Visualising the digital transformation of research data management and student administration the Milky Way

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Abstract

This paper presents a novel enterprise architecture concept for mapping business capabilities called the Milky Way. It aims to create an anchoring image that can be used to communicate with various stakeholders. We look at examples from research data management and student administration. All the presented projects, from different universities, were highly successful in achieving stakeholder buy-in. The paper ends with lessons-learned and we conclude that this is a very promising avenue for further exploration in the higher education sector.

1 Introduction

Higher Education institutions are–like many other organisations–finding it difficult to realise benefits from IT investments. At the same time, the imperative of digital transformation is increasing pressure for development and the need for IT-business alignment. Two domains with strong ongoing developments are Research Data Management on the one hand and Student Administration on the other. The challenges are in many ways very different but there are also similarities, like increasing calls for interoperability across institutions and national borders.

Enterprise Architecture (EA) is often perceived as the methodology to achieve IT-business alignment, and within EA capability mapping has become a very central concern. While much of EA

draws on providing different viewpoints, we here look at the Milky Way concept (developed by Annika Klyver and promoted by IRM, c.f. Nordén 2018) which aims at a unified view of the organisation.

2 The Milky Way Concept

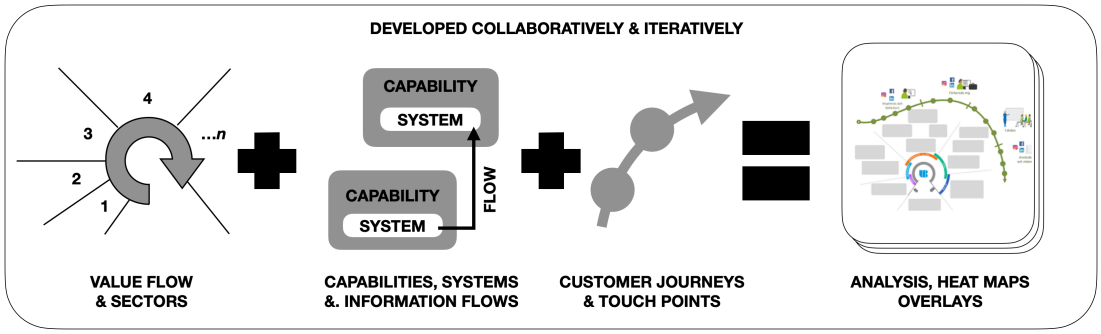
Visualisation is an essential to enterprise architecture, both for analysis and stakeholder communication. The EA practice includes numerous architectural artefacts that support the visualisation of different aspects. The Milky Way concept calls for an integrated approach where primarily capabilities, systems and value streams are integrated in a single anchoring map. Similar to capability maps, heat mapping and similar techniques can be used to highlight various aspects such as the impact of change initiatives.

Thus, the Milky Way concept is best considered a visual methodology, combining a certain way of visualisation with a set of recommendations on how to produce the visuals as well as on how to use them for analysis. Nordén (2018) states that the concept has three components: the model, the process and the philosophy behind it. Importantly, it is a pragmatic concept to be adapted, not rigorously followed.

What sets the Milky Way apart from other approaches is that it aims for a unified view, a single "map" where different aspects can be highlighted or layered on top–rather than having a number of different visualisations.

On a more abstract level the Milky Way concept is related to geographic maps on the one hand and temporality on the other. The idea is that geographic maps support a unified view of the landscape, at different levels of resolution. Temporality is also critical as the map is organised around the organisation's flow, capturing the pulse of the organisation. In short, the Milky Way aims to create a cognitive map of the organisation that can be shared between different stakeholders.

The basic Milky Way model is developed in the following steps. First the overall value flow is identified (which tend to be variations of a plan-do-check-act cycle). Depending on the steps identified a number of sectors are drawn around the hub. Next, each sector is populated with the required capabilities, the supporting IT-systems and the information flow between the systems. Together this forms the basis. In addition to this, the model is complemented with customer journeys, which depict how a customer (or other roles) relate to the value chain. Touchpoints are also indicated, where the customer interacts with the organisation. Detailing all of this should be a collaborative and iterative undertaking. Once the basic model is produced, additional layers of information can be added to highlight different aspects (i.e. quality, organisation, initiatives, different development scenarios).



It should be stressed that the Milky Way concept is not a specific system, the visualisations can be achieved using a variety of tools, although there are some templates available that facilitate modelling.

The pragmatic approach should also be evident by examples presented in this paper, that all are variations of the core concept.

Recently, the Intersection group has also demonstrated how the Milky Way concept might be fused with the concept of Enterprise Design facets (Gunther, 2012) putting even more emphasis on experience and identity/values.

3 Mapping Research Data Management Capabilities

In this project, the business architecture has been used to describe the business using the Milky Way as a method. The anchor model is used to insert the research journey into the business and shed light on important parts and how these are structured in the business, what components these important parts consist of and where the research journey is found and how the components fit together and interact.

The study was based on interviews with researchers, workshops with researchers, interviews with expert roles and support organization staff, and a survey of support organizations. Analyses of collected material have resulted in graphic representations of abilities that the university needs to have, and in a picture of the current status, in a so-called heatmap.

Following the researcher's journey as a guiding principle was found to be very helpful when identifying the various capabilities needed. Furthermore, the unique qualities of the capability concept were found to be very helpful in the discussions. One reason for this was that it allowed participants to see beyond the current situation, i.e. the existence or lack of supporting structures, information systems etc. Rather, they could envisage what capabilities were needed to support the researcher along the journey. Similarly, the journey concept was more open than looking at formalised processes, of which there were few in place.

The study was well received and proceeded in a second stage, validating and developing the approach from the first study. This project ran for half a year, from late 2021 to spring 2022 (and is not formally reported as we write this). This second stage had a different setup, as a collaboration project between Sweden's national research infrastructure providers (SNIC, SUNET and SND) and two universities. Background to the collaboration was that the research support infrastructure was found to be somewhat fragmented not only at the individual institution but also at a national level. Hence, the project aimed to identify gaps in the services provided. The image below is a preview of the results from the second stage project.

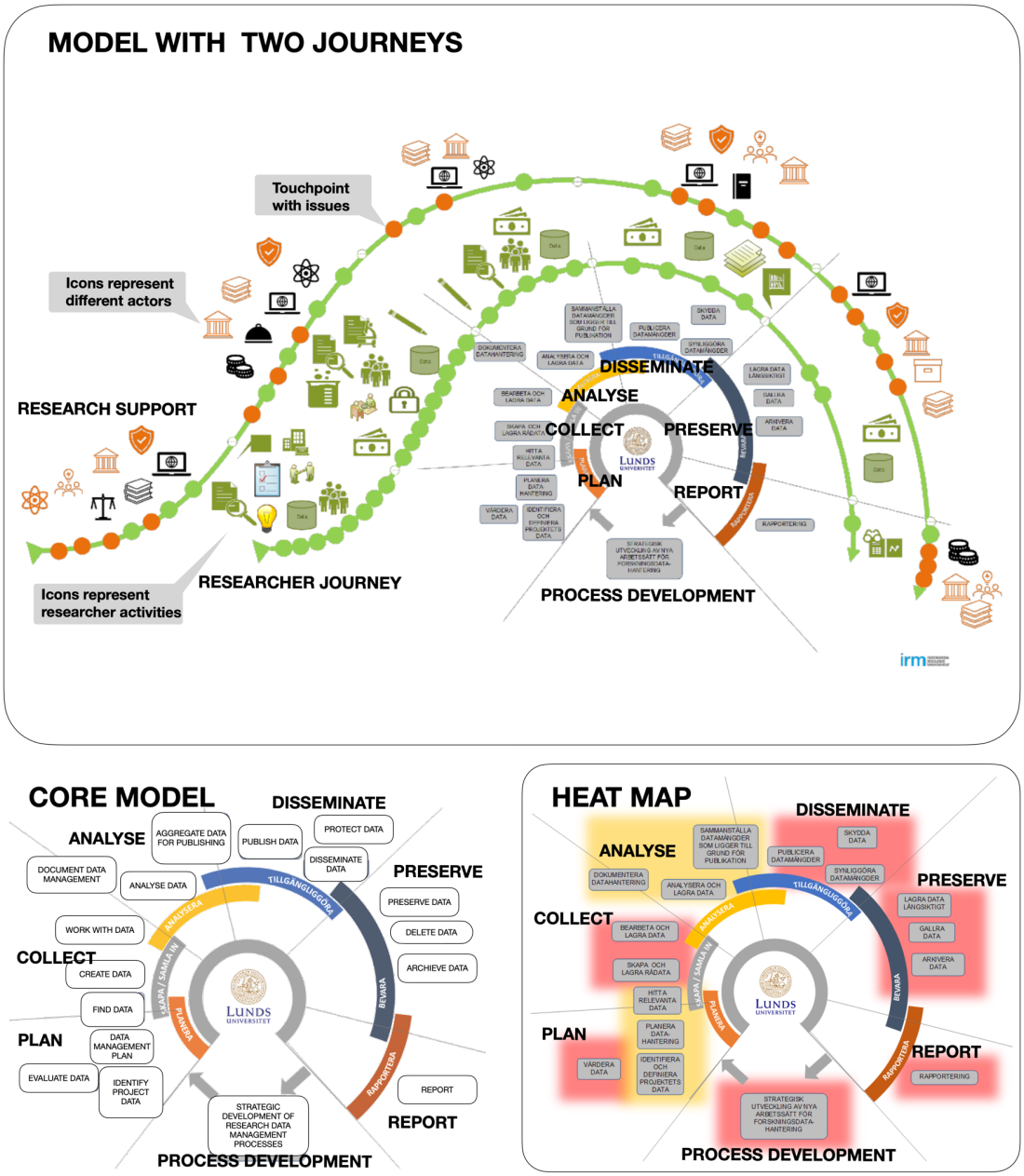


Figure 1: The top image depicts the researcher's journey and the interaction with supporting actors. The core model is shown bottom left. Bottom right is the same with a heat map indicating areas that need improvement (red).

The above image shows two versions of the same map. The left highlights the researcher's activities (grey boxes) and how they map to the various capabilities in the inner circle. The right image showcases quotes from researchers commenting on the various interactions in positive and/or negative terms.

The dotted, coloured line illustrates the researcher's journey through a research project and related challenges to research data management. The journey begins in a planning stage and moves through collection, analysis, publication over to preservation and concludes with reporting.

4 Mapping Student Administration Capabilities

Student administration is an important enabler for teaching and learning. In Sweden, much of the student administration is managed via national information systems. Generic processes do exist in support for these systems, the actual implementation at the respective higher education institution still varies–and even within one institution, there can be important variations between faculties and departments. The following examples are drawn from two different universities; however, both were triggered by a need to optimise the student administration, and achieve cost reductions. In both cases, the Milky Way concept was identified as an interesting approach to visualising the very complex structures supporting student administration. Both projects took place in 2019 and while successful there was no immediate continuation of the efforts, although the visualisations are still in use.

4.1 Example 1

The background to the project was an evaluation in 2018 that had identified a need for business improvements in general and business-IT alignment in particular. The latter included a number of dimensions spanning development roadmaps, information flows, system governance and promoting dialogue between the IT side and the business side. Furthermore, it was identified that this needed to be a sustainable approach that realistically could be kept updated. The Milky Way concept was identified as an interesting option and the project should therefore also evaluate the feasibility of the approach. A project group and a steering committee was formed. The project started with a training session and there were 12 workshops distributed over the year, aiming at iterating the model.

The project focused on the student's journey through the student administration. However, in addition to this the project worked through a number of dimensions and perspectives. This included highlighting ongoing projects, system support, "pain points" and sub optimisations.

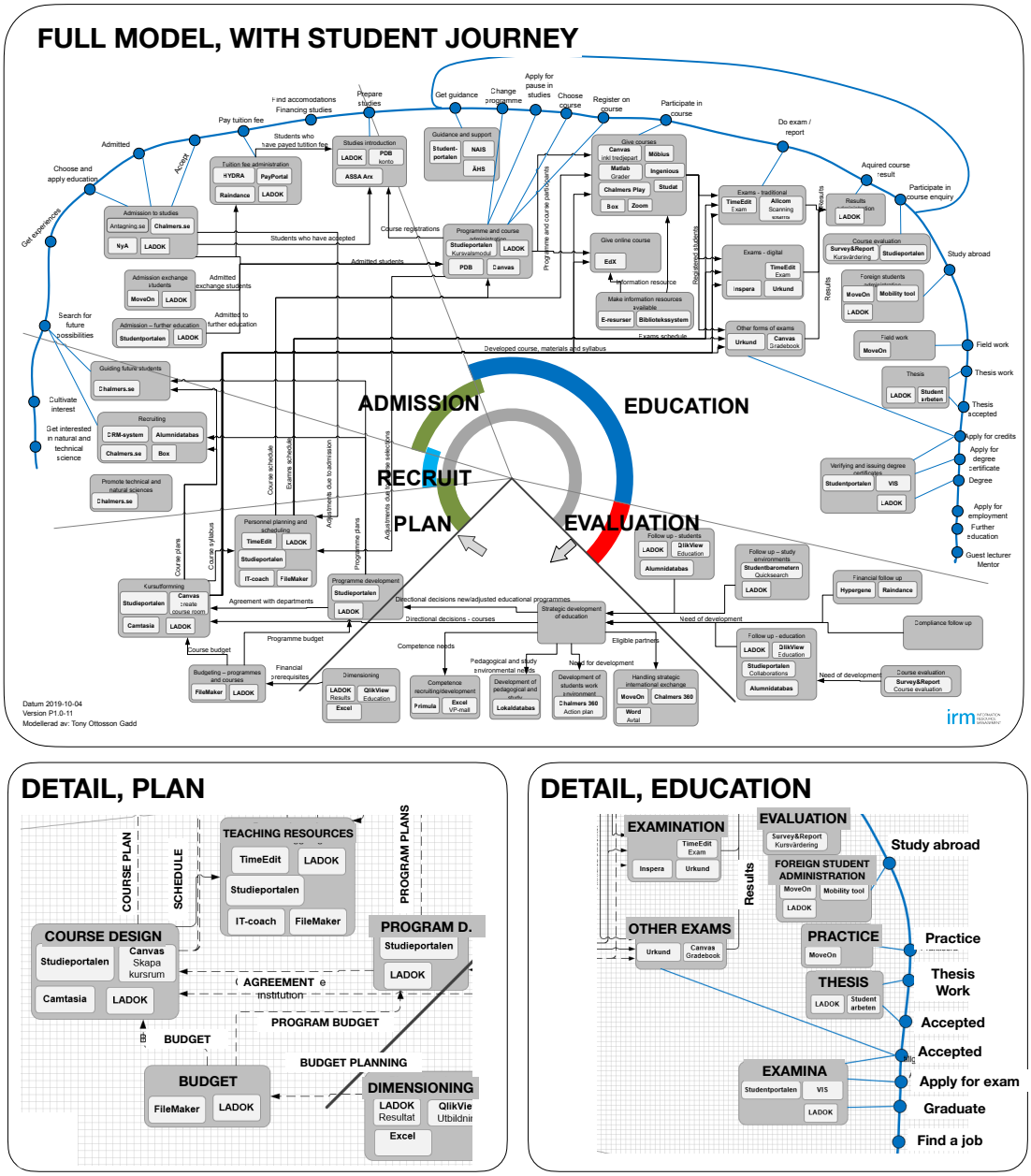


Figure 2: Student Administration with student journey, University A.

The figure above depicts the base map, divided into different sequential sectors. The grey boxes are related capabilities, the inner white boxes are information systems. The dotted lines indicate information flows. Finally, the line on the top illustrates the student's journey, with the small dots indicating touch points. (The details are just to add more readability.)

4.2 Example 2

We end with an example that illustrates how the Milky Way concept can be extended in terms of visualisation. Here again, the key concern was student administration. The project was managed by IT in close cooperation with the student administration, and included a number of representatives from different departments, working with student administration.

The project focus was on processes rather than capabilities, the processes are however on a high level of abstraction and could probably be translated into capabilities. The final map is whown below.

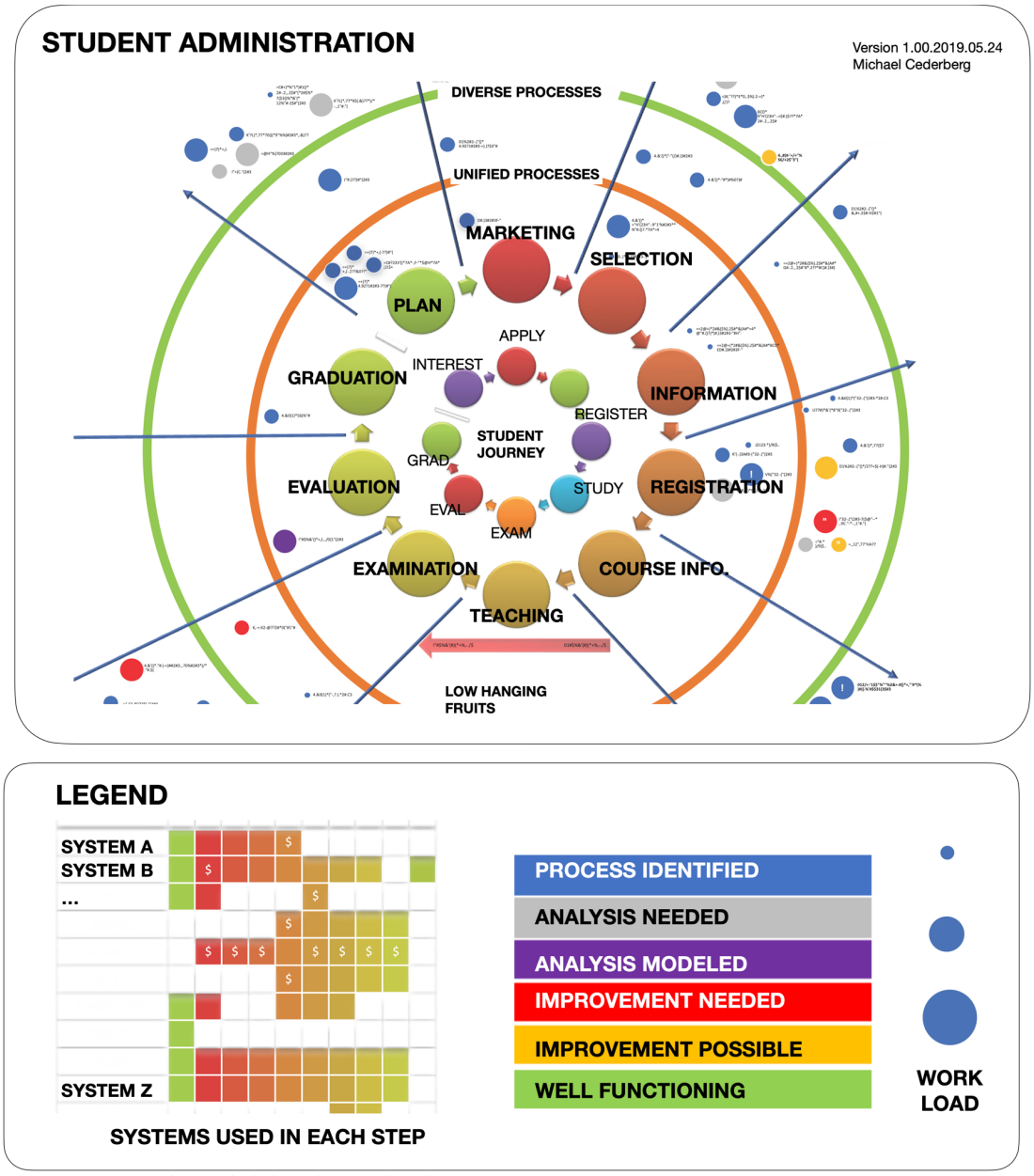


Figure 3: Student Administration. University B.

In order to visualise the diverse stakeholders involved the project started with a standard capability mapping approach. In this particular case it did however not resonate with the stakeholders involved. By coincidence, the Milky Way concept had just been demonstrated and the project decided to try that approach. Already the first proof of concept demonstration proved successful, sparking much more engagement and interest from the stakeholders.

What is interesting here is the way the Milky Way gets extended into a full blown infographic, encompassing a number of dimensions in a single image, as shown above.

Similar to the other maps the base figure revolves around the hub. It is divided into sectors depicting various stages of the student administration (from course design to exam). However, also the colours, size and position of the circles convey information. Colour indicates the quality of the process. Size is an indication of how much effort is associated with a particular process. The distance from the centre indicates decreasing level of homogeneity and circles clustered to the left in a particular sector have been identified as "low hanging fruits", i.e. candidates for optimisation.

In addition, the two inner circles are coloured to indicate what information systems are being used in the various stages.

5 Lessons Learned

There are many lessons to be learned from these grounded approaches to capability mapping building on the Milky Way concept. First and foremost, it seems that the concept indeed enables stakeholder engagement and thus serves as a valuable introduction to Enterprise Architecture in practice.

All the examples have built on close interaction with stakeholders, through interviews and workshops. This kind of bottom-up approach to capability mapping is very important.

On a more practical level, we have identified a number of hands-on issues that should be observed, like deciding on a resolution that is possible to work with (should ideally fit on A3 paper/27 inch screen), how to iterate through the map etc.

A challenge–similar to so many other initiatives–is that the next step *after* the mapping is more complicated as we then move into organisational politics and funding. Also, the future development and governance of maps is highly dependent on individuals and their interest in these tools. Success in the long run is dependent on having a sustainable EA function and/or program office.

6 Discussion and Conclusion

We have in this paper briefly introduced the Milky Way concept and showcased three capability mapping efforts, with varying scope and resources. There is still ongoing work in some domains and most likely some other similar initiatives within the Swedish sector of higher education.

We believe that the Milky Way concept is a promising approach to enterprise architecture capability mapping, perhaps especially when it comes to involving stakeholders on the academic side. The results from the granular bottom-up approach should also provide valuable input to the ongoing work with the development of the higher education reference model, HERM. Finally, it would be an interesting challenge–or theoretical exercise–to merge the respective perspectives of research and education into one overarching map, in the spirit of the unified view of the Milky Way concept.

Acknowledgements

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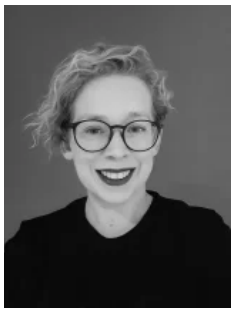
Author biographies

Michael Cederberg has a post secondary education in system development at Bandhagen College (1991).

Since 2019 he has been working as an Enterprise Architect at Stockholm University, before that he was responsible and develop a business system for bigger faculties in Stockholm University called Fastreg.



Monica Lassi, PhD, has been researching, and working professionally with, digital infrastructure for research since 2006. She is based on a socio-technical approach, with a change in working methods, organizational conditions, and technical tools in focus. Since 2014, Lassi has worked with business development in research data and e-infrastructure at Lund University; since 2016 directly for the university's management. As a senior advisor, she has expertise that spans strategy, policy, development and implementation of support for research data. In 2019, Lassi participated as a civil servant support in the formulation of VR's and SUHF's direction proposal for a new e-infrastructure authority, which formed the basis for the government's special investigation into research infrastructure (SOU 2021: 65). National and international e-infrastructures have hired Lassi as a senior advisor, including SND (Swedish national data service), SNIC (Swedish National Infrastructure for Computing) and NeIC (Nordic e-Infrastructure Collaboration). She represented SND in the formation of the EOSC (European Open Science Cloud) Association, in the transition from a fragmented time-limited organization to a stable and long-term organization.

Gerolf Nauwerck is a business architect at Uppsala University and a member of the working group on digitalisation at the Association of Swedish Higher Education Institutions (SUHF). In his spare time, he is also active in the EUSSET research community, which is focused on practice-oriented computing.
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Anna Winckler is a business developer at Chalmers University of Techniology in Gothenburg. As a business developer, Anna supports business managers in various development work in various ways. The starting point is usually process-based business development. She is responsible for Chalmers process development method and for the process model, as well as for training in process development at Chalmers.