A VALUE NETWORK ANALYSIS OF AUTOMATED ACCESS TO E-GOVERNMENT SERVICES

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Abstract

This research maps out the value network of collaboration enabling automated access to e-government services, motivated by the dissemination efforts of the EU-funded Access-eGov project. The main contribution of this article is the stepwise development of a value map which highlights the exchange of tangible and intangible deliverables and an initial value network analysis based on two different scenarios of technology choice. Results are expected to help decision makers in the participating institutions to direct their investments, and to help policy makers considering options for introducing new (public or private) actors to the collaboration network. However, value network analysis in e-government is only at the beginning, and further research should collect more empirical data, focus on reusing existing e-government assets, quantify the value exchanges, and bring value network analysis closer to decision making in governmental practice.

1. Introduction

Providing a portfolio of e-government services increasingly requires a collaborative effort. The computer-supported service delivery from the responsible public administration (PA) to citizens or businesses remains at the core of e-government. However, the integration effort required to provide a one-stop government involves many more actors: for example, backend integration among PAs, provision of directories and responsibility finders, brokerage of PA services, building and maintaining an appropriate IT infrastructure, developing and disseminating standards. All of these are essential success factors which can only be achieved through a network of actors who are willing and able to contribute in a shared framework of mutual collaboration. In principle, the need for collaboration is acknowledged by all actors involved. However, in many cases it remains unclear why, when and how a single institution should engage in activities that might contribute to improving the overall quality of service delivery, but have an uncertain return for that particular institution.

For example, recent advancements in e-government have enabled citizens and businesses to access PA services on-line. However, this is mostly limited to obtaining service information, with only little support for personalization and service activation, and without integration. Now efforts are under way to close this gap by providing computer- and internet-based solutions aiming to automate most (if not all) aspects of service access, along with a considerably higher degree of personalization. *Automated* access allows software agents to locate, access, and combine information and services in a way that is meaningful to a human user. The key to automated access

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are formalized service descriptions and the functionality that can be triggered from interpreting these descriptions. Thus, advances in automated access rely on increased value creation on behalf of the service provider *before* service execution – which has an impact on the exchange of values among the actors involved. E.g. in Germany a number of ongoing projects aim for significant improvements of automated access to e-government services:

- *Behördenfinder Deutschland* (a responsibility finder for German administrations)[2]: this project strives to offer citizens, business users as well as call-center agents (the latter are operating the "115" service number) unified access to service information through mediating access to existing responsibility finders at all levels, i.e. local, state and national. It uses a registry-approach based on a nation-wide catalogue of services. Existing responsibility finders are manually registered in a central registry. Based on entering location and one or more keywords, a list of links to local responsibility finders with the relevant service information is provided.
- *EC service directive*: the directive calls for a "point of single contact" primarily serving commercial service providers. Such "point of single contact" (still subject to discussion in many of the member states: cf. [12]) is expected not only to provide service information but also to serve as a mediator able to except documents on behalf of an administrative service provider and able to initiate services on behalf of the service consumer (the commercial service provider).
- *Access-eGov*: this project [3, 4] aims at one-stop e-government based on unified access to government services, embracing access to service information, service activation and service integration. This kind of advanced automation requires annotation of services covering service information, service interaction and interoperation properties. In the pilot projects of 2007/08 information consumers in Schlewsig-Holstein used a Web-based interface for service identification, activation and integration; additionally fully automated access to machine-readable service descriptions is made available via a Web-service. The supporting infrastructure comprises components for mediation, reasoning and security, among others.

While experts are debating the best technical solutions for the above requirements, it is important to note that all of these solutions require significant contributions from independent actors (mainly PAs on all levels) that will engage only on the basis of a reasonable cost-benefit analysis and an outcome in their favor. And feedback from our pilot projects reveals that PAs are reluctant to put in a lot of effort and other resources as long as the benefit for the single institution remains marginal or uncertain. In order to facilitate solutions which are of mutual benefit this research seeks to analyze the value network of the actors involved and therefore asks: What are or what could be the mutual value propositions of the actors who are collaborating to enable automated access to e-government services? How does a certain technology choice impact the relations among the collaborators and the overall productivity of the value network? Answers to these questions are expected to help decision makers directing the investments of their institutions, and it also will help policy makers with allocation of resources and with considering options for introducing new (public or private) actors to the collaboration network.

The research approach follows the value network analysis as developed by Verna Allee [1, 2]. The main contribution of this article is (a) the step-by-step mapping of the value network which highlights the exchange of values in the context of the provision of access to e-government services and (b) an initial value network analysis based on two different scenarios of technology choice. The research is motivated by the dissemination efforts of the EU-funded Access-eGov project, using the expected results from this project as the basis for one of the scenarios. However, in this article we

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[2] See http://www.deutschland-online.de/DOL_en_Internet/broker.jsp?uMen=e1a071d6-f2a2-114f-bf1b-1ac0c2f214a8; one of the authors regularly participates in the Behördenfinder working group meetings.

do not claim to provide a complete and accurate analysis, but rather seek to demonstrate the feasibility and benefit of value network analysis for shaping the future of e-government.

The remainder of the paper is structured as follows: next, we review previous efforts to shed light on e-government value networks and justify our selected approach. In the third section we develop step-by-step a value network map as the prerequisite for further analysis. In the forth section we then conduct an initial value network analysis on two scenarios of technology choice. Finally, we conclude with practical implications, limitations and outlook to future research.

2. Understanding e-Government Value Networks

Achieving an acceptable balance of giving and taking is driving the value exchange not only among business units and partners. Similarly, PAs become aware of their spending on IT and related efforts in relation to the returned value. Some research has focused on cost-benefit analysis related to PAs' IT investments (e.g. [16]), others try to apply the concept of business model to PAs (e.g. [11, 5] and highlight the linkage to citizens, businesses and other (specialized) PAs within an "e-governmental value chain" [15] or "public sector value chain" [10]. However, e-government interoperation and integration entail new organizational alliances of various types (cf. [14]) which leads to the need of rethinking the institutional strategic instruments and finding new approaches of strategic reflections of value production and exchange. As in e-business, we need to "untangle the value web": Cartwright and Oliver [6] stated that "the key to value creation in e-commerce lies in understanding the significance of network relationships" and argued (among others) that a value chain analysis based on Porter's approach alone cannot sufficiently explain the value exchanges among business partners. For example, if one institution realizes that its own IT-related investments have even greater value for other actors in the same domain than itself, then this is a reason to re-assess the institution's value production strategy in the area of information systems.

Certainly, value production in public administration is governed by different aims and mechanisms (compared to enterprises), and current practices of cost accounting in PAs do not allow simply using the same instruments as in enterprises. But with tight financial budgets and always limited resources, PAs are increasingly under pressure to justify how IT-related spending is leading to resource efficiency gains and/or improved service quality. Especially small municipalities are reluctant to engage in wide-spanning projects because they find it difficult to identify a reasonable return for their efforts while witnessing other actors harvesting the benefits. For example, building and maintaining a central e-government service directory more often than not requires substantial effort from local PAs whereas the benefit at the local level remains at least uncertain.

For information systems planning, Zarvić et al. ([18], p. 118) point out the underlying problem that each actor in a value web is profit-and-loss responsible:

> Any actor will only participate if it expects this participation to be profitable. Each actor will make this decision for itself, but needs sufficient information about the network in order to enter negotiations with the other potential participants. This information must include information about who delivers which service to whom, and what is provided in return for this.

Recently e-government research has started to pick up the issue. For example, Wolf and Krcmar [17] employ the idea of e-government value webs to understand business-to-government relations in order to inform a systematic needs-driven design approach. However, no research is available that analyzes mutual value propositions in order to provide investment decision support to the actors collaborating in an e-government network.

For this reason this research is exploratory, and the first step is to select an appropriate methodology for analyzing value networks or value webs in e-government (according to [1] the two terms can be used synonymously). In the literature several concepts have been proposed to conceptualize the value network (mostly cited from [13, 7]) but these proposals are partly contradictory and have not led to a consensus in the research community. In our research we adopt the approach introduced by Verna Allee [1, 2] according to which a value network can be seen as "any set of roles and interactions in which people engage in both tangible and intangible exchanges to achieve economic or social good" ([2], p. 6). Tangible exchanges are defined as contractual transactions whereas intangibles are non-contractually committed values of exchange. This distinction is especially important for understanding e-government settings because contractual relations among collaborating PAs are much less developed compared to business networks. Our choice of this methodology is due to the following advantages:

- Large scope of applicability ("Virtually any organization can be understood as a value network. Yes, any organization, including government agencies and non-profits." ([1], p. 5))
- Focus on roles related to actors and activities (which allows for deriving recommendations for actors how to engage in collaboration)
- Detailed analysis of the relationships involving exchange of tangible and intangible assets and how they contribute to the overall value creation
- Mature approach including detailed value network mapping and analysis method

In the following section we start applying this approach to untangle the value exchange when providing automated access to e-government services.

3. A Value Network Map for Providing Access to e-Government Services

To conduct a value network analysis the mapping of the value network is a prerequisite. Elements of the value network map are as follows ([2], p. 14):

> (1) *Roles* are played by real people or participants in the network who provide contributions and carry out functions. Participants have the power to initiate action, engage in interactions, add value, and make decisions. They can be individuals; small groups or teams; business units, whole organisations; collectives, such as business webs or industry groups; communities; or even nation states.
> (2) *Transactions*, or activities, originate with one participant and end with another. The arrow is a directional link that represents movement and denotes the direction of what passes between two roles. Solid lines are formal contract exchanges around product and revenue, while the dashed lines depict the intangible flows of market information and benefits.
> (3) *Deliverables* are the actual 'things' that move from one role to another. A deliverable can be physical (e.g. a document or a table) or it can be non-physical (e.g. a message or request that is only delivered verbally). It can also be a specific type of knowledge, expertise, advice, or information about something, or a favor or benefit that is bestowed upon the recipient.

We follow the above instructions to map several stages and variations of providing access to e-government services. Note that, although value can be offered by any role on any level, it is only when that value is accepted or validated by another role in the network that the value conversion is complete. This condition limits considerably the choice of what should be reasonably included in the map. However, the identification of roles, transactions and deliverables still leaves much freedom to the analyst. Since this research is explorative, the maps provided here should be considered "prototypes", i.e. developed quickly and inexpensively for demonstration purposes. They represent mainly the view of the researchers after several years of working in the field. Such value network maps can be developed in much more reliable fashion e.g. through a series of well-documented workshops with the stakeholders involved. However, we refrained from such effort at

this point of time because we first seek to explore (a) the feasibility of the approach in the given domain and (b) the usefulness for understanding value networks *prior* to technology dissemination.

The core of the proposed value network mapping is the service relation between PA and citizen (or businesses, or even other PAs). The role of the PA is restricted to being responsible for providing the service to the requesting citizen according to competence, region or other defined criteria. Note that the mapping itself (see *figure 1*) highlights the abstract roles which can be instantiated by a multiplicity of actual actors. Tangible deliverables are related to the specific service delivered (here only denoted as placeholder "admin service") and include also personal data of the requester and (in many cases) the collection of service fees. Intangibles may comprise the PA's provision of personalized care and sense of community which in return usually has a positive impact on loyalty towards the PA. Again, we do not claim that the depicted transactions and deliverables are complete and in all cases accurate. Rather we want to demonstrate how this approach can be used to make the exchange of important – possibly strategic – values negotiable through visualization.

As PAs engage in e-government they often form a contractual revenue-based relationship with external IT providers and/or IT service providers for obtaining and using e-government applications including IT infrastructure and support. Even if external IT providers are not legally bound by contracts, the relation with the PA's internal IT function tends to be more explicit and increasingly formalized. Significant intangibles include the successful orientation of the IT provider towards the needs of the PA, and the IT provider receives important information about trends in PA service delivery and feedback about the success of the IT provider's solution. With the help of the IT provider the PA extends its value proposition towards its clients, e.g. by offering multi-channel access to its services.
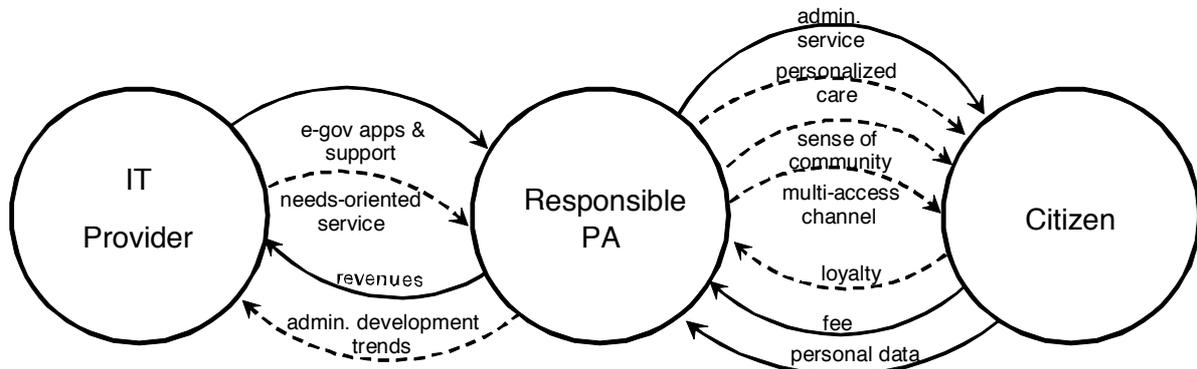

Figure 1. Core relation between PA and citizen (or business) and outsourcing of the IT function

The next stage of e-government development is captured by the vision of a one-stop government. E-government portals are developed to enable PA service clients accessing multiple services (provided by multiple PAs) through a single point of access, at the core of which is the provision of e-government service directories (*figure 2*). The directory provider disseminates the information architecture of the directory to the PAs and receives structured service descriptions in return. As we will discuss below (section 4), the form of these service description and the extent to which they are machine-readable make a difference to the balance of who produces the value and who is able to harvest the benefits. To the service requester (i.e. the citizen or business) the directory provider delivers access information which may have various degrees of personalization (minimal: identification of appropriate service and responsible PA to serve the need of the requester). Intangibles include the recognition of the PA and its services by the directory provider, and giving the service requester an image of (hopefully) successful one-stop service which in return may lead to trust and loyalty regarding the use of this directory.

There are service directory providers on local, regional, national and international level. In some cases we find close collaboration among these providers up to the extent that, for example, the directory is provided for local use by simply mirroring the functionality of the next higher level. However, more often than not these directories follow different strategies resulting in significant variations concerning scope and underlying information architecture. For this reason the issue of standardization has moved into focus, and in many areas (mostly on national level) we do find the task of standards development and dissemination assigned to a specific governmental unit. For the directory providers these standard providers may develop and issue binding information architectures for service descriptions and catalogues and/or controlled vocabularies. Usually these standards are built on a certain interpretation of e-government strategy which may not be in line with the strategy of the directory providers, who are expected to adopt the standard. The success of the standardization body relies to a great extent on the acceptance by the multiplicity of PAs; otherwise collaboration becomes quite difficult and the overall value production remains sluggish.

It should be noted that with every new role, transaction and deliverable introduced to the collaboration, prior relations may be impacted. For example, the citizens' experience with one-stop government efforts may change the loyalty (and sense of belonging) towards the responsible PA, and standard providers affect the relation between PAs and directory providers.
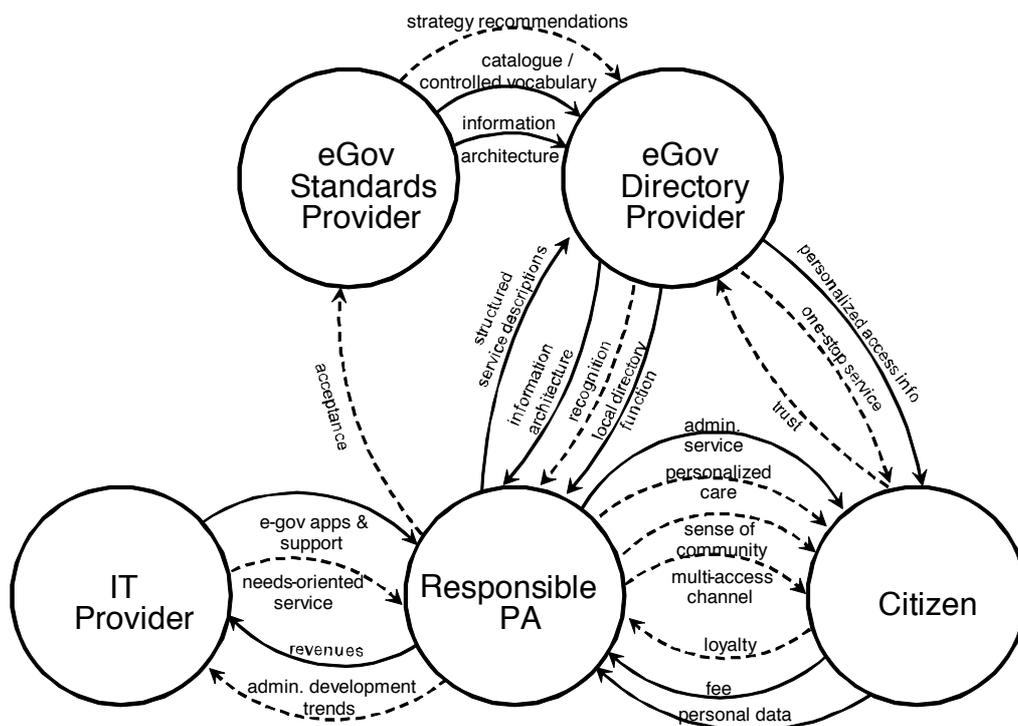

Figure 2. Value network mapping with e-government service directory and standards provider

So far we aimed at mapping a generic value network for access to e-government services which can be used to analyze factual collaboration in certain areas. Thus, the above maps are only blueprints which need to be validated and adapted according to localized strategic analysis and/or further empirical research. For this purpose additional actors might be relevant, such as policy makers and other top decision makers (providing legal frameworks and resources), or researchers (providing methodologies, prototypes, recommendations). In the next section we will use the above mapping approach to analyze two scenarios of technology choice which both aim at automating the access to e-government services. Our value network analysis ultimately aims at analyzing how a certain

technology choice is likely to impact the relations among the collaborators and the overall productivity of the value network.

4. The Potential of Value Network Analysis: Technology Choices for Automated Access to e-Government Services

The future of access to e-government services depends largely on the technological and organizational choices forming e-government infrastructures which allow for certain types of applications while restricting others. In this section we extend our value network map to outline collaboration for automated access to e-government services and start a value network analysis to identify the impact of technology choices on value relations. The key to automated access are formalized service descriptions and the functionality that can be triggered from interpreting these descriptions. Therefore, we extend our value network by including the role of a service description editor as well as a service broker, the latter representing a provider of agents which seek for service access (i.e. identification, activation and integration) and which may provide access to information and services even outside the scope of the value network in focus (*figure 3*; for simplicity some actors are suppressed).
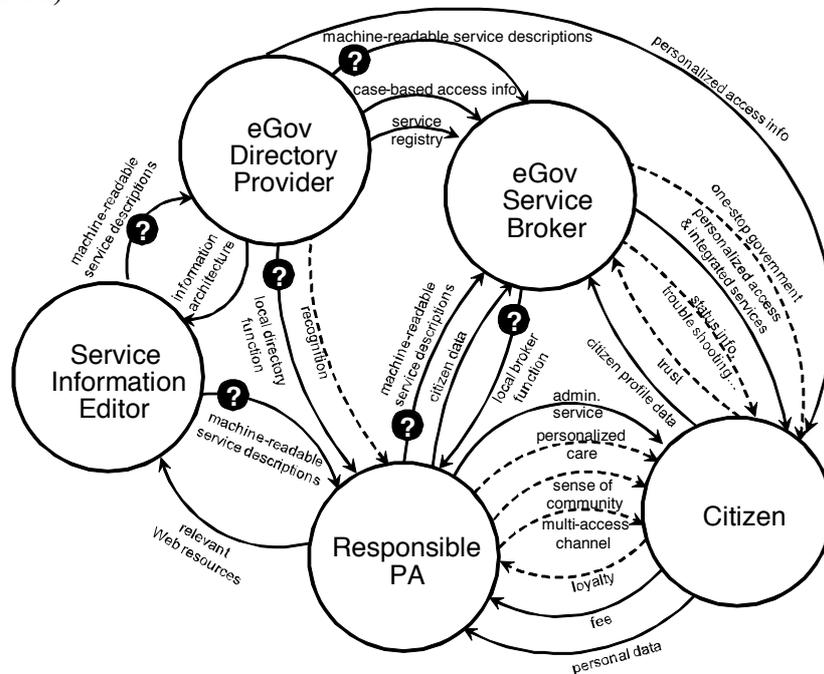

Figure 3. Value exchanges in collaboration for automated access to e-government services

For analyzing the overall pattern of exchanges and value creation it is essential to follow the flow of the machine-readable service descriptions. Since it needs considerable effort to produce and maintain these descriptions (but the beneficiaries are elsewhere in the network) we need to ask: Will the role of service description editor be performed by an institution in its own right? (If yes, who will finance it?) Or on behalf and financed by each responsible PA? (If yes, what value does the PA receive?) Or on behalf and financed by directories? (If yes, how do they obtain revenue?)

For further analysis we briefly contrast two scenarios each representing technology paths that could be followed during design and implementation (e.g. in the projects mentioned in the introduction): 1) Access through centralized information systems based on service descriptions stored in central information systems, and 2) access through Semantic Web applications based on machine-readable service descriptions locally stored at each PA's site. The following *table 1* highlights the differences of specific scenario aspects.

Characteristics of possible access scenarios	Scenario 1: Access through centralized information system	Scenario 2: Access through Semantic Web based application
e-Government access vision	information, activation (if feasible)	information, activation, and integration
Required format of service description	format according to schema of information system	formalized according to predefined ontologies
Required IT infrastructure at local PA	tools to enter or transfer service descriptions into central database	tools to create and openly provide formal semantic descriptions
Required standards	standard for service description as well as exchange formats of service descriptions	standards for service descriptions as well as universal machine-readability of service descriptions
Intrinsic benefit for local PA	none (must be externally provided)	full control over service descriptions at any time
Required effort from local PA	enter or transfer service descriptions into central database	create and maintain formalized service descriptions locally

Table 1. Characteristics of possible scenarios for providing access to e-government services

Analyzing the two scenarios, it is likely that different transactions and deliverables will emerge in each case (the question marks in *figure 3* highlight those relations that may differ between the two scenarios). If access is channeled through centralized information systems (scenario 1), service descriptions will have to be delivered primarily to the directories – and in the worst case each interested directory will request (if not impose) its own specific information architecture for producing these descriptions. If the responsible PAs provide these descriptions, they expect in return at least a full directory function for all citizens and businesses they are responsible for (preferably integrated in their local infrastructure) in order to maintain their value relations with their clientele. However, any service broker seeking to automatically interact with specific PAs is likely to face significant barriers: an agent may find all service descriptions at the directory in focus, but the directory's description is not designed to be complete or not standardized for actually activating the PAs' services and integrating results into a process of service management. For this reason, the service broker must consult the PAs directly, i.e. the PAs are challenged to additionally maintain their own machine-readable service descriptions.

In case access is channeled through Semantic Web based applications (scenario 2), the upfront effort for producing and maintaining service descriptions is higher than compared to scenario 1, because standards for describing services as well as for universal (i.e. ontology-based) machine-readability of service descriptions must be provided and applied. However, this would have an impact on value input and value creation by other actors and lead to a much higher flexibility in value exchange. If the responsible PAs invest in these descriptions, the generated value will remain with them, offering multiple options: it is then the task of each directory to automatically obtain and transform the content of the ontology-based service descriptions into its own specific information architectures, and the same applies to any service broker when accessing the directories (for service identification) and the PAs (for activation and integration). Since the whole network operates on a higher level of technical standardization, the transactional costs of interoperation and providing automated value-added functionality are lower for everyone involved. In fact this would lower the barriers for new actors to enter the collaboration within the given area (e.g. for new private business providing service brokerage) or from outside (from other regions, countries) in order to exchange information and extend service management processes.

Reconsidering the initially mentioned German projects, the *Behördenfinder* relies on a standard catalogue of services ("LeiKa") but does not (yet) provide machine-readable service descriptions nor service broker functionality. Local administrations are left with defining and maintaining a mapping from the standard catalogue to their local responsibility finders. In need of a uniform user interface the *D115* call centre project has additionally defined an XML-based data interchange

format, requiring participating administrations to transform and upload their data into a central database. However, if the *Behördenfinder* would have been realized using machine-readable service descriptions, then these descriptions could now be used by both the *D115* project as well as the implementation of the *EU service directive*. But because of uncertain returns, none of the involved actors ventured to spend the required initial effort, i.e. designing and disseminating standards for machine-readable service descriptions (using e.g. RDF or OWL) as well as upgrading the local responsibility finders to produce machine-readable service descriptions according to theses standards. The *Access-eGov* project has built on semantic technologies from the start and allows local administrations to provide their machine-readable service descriptions through a Web-based annotation tool (no IT changes required, but double effort on maintaining service descriptions) or through systems upgrades in order to provide service descriptions as WSMO fragments. Collecting the descriptions in one registry, the *Access-eGov* still leans towards a centralized approach. However, automated access is enabled through a Web-based user interface ("personal assistant"), through a Web-Service as WSMO-fragments, and through a Web-Service as linked RDF data, thus allowing for free decentralized reuse of the descriptions. Compared to the other projects, the technology choice made by *Access-eGov* seems to enable a greater variety of options and future collaboration, but the technology choice does certainly not relieve from standardizing the collaborative information architecture on the basis of which the informational needs of e-government users are to be served.

5. Conclusion and Future Research

In this article we demonstrated that the suggested approach to value network analysis is feasible and can be used to evaluate an e-government ecosystem as a whole (e.g. from the perspective of policy makers) or to assess the transaction-based value relations from the perspective of a single actor trying to optimize its role-fulfillment and related IT investments. For investigating specific actor relationships in certain areas the provided value network mappings can be used as templates for a jump-start value network analysis. However, the research presented here certainly has limitations: we have built our mapping and analysis on a number of assumptions and scenarios which are experience-based but nevertheless remain non-validated within this article; so far we did not investigate issues of scale such as the number of collaborators with similar roles which certainly has an impact on the individual value exchange as well as on the overall value production (e.g. investments in Semantic Web based solutions may only pay off with a large number of information consumers). And most significantly, we did not yet complete what according to Allee ([2], p. 14) a value network analysis (beyond the mapping) should deliver:

> (1) *Exchange analysis* – What is the overall pattern of exchanges and value creation in the system as a whole? How healthy is the network and how well is it converting value?
> (2) *Impact analysis* – What impact does each value input have on the roles involved in terms of value realization?
> (3) *Value creation analysis* – What is the best way to create, extend, and leverage value, either through adding value, extending value to other roles, or converting one type of value to another?

To some extent we have discussed the exchange analysis, but further research is needed to

- empirically study existing e-government collaborations in which the roles depicted as templates can be analyzed as performed by specific (designated) actors in the field and actual/expected impacts can be studied from their perspective
- focus on how existing e-government assets are being reused to create the value outputs
- quantify or assign weights to the flows: e.g. Allee ([2], p. 17) suggests using a spreadsheet and scorecard approach to capture even non-monetary values

- investigate if and how decision making in governmental practice is actually ready to take value network analysis into account and how the approach can be tailored to this end (e.g. what kind and degree of qualification and quantification is appropriate for decision makers?)

As effective collaboration becomes an increasingly critical success factor in e-government, we highly recommend that research and development is accompanied by value network analysis in order to assure the optimal and sustainable value production for the intended beneficiaries. Our scenario-based analysis of providing automated access to e-government services is one example of how to use the methodology in order to make value exchange more negotiable and thus to enable PAs and others to make a more reflected choice on any given technology option. The project examples show that value network exchange analysis should not stop at looking only at the service providers, but also include the tangibles and intangibles especially in relation to citizens and businesses. Who actually seeks to deliver personalized access and integrated services, i.e. one-stop government? Should this be delivered centralized or decentralized? What should be included in a local PA's e-government portal? Our hypothesis for future research is that if the collaboration network has low transaction cost in sharing machine-readable service descriptions, there are more options for providing automated service access at a higher level as well as for taking up roles in the network according to the value proposition of the participating institutions.

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