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Designing Enterprise Architecture Management Services – A Transformation Journey in the Public Sector

- Practice Track -

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Abstract

Enterprise Architecture Management (EAM) is widely used in the public sector and is increasingly understood as a driver of digital transformation. After reviewing the current literature on the EAM Services in the public sector, this article reports on experiences in the realignment of the EAM services in Deutsche Rentenversicherung (DRV - German pension insurance), presents an approach supported by Value Proposition Canvas (VPC), and details the EAM services that were designed using the method.

1 Introduction

Due to digitization, and the introduction of new technologies, processes, and practices, organizations are constantly adapting their value propositions to new market requirements. Flexibility is becoming more and more important as the landscapes constantly change, not to mention the pressure of competitors and the need to learn from the ever-growing amount of data. Especially during the COVID pandemic, this challenge has another dimension, such as switching to "hybrid working modes" almost overnight. Employees of all functions have learned how to complete tasks remotely using digital communication and collaboration tools. This required adopting new tools, technologies, and processes at an unprecedented pace.

The Deutsche Rentenversicherung (DRV – German pension insurance), with 59,000 employees serving around 56 million insured citizens and almost 21 million pensioners in Germany and abroad, is also in constant change. One indicator is the introduction of innovative services that are aligned with the organization's digital strategy. Aiming to have flexible, reliable, and location-independent offerings in place the DRV has made 17 online services available to citizens since the BundOnline initiative in 2005. These services need to be further improved in line with the Future Perspectives 2030 digital strategy [5], which illustrates the long-term transformational target that DRV pursues. The core idea of Future Perspectives 2030 is that citizens have simple and secure authentication procedures as well as a consistent transparency

regarding the processing status of their applications or inquiries. Citizens and companies only have to provide certain standard information to the administration once. This ensures that information that has been transmitted, regardless of which public body, is automatically retrievable. Furthermore, the strategy aims to equip the DRV workforce with tools and skills such that face-to-face services are also offered digitally.

The Future Perspectives 2030 digital strategy contributes to the issues addressed by the Society 5.0 paradigm in terms of merging cyberspace and physical space and creating a people-centric society [4]. One challenge in this journey is managing the transformation of the enterprise and aligning the needs of the citizens and the business with the Information Technology (IT). Enterprise Architecture Management (EAM) can be offered as a solution approach to this challenge, which connects various aspects of a company and thus shows the mutual dependencies through models, analyses, reports, and evaluations. It offers a holistic view of the company structure and helps the stakeholders in aligning their goals, processes, information systems, data, and technology artifacts. Since EAM requires observing an organization from different perspectives, its functions can be transformed and offered as "services". An EAM service can be defined in line with [23] as "the extent to which the strategic decision-makers are provided with relevant, timely and high-quality information and recommendations on an organization's current and planned systems". The provision of EAM services requires a systematic approach, which involves the specification of service processes, roles, and eventually, the transformation of the functions.

EAM is widely used in the public sector and is increasingly understood as a driver of digital transformation [22, 11, 16, 7]. There are numerous works on the benefits of EAM in the literature. The functions of the EAM are also widely known, which are defined using standardized frameworks such as TOGAF. However, we are not aware of any studies focusing on how these benefits can be realized in an organization once they are offered as services. Such service-oriented architecture management would aim to facilitate the establishment of standards, and create close cooperation with users, development teams, and operations. Furthermore, it would enable an organization to react flexibly to the needs of the customers, and stakeholders, while taking the comprehensive view of the organization into account.

This article reports on experiences from designing the EAM services in the DRV. In particular, we discuss an approach to transforming EAM functions into EAM services, including a procedure, tools for communication, and documentation, such as Value Proposition Canvas (VPC) or wiki systems. The transformation journey is aimed at offering the EAM services to the business leadership and to the executives of the IT department, which should form the basis for the common understanding and support informed decision making. In this context, Section 2 presents the background to the introduction of EAM in DRV and briefly discusses the EAM functions. Section 3 discusses the literature on architecture management services in the public sector. Section 4 presents our approach to designing EAM services, which are detailed in Section 5. Section 6 summarizes the work.

2 Drivers and Challenges of EAM at the DRV

In 2004, a law was passed to reorganize the statutory pension insurance system in Germany. The law was implemented in October 2005 and resulted in all German pension insurance institutions being combined in a new federal structure to form the German Pension Insurance (DRV). The carriers included the Federal Insurance Agency for Employees (BfA) and the Association of German Pension Insurance Institutions (VDR), which were merged into today's DRV Bund. The three special bodies, the Bundesknappschaft, Bahnversicherungsanstalt and Seekasse, were

merged into the DRV Knappschaft-Bahn-See (DRV KBS). The 22 state insurance institutions (LVA) were restructured into 14 regional carriers (DRV <region name>). The insured persons were divided among the 16 new institutions according to statutory quotas (40% - 5% - 55%). Before the reorganization, the federal and regional agencies used two different existing systems for IT support of the core business processes, so there was a need to standardize both systems. Today the merger of the two existing systems into a common system has been completed.

The organizational reform of the DRV and the associated IT consolidation were the main drivers for the introduction of EAM. Challenges such as the new federal structure of the DRV, the need for digitization and automation, the ever faster and dynamic development cycles of our own and purchased IT systems and services as well as the requirements for traceability, in particular, due to the KRITIS law, increased the complexity the development and provision of DRV's IT services. This required consistent, structured, and systematic planning of the entire IT landscape and motivated documenting of the enterprise architectures, with applications, functions, processes, and data.

A major challenge was (and is) to integrate the EAM department into the hierarchical and federal structures of the DRV. The initial assignment of the team to the strategic level of IT led to acceptance problems in development and operational management. The EAM was perceived as being too theory-driven and without concrete practical use (ivory tower problems). As a result, the team was assigned to development management. This led to acceptance problems in operational management. Currently, the EAM team is located as a staff unit in the departmental management of IT and is still confronted with the ivory tower accusation (see above). Furthermore, the assignment of the EAM team to the IT department also leads to misunderstandings between the business and IT departments and hinders their alignment, one of the central tasks of the EAM.

Various EAM functions have been introduced over time, such as IT-Architecture Planning, IT Development Planning, Architecture Board, IT Compliance Check, and Solution Architecture Planning. Although these EAM functions have contributed to a higher acceptance of EAM, their realization was dependent on the initiative of the teams in the development and operational management. Empirical data shows that organizational awareness and EAM understanding are crucial factors in successfully deploying an EAM initiative [12]. Due to the high complexity of the interrelationships in the IT landscape, the required syntax knowledge to understand the architecture models, the ivory tower accusation against the EAM, as well as the scarcity of marketing activities, DRV experienced moderate levels of awareness and understanding. In return, the collaboration with the respective teams suffered, and the potential of EAM could not be optimally exploited. To combat these challenges and support the Future Perspectives 2030 strategy, a service-oriented EAM was introduced and the existing EAM functions were transformed into EAM services.

3 Literature Review

3.1 Method and Approach

To investigate the state of the art in EAM Services in the public sector, we used the guidelines and steps proposed by Kitchenham and Charters in their Systematic Literature Review (SLR) approach for paper identification [9]. The identification process was complemented with the "Literature Search Checklist" proposed in [24].

The central aim of our study is to find out which EAM services exist in the public sector. The test search term "Enterprise Architecture Management" AND "Services" AND "Public

Sector" on Google Scholar showed that the contributions focus on Service-Oriented Architectures (SOA). This subject area focuses on "Application Services", i.e., on the encapsulated functionalities of applications. For this reason, the relationship between SOA and EAM is only partially relevant for our study, which led to a step-by-step adjustment of our search term. After a few iterations, the final search term the authors agreed upon was ("Enterprise Architecture Management") AND ("Service" OR "Function") AND ("Public Sector" OR "Public Administration"). This adaptation assumes that the goals of the EAM introduction, its benefits, and services are understood in the broadest sense as "EAM functions".

In the second step, the feasibility of the study was assessed. Due to the scarcity of resources, we decided to focus on the minimum necessary for the literature analysis. Therefore, the three scientific databases Web of Science, AIS eLibrary, and Google Scholar were selected. The first two databases covered relevant articles in the field of public sector EAM in the initial search process. Google Scholar would help us to identify the other relevant articles from one source and with a reduced effort.

In the third step, a template (review protocol) was developed to make the analysis process transparent. The template included the scientific databases to be searched, the search term, the number of publications identified, the title, the abstract of the article, and the criterion to exclude or include a given article.

The search was carried out in the title, abstract, and full text of the articles for a week and resulted in 796 literature articles. This set was checked for inclusion or exclusion based on the guidelines of [10] as follows:

- Inclusion: peer review studies, conference papers, journal articles, book chapters, dissertations with a focus on EAM services/functions/benefits or acceptance of EAM in public administration.
- Exclusion: Short contributions, articles without access, publications not related to the research question, duplicates, and articles not in German or English.

After applying exclusion criteria, the number of publications that were analyzed in detail decreased to 78. The title and abstract of 78 studies were checked to decide whether the article is relevant or not. If there was any ambiguity in the decision, the full text was read. Finally, the selection process ended with 15 final articles (cf. Table 1).

Database	**Initial**	**Criteria**	**Abstract Analysis**
AISeL	4	4	1
Web of Science	9	9	2
Google Scholar	783	65	12
Sum	796	78	15

Table 1: Results of the search process

3.2 State of the Art: EAM Services in Public Administration

Our literature analysis hints at a larger cluster of articles that discuss the benefits and challenges of EAM for public administration [18, 14, 15, 17, 19, 22, 16]. [14] attribute an important role to EAM in the provision and innovation of public services and define 12 benefits in this context, including "common understanding in the organization", "reduction in complexity" or "better decision-making". [15] mention that "the benefits are based neither on empirical

results nor on theoretical explanations". The authors use a meta-analysis from the studies to report on the advantages of EAM, among other things. [17] define 36 requirements for an EAM concept in the public sector. The requirements are divided into five main categories. These are Modeling, Stakeholders, EA Governance, Integration, and Management. The study looks at the advantages of EAM, e.g. cost reduction, generation of synergy effects, or cost-effectiveness of IT, which from our point of view can be realized through service offerings in public administration. The reference to the specific EAM services is not described in the studies mentioned above.

Regarding challenges of EAM adoption, the findings support our observations discussed in Section 2. To begin with, [6] emphasize five factors, "ad hoc EAM requirements, unclear business goals, lack of experienced architects, unclear requirements for the EAM team, and a rapidly changing environment" that complicate it, to realize the potential of EA. Similarly, [14] and [1] point to the lack of common understanding of EA communication. Most notably, [1] show through three public sector use cases that top management could not understand what EAM was about. Communication and unclear responsibilities are also emphasized as major challenges in [19]. [22] find in their quantitative study that the goals of the EAM do not solve the real problems and cannot contribute to the organization.

We opt for the idea that designing EAM services can counteract these challenges and emphasize the benefits. That EAM services contribute an impact on the usefulness and success of EAM has been confirmed in [13, 23] and [16]. The latter study addresses that the role of services is often underestimated, and EAM services are particularly relevant for stakeholders who are unfamiliar with architectural thinking. The models produced by EAM teams and their contribution to creating a holistic organizational view can be the core value proposition of EAM services (cf. [25]). This aspect is demonstrated in [7], where EAM connects the stakeholders, the strategy, and the elements of the information system and technology architectures. This can make the complexity of coordinating services manageable.

In summary, there is sufficient evidence in the literature that the introduction of EAM and its services must meet certain requirements. Some challenges, such as the understanding, tasks, and contributions of EAM in the organization, are expected. At the same time, it is also shown that, especially in public administration, EAM can play an important role concerning strategic and transformational topics. However, these studies do not describe i) whether and how these benefits can be realized through EAM services and ii) which and how concrete EAM services can be set up.

4 EAM Service Design Approach

One approach for designing EAM Services was mentioned in [2], where business services are interpreted as a link between IT and business architectures. The method relies on identifying business services based on an organization's processes and defines two roles, "business analyst" and "solution architect", which together derive functions from the tasks and transform them into business services. Investigating the suitability of this method for the problem at hand, we identified that the method prerequisites the existence of business process models. In the DRV context, the process models could only help to a limited extent, since they were incomplete and stored in different places.

With this in mind, we took a slightly different approach to designing EAM services. The process, which is described in more detail below, can take the EAM functions (see Section 2) as input and transform them into EAM services (see Section 5). However, the existence of an EAM function is not a mandatory condition for the application of the process. The need on the customer side, market developments, regulatory changes, or new projects can trigger the



Figure 1: EAM Service Design Process

design of an EAM service.

The design of each EAM service consists of six steps (see Figure 1). Each resulting artifact is subject to quality assurance by the EAM department. To better anchor the services in the organization, the EAM team was supported by communication experts who accompanied the description, structuring, representation, presentation, publication, and communication of the services.

In the first step, "Define EAM Service owner", the responsibility of the architecture management team for the design and maintenance of the service was determined. Enterprise architecture management looks at an organization from different perspectives. This means that architecture management services can be offered in a wide range, which can have a professional and/or technical focus. To this end, one or a maximum of two service owners (architects) were initially named. They were then informed about the service offer. In this phase, there was only an initial idea of the service offering, which gives the service owners a certain amount of freedom in designing the service.

In the second step "Create service description and models", the service owner has made a first draft of the service. A catalog of questions containing the following questions was made available for support.

1. How can the service be described in one sentence? Here, the architects were provided with the gap text "The service XYZ (what does the service do) ... and (what does the service do it for) ...."

2. What is the purpose and benefit of the service? Here it is explained which challenges the service solves for the customer. In addition, the following can be answered: Why is the service unique? What are the advantages for the customer and what are the advantages for the DRV Bund?

3. What is the service performance? How does the service support the IT landscape? Here the supportive character on which the service is focused is emphasized.

4. What is the range of the service? The areas (organizational units) affected by the service are listed here.

5. When and why does the service become relevant to the customer? This describes the situation that motivates the customer to use the service.

6. How does the service work? This describes the process of how the service is requested, performed, and completed. The process not only refers to the steps but also the results and actors.

7. Who is the primary customer? Here the customer is described in more detail in his role (project manager, specialist department, committees, etc.).

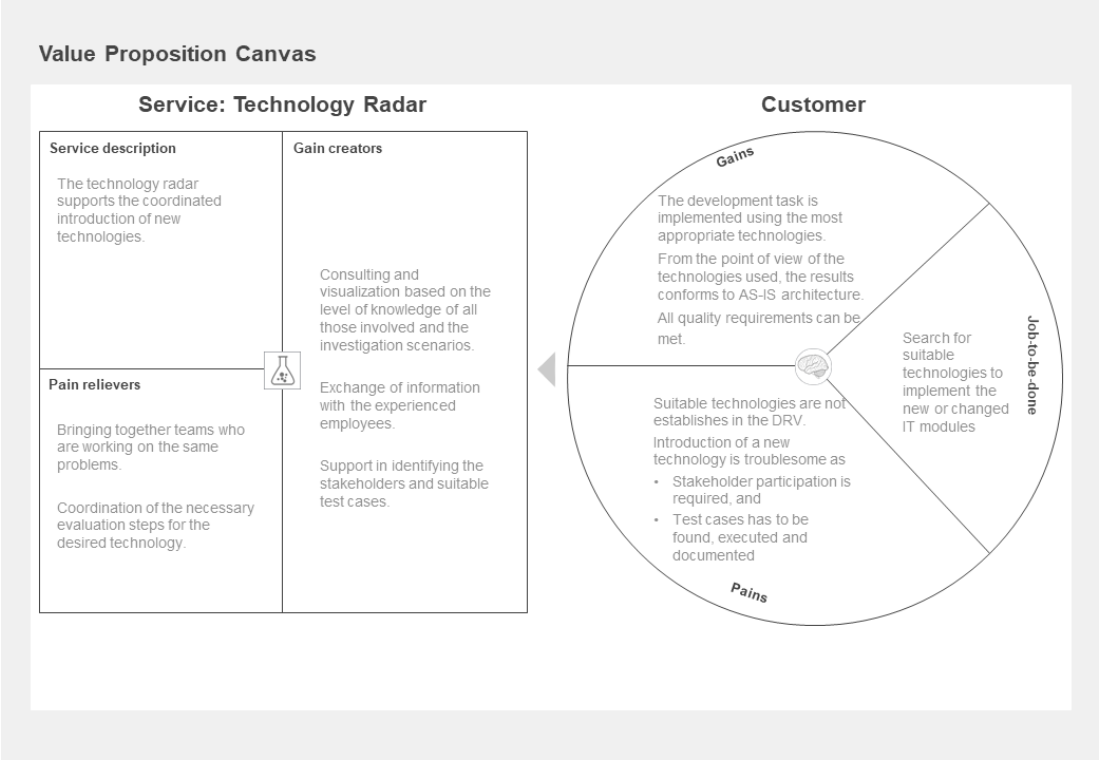

Figure 2: VPC for the EAM Service "Technology Radar"

This step resulted in semi-structured documents and process models (see Question 6 above), which were presented to the EAM team in the third step "Present and discuss results". After the team discussion, the drafts were adapted and initially approved internally. In this phase, the service descriptions cannot yet be communicated to the customer, they are created from the service provider's point of view.

After this step, a textual description of the service was available. To define the service in more detail and in a customer-friendly way, enterprise modeling methods were used. Following [25], our approach was emphasizing the value proposition of the EAM services. Hence, we used the "Value Proposition Canvas" (VPC) which is a model-based approach to representing an organization's value proposition [21]. The canvas is divided into two areas (see Figure 2). On the right, the focus is on the customer, presented by the three aspects "Job-to-be-done, pains, and gains". On the left, the focus is on the value proposition, an EAM service in our case. The three aspects "brief description (of the service), gain creators, and pain relievers" are presented here. This comparison of "value proposition" and "customer profile" helps to compare one's value proposition with the needs of the respective target group. The aim is to present the EAM services to the customer with a simple picture. The VPC was complemented by the service process models documented in Business Process Model and Notation (BPMN) [20].

In the fourth step, up to three "Customer Journey workshops" were carried out together with the communication experts to analyze the EAM service again from the service user's point of view and adapt accordingly. The aim is to more precisely trace and understand the

customer's experience along with the touchpoints with the service. In many cases, the service description has been adjusted mainly concerning the terminology used, such as the role of the customer or the scope of the service. The individual steps of a customer journey were:

1. Description of a typical service user
2. Identification of the contact points of the service user to the service or EAM team
3. Description of the content and timing of contacts before, during, and after using the service
4. Identification of the events or situations that trigger the use of the service
5. Determination of the potential for optimizing the service, and
6. Creation of a poster

The services were then published in the knowledge management system "Confluence" after the fifth step. With the help of the communication experts, the pages were designed in such a way that the poster, the short description, and the structure of the service description with links to the specific content are displayed on the start page. During the entire process, both the department heads and the board of directors were informed at regular intervals. After the roll-out, the service was presented in detail to the department heads and relevant organizational units for increasing awareness.

The last step relates to the maintenance of services. The need for a change in the service can be triggered by both the customer and the service owner. It should be mentioned that there is currently no precisely defined maintenance process. The customer feedback is usually retrieved before or during service use, and in both scenarios, the EAM team is involved in the service delivery process.

5 Specifying the EAM Services

The aim of transforming the EAM functions into services was i) to facilitate access for the development and operations teams, as well as the managers of the IT department to EAM, and ii) to achieve a common understanding. This increases the flexibility of everyone involved and thus increases acceptance and ensures the future-proof and sustainable further development of the IT landscape. Furthermore, the EAM services should also be used by the management, their staff departments, and the heads of other cross-sectional and specialist departments.

The challenge was to maintain the previous level of support through EAM functions and at the same time provide additional EAM services that were particularly requested by the executives. For this reason, an iterative approach was used. A set of criteria accompanied by a five-phase model was used for prioritizing the design of the EAM services. The highest priority was obviously on services that could already be derived from existing EAM functions and information. Further criteria were the availability of the service users and the service criticality. After the analysis of the criterion, the EAM service design was divided into the phases shown in Table 2.

Following the process for designing EAM services, which is introduced in Section 4 the following information was worked out and documented in the individual phases for each EAM service:

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Architecture Support	Software Conformity	AS-IS Architecture	Technology Roadmap	TO-BE Architecture
Technology Radar	Standards and Technology	Architecture Board	Heatmap	IT-Architecture Plan
Innovation Radar	Solution Architecture Review		Architecture Colloquium	Reference Architectures
				Business Architecture

Table 2: EAM Services and Phases

- The service in practice (relevance, function, roles and responsibilities, result, customer benefit)
- The process for using the service at a glance (VPC and BPMN)
- The possible interfaces to other services
- Helpful documents and information about the service
- Frequently asked questions and answers about the service (FAQ)

As part of the customer journey workshops (see Figure 1, Step 4), a poster and a short description of the service were created to present the value proposition and its benefits in a concise, understandable, and targeted manner. This information is used to "market" a service to the user. The poster contained a powerful slogan, a short and understandable description of the service in one sentence, and an illustration. The brief description included the objective and the benefits of the service. After going through all six steps to provide a service, information was published in Confluence as part of the communication strategy.

Currently, the services from phases 1-4 are rolled out. Architecture Support, AS-IS Architecture, Technology Radar, and Innovation Radar are in greatest demand. Architecture support is mainly used by executives and project managers or those responsible for projects. The Innovation Radar is used by executives, in particular by the IT department management, and has also attracted the attention of IT managers outside of the DRV Bund, so efforts are being made to make it accessible outside of the DRV Bund. A community involving the technology experts has formed within the IT department for the Technology Radar service, who regularly update the radar together with moderation from the EAM team. The EAM department reports regularly to the executive committee on the AS-IS Architecture, which is updated twice a year and shows the need for action derived from the analyzes and evaluations. The Architecture Board in connection with the Architecture Colloquia, the development planning, the standards and technologies, the software conformity as well as the solution architecture review belong to the daily business of the EAM team. The architecture board meets once a quarter or on request and serves both as a decision-making body and as an information exchange platform, with the latter predominating. So far, nine architecture colloquia have taken place, which have prepared alternative solutions for decisions taken by the architecture board.

6 Conclusion

The Future Perspectives 2030 digital strategy builds on the corporate strategy of the DRV with its five target areas: customers, employees, performance, sustainability/innovation and society/politics. The realization of Future Perspectives 2030 requires to offer meaningful solutions for the problems, such as converging the real world and the physical world, increasing the digital literacy, to name a few. In doing so, Future Perspectives 2030 contributes to a data-driven society as addressed in the Society 5.0 paradigm. At the DRV, EAM is becoming more relevant in

order to enforce the digital transformation and the Future Perspectives 2030 strategy. Looking from this lens, this paper documents the first results on how a service-oriented EAM can create added value in the public sector and which concrete EAM services can be implemented.

The need for a scientific discourse on this topic was demonstrated using a literature review, following the steps of [9]. To enable a critical reflection of the process, the results of the "Literature Search Checklist" based on [24] are documented and discussed as follows.

Before the literature search, an initial search was carried out and all three authors have EAM experience varying between 10-20 years. The justification of the literature review was that the research on the state of the art should be transparent, structured, and repeatable. We partly defined an appropriate search scope. Our goal was not to conduct a comprehensive meta-analysis in this area, the results of which would inform the researchers about the priorities. The feasibility and coverage of the search were assessed, and based on the results, the decision was made to reduce the number of scientific databases to the necessary minimum.

During the literature search, alternative approaches to searching the literature were tested. Initially, the snowballing approach by [26] was implemented, as it was "more efficient when the search term contains general terms" [8]. However, after the backward and forward snowballing of the first articles, no further relevant articles could be identified. We used justifiable search techniques and parameters, especially concerning the search terms. After each attempt, random articles were selected and the search term was adjusted based on relevance. As discussed in Section 3.1, criteria for inclusion and exclusion were applied. Throughout the process, team discussions took place, yet they rather focused on the selection of the search terms. Topics relating to scientific databases or exclusion criteria could have been discussed in greater detail.

After the literature search, we did not assess the sensitivity and specificity of the research, but we implemented this when using justifiable search techniques and parameters. The search process and the results as documented using a review protocol. Moreover, we compared the results with those of other literature reviews. An important finding, also as noted in [3], is the lack of academic papers reporting on EAM implementation in the public context in terms of methods, frameworks, and practices. Furthermore, with each step, feedback from colleagues was collected.

One limitation of this work is the lack of a systematic evaluation of the EAM service performance. There is already initial feedback from the service users that the EAM services have gained recognition by large parts of the organization. The IT department in particular benefits from the services, as processes and requirements are documented clearly and there is less ambiguity in terms of the EAM team tasks. Above all, new and non-IT-specific services are very popular in various organizational areas. In particular, the Architecture Support service has a strong accompanying effect on the digital transformation projects and the optimization and adaptation of business processes and procedures. The "Innovation Radar" service not only focuses on IT topics but also on other technological and scientific innovations (e.g. energy sustainability) and is therefore interesting for many areas of the DRV and an important working tool in the future. To close this gap, and get insights into how the services perform, it is planned to conduct interviews with the service owners and service recipients in the future.

The next goal concerns the implementation of EAM services, which are currently in Phase 5. Among others, the focus here is on the "Business Architecture" service. which should be derived from the corporate and IT strategy. It describes the customers, business capabilities, business processes, and business domains of an organization and their interactions. The interfaces and processes between EAM and the business side for the implementation of the business architecture are currently under construction.

Given the need to further develop the IT Landscape regarding Future 2030, EAM services

ensure comprehensive control in the establishment of technologies and their alignment to the business requirements at the DRV. In further future work, the authors intend to examine this interaction in the context of the architectural processes in more detail.

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