funding and recommends putting additional attention to get FNR projects. The experts' team recommends putting additional attention to get FNR funding, e.g. by

explicitly supporting specific internal projects in order to obtain first results that support the preparation of applications in the FNR's various programmes. Given the ITIS national focus, FNR projects will enhance ITIS visibility and recognition.

The number of PhD candidates and Post-Docs has to be increased. The experts' team recommends using the full supervision capacity in order to increase the research culture and augment the visibility of the department. This way, ITIS would have a stronger impact as an educational institution to the national labor market.

7. **Increase research performance and develop international cooperation**

Experts recommend taking actions in order to increase the ITIS publication intensity in high impact journals expecting an RCR >1 similar to the one of the preceding Institute Henri Tudor (1.16).

ITIS today is mainly a national player with some areas where the department is good enough to be visible and active at the international level. Experts are of the opinion that ITIS has the potential to reach this level across the board and encourage the department to act in this direction, in particular by developing its cooperation with European and international institutions.

8. **Create a structure to facilitate cooperation and foster potential synergies between ITIS and SnT.**

There is a need for clarification concerning the activities of the interdisciplinary SnT center of the University and those of the ITIS department, where overlaps are perceived both by the researchers of the department and by external stakeholders, despite different orientations and missions. There exist certain complementarities of SnT and ITIS activities that could be exploited for the benefit of both institutions, LIST and the University and for Luxembourg in general. In the light of an informal agreement of the past period, experts recommend the creation of a formally defined 'inter institutional RDI group' to organize and manage collaborative projects on IT, i.e. big data treatment & high performance computing, intelligent algorithms and transport systems, cyber security.

9. **Enhance external visibility and improve communication on skills and competencies toward potential customers and partners.**

Experts became aware that the competencies of ITIS are currently not clearly articulated to potential customers and partners. This results in some confusion when multiple teams from ITIS meet with these external actors. This issue could be easily addressed by having a shared vision and importantly a well-defined set of competencies owned by the different units and their groups and appropriately communicated to key Luxembourgish economic players. ITIS might also adopt other methods such as sending regular newsletters to clients updating them on new endeavours and expertise or to have industry days or expos.

10. **In the light of the new director coming in the near future, increase delegation of responsibility at suitable levels, increase transparency and shorten critical decision making processes.**

Related to the cost structure, the use of block grants, and an observed lack of transparency of decision making, experts suggest to increase the delegation of responsibility to the department and the unit level. This delegation of responsibility should be clearly documented in some kind of "administrative handbook" or other suitable collection of administrative process descriptions.

Appendix A Members of the Assessment Committee

Colette Rolland is Professor Emeritus at the University Paris1 Panthéon-Sorbonne. Her research interests lie on topics such as conceptual modelling, methodologies and CASE tools, method engineering & CAME tools, requirements engineering, business process modelling, co-evolution, IS and business alignment and change management. She has been involved in a large number of European research projects and she is used to lead cooperative research projects with companies. Colette has an extensive experience in supervising PhD theses (110); she published about 350 reviewed papers in Journals and Conferences, cumulated 10000 citations, has been editor of 30 Conference Proceedings, is member of the board of 10 International Journals and has delivered more than 60 keynote talks in International Conferences. She is an IFIP officer, IEEE member and received several awards such as IFIP Silver Core, IFIP service Award, Franqui's Foundation award (Belgium) and European award of 'Information Systems'. She is Doctor Honoris Causa of the University of Geneva.

Marina Jirotka is Professor of Human Centred Computing in the Department of Computer Science at the University of Oxford. Her expertise involves co-producing user and community requirements and human computer interaction, particularly for collaborative systems (CSCW). She has been at the forefront of recent work in Responsible Innovation (RI) in the UK and the European Union. She leads an interdisciplinary research group investigating the responsible development of technologies that are more responsive to societal acceptability and desirability. Her current projects involve a range of topics in RI: she leads the Responsible Innovation initiative for Quantum Technologies; Co-PI on EPSRC Digital Economy TIPS project, Emancipating Users Against Algorithmic Biases for a Trusted Digital Economy (UnBias); PI on EPSRC Digital Economy TIPS project Rebuilding and Enhancing Trust in Algorithms (ReEnTrust), and co-directing the development of an Observatory for Responsible Research and Innovation in ICT (ORBIT) that will provide RRI services to ICT researchers. Marina is a Chartered IT Professional of the British Computer Society and sits on the ICT Ethics Specialist Group committee. She has published widely in international journals and conferences on e-Research, Human Computer Interaction, Computer Supported Cooperative Work and Requirements Engineering.

Professor **Pericles Loucopoulos** has held appointments at the University of Manchester (UK) and Loughborough University. He is a Visiting Professor at Harokopio University of Athens (Greece) and at Bournemouth University (UK). He has been awarded numerous research grants supporting over 25 research projects, most of them in collaboration with industry. He is the editor-in-chief of the Journal of Requirements Engineering and also serves as Associate Editor on 15 other journals. His research focus is on the use of conceptual modelling for achieving alignment between enterprise and information technology systems with particular focus on requirements specification and analysis. He has developed the Enterprise Knowledge Development (EKD) and more recently the Capability Oriented Requirements Engineering (CORE) methods, both of which are part of the Open Models Initiative (OMI) platform. He is a member of a number of international professional bodies, has served as General Chair or Programme Chair of many international conferences and has served on over 300 conference programme committees. He has been awarded the Edelman Laureate medal and the President's Medal of the UK OR Society. He has authored 9 books, edited 23 books and conference proceedings and has published over 250 papers in journals and international conferences.

Martin Matzner is Professor of Information Systems and the Chair of Digital Industrial Service Systems at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU Erlangen-Nuremberg), Germany. In 2012, he received a Ph.D. degree in Information Systems from the University of Münster, Germany, for his work on the management of networked service business processes. His research areas include business process management, business process analytics, as well as service engineering and service management. In these areas, he concluded and currently manages a number of research projects funded by the European Union, by the German Federal Government and by industry. He has published more than 80 research papers and articles, among others in MIS Quarterly and IEEE TEM. He is editor of the Journal of Service Management Research.

Günter Schäfer is a full professor at the Technical University of Ilmenau, Germany (since 2005), working in the field of network security and computer networks. Since 2014, he also serves on the supervisory board of the German company secunet Security Networks AG, and since 2017, he is Dean of the department of Computer Science and Automation of TU Ilmenau. He has more than 15 years of experience as an evaluator of research proposals and projects for the European Commission, as well as Luxembourg's FNR and Germany's BMBF & DFG in various programmes. Prior to joining TU Ilmenau, he held research positions at Technical University of Berlin, Germany, Ecole Nationale Superieure des Telecommunications, Paris, France, and University of Karlsruhe, Germany (now Karlsruhe Institute of Technology). He holds a PhD degree (1998) and a Diploma (1994, comparable to M.Sc. degree) in computer science from University of Karlsruhe, Germany.

Appendix B Site visit programme

Tuesday 18 September

Time	Programme	LIST Attendees
9:00	Welcome coffee Short introduction to the institute, the department (and critical self-assessment of the department); discussion	Fernand REINIG, Eric DUBOIS, Jorge SANZ, Eric RAS, Djamel KHADRAOUI, Anne HENDRICK.
11:15	Tour around the department	Eric DUBOIS, Luc VANDENABEELE, Francesco FERRERO, Cindy GUERLAIN, Béatrix BARAFORT, Séverine MIGNON, Annie GUERRIERO, Christian MOLL, Johannes HERMEN, Anne HENDRICK.
12:30	Lunch	Eric DUBOIS, Jorge SANZ, Eric RAS, Djamel KHADRAOUI, Anne HENDRICK
13:30	Presentation and discussion on “Human Dynamics in Cognitive Environment”	Eric DUBOIS (replacing Thibaud LATOUR), Eric RAS, Yannick NAUDET (via phone call), Christoph STAHL, Valérie MAQUIL, Alexandre BAUDET.
15:00	Tea/coffee break	
15:15	Presentation and discussion on “Trusted Service Systems”	Djamel KHADRAOUI, Pascal LHOAS, Erik PROPER, Francesco FERRERO, Nicolas MAYER, Uwe ROTH.
16:45	Short break	
17:00	Presentation and discussion on “Business Analytics and Regulatory Technologies“	Jorge SANZ, Béatrix BARAFORT, Michel PICARD, Nicolas BIRI.
18:30	Draft conclusion on the first day	
19:00	Return to the hotel	
20:00	Dinner	Eric DUBOIS, Jorge SANZ,

		Djamel KHADRAOUI, Eric RAS, Anne HENDRICK.

Wednesday 19 September

Time	Programme	LIST Attendees
08:30	Presentation and discussion on "Digital Built Environment Management"	Eric DUBOIS, Séverine MIGNON, Annie GUERRIERO, Thomas SCHWARTZ.
9:30	Meeting with ITIS young researchers	Peiman ALIPOUR SARVARI, Dimitra ANASTASIOU, Silvio Domingos CARDOSO, Anusha CHOORY BALAJI, Gabriel DA SILVA SERAPIAO LEAL, Uzma IFFAT, Adnan IMERI.
10:15	Tea/coffee break	
10:30	Meeting with ITIS clients/partners	Hendrik HOEHNDORF (ROAMSYS SA), Nina BURMEISTER (Digital Lëtzebuerg, Service des Médias et des Communications du Ministère d'État), Christophe BUSCHMANN (CNPD), Jean-Michel REMICHE (POST TELECOM SA) Cédric SCHOCKAERT (PAUL WURTH), Philippe DANN (EBRC European Business Reliance Centre),
11:30	Time reserved for clarification questions	Eric DUBOIS, Béatrix BARAFORT (replacing Jorge SANZ), Eric RAS, Djamel KHADRAOUI, Anne HENDRICK.
12:15	Lunch	
13:15	Time to draft preliminary conclusions	
14:45	Tea/coffee break	
15:00	Presentation of preliminary conclusions and discussion on possible recommendations	Fernand REINIG, Eric DUBOIS, Béatrix BARAFORT (replacing Jorge SANZ), Eric RAS, Djamel KHADRAOUI, Anne HENDRICK, Representative of Ministry of Higher Education and Research.
16:00	End of programme	

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