

# Smart Cities Governance Informatability?

## Let's first understand the Atoms

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### ABSTRACT

In this paper we search for and analyze the atomic components of general governance systems and discuss whether or not they can be informed, i.e. tangibly represented within the digital realm of information systems. We draw a framework based on the theories of Downs, Jellinek, and Hohfeld and find that the therein identified atomic components cannot be informed directly, but only indirectly, due to the inherent complexity of governance. We outline pending research questions to be addressed in the future.

### Categories and Subject Descriptors

H.1.0 [Information Systems]: Models and Principles – *general*

E.0 [Data]: General

### General Terms

Design, Standardization, Theory

### Keywords

e-Governance, Informatability, Jural Eligibilities

## 1. INTRODUCTION

Amongst the manifold dimensions of the Smart City concept [1], the provision of e-governance and e-democracy features on city-level are paramount objectives. As such, Smart City research falls into the broader domain of e-governance research, whose objective is the informatization of governance to an extent where latter is assumed to become transformed by means of ICTs.

However, more than two decades since the popularization of e-governance in the public discourse, e-governance has been labeled to be “unsustainable” [2], while the rhetoric by which the main developments have been driven has been debunked to rely on myths [3]. Twenty years after the hype the question is: Why haven't ICTs transformed governance like they did credit transfer, commerce, entertainment, transport, communication? While we experienced massive flooding of heterogeneous technical artefacts

aimed at providing utility and improvement to heterogeneous government agencies and related stakeholders, no homogeneous technological foundation has yet emerged so far, which would enable sustainable transformation of the domain of government for centuries to come.

Looking beyond functional requirements of governmental stakeholders, this article aims to find which atomic “nuts and bolts” of governance can be abstracted into the digital world of informatics to serve as a foundation for a generic communicational platform for empowering, steering and supervising public domain action. Leaving visionary ideas of the use of artificial intelligence / government automation or machine-moderated policy-making deliberately aside, this article aims to contribute to following research questions:

R1: What are the atomic factors of governance?

R2: Can the atomic factors from R1 be informed?

To address R1 we shall deploy the instrument of an informed argument to elaborate an overview of knowledge on how public domain empowerment, action, and control is established. We shall restrict the exploration to timeless features of public domain action, rather than focusing on a particular epoch or government system. Question R2 shall be explored by discussing if, and how, respectively, the results from R1 can be abstracted into the digital realm by means of know technology.

Answering these questions is important to smart city context given that Smart Cities are to provide amongst others for strong participative governance of public matters on micro and macro levels of city administration. This includes the distribution of public resources, and the participation in decision-making on public domain action, in general. From adequately informed governance, added value is expected to emerge, similar to the transformational effects ICTs had on other areas of human interaction.

This article is structured as follows: section 2 provides a general overview over the problem domain of government informatability, and defines the theoretical constraints. As part of this section, we aim to drill towards the core principles and constraints of governance, addressing question R1 in section 2.1. Section 3 addresses R2 by analyzing and discussing the informatability of the outcome from R1. Section 4 concludes.

## 2. BACKGROUND

Smart City governance is sharing challenges and goals with general electronic governance objectives, with specific focus on the governance of the urban public space. With typical application scenarios and research endeavors centering on mass-scale

applicative contexts such as traffic management, urban planning, public transport, communal service provisioning, etc., crucial implications of political spaces are often marginalized and taken out of consideration in scientific and industrial research. As has been argued [2], ignoring the political implications can have severe adverse effects on the sustainability of technical artefacts, in terms of premature project failure, vendor lock-in situations, and the violation of democratic principles.

The density of population in urban spaces implies the need for laying special care on adhering to democratic principles in public domain governance, in order to prevent unnecessary tensions to emerge. Core features of democratic spaces, such as transparency, participation, and collaborative decision-making need thus to be taken into consideration when planning and developing informed governance systems.

Using concepts as defined hereinbelow, we shall in this section analyze the implications for governance informatability and search for atomic elements of governance, in order to respond to the first research question.

### **Governance**

“Governance” is a term that bears significant ambiguity, and has heterogeneous meaning in different contexts [4, Pt. I]. For sake of clarity, we shall use this term in the context of the present discussion to denote the set of all public-domain (i.e., nonmarket) social functions, including functions such as collaborative decision-making (e.g. the passing of a new law or policies), dispute resolution (the function of judges), and the empowerment and activities of authority (e.g. the many heterogeneous functions of the various levels of public administrations).

With this in mind, we shall limit our exploration of governance to the analysis of its atomic elements and shall deliberately avoid discussing humanistic implications of such. Thus, we are interested in how governance can be seen in strictly technical terms, rather than what it ought to be in order to meet expectations of various stakeholders.

### **Artefact**

We shall follow the notion of the word “artefact” as used in the domain of design science information systems research, where it refers to “*constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems)*” [5]. The artefact is thus a describable and isolatable component that can be described on its own and can be used as part of a system.

### **Informating / Informatable**

We shall use “informating” to denote the action of modeling real-world artefacts into digital representations for their use in the domain of software systems. “Informating”, correspondingly, shall denote the ability of an artefact to be informed.

“Informating” has been used already by Zuboff [6] and carried there a similar meaning. Informating something in this discussion does not imply using such artefact in an automated context, nor using it for computation; the result of informating an artefact is rather making this artefact representable in the digital realm – the so informed something *can*, but needs not, later be used for computation or automation. A scientific article obtained through the web is, in this context, an informed artefact, but has not been

automated, nor computed, despite that the process of typing, storing, downloading, and rendering it on one’s screen heavily relied on- and contained elements of both automation and computation.

## **2.1 Informating governance: a wicked problem?**

If a visual artist uses IT to craft its creations, he will use software tools, which aid him in creating informed art. This art, though rendered to the human observer in form of a picture, will in reality be a complex multidimensional set of informed strokes, their attributes, and instructions to the rendering system how to present them to the consuming presentation device. Latter might be the computer screen or the printing system, or any other consuming device that has been designed to handle the inputted set of informed entities without regard to whether or not it has been designed to adhere to their semantics as the human author of the informed art intended them to be. Scalable Vector Graphics (SVG) images for example are such that they can be seen as pictures – static, interactive, or moving, or edited as text.

Ever since in human history, man-crafted visual arts have been all about arranging material (paint, pencil strokes, fiber, etc.) to form the intended result. IT however has enabled to informate the atomic elements of which art is composed and thus transformed this domain in an unprecedented way. Production- and service-oriented commercial activities have experienced revolutionary transformation due to informatization – speed, precision and cost was radically optimized, providing added value beyond what was possible till then.

If a banker transfers funds across the ocean, the informed credits are transferred as sets of informed numbers and their attributes, which together form a system representing instructions to achieve the effect intended. Unlike the above-outlined revolution of the various fields of production, informating credits and their transfer is a legacy from our past generations – think of bank checks, telegraphic transfer, and the age-old concept of currency as such. Nevertheless, modern ICTs equally brought an unprecedented boost to the evolution of credit transfer up till the point where global transfer systems enable new experiences in travel, commerce, etc.

Informatization has brought revolutionary transformative effects to nearly all aspects of human interaction in society, often eliminating the necessity for human action in processes of production, trade, entertainment, knowledge acquisition and dissemination, etc. ...

... But what were the effects modern ICTs had on governance? The introduction of ICTs in governance, Paulin [2] argues, had no transforming effect on the domain, but rather contributed to strengthening existing patterns of conduct, leading to increasing overall cost of governance, while leaving the utility of state-delivered social functions at a stagnating level. Aside from the lack of perceivable optimization on the macro-level, looking closer at individual technologies, the approaches chosen for the construction of individual technical systems for governance have been found (ibid.) to be inappropriate due to the political nature of the domain, and the thus perpetually pending danger of unpredictable context change that renders solution-focused technical artefacts obsolete. Another consideration why systems for governance are constructed using inadequate approaches has

been offered by Lenk [7], who points at the differences between private-sector business process reengineering and the particularities of decision-making in the context of the public administration. In latter, he argues, “many decisions are made at the shopfloor level every day”, while in former processes can be structured upfront, as such executed, and hence, automated.

In trade and manufacturing global technical platforms, such as the SWIFT (intl. financial transfers) system or global distribution systems like the Amadeus computer reservations system for travel ticket reservation gave rise to whole new economies. The business of providing social functions by means of governance, on the other hand, has no such infrastructure available around which it could center its activities and from which new added value could emerge.

Focusing on public administration, which plays a major role in the governance domain as such, Lenk (ibid.) divides governance processes into three coarse categories:

- a) *recurrent and well-structured processes* (e.g. allocating kindergarten spaces or parking rights) which give little discretion to the involved;
- b) *individualized decision making*, which is determined by strong interaction between stakeholders, whereby the flow of interaction through the process is often not foreseeable in detail;
- c) *negotiation processes*, which are highly complex situations with no foreseeable structure.

Informating is possible as long as the artefact we want to informate can be abstracted in such way that its informed representation can cause real world effect. Such is possible with informed brush strokes, informed currency, informed airplane tickets, informed industrial parts, etc. In Lenk’s categories, artefacts from category “a” could easily be informed, was it not for Paulin’s [2] sustainability concerns; artefacts from that category can further be, to some extent, automated, as is such the case in modern e-government systems that automate the processing of tax returns, car registration, and similar routine governance processes. Category “b”, due to lack of structure and foreseeability, cannot be automated, but could, to some extent, be informed, provided that the object of the decision-making process would be informatable, and stages of the process could be appropriately defined – the thus informed object would be transformed according to stages of maturity of the overall process. Same could be argued for artefacts from category “c” – if e.g. the object of negotiation would be an informatable entity, the outcome of the negotiation could be an informed artefact – such as e.g. a passed law, or a signed deal.

The prevailing view amongst digital government scholars is, that the nuts and bolts of governance (predominantly: public administration) is the handling of information along processes – such is e.g. the premise of Lenk [7], Scholl & Klischewski [8], Yildiz [9], to name but a few. Such premise *per se* is not incorrect, however, from a perspective of informatability, it renders the problem of governance informating into a wicked one.

*Wicked problems*, according to Rittel [10] are such problems in science, which cannot be solved in their entirety. Science, thus, can merely “tame their growl”, or address a small part of them, rather than provide a clear explanation of their extent, or provide a solution. If governance informatization is attempted from the

premise of governance being about handling information, the objective of governance informatization becomes the aim to informate the perpetually-transforming myriads of heterogeneous artefacts which are handled by uncountable governance bureaus, institutions, and stakeholders of the system-of-systems that makes up the society. Taking the findings of Lenk [7] and Paulin [2] into consideration however, this objective would be rendered impossible to reach – governance informatization would thus become a dead end.

## 2.2 In search of the atoms<sup>1</sup>

We defined governance as the provision of nonmarket social functions in the public domain. The set of modern governance agents whose objective is to provide social functions to lesser or larger parts of the society, is so vast and complex that a concise overview of its extent and formal inter-agent relations cannot feasibly be established. Unlike pieces of visual art, at whose core lie brush strokes, which easily can be informed, or computer reservation systems whose core represent informed travel tickets and available seats, the core of governance agents is harder to determine. The question in the process of informing the core however remains the same: “*what are the informatable artefacts that need to be controlled to determine the system’s outbound behavior or representation?*”

Thus, the question is not “what do we want a system to be”, but rather, “how do we want to control it” – the ultimate objective of informing an artefact lies in the optimization of its control, in its consequent adjustability and interactivity. The informed scientific article’s added value lies in its ability to be controlled in more powerful ways than its hand-typed legacy version was decades ago. Same is true for the informed credit transfer, informed airplane ticket, or the informed industrial plant. Likewise, the key to governance informating lies in its ability to be controlled in more powerful ways, and consequently optimized, rather than in the refactoring of its internal affairs.

In governance, the content of the provided social functions is often of minor importance in comparison to the choice of individuals who deliver it. Downs [12] for example argues that the survival of individual bureaus depends on being exempt from the public’s antipathy – hence, bureaus survive for being tolerated, not for being needed or wanted. Thus provided social functions are born out of the *possibility* for their existence, which does not imply crucially a rational *need*.

Quality, cost, and other parameters of the individual functions of government are hence determined by the personal characteristics of human agents who provide them. Thus, it is the personal qualities of judges who determine the outbound performance of the court, the charisma and devotion of teachers is what determines the quality of a school’s output, the personal integrity and work ethic is what distinguishes a respectable public official from a corrupt and sluggish one, and the politician’s worldliness and experiences are what separates the statesman from the shortsighted bigwig.

Controlling behavior of governance is thus a matter of empowering individuals (or bureaus / institutions, respectively) to assume the respective status of power on all levels of governance. Giving and taking away power, as well as regulating the flow of

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<sup>1</sup> The *atomos*, (Greek for “uncuttable”), refers to elements of a system that are not further dividable [11].

public resources to a particular governance body are the core-most levers to control and adjust the social functions provided by such.

Jellinek [13] described the society as a system of subjective public rights. The core factor in this system is the jural status of the individual, which is a variable that defines the quality and extent of an individual's relation towards the society. The result is the model of a system consisting of simple and concise, yet incredibly powerful atomic relations, which determine the jural eligibilities of the individual in the relation to the society as a whole.

A third pillar for understanding the atoms of governance is provided by Hohfeld's theory of rights [14]. Hohfeld's treatise elaborates on four categories of jural relations between individuals – namely claims, liberties, authorities, and immunities.

Combining the theories of Jellinek, Hohfeld, and Downs, we can construct a generalized and timeless model of governance: Social functions which are the claimed objectives of Downs' bureaus (e.g. the court's objective to solve disputes), are provided by individuals whose jural status enables them to do so (e.g. judges whose status enables them to issue rulings), while their power (e.g. the relevance of a court's rulings), entitlement to the social position (e.g. the judge being entitled to a title, public honor, and protection), and resources required to conduct them (e.g. the court's budget as a share of the national budget), base on the constraints of Hohfeld's jural rights.

More complex systems, such as hierarchies of checks-and-balances, collaborative decision-making, voting, etc., can then be modeled by means of atomic components provided by these three pillars. Such modeling does not conflict with other views (like, e.g. the view of the systems theory), as it is not focusing on the level of the concrete systems or their intrinsic processes, but purely on the factors that enable such systems on the atomic (i.e., not further dividable) level.

By informing these atomic components, optimization of governance by means of ICTs becomes hypothetically possible. The basic vision of e-governance research, i.e. the utilization of technology to make governance better, more transparent, more accountable, more participative, etc. can thus be approached by means of a lever composed of the power to control the jural status of individuals and bureaus entrusted with social function provision. The objective of governance informatization thus shifts away from researching technology that would hopefully make existing bureaus' social functions ambiguously "better", and focuses on designing an effective lever that would enable the control over latter. The premise thus becomes that control over social functions, their quality, necessity, and cost, could be established and informed, and that based on thus informed foundation, governance transformation could occur.

### 3. INFORMATING GOVERNANCE

In previous section, atomic components that are of crucial relevance to governance were narrowed down to a system of individuals who, due to their particular position within the society, provide their individual contributions to more complex social functions. Within the academic environment for example, the quality of teaching which students experience, is determined by the quality, charisma and devotion of the teaching faculty, while the quality, charisma, and devotion of latter will depend on satisfaction with their working conditions, their career perspectives, job security, private life, etc. While no technology

will ever transform a bad teacher (or a bad judge, or a corrupt official) into a good one, technology can enable students to transform the way their academic curriculum is conducted or how their degrees are obtained.

On the atomic level, the challenge thus boils down to informing and controlling jural eligibilities, whereby each eligibility is determined by answering the "PAC<sub>T</sub>" question "*is person P eligible to action A in context C<sub>T</sub>?*", whereby context C<sub>T</sub> is the constantly evolving environment (hence "T" for time), and action A is the desired status change of someone's jural status. Pioneering research in this regard has been conducted by Paulin [15]–[18], who elaborated a theoretical model for such informatization of jural eligibilities.

Paulin's approach to making jural eligibilities computable however does not informate eligibilities in form of informed Hohfeldian relations, neither does it informate the Jellinekian jural status. Rather, the system of determining eligibilities bases on a network of registries, which store information in form of *fiat* semantics, i.e. information, which has a meaning which is not explicitly stored in the system. (Chinese characters likewise deploy *fiat* semantics, which unfold meaning based on contemporary conventions, which allows for dynamic adaptation to future extensions / modifications.) The independence of the system behavior from the semantics is what makes this system assumingly universal and applicable to hypothetically any governance relation imaginable.

The result can best be described as a blanc-slate marriage between e-government at a fully transactional-state maturity level (thus, everyone can themselves interact with the system to influence their jural status and –relations to others) [16], open government data (access to the thus stored data is enabled by design) [16], liquid-democratic empowerment and liquid-democratic rule-creation and –modification [17]. The data stored within the system is governed by regulations, which regulate under which conditions a particular person can read / write / modify a particular data field, whereby these regulations rely on constellations of existing data stored in the system in order to regulate access – thus, through properly changing the set of data stored in the system, one changes the level of access granted by the system itself. The regulations then, are themselves data stored in the system, which means that they can be, like all other data, also read / written / modified under the same principles, i.e. also access to them is regulated by the very same regulations and thus, they can be changed to globally change the regime of read-write access to the data. Latter is crucial to enable collaborative setting of regulations (such as e.g. through liquid-democratic principles), which allows a society to directly enact new regulations (or regulation changes) within the core system itself. Since access to data is regulated on its atomic level (i.e. on the level of each data field itself), a custom fine-grained-access-control system with an embedded regulation-policy change mechanism has been proposed [18] to cater for this functionality.

Both the Jellinekian jural status and the Hohfeldian jural relations between individuals are calculated from the stored data in the form of PAC<sub>T</sub> questions. What is informed in Paulin's approach, is the format of regulations, which govern access to the data, as well as the structure of the request and response messages for the interaction with the system. The proposed approach to querying data is to use existing SQL technology, which is a well-established system for creating, storing, and querying data.

The feasibility of this approach to governance informatization crucially relies on three factors – the informatability of identity, to provide non-repudiable identification towards the system, the informatability of the jural status, which is required to control one’s eligibilities towards-, and status within the society, and the informatability of collaborative decision making, which is required to control the atomic factors (the eligibilities, the status, the regulations) in a direct, collaborative manner. In below subsections we shall discuss the constraints of each of these three factors.

### 3.1 Informing identity

An informed identity is crucial for any kind of authentication towards systems for informed governance. The modern digital identity – i.e. functionality for identification, authentication, and signing, as of today is, due to manifold incompatibilities [19], a challenging topic on its own and requires further focus to reach a status in which a clear and sustainable digital representation of identity can be achieved. Informed identity is required both at the level of stored data – where a representation of it is stored as a reference to the identity-holder, as well as on the level of authenticity of communication, where the identity-holder not only non-repudially signs the PAC<sub>T</sub> statement, but does it in such way, that its identity can be retrieved from the signature.

Although digital identity is today a well-established field of research and development, applying it in giant-scale informed governance implies new challenges: How, for example, would an individual receive its digital identity? Who could it change it? What would happen, if the informed identity would become compromised? How would be the entity providing identity? And, could there be many identity-providing entities?

Aside from the question how to represent identity, further challenges lie in finding how proxies could be utilized to act on behalf of subjects. Proxies would be crucial to enable advanced services, such as when PAC<sub>T</sub> statements are routed through many complex instances, or when the requesting individual is not capable (too old / young, deceased, handicapped, etc.) to act on its own behalf.

From a point of view of its informatability, identity can be considered a successfully closed chapter. Taking the implications of its long-term, giant-scale, real-world applicability into account however, identity yet requires much attention to cover aspects which lie only partly in the domain of technology design.

### 3.2 Informing eligibilities

Determining eligibilities implies the existence of the external recipient, who knows how to interpret the response to the PAC<sub>T</sub> statement. This recipient may be a human actor, who derives the legitimacy of its real-world action from the received response. The response will be influenced by the identity of the requester and the context of the request. The identity of the requester implies (but not explicitly conveys) its jural status, which further depends on the context. The context of governance, then, is a perpetually unpredictably morphing system of environment rules and inter-stakeholder relations, which fills political and jurisdictional spaces, interflows and overflows the borders of non-tangible territories.

Most importantly however, the constraints of the context are not storable in monolithic documents, but are rather derived from a multitude of co-existing regulations, which act cascadingly (think

of the system of laws, bylaws, court cases, etc.). The individual regulation can be designed and stored as an informed document (Paulin for example does so by means of a specific XML format and a system of cascading SQL queries [18]), however it cannot be foreseen which other such documents will co-exist at a specific point in time. Furthermore, it is not possible to predict which set of regulations will apply to a concrete PAC<sub>T</sub> request, as the set of applicable regulations will be further dependent on the content of the PAC<sub>T</sub> request itself. This overall non-foreseeability of the concrete context’s details is a crucial factor why the context as a whole cannot be informed as a holistic system – the tempting idea of government as a “god class” [20], “platform” [21], or perfect “one-stop-shop” [22] thus vanishes into thin air.

Aside from the informatable structure for describing PAC<sub>T</sub> statements, constellations of stored data can be considered as ad-hoc informed artefacts. “Constellation” here denotes the relation between individual data tuples, which are stored within the relational data collection. Such constellation would for example be the relation between an identity identifier, a land parcel identifier, and an attribute denoting the identity’s entitlement to the land parcel at stake. The relation between the tuples however can only be an implied one, which again, as argued above, requires a recipient to understand its meaning. This is crucial, as the relation as such does not constitute a concrete context-immune eligibility – on the contrary: the eligibility relies on the context, which implies the extent of rights.

Controlling the context and thus the eligibilities is a matter of designing and enacting on the one hand the regulations which apply to the context, and on the other designing constellations which act as meaningful templates for PAC<sub>T</sub> requests – to answer e.g. questions such as “*is person P currently a teacher entitled to fail student S at course C?*”

### 3.3 Collaborative decision-making

Governance without collaborative decision-making is impossible to imagine – taking into account, naturally, that collaborative decision-making does not mean only direct / base-democratic decision-making, but rather refers to any kind of decisions taken by collective bodies, such as the board of directors, or any other steering committee. Few are the cases where a single man would make a public-sphere decision singlehandedly, even less a decisions that would influence the jural context.

Enabling collaborative decision-making by means of controlling eligibilities is thus a crucial prerequisite for a system of informed governance. It enables the collaborative empowerment of individuals (by creating data, which influences their jural status), the collaborative provision of funding (by, again, generating data, that entitles individuals to access public funds), as well as the collaborative control over regulations.

As demonstrated in [17], collaborative decision-making can be catered-for by means of controlling eligibilities. The guiding idea here is that a collaborative decision can be enacted provided that the context has been shaped favorably for the enactment to happen. The shaping of the context occurs for example, if a majority of members of a committee (or parliament, or voting base, or participating voters, etc.) has declared their support for the enactment at stake – a dedicated regulation which governs the enactment then can take such implicit majority into account for allowing the enactment to take place. This way collaborative decisions can be made, which in the real-world for example empower a citizen to become major of a town “elected” by the

town's residents, or the president of a shareholder company "elected" by the shareholder assembly, or professor appointed by the dean of a faculty, based on the consensus of the curia. Likewise, regulations (like real-world laws or bylaws) can be collaboratively enacted or modified.

#### 4. CONCLUSION

This article aimed at addressing two research questions: R1 was about finding the atomic factors of governance, while in R2 we were interested in whether such atomic factors can be informed.

R1 was answered by identifying *governance* as a system of providers of heterogeneous social functions, which are delivered by individual agents empowered to do so. Within this system Jellinek's concept of the *jural status* and Hohfeld's system of *jural relations* have been identified as the atomic artefacts which can be used to model hypothetically any governance system. The atomic elements thus are: the *jural status*, the *jural relation*, and the *identity*, which denotes the individual subject.

R2 revealed that from the atomic elements revealed through R1 only *identity* can be directly informed. The *jural status* and *jural relations* cannot be feasibly informed directly, due to their recursive interdependency on the *jural context*, which at the same time determines the extent of the *jural status* and *relations*, while being itself determined by their extent. We found however that potential for transforming governance by means of ICT nonetheless is provided, if indirect informing is taking into consideration, whereby the *jural status*, as well as the *jural relations* are calculated ad hoc when required.

The thus gained knowledge contributes to understanding core principles for developing sustainable core technology for governance in general, and thus including city-level governance specifically. The creation and steering of the manifold social functions within such ecosystems thus becomes comprehensibly informatable, enabling disruptive innovation beyond legacy approaches.

#### 5. REFERENCES

- [1] L. Anthopoulos and P. Fitsilis, "Using Classification and Roadmapping techniques for Smart City viability's realization," *Electron. J. E-Gov.*, vol. 11, no. 1, pp. 326–336, 2013.
- [2] A. Paulin, "Twenty Years after the Hype: Is e-Government doomed? Findings from Slovenia," *Int. J. Public Adm. Digit. Age*, vol. 2, no. 2, pp. 1–21, 2015.
- [3] V. Bekkers and V. Homburg, "The Myths of E-Government: Looking Beyond the Assumptions of a New and Better Government," *Inf. Soc.*, vol. 23, no. 5, pp. 373–382, Sep. 2007.
- [4] M. Bevir, *Key concepts in governance*. Sage, 2009.
- [5] A. R. Hevner, S. T. March, J. Park, and S. Ram, "Design Science in Information Systems Research," *Manag. Inf. Syst. Q.*, vol. 28, no. 1, p. 6, 2004.
- [6] S. Zuboff, *In the age of the smart machine : the future of work and power*. New York: Basic Books, 1988.
- [7] K. Lenk, "The nuts and bolts of administrative action in an information age," in *Public Administration in the Information Age: Revisited*, I. Snellen, M. Thaens, and W. van de Donk, Eds. Amsterdam: IOS Press, 2012, pp. 221–234.
- [8] H. J. Scholl and R. Klischewski, "E-Government Integration and Interoperability: Framing the Research Agenda," *Int. J. Public Adm.*, vol. 30, no. 8–9, pp. 889–920, Jul. 2007.
- [9] M. Yildiz, "E-government research: Reviewing the literature, limitations, and ways forward," *Gov. Inf. Q.*, vol. 24, no. 3, pp. 646–665, Jul. 2007.
- [10] C. West Churchman, "Guest Editorial: Wicked Problems," *Manag. Sci.*, vol. 14, no. 4, p. B–141–B–146, Dec. 1967.
- [11] "Ancient Atomism," *Stanford Encyclopedia of Philosophy*. 2005.
- [12] A. Downs, *Inside Bureaucracy*. Boston, Mass.: Little, Brown, 1967.
- [13] G. Jellinek, *System der subjektiven öffentlichen Rechte [System of subjective public rights]*. JCB Mohr (P. Siebeck), 1905.
- [14] W. N. Hohfeld, *Fundamental legal conceptions as applied in judicial reasoning: and other legal essays*. Yale University Press, 1923.
- [15] A. Paulin and T. Welzer, "A Universal System for Fair Non-Repudiable Certified e-Mail without a Trusted Third Party," *Comput. Secur.*, vol. 32, pp. 207–218, 2013.
- [16] A. Paulin, "Towards Self-Service Government - A Study on the Computability of Legal Eligibilities," *J. Univers. Comput. Sci.*, vol. 19, no. 12, pp. 1761–1791, Jun. 2013.
- [17] A. Paulin, "Through Liquid Democracy to Sustainable Non-Bureaucratic Government - Harnessing the Power of ICTs for a novel form of Digital Government," *EJournal EDemocracy Open Gov.*, vol. 6, no. 2, pp. 216–230, 2014.
- [18] A. Paulin, "Secure SQL Server - Enabling Secure Access to Remote Relational Data," *arXiv:1201.1081*, Jan. 2012.
- [19] A. Paulin, "Status and Outlook on Electronic Identity in Europe: The Case of Austria," in *Electronic government and electronic participation : joint proceedings of ongoing research and projects of IFIP EGOV and IFIP ePart 2012*, Kristiansand, 2012, vol. 39.
- [20] H. Dierking, "Engineering Good Government," in *Open Government - Collaboration, Transparency, and Participation in Practice*, D. Lathrop and L. Ruma, Eds. 2010, pp. 71–81.
- [21] T. O'Reilly, "Government as a Platform," in *Open Government - Collaboration, Transparency, and Participation in Practice*, D. Lathrop and L. Ruma, Eds. 2010, pp. 11–39.
- [22] M. A. Wimmer, "A European perspective towards online one-stop government: the eGOV project," *Electron. Commer. Res. Appl.*, vol. 1, no. 1, pp. 92–103, Mar. 2002.