Approaches for Mapping E-Government Services

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Abstract: A process cartography, or process map, hierarchically classifies the processes of an organization into meaningful domains. It provides an overview of the operations in the organization, eases the identification of processes and facilitates the communication across departments. Switzerland has defined a unified cartography for E-Government Services (eCH-0145). In this work, we discuss advantages and disadvantages of this cartography by comparing it to related work and applying it to map the processes of a Swiss canton in a proof-of-concept field study. Then, inspired from related work, we introduce the matrix cartography based on a meta-process describing E-Government Services. We provide initial evidence that the matrix cartography can be used as an alternative to eCH-0145. Future work will include further confirming the suitability of the matrix cartography in collaboration with Swiss public administrations.

1 Introduction

The process cartography, or process map, is an important management tool for process-oriented organizations. It provides a hierarchical classification of processes into meaningful domains and delivers an overview over all the processes implemented within and across its departments. Therefore the cartography facilitates the identification of individual processes and their relations with one another, helping to get an overview of the operations of the organization as a whole and easing the communication between different departments of the organization. In the domain of E-Government, the cartography of public services is an important asset, as it serves as a common reference for all actors in the public administration. Individual governmental organizations or entities can classify their own processes in the unified cartography, which simplifies the communication between them and the implementation of cross-organizational processes. However the task of building a cartography of public services is not straightforward. In this article, we explore several approaches and discuss their limitations following the example of the envisioned Swiss cartography of public services eCH-0145 [De13].

In 2007, the federal council of Switzerland (the executive organ of the federal government) has established a strategy [Di09] to promote E-Government in Switzerland. The goal of the strategy is to enable every citizen, enterprise and organization to carry out

their transactions with the administration by electronic media. The strategy also requires that this transformation be done in a cost efficient manner. To achieve this, administrative processes must run seamlessly across different organizations within and across all three federal levels of Switzerland. Thus, the implementation of the strategy requires a joint effort from all partners involved. An important step towards a successful collaboration of the partners is that all the existing services provided by the different administrative entities have to be assessed and collected in a repository. More than 2300 different services have been identified and documented in this repository (eCH-0070 Version 3.0 [Sc09][1]). This number is quite large, and makes the management of these services a complex task. Therefore these services have been re-grouped and clustered, resulting in only 366 services, in a revision of this document [De12]. But first feedback based on a comparison with the service repository of the canton of Aargau hints to the fact that this reduction was too ambitious. A service assessment in the canton of Aargau identified about 539 services. These services form a superset of the 366 processes identified in the standard eCH-0070 [De12]. Independent of the concrete number, we can state that the number of services, and thus processes in the public administration will be in the magnitude of at least several hundreds. A process repository of this size requires tooling for navigating and managing the large number of processes. In other words, a process cartography, or process map, is needed. Therefore, a cartography project was initiated by eCH. The resulting process cartography is documented in eCH-0145 [De13], which will be likely published as a *best practice* of the eCH organization.

In the following we present the current developments in the eCH proposed standard for the mapping of services, which is eCH-0145 and its principles. Afterwards we discuss related work, e.g. how processes are organized in other countries. We also highlight some shortcomings of process maps in general and eCH-0145 in particular. Then we present an alternative approach that can allow us to overcome those shortcomings. Finally we give our conclusions and present the future work envisioned.

2 The eCH-0145 Cartography

As outlined above the cartography of Swiss public services has been encoded in eCH-0145 [De13]. The cartography is a hierarchical four levels sorting structure composed of: (1) Missions types, which contain, (2) Missions fields, which contain, (3) Missions groups, which contain and (4) Missions.

The structure of the cartography is based on the functional classification of the harmonized accounting plan [Sr11] used by the Swiss administration. As the accounting plan focuses mainly on cost and revenues, its functional classification tends to hide some fundamental missions of an administration like, for example, maintaining the inhabitant register. Therefore, it was necessary to adapt the structure of the functional classification by adding missions and missions groups. The eCH-0145 cartography therefore contains

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[1] The eCH association publishes standards and related specifications, which are recognized by the *Convention-cadre de droit public concernant la collaboration en matière de cyberadministration en Suisse* [Di12] as the lawful reference for E-Government in Switzerland.

a total of 230 missions, 92 missions groups, 26 mission fields and 3 main types of missions. A sample of the classification can be seen in figure 1. Each small box represents a mission field, while the others represent a mission type.
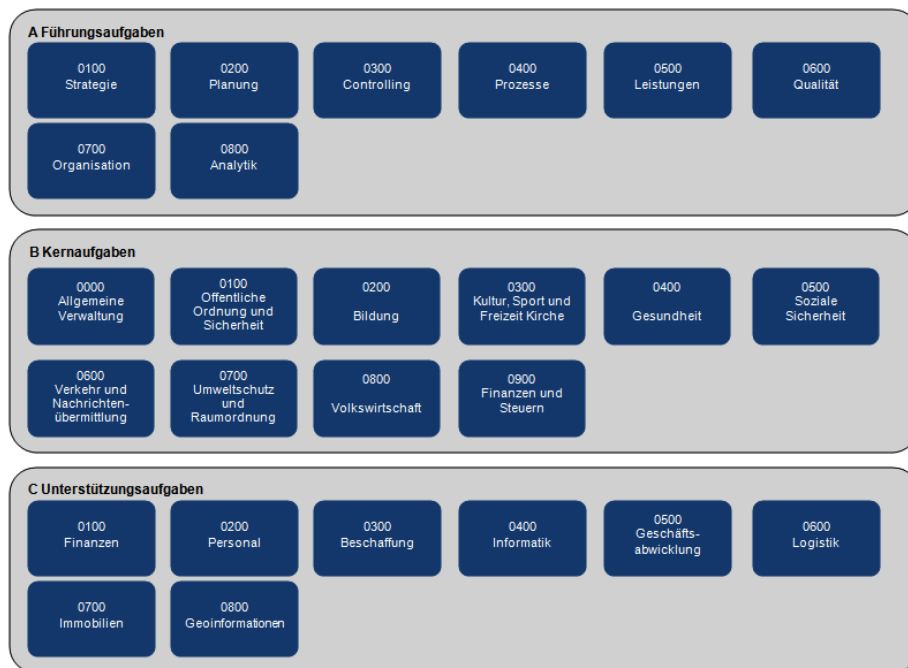

Figure 1: Sample of the cartography presented in eCH-0145

Basing the Cartography on Accounting Plan: Advantages and Disadvantages

The cartography of public services of Switzerland had some big challenges to overcome.

- Switzerland is a federal state with three federal levels. Cantons are divided into communes, and grouped together in a confederation. The principle of sovereignty gives each of the three federal levels very different missions in very different fields, and a great autonomy to carry out those missions. A cartography should be usable on all federal levels to enable and/or facilitate the communication between them.

- Also the cartography should cover all services of the Swiss administration.

- In [BJ11] and [MLF10] it has been pointed out, that the interconnections between services should be considered as an important modeling aspect.

By choosing the functional classification of the harmonized accounting plan, we handled the first challenge, as it provides the same structure for all authorities at all federal levels. Also, the decision to use an accounting plan as the basis for the service cartography allows an easier linkage between accounting and process management. The communica-

tion between these two most often distinct fields in public administration is facilitated too. Another advantage of the re-use of the harmonized accounting plan was the possibility to set-up the structure very efficiently. The financial account is established in public administration, and covers wide areas of missions of the public administration, so an initial coverage was satisfactory, even though it was not complete, as mentioned above.

To improve the coverage a field study was done in cooperation with the canton of Aargau. The services repository of that canton contained, at the time of the proof of concept, 539 services. That was 173 more than the official services repository, which made that an excellent opportunity for a proof of concept. The field study was carried out by two people from Aargau, each one of them individually sorting the 539 services of the canton's repository into the eCH-0145 cartography. Then, their works were compared to point out the differences and merge the remarks about the cartography. Finally, the merged result of their works was compared with our own clustering of Aargau's services repository into the cartography, once again to assess the differences.

The quantitative criteria for the cartography to succeed in this proof of concept were:

- Use of at least 20% of the missions of the whole cartography.

- Ability to classify 100% of the services of the Aargau repository in the cartography.

- Disagreement between two different people classifying the same services of less than 40% (i.e. similar to an Intercoder reliability rate ICR > 60%).

The result was the repartition of 100% of the services in only 84 missions (37% of the cartography) with a percent of disagreement of 10.7% between the two people from Aargau's administration who carried out the field study. The disagreement between the classification they agreed on and ours was 21.3%. This difference can probably be explained by our low knowledge of Aargau's internal business. Thus, all services assessed so far could be located in the cartography, and a significant part of the cartography has been used. This led us to confirm the capacity of the cartography to cover all services of the Swiss administration.

Nevertheless, being based on the accounting plan also imposes some disadvantages on the cartography of public services. In the following we discuss the disadvantages this decision had on eCH-0145.

The resulting structure is huge, and thus hard to learn. With 230 missions, the structure is almost as big as the repository of public services it is supposed to sort out. It was criticized several times that it would always be half blank and the proof of concept of Aargau tends to confirm that criticism as only 37% of the cartography was used to sort out the 539 services of the canton.

The classification of services in the missions of the cartography is not always unique and is done manually. In the services repository, the only information that can be used to cluster services is their names [De12]. This can result in ambiguities if the clustering is done by different persons. Even though almost 90% of the services had been clustered in the same way by two people of Aargau's administration during our field study, there was

a number of processes that has been classified differently by the persons involved. It has to be noted that in case of different classification this difference was mainly in different missions (smallest level of granularity), and the mission group were identical. Even though the degree of arbitrariness is smaller than the 40 percent we expected, it still exists.

Finally a clustering of services into missions lacks of capturing the links between processes and tends to create silos of processes. A service put in a mission may have connections with another service in another mission, even in another group of missions or in another missions field.

3 Related Work

In this section we outline previous work done, mostly for public service cartography in other countries. In particular the United States of America and the European Union have made effort for the cartography of public services.

The European Union's cartography is currently a work in progress. It is part of the European-Interoperability Framework for European Public Services 2.0 [Is09]. Due to its still immature state, the efforts of the European-Interoperability Framework for European Public Services do not offer a sufficient guideline for a cartography, at the moment.

The USA have created the Federal Enterprise Architecture (FEA) [Of07], a framework containing a cartography [Of07, p.27]. The FEA cartography is, from the perspective of its functionality, complete. But it seems that this approach is not well perceived and we can hardly see a significant uptake of this effort. A rather common statement regarding these efforts is made by Gaver: "In short, the Federal Enterprise Architecture program hasn't been working." [Ga10]. As the FEA has not been in proper operation, we cannot draw any conclusion about the usefulness of this approach for practical purposes.

Also in Germany a process library has been developed, called the "Nationale Prozessbibliothek". In this library the processes are structured into a six dimensions model. Examples for such dimensions are "Bundesländer", federal levels, the modeling methods and 33 themes of fields of application (e.g. health, environment...). The themes of this multi-dimensional model share a lot of similarities with the Swiss services cartography (eCH-0145). In particular, all 33 themes have a correspondent mission in the Swiss cartography.

Thus, in principle, the German model has, in our opinion, the same flaws as the Swiss one:

- The decision to classify a process under a particular theme can be ambiguous (for example, choose between "Frauen", "Justiz", "Arbeit" and "Sozial" (women, justice, work and social) as those may all be relevant when it comes to processes related to gender equality).

- The structure lacks of capturing the links between processes and tends to create silos of processes.

We also suspect that the small amount of themes (33 in comparison to the 230 missions of the Swiss cartography) and the absence of some important aspects of public administration, like taxes and foreign relations, can create difficulties when it comes to the systematic identification of processes.

As outlined above, we consider that the current German approach seems to suffer from the same or similar weaknesses as the Swiss one. Therefore, we are not going to investigate this approach in more detail.

Another criticism of existing cartographies has been made by Barros and Julio [BJ11]. In their article they review different architecture frameworks and criticize them as describing enterprises only by structure and process components, but not considering the relationships between those elements [BJ11].

In another work, Barros et al. have proposed a method to overcome this weakness [BSQ12]. They have proposed to classify all processes according to their macro-processes, which are in fact some form of a meta-process model. This approach takes into account the complexity of the interconnections between processes in the structure of the organization. They have demonstrated the usage of their concept of macro-processes, and proved its applicability to cartography the services in a hospital [BSQ12]. We draw inspiration from their work for the approach presented in the following section.

4 Basing the Cartography on Meta-process

As pointed out before, the usage of an accounting plan offered a number of advantages, but also falls short in modeling interconnections between services, something that has been identified as important too, see the discussion in Section 3. Due to the convincing results, presented in [BSQ12], we decided to adopt the approach, and to investigate if the idea of macro-processes can be used for the cartography of Swiss public services. In contrast to the work of [BSQ12] we do not consider abstract BPMN diagrams, as we consider them to be too fine-grained for structuring such a large amount of processes. Instead, we advocate for the usage of more abstract flow information. Therefore we have called this abstraction a *meta-process*.

Usually, an enterprise creates its cartography based on their value chain, according to the well known model by Porter [Po85] Today, the typical enterprise cartography has three major processes for: (1) Management, (2) Production, (3) Resources.

We can state that these three major processes correspond well to the three missions types of the eCH-0145 cartography.

So, at first glance, the outcomes of both cartography approaches seem to be nearly identical. But, the difference between the meta-process of an enterprise and the meta-process of an administration is huge. The theory this classification is built upon, typically as-

sumes that enterprise usually have a rather small set of products, which often have similarities. The car industry, for example, produces only cars, and in the multitude of the models of cars existing, there are only very few different "types" of cars.

However, the situation is different for an administration. It has to deliver a huge amount of services due to the huge amount of laws that the administration has to implement. Services of a public administration are of very different kinds. As mentioned above, the eCH-0145 contains 230 missions, each one supposedly corresponding to one or more services. Those services cover a variety of totally different tasks, e.g. public education, territorial defense, health of the citizen and diplomacy.

However, the strategy of E-Government in Switzerland is only addressing services that can be realized electronically, and thus mainly rely on pure information exchange. Therefore we were able to propose an example of a meta-process for the Swiss administration. Its main structure is shown in figure 2. The letters G, K and B correspond to the three federal levels of the Swiss federal states, respectively the communes (Gemeinden), the cantons (Kantone) and the confederation (Bund).
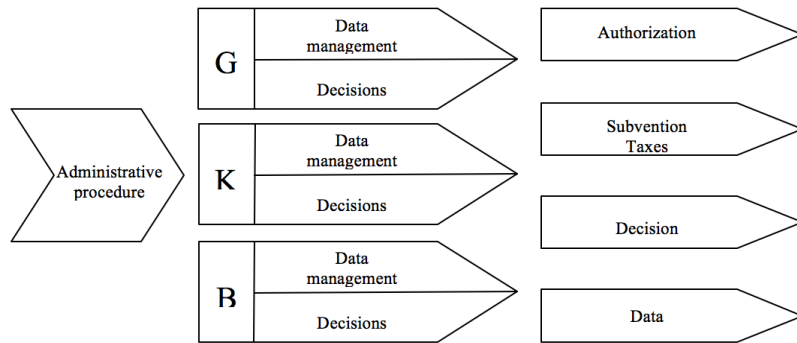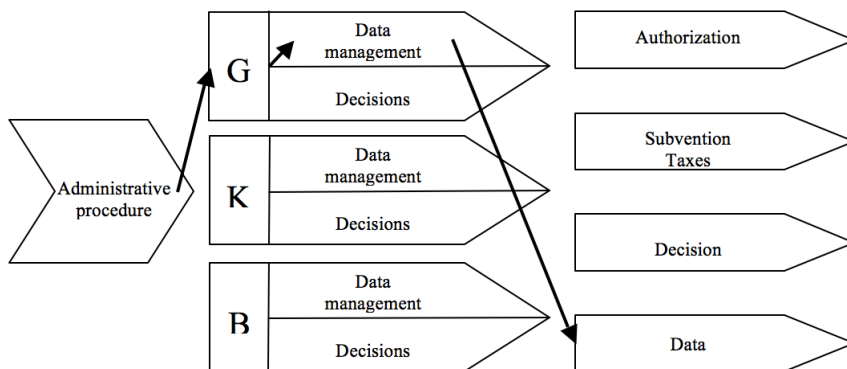

Figure 2: Meta-process of the E-Government services

Figure 3: Ilustration of a *primitive process* into the meta-process

An administrative procedure can run within a commune, a canton, the confederation or among them. For the process execution, resources on the corresponding level will be used, which will either effect the data management or the decision making of each of the administrative levels, while executing the process to create the desired service.

Such a service can be an authorization, a subvention/tax, a decision or the delivery of data. Figure 3 illustrates an example of a *primitive process* and how it would be mapped into the meta-process. In the following we call a process *primitive* if it delivers one service and does not need to call other services in order to do so. The example shown in Figure 3 is a request to a commune about the final date to fill the tax declaration. The commune only needs to receive the request and communicates the date to the citizen or enterprise requesting it.

Each and every process has an outcome of one of the following types, and therefore can be considered as different results of the meta-process:

1. Authorization: Service, in which a document granting a lawful right is created and transmitted, e.g. driving license, work authorization.

2. Subvention, taxes: Service, in which a money flow (in or out) is effected, i.e. created, changed or terminated. This covers taxes, taxes exoneration or agriculture subventions, for example.

3. Decision: Service involving a decision making process, e.g. date and time of appointment, granting consular protection, extension of the deadline for the payment of taxes.

4. Data management: Service that collects, saves, manages or delivers data, e.g. nationality, birthdate, revenue or laws.

It may be necessary to combine several *primitive* processes to create the requested deliverable. Services from other authorities in the public administration might be needed. In fact, a service requested to an authority may even be delivered to the requestor by a different authority. In the following we refer to a process that requires a number of other services as a *complex process*. The mapping of a complex process in the presented meta-process is shown in Figure 4.

In the example shown in Figure 4, a service is being requested to the canton, which must decide to accept or not the request. Therefore the canton requests more information through another service. Also it requests more information from an authority on the federal level. Afterwards the canton delegates the decision making to the commune. The commune executes its decision making process and finally communicates the decision to the requester.
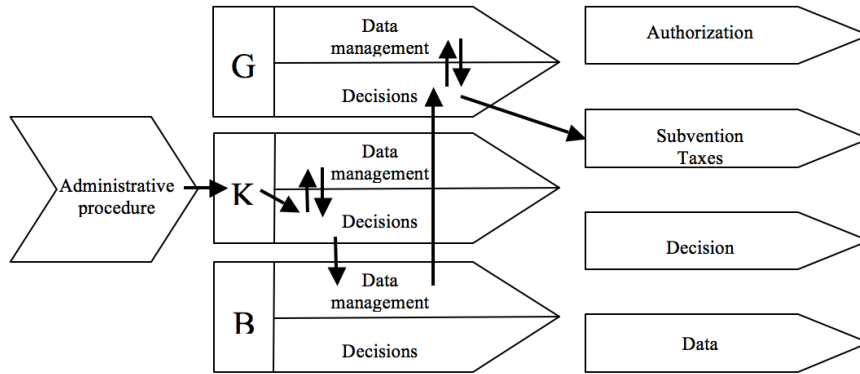
Figure 4: Ilustration of a *complex process* into the meta-processes

5 The Matrix Cartography

Based on the four outputs identified in the meta-process of the administration we pro-
pose to build an alternative cartography, in the form of a matrix. Thereby the identified
outputs of the meta-process serve as column headers, whereas the row headers have been
taken from the E-Government Referenzmodell Kantone, a former eCH best practice
[Bo10][2]. The resulting matrix is shown in figure 5.

		01 Authorization	02 Subvention, Taxes	03 Decision	04 Data management
01	Work				
02	Construction				
03	Formation				
04	Foreign relations				
05	Justice				
06	Social				
07	Democracy				
08	Culture				
09	Agriculture				
10	Security				
11	Taxes				
12	Environment				
13	Health				
14	Economy				
15	Mobility				

Figure 5: Matrix cartography

In the following we argue that this matrix cartography is able to fulfill all requirements
needed by a service cartography and also avoids weaknesses of the solution proposed in
eCH-0145.

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[2] Note that this document is not valid anymore.

As pointed out above the current structure of eCH-0145 is too large, making it hard to use and train people. In contrast to the 230 missions in eCH-0145, the matrix cartography only has 60 cells and in reality only 19 constituent elements that need to be understood and remembered.

Another criticism of eCH-0145 was that the clustering is not unique and sometimes the assignment of a service to a particular mission is arguable. The matrix cartography is clearer in its classification, as:

1. The definitions of the four different outputs of the meta-process allow a clear classification regarding the column a service should be assigned to.

2. From our field study for the eCH-0145 in collaboration with the canton of Aargau, we have learned, as mentioned above, that the assignment to service groups was more reliable than the assignment to a concrete mission, which could deviate. The matrix cartography has in its rows a coarse-grained structure, which is comparable to the mission fields of the eCH-0145, which will allow a better assignment of a service to a particular row in the matrix.

Thus, taking these arguments, we postulate that the classification precision of the matrix cartography will be higher, if done by different persons.

The structure of the eCH-0145 is composed of silos, ignoring the transversal characteristic of processes. The matrix cartography acknowledges the existence of the relations between services, in the form of *complex processes*.

It allows illustrating and visualizing complex processes within its structure, as shown in figure 6.

	01 Authorization	02 Subvention, Taxes	03 Decision	04 Data management
01 Work				
02 Construction				
03 Formation				
04 Foreign Relations				
05 Justice				
06 Social				
07 Democracy				
08 Culture				
09 Agriculture				
10 Security				
11 Taxes				
12 Environment				
13 Health				
14 Economy				
15 Mobility				

Figure 6: Ilustration of a complex process into the matrix cartography

Also the matrix cartography can be used for all federal levels, by adding a third dimension for the federal level. The resulting 3-dimensional structure is sketched in figure 7.

5.1 Critical review of the matrix cartography

The development effort for the matrix cartography was larger than the one for the development of the eCH-0145, as the information from the accounting plan reduced the development effort for eCH-0145 dramatically.

At the moment we have indicators that the matrix cartography is able to offer an effective and also efficient way to map services. At the moment we still were not able to provide a second field study, as it requires a significant effort in the public administration. Also comparing afterwards the results of the mappings is a challenging process.
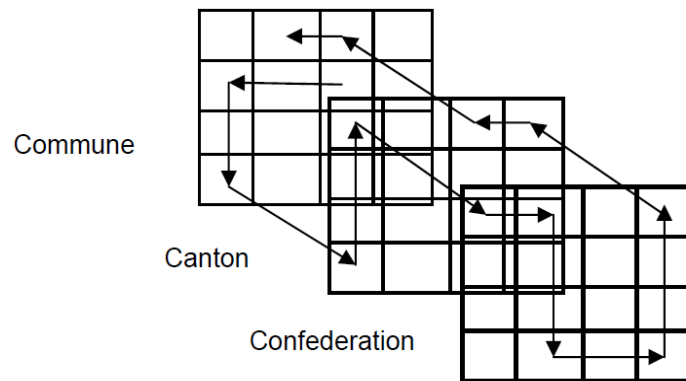

Figure 7: Example of a complex process through multiple federal levels

Up to now, we have been able to perform a pre-test, in which we mapped the Swiss service repository [De12] into the cartography. Thereby we were able to make the following observations:

- 356 out of 366 fitted in the matrix cartography. The ten remaining were arguably not E-Government services, e.g. muschroom control

- 150 services have been labeled as *authorization services*.

- 130 services have been labeled as *data management services*.

- 46 services have been labeled as *subvention, taxes services*.

- Only 30 services have been labeled as *decision services*.

The result of our pre-test is therefore positive. Note that also in this cartography we have identified two cells that contain a larger number of services: the cells *Work – Authorization* (83 services) and *Social – Data management* (51 services). Both indicate that a

particular number of different processes have been created in Switzerland, which are sometimes similar but differ in details.

Within the matrix cartography we were able to represent also the interactions between public services, thus illustrating the *chains of services*, which can facilitate the coordination process among public authorities.

To sum up our observations working with the matrix cartography we have provided evidence that it suits the need of a cartography, while avoiding the shortcomings of the approach provided in the current eCH-0145, which have been outlined above.

But we also have to state, that even if we can provide results of the matrix cartography in favor of the current approach used in the eCH-0145 it will be hard to implement it in the public administration. The uptake of an approach based on already existing guidelines and standards as the MCH2 allows an easier adoption in the administration.

6 Conclusion

In this paper we have outlined the need for a cartography of services provided by the public administration to make them easier to access and manage process repositories. We have presented the results of joint efforts providing a suitable cartography for the Swiss administration, which has lead to the eCH-0145 cartography. The eCH-0145 is based on an already used accounting scheme and therefore allows mapping processes and financial data. Within a proof-of-concept performed together with a cantonal administration we were able to prove its usefulness, but on the other hand identified some shortcomings of the approach. Therefore we have, based on a literature research, developed a meta-process for the Swiss e-Government. Based upon this meta-process we defined the matrix cartography and gave evidence of is applicability and that it avoids the shortcomings identified in previous work.

As outlined above we are still missing a proof-of-concept for the matrix cartography as we have done for the eCH-0145 in collaboration with an administration. This is an important aspect we want to perform in our future work. Moreover, the matrix cartography allows illustrating the linkage of services within the administration. But, in contrast to the eCH-0145 it does not allow to link processes and financial data. Therefore we want to explore, if we can provide this linking, too, by adding a fourth dimension to the matrix cartography.

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