

Towards a Sector Specific Higher Education Reference Model—introducing HERM

Gerolf Nauwerck¹, Patrik Maltusch²,
Valérie Le Strat³, Esa Suominen⁴,

¹Uppsala University, Sweden

²Aalto University, Finland

³AMUE, France

⁴University of Helsinki, Finland

`gerolf.nauwerck@uu.se, Patrik.Maltusch@aalto.fi,
valerie.lestrat@amue.fr, Esa.Suominen@helsinki.fi`

Abstract

Enterprise Architecture (EA) is often considered critical to higher education’s digital transformation. Up until now the higher education sector has mainly relied on generic models or even models imported from other sectors. In 2021, the higher education reference model (HERM) was introduced, giving the sector a common platform with solid support from various communities such as CAUDIT, EDUCAUSE, UCISA, and EUNIS. This paper takes a practitioner's perspective introducing the concepts of EA, the business model canvas, business capabilities, and a short introduction to HERM. The paper concludes with an overview of best practices to get started with EA in general and HERM in particular.

1 Introduction

Enterprise Architecture (EA) is a high-level, strategic technique designed to help senior managers achieve business and organisational change.

A reference architecture described using an EA approach is the overall blueprint for an organisation. A capability model summarises the essential operational components.

Together these components give a holistic view of an organisation allowing stakeholders from different parts to plan and deliver significant change projects using a shared understanding of use cases and priorities.

The Higher Education Reference Model (HERM), introduced in late 2021, is a game-changer for the higher education sector as it provides a sector-specific model to collaborate around—rather than adopting models from other domains or starting from scratch.

The paper begins with an overview of EA and a short introduction to HERM and why the model is vital to the sector. The paper concludes with a discussion on best practices to adaptation, based on the literature and experiences from the EUNIS EA SIG.

2 Enterprise Architecture in Higher Education

Universities that want to achieve digital transformation need a strategic approach and understanding of the overall architecture; otherwise, there will likely be waste, inefficiency and user dissatisfaction.

EUNIS member AMUE had this to say in a guide to governance produced for the French EA community in 2021 (<https://www.csiesr.eu/wp-content/uploads/2021/02/Packurba.pdf>):

"Our community is facing a profound structural transformation that is forcing it to constantly rethink and reinvent itself to meet the challenges of attractiveness and performance, previously reserved for the private sector.

A response to these challenges can be provided by sound knowledge and control of the institution's information and ecosystem. It is this knowledge and control that an enterprise architecture approach can provide. Enterprise Architecture facilitates the progressive and continuous transformation of an ecosystem to support the institution's strategy with the best possible Cost, Quality, Time (CQD) ratio for each project.

Why has this approach become vital within institutions? Controlling the ever-increasing flow of data collected is one of the main objectives of IS players. To save time and thus aim to optimise resources, documentation and information sharing can significantly improve the quality of work. The approach facilitates the management of resources and costs, the integration of projects, the optimisation of IS operations, the traceability of data and the quality approach."

Although it has been used for many years in the corporate world, Enterprise Architecture (EA) has been slow to take off in higher education. There were early adopters well before 2010 (Ferrell, 2011) and while EA now seems to have reached a critical mass in HE a recent French survey notes that only 18 percent of HEIs have an enterprise architect. (An Enterprise Architecture function may still exist even without that specific role in place.)

EA thus covers much more than technical infrastructure: it links organisational mission and goals, processes, information and technology. It is a way of formalising stakeholder interests and presenting them in the context of the enterprise. It provides a way of understanding functions that differ in essence and making sense of their interrelationships. In short, EA is a way of describing:

- what your organisation does;
- the processes by which it does these things;
- who carries out the activities;
- what data is used, how it flows through the organisation and where it is stored;
- what information technologies are employed and how they are used;

If you are undertaking a change project, this holistic approach can enable you to understand the touch-points and problem areas better. EA shows the interaction of technology and business processes, and the capability model structures the operations based on the specific industry or sector.

EA allows us to deal with the world in a simplified manner, avoiding the complexity, danger and irreversibility of reality. The purpose of EA is to optimise the often fragmented legacy of processes (both manual and automated) and systems into an integrated environment that is responsive to change and supports the delivery of the business strategy.

The benefits of EA stem from having a holistic view of the organisation that can help you identify and rectify existing problems, reduce duplication and inefficiency and plan for the future by modelling the impact of change.

This holistic view is a benefit as it provides a shared understanding and language between business and technical staff.

2.1 Capabilities

The concept of capabilities can be challenging to grasp, and there are different approaches. Capabilities are often contrasted with processes and the organisational structure. A capability is what the organisation does, not how (the same capability can be supported by changing processes). In the same way, the organisation may change. Still, its capabilities may stay the same, and a capability (such as human resource management) may exist at different departments, not just HR. Also, note that capabilities are *not* a synonym for skills.

The concept of business capabilities is central to current enterprise architecture practice. It has its origins in strategic planning in general and military planning in particular (i.e. defence capabilities, c.f. NATO, 2018). However, in organisational theory—in particular, the resource-based view of the firm—the concept of dynamic capabilities has become mainstream. The border between these approaches is blurred or fused within Enterprise Architecture. Thus a capability may, on the one hand, refer to a more tangible capability (i.e. to enable online meetings for 1000 simultaneous participants). Still, on the other, it may refer to a more intangible capability (i.e. change management or strategic leadership). The distinction between the two approaches is minimal in research related to digital transformation. Indeed, the practice of Enterprise Architecture itself may be understood as a dynamic capability, enabling the alignment of business and IT. Finally, these two approaches have been complemented by ideas from service design, most notably the business model canvas.

The two approaches can also be found in research on higher education. The resource-based view was central to Clark’s seminal writings on the entrepreneurial university (Clark 1998, 2004). There is also research on the commercialisation of research that draws extensively on dynamic capabilities.

In the context of EUNIS, Kähkipuro (2017) has introduced business capabilities in relation to IT governance and IT strategy. In a paper about essential IT capabilities in higher education, the approach is taken to simply the institution requirements. These requirements can be arranged into a prioritised set of capabilities to provide a more accessible way to deal with the change. The approach defines three layers of capabilities: Basic, Standard and Advanced. Basic capabilities keep your shop running, standard capabilities enable you to grow, and advanced capabilities give you a competitive advantage.

The capability model provides the pre-assessed structure and context of the business area so that each organisation may use and populate it directly with relevant operational data. The capability model enriches and specifies the reference architecture based on a predefined definition of subject and context.

Capabilities come in many forms and levels of abstraction. They have common semantics that should be used when planning and building, or populating your capability model.

Care must be taken to have a clear purpose for developing any architecture or adding new capabilities to a model.

Below is a simple chart to illustrate the used semantics (interchangeable) that you can find when people are talking about capabilities.

Meta	Capability			
Type can be	Strategic	Operational / Functional	Supportive	
Simple description	A capability is the ability to execute a specified course of action or to achieve certain outcomes.			
Is composed by	Process	Resources	Tools	Information

Alternative semantic used commonly	Activity, behaviour, procedure, practices	People, ecosystem, skills	Technology, systems, software, devices	Data, integration, interfaces,
------------------------------------	---	---------------------------	--	--------------------------------

Shared capabilities are consistent and consistent within the company/project. There is no deviation in the meaning, the same thing is not described by slightly different concepts in different places, and the level of abstraction is the same. Generic models must be both translated and localised to address the specific cultural context.

The shared capabilities can, and in most cases should have a hierarchy. Strategic results are linked to higher levels of abstraction capabilities (e.g. collaboration) and individual services and projects to a more specific level of the same capabilities (e.g. business collaboration).

As a result, the capabilities correspond to each level of abstraction. The hierarchy allows for the desired level of scrutiny (e.g., whether one wants to view collaboration to include all, more specific levels or merely business collaboration). If the concept of resources circumvents this, then the same requirement applies. Ideally, shared capabilities can be selected from the set of capabilities that covers the capabilities of the entire company/project. This can be established with a capability map that has been identified to involve as many different actors as possible within the company/project and are preferably compatible with the capabilities used by other actors in the same industry. The map supports all co-operation, and the capabilities are developed in part in co-operation with others.

3 The higher education reference model (HERM)

A reference architecture serves as a lingua franca and provides a unified way of describing complex real-world objects. This also applies to the capability models that address the specific business area, value streams and outcomes. The role of a reference architecture and capability model is to simplify particular aspects so that the different stakeholders can understand one another's use cases, and these descriptions can be captured digitally.

The Higher Education Capability Reference Model (HERM) is developed specifically for the higher education sector. The availability of the HERM is a game-changer because it allows us to share experiences and learn from one another rather than having to adapt models from other sectors.

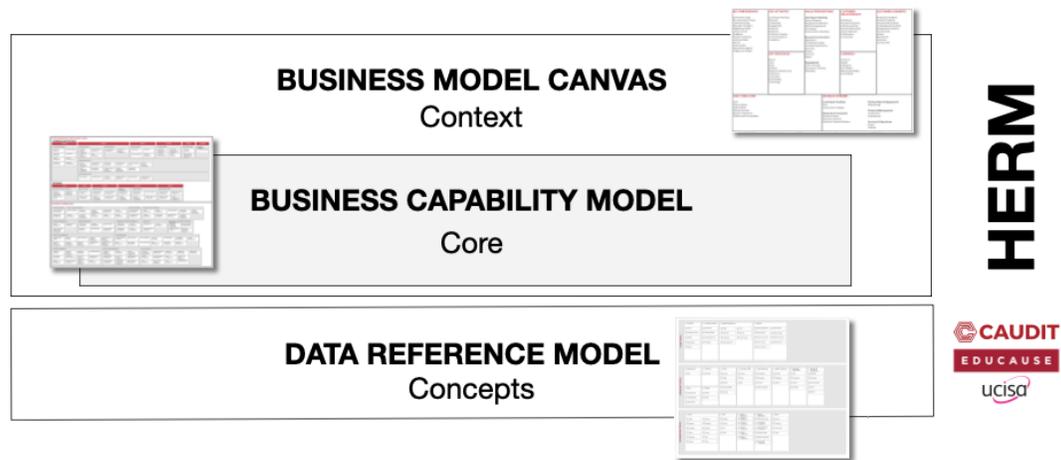


Figure 1: An overview of HERM

HERM builds on work done by the CAUDIT Enterprise Architecture Community of Practice in Australia and New Zealand. Gartner has described the original CAUDIT model as one of the "the most mature business capability models for higher education". According to (Modena et al. 2021), more than 300 institutions worldwide use it. With the release of HERM, CAUDIT entered cooperation on the model with both EDUCAUSE and UCISA and will, in 2022, be joined by EUNIS.

The HERM consists of three views: Business Model Canvas, Data Reference Model and Business Capability Model. The model describes a standard set of business architecture elements relevant to higher education. It can be used by business stakeholders, enterprise architects and technology strategists to discuss the effectiveness of the organisation, its needs and challenges. (Ref. 3).

The business model canvas (a concept introduced by Osterwalder, 2004) complements the more static view of the capabilities. It should be stressed that there are various extensions to the BMC that could be relevant for the future development of HERM. Notably, the BMC has been extended towards services and the public sector, incorporating a wider set of values, i.e. public value and/or social values (Franco-Santos, 2016). Thus, the BMC enables the organisation to include strategic intent and critical activities of operational development focus. The context in this canvas describes your business model in more detail. You may argue that the context has indications about strategic capabilities, but it has the benefit without the need to expand the capability model itself.

The data reference model describes high-level conceptual data central to higher education, grouped into topic areas (i.e. the research area containing data on research applications, output etc.) Furthermore, the data model differentiates between core (i.e. learning & teaching), enablers (i.e. finance, HR) and foundations (i.e. persons, groups and organisations).

Below is an illustration of a Capability model to describe the high-level structure (Parent capabilities) for Higher Education (a simplified model of the HERM). It also includes a value stream for two business areas (the red boxes).

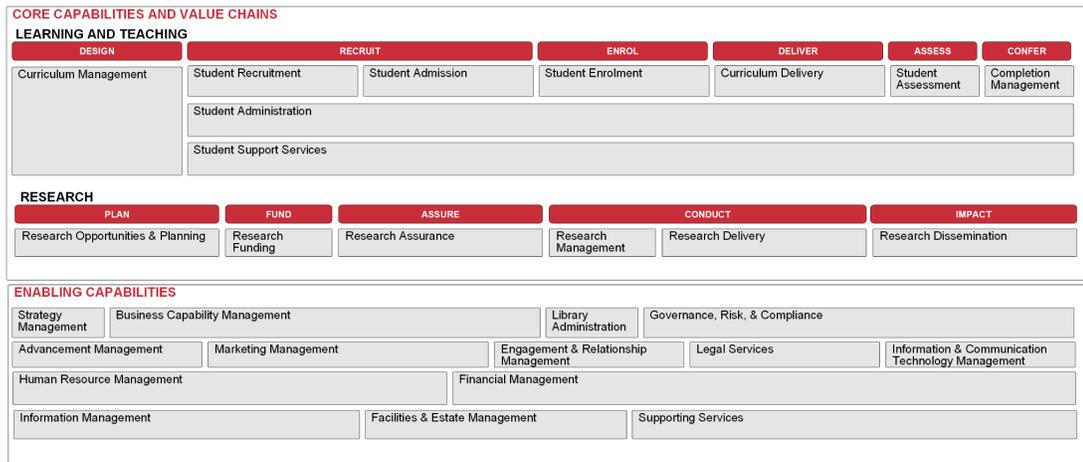


Figure 2: An example of a capability model.

The Capability Model serves as an anchor for assessing strategic importance, maturity, business operational pain points, capital investment, and organisational structure.

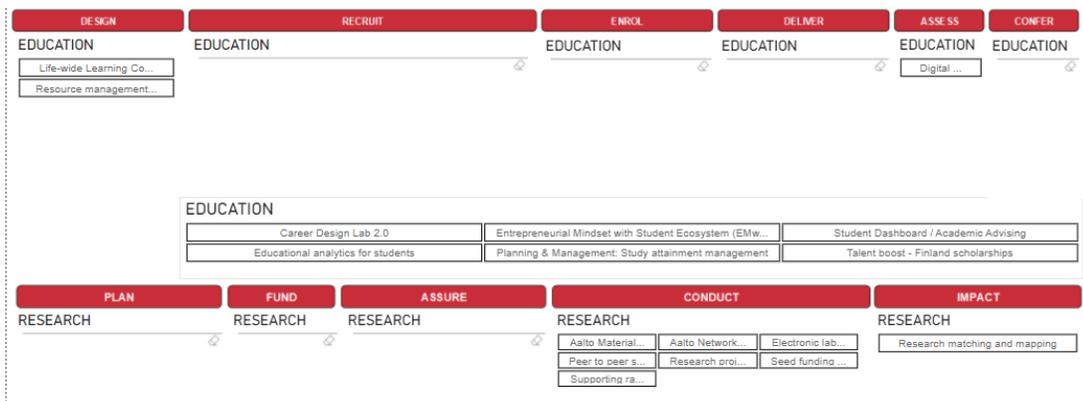


Figure 3: Snapshot of mapping the university project portfolio to the model.

The figure above illustrates how the university project portfolio (case from Aalto university) can be mapped to the capability model (presented in figure 2, above).

4 Best Practices for EA and HERM

Since HERM is a resource for enterprise architecture, establishing the EA function is a precondition for introducing HERM. At the same time, HERM may provide a good starting point for establishing an enterprise architecture function, with its strong focus on the business side. Approaches to HERM will vary depending on the EA maturity of a given higher education institution. Therefore, we first present a few recommendations for the EA functions before making some early observations on how to introduce HERM.

4.1 Start Small

You should first decide what you aim to achieve by using the approach. Although we emphasise that this is a strategic approach, you may want to start small and show some benefits quickly rather than tackle significant initiatives that take time to show benefits. As with any organisational change, this takes time and effort. The academic EA network ITANA has developed a five-step maturity model for EA adoption, that spans the five dimensions of scope, engagement, impact, delivery and management (ITANA, 2018). Using such a model might help frame an EA implementation.

4.2 Who needs to be involved in my organisation?

The short answer to this question is anyone that is a stakeholder in implementing the organisational strategy at the core level. Leadership, governance and culture are vital to the success of these initiatives.

There are numerous papers on leadership and governance and some excellent papers specifically addressing EA methodology supporting leadership. Dang (2018) highlights some of the challenges you might face in your institution. Dang concludes that senior managers have a strong influence on other stakeholders and the adoption of a methodology. Also, institutional process owners can be either blockers or enablers to adopting EA methodology depending on whether the approach is seen as threatening by challenging their processes.

4.3 Benefit realisation

As practitioners, we firmly believe that the value of EA comes from actual use rather than as theoretical exercises. The purpose of EA is not to model the entire enterprise. An EA should encompass the architecture definition process described by ISO/IEC/IEEE 15288-2015.

“Modeling, in the broadest sense, is the cost-effective use of something in place of something else for some cognitive purpose. It allows us to use something that is simpler, safer or cheaper than reality instead of reality for some purpose. A model represents reality for the given purpose; the model is an abstraction of reality in the sense that it cannot represent all aspects of reality”. (Rothenberg et al. 1989).

Benefits realisation is one of the critical factors for success when using a methodology or model. Niemi (2016) has presented a comprehensive EA benefit realisation models synthesis. The paper also lists a comprehensive set of stakeholders in relation to EA and thus are object to the benefits realisation.

4.4 A note regarding tools

There is a wide array of tools on the market to support EA approaches. If you are starting from scratch, choosing a tool can be difficult. (Gartner lists 20 EA tools on their website.)

Archimate is a modelling language developed specifically to support EA. The free, open-source tool Archi is an excellent starting point as a cross-platform tool to create Archimate based models.

5 Getting started with HERM

Much of what is said above about EA also applies to HERM, start small, get stakeholder support, and focus on benefit realisation. Below are some early observations on how to approach HERM.

5.1 Learn HERM

The first step is obviously to get to learn HERM. The reference model is already well documented, but there are plenty of examples, use-cases, and other information to be found online. EA networks at the national or international level, like the EUNIS EA SIG, are good places to learn. In the spring of 2022, EUNIS held its first workshop focused on applying HERM.

5.2 Translate the model

Translating HERM into the local language will highlight differences either in the terms used or in the capabilities identified. Contextualisation can improve the intelligibility of the HERM model by providing clarifications of terms and vocabulary without modifying its structure. The model becomes easily understandable to recipients because the vocabulary sounds familiar.

For example, in France, the corresponding area to "teaching and learning" HERM capability is commonly named "Formation, vie de l'étudiant et insertion professionnelle" that means "Training, student life and employment integration". Contextualisation can impact the capability name or lead to slight changes in its definition. Once the translation and contextualisation are done, it may be necessary also to make changes to the model because it does not fit precisely with local activities.

For example, the country may not use some capacities, e.g. there is no or little "commercial activity" in French higher education. Conversely, the model may be enriched with missing capabilities: "cultural conservation" (i.e. university libraries, archives and museum collections) is important in some countries. "Mission and travel management" are important capabilities in several countries.

Once the modifications have been done, the local model can be considered as a profile of the HERM model and a local customisation layer identifying the specificities. It will be necessary to record the changes that localisation has made to the original model to keep track of them.

5.3 What if we already have a model?

In some cases, there may already be an existing capability model in use in a country or an institution that may be quite different from the HERM model. Therefore, the question may arise of whether or not to replace this local model. The replacement may readily appear as the preferred option if the pre-existing model is not widely distributed and adopted within the local community.

If the local model is widely used, co-existence can be envisaged. The HERM model and the local model could co-exist, with this coexistence facilitated by establishing and maintaining a correspondence between the two models.

In this scenario, HERM could be used for international case studies or when discussion within the international HE community is needed. Local models could still be used for local use cases or when HERM requires too much adaptation to the local model in the context of the work carried out.

The drawback to this approach is that the local team will always have a maintenance overhead to maintain the alignment. The global model will save effort if it is acceptable to your community.

5.4 Use cases and heat maps

However, most of the benefit derives from the things you can do with this representation of your organisation. One tried and tested method is to use heat maps to look at where you spend most time, effort and resources and see how this maps to your stated priorities. For example, it can help you to:

- re-design business processes to be better, faster and cheaper
- reduce data duplication and redundancy
- articulate your requirements to suppliers

- plan your technology replacement/updating effectively
- undertake options appraisal and impact analysis

The figure below illustrates how the capability concept (at the bottom) presents a view of the organisation with traceability from business objectives through to the information, technology, and other resources required to support them.

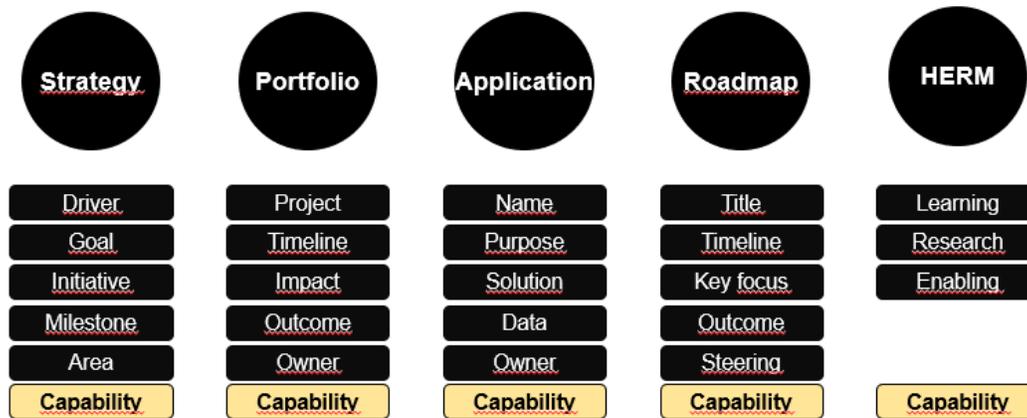


Figure 3: Minimum data example to map different sources with capability as the common nominator.

Some of our members report that senior management fear models of this type may lead to standardisation that is not appropriate in higher education. In reality, the reverse is true. By using techniques such as heat maps, you can readily see what generic capabilities should be done as efficiently as possible and what capabilities make up your university's unique selling point and give a real competitive advantage.

5.5 Contribute

Last but not least, remember to bring back your experiences and ideas to the community as we all learn from each other. In the discussions within the EA SIG—including guests from both CAUDIT and UCAIS—we have noted numerous initiatives at various development stages. We expect a significant build-up of knowledge around these themes in the HE community in the years to come.

6 Summary

EA and capability models are valuable tools that have already been shown to benefit higher education institutions. The creation of a global higher education model, HERM, opens a new chapter in international collaboration and the possibility to deliver additional value.

The EUNIS community has already gained considerable experience in making these approaches work in the context of European (and more localised) drivers and goals. Models need to be adapted to the local culture. Elements such as politics, funding models, pedagogy and public values influence how a capability model will be perceived and how readily institutions will see their drivers and goals reflected. Our experience of working in a multicultural context will add value to international collaboration.

The question is not really ‘why is this relevant to higher education?’ but rather ‘why has it taken higher education so long to see the benefits?’

The answer is partly, as already stated, a lack of understanding (and indeed mistrust) of techniques from the corporate world. It is, however, also the case that many universities have not taken a strategic approach to digital transformation until quite recently. IT has previously been seen as operational and something that can be left to the IT department rather than something that concerns the most senior leaders in the organisation and is fundamental to delivering their strategic objectives.

Universities that want to achieve digital transformation need a strategic approach and understanding of the overall architecture. Otherwise, there will likely be waste, inefficiency and user dissatisfaction.

7 Acknowledgements

We are very grateful for the support and encouragement from our national and international EA-SIG members. Especially we want to acknowledge Gill Ferrell and Lluís Alfons Ariño Martín for great discussions.

References

- Bernard, S. (2006). *Using enterprise architecture to integrate strategic, business, and technology planning*. Journal of Enterprise Architecture, 2(4), 11-28.
- Clark, B. R. (1998). *Creating entrepreneurial universities: organizational pathways of transformation*. Issues in Higher Education. Elsevier Science Regional Sales, 665 Avenue of the Americas, New York, NY 10010 (paperback: ISBN-0-08-0433545; hardcover: ISBN-0-08-0433421, \$27).
- Clark, Burton R. 2004. *The Organizational Foundations of University Capability*. Self, Social Structure, and Beliefs: Explorations in Sociology 168.
- Dang, D. D. (2018). *Enterprise architecture in the public sector: Adoption and institutionalization*.
- Dang, D.D., & Pekkola, S. (2016). *Institutionalising Enterprise Architecture in the Public Sector in Vietnam*. ECIS.
- Ferrell, G. (2011) *Enterprise architecture. Jisc Guide*. Retrieved 27 January 2022 from: Jisc <https://www.jisc.ac.uk/full-guide/enterprise-architecture>
- Franco-Santos, M. (2016). *Designing better performance measurement systems in universities using the business model canvas*. 5th World Conference on Productions and Operations Management.
- Kähkipuro, Pekka. 2017. *Essential IT Capabilities for a Successful Digital Transformation in Higher Education*. European Journal of Higher Education IT 2017 1.
- Modena, Karen, Nigel Foxwell, Allan Dent, Sasenka Abeysooriya, Paul Tasker, Michelle Phillips, Galen White, and Jeff Kennedy. 2021. *The Higher Education Reference Models*. Retrieved February 7, 2022 (<https://library.educause.edu/resources/2021/9/the-higher-education-reference-models>).
- NATO (2018). *NATO Architecture Framework Version 4*. Architecture Capability Team Consultation, Command & Control Board. Retrieved February 7, 2022 (https://www.nato.int/nato_static_fl2014/assets/pdf/2021/1/pdf/NAFv4_2020.09.pdf)
- ITANA (2018). EA Maturity Model Home. Retrieved April 10, 2022 (<https://spaces.at.internet2.edu/display/itana/EA+Maturity+Model+Home>).
- Niemi, E. (2016). *Enterprise Architecture Benefit Realization*. Tampere University of Technology.
- Niemi, E. I., & Pekkola, S. (2016). Enterprise architecture benefit realization: Review of the models and a case study of a public organization. ACM SIGMIS Database: the DATABASE for Advances in Information Systems, 47(3), 55-80.
- Osterwalder, A. (2004). *The business model ontology a proposition in a design science approach*. Université de Lausanne, Faculté des hautes études commerciales. <https://doi.org/10.22005/bcu.15985>

Rothenberg, J., Widman, L. E., Loparo, K. A., & Nielsen, N. R. (1989). The nature of modeling. in Artificial Intelligence, Simulation and Modeling.

Author biographies



Valérie Le Strat is a member of EUNIS EA-SIG since 2020. She has been working for Amue as an Enterprise Architect for five years and was previously project manager of the student management systems offered by Amue to its members. As an Enterprise Architect, she promotes the enterprise architecture approach to Amue members as well as internally and co-manages the EA group of French higher education with the Csiesr. She is also a member of the "club urba-EA", a non-profit association that promotes interaction and good practice between enterprise architects in France, whatever their field. Valérie Le Strat holds a PhD in molecular chemistry. <https://www.linkedin.com/in/val%C3%A9rie-le-strat-52688117>



Patrik Maltusch is the head of EA architecture team at Aalto University. He is chairing the Finnish EA-SIG, EUNIS EA-SIG and has been one of the lead educators coaching administration staff in the national Higher Education EA program. Early experience, including working as a customer service instructor and further fifteen years as a network architect and business owner for infrastructure design in a global Telco company. Patrik is also a distinguished and accredited security professional, risk manager, system auditor and Education Enterprise Architect. As an entrepreneur and start-up facilitator, he understands what staying practical means for business. For Patrik, interoperability is the key to mastering the ever-growing digitalisation needs in a more complex and complicated ecosystem landscape. <https://www.linkedin.com/in/maltusch>



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. <http://www.linkedin.com/in/gerolf>



Esa Suominen works as an Enterprise Architect at the University of Helsinki. He is also secretary of the EUNIS EA SIG and the Finnish EA SIG. He has long experience in IT sector at Higher Education Institute. He holds M. Sc. from the University of Lappeenranta. He is interested in to implement Enterprise architecture in a practical way in organisations. <https://www.linkedin.com/in/esa-j-suominen>