

Towards Decentralized IT Governance in the Public Sector: a Capability-oriented Approach

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Modern public organizations undergo an important transformation becoming a part of dynamic “innovative ecosystem” where they co-create value with citizens, government, policy makers and other institutions. Information Technology plays a central role in this transformation. Getting more value from IT becomes an intrinsic part of organizational mission. Information Technology Governance (ITG) is an important instrument that ensures that the organization will succeed in its mission. Efficient yet adaptive ITG is indispensable. To respond to the increasing service demand, public organizations require resources and capacities that lay outside the organization. Co-production, engagement of citizens and partner organizations, open innovation – are some of the major challenges. Meeting these challenges, public organizations need to master new governance styles to overcome the shortcomings of hierarchical structures and centralized decision making. In this work, we define a model where we adopt the theory of *public value* in order to reason about different contexts where ITG mechanisms are proposed as *capabilities*. We distinguish between three ITG styles: centralized, federated and decentralized and thereby provide a rationale allowing public organizations to identify an ITG style that fits best to their value-creation context and corresponding capability patterns as reusable ways for implementing governance of IT.

1 Introduction

Today, technologies are emerging and evolving at an ever-increasing rate - e-Government, distance/hybrid education (e.g., MOOC), e-Health, e-Commerce are just few examples of influential applications of Information Technologies (IT) which shape strategies in both private and public sector. Getting more value from IT is an increasingly important organizational competency (Weill and Ross 2004); in this view, Information Technology Governance (ITG) is an instrument that can ensure that the organization will meet its strategic goals.

(Weill and Ross 2004) defines IT governance as a part of corporate governance, focused on *specifying the decision rights and accountability framework to encourage desirable behavior in using IT*. ITG can be persisted in an organization *as a set of organizational arrangements and patterns of authority addressing the major areas in the organizational IT* (Sambamurthy and Zmud 1999). In (De Haes and Van Grembergen 2015), the authors emphasize the importance of IT governance in the organization, *as an integral part of the corporate governance, overseeing the definition and implementation of processes, structures and relational mechanism in the organization that enable both business and IT people to execute their responsibilities in support of Business/IT alignment and the creation of business value from IT-enabled business investments*.

In this chapter, we examine IT Governance in the context of public organizations. According to (Moore 1997), strategies in public sectors are 1) focused on long-run over short; 2) attending to large issues with big impact on performance rather than small issues with impacts on productivity; 3) concentrating on ultimate ends rather than needs. Missions of public organizations are mostly associated with important social outcomes and require long-term strategies and strong commitment in all the operational areas, including IT. Whereas opportunities are limitless, resources are scarce and complexities are growing. In order to be successful in creating value from their IT, modern public organizations have to ensure: (i) continuous analysis of the aimed value, including social and political impact; (ii) continuous engagement of beneficiaries (clients, customers, citizens) into setting the objectives for the IT and evaluation of the results; (iii) continuous engagement of partner organizations (co-producers) into standard creation and use (Weill and Ross 2004), (Moore 1997), (Moore and Khagram 2004).

Meeting these requirements is challenging due to inherently hierarchical structure of public organizations and centralized decision making that also applies to their IT. According to (Mintzberg 1979), *“Centralization is the tightest means of coordinating decision making in the organization. All decisions are made by one individual, in one brain, and then implemented through direct supervision”*. Whereas efficient in closed stable environment, centralized decision making shows serious drawbacks in open environments driven by innovations. Modern public organizations need to become a part of dynamic innovative ecosystem

where *they co-create value* with citizens, government, policy makers, other public and private organizations and institutions. To succeed in their missions, *public organizations need to master governance styles that overcome the shortcomings of hierarchical structures and centralized decision making.*

Whereas centralized organizational structures have been long dominating in the past with their governance styles (Weill and Ross 2004), (Gordon 2014), organizations adopting federated and decentralized decision making are gaining attention over the last decade (Morgan 2014), (DuMoulin 2015). Decentralized style of ITG does not rely on traditional structures such as executive committees, boards and management hierarchies, but rather on a broad participation of stakeholders. Decentralization should not however be confused with anarchy that accepts neither structure nor control: modern decentralized organizations support hierarchies based on merit and experience (not on a position in an administrative ladder); *they adopt decentralized communication, coordination and control following the principles of social peer-to-peer.*

IT-enabled value creation depends strongly on the organizational context. To effectively develop its ITG structures, processes and relational mechanisms, the organizations need first to *define the context* of IT governance and to *identify the governance style* that fits best to this context. We adopt the public value approach for strategic management in public sector developed in (Moore 1997), (Moore and Khagram 2004). Public value describes the value that an organization contributes to society. For public organizations, it is the value developed for individual citizens, communities and organizations through provisioning new services and improving existing services, including IT services and services enabled by IT. Thus, we consider public value as an important concept for ITG creation. We propose to examine the following elements in order to define the ITG context: (1) *the public value* from the IT that the organization is going to produce (2) *the sources of legitimacy* and support that would authorize the organization to act and (3) *capabilities* the organization will need in order to deliver the result. We identify four context models and map these models on three ITG styles – centralized, federated and decentralized (Fig. 1).

To facilitate a value, and context-based formalization of ITG, we consider it as an *organizational capability*. In the context of business planning, it is becoming recognized as a fundamental component to describe what a core business does and, in particular, as an ability for delivering value, beneath the business strategy (Ulrich and Rosen 2011). The interest in reasoning about ITG in an organization in terms of capabilities is twofold: a) ITG capabilities can describe the value from IT and an ability for delivering this value by encouraging context-specific relevant behaviors in using IT; b) ITG capabilities support configurability of ITG structures, processes and relational mechanisms on a higher level. We distinguish between three ITG styles (centralized, federated and decentralized). These styles imply the use of different ITG capabilities. We define the corresponding *ITG capability patterns* as the regular and repetitive means for the implementation of the three ITG styles. These patterns can be used to simplify and to guide a context-specific description of ITG structures and processes. Fig. 1 presents a short

considered as an IT governance capability. We discuss the capability-driven approach in Section 2.5.

2.1 IT governance and Related Frameworks

According to the Organization for Economic Cooperation and Development (OECD), corporate governance provides the structures for determining the organizational objectives, for attaining those objectives and for monitoring performance (OECD 2015). As a part of corporate governance (Weill and Ross 2004), IT Governance is focused on the management and use of IT to achieve corporate performance goals needing to address three questions:

1. What decisions must be made to ensure effective management and use of IT?
2. Who should make these decisions?
3. How will these decisions be made and monitored?

For implementing ITG, an organization has to identify the scope of IT and the main areas/issues where decisions have to be made; it has to define decision-making structures (i.e., organizational units, specific roles, committees) responsible for making these IT decisions; it has to design and implement processes for IT decision-making and IT monitoring to ensure the desired behaviors using IT; eventually, it has to specify the mechanisms supporting the active participation of, and collaborative relationship among entities appointed to defined governance structures, and according to an organizational governance style (Weill and Ross 2004), (De Haes and Van Grembergen 2015).

Over the years, a number of frameworks have emerged, such as: ISO 38500 (ISO/IEC 38500 2015) is an international standard for corporate governance of IT at the highest level of organizations to understand and fulfill their legal, regulatory, and ethical obligations in respect of their organizations use of IT; COBIT (ISACA/COBIT 5 2012) provides a framework for governance and control process of IT with the focus of aligning it with business; IT BSC (Grembergen and De Haes 2005), where the theory of the balance scorecard is used as a performance measurement system for IT governance enabling strategies for improvement. Once an ITG framework is designed and implemented, the effectiveness of ITG can be measured based on some indicators. For example, the effectiveness of ITG can be perceived through the (increased) effectiveness and efficiency of the organizational IT, improved Biz/IT alignment, risk management etc. (De Haes and Van Grembergen 2015), (Wiedenhöft et al 2014).

In our study we focused on a single perspective of ITG, i.e. its patterns for different organizational governance styles ranging from centralized to decentralized. Not aiming to design a new framework, we ground our proposal on a well-established ITG theory of Weill and Ross provided in (Weill and Ross 2004).

2.2 IT governance Framework of Weill and Ross

Peter Weill and Jeanne W. Ross from the Center for Information Systems Research, Sloan School of Management of MIT, proposed an approach toward designing and implementing IT governance based on an extensive research and experience with a large number of organizations working in private and public sector (Weill and Ross 2004). The main concerns of their approach are the following:

IT Decision Domains: Five interrelated IT decision domains are: IT principles, IT architecture, IT infrastructure, Business application needs, IT investment and prioritization. IT principles define desirable behavior for IT professionals and users. IT architecture is an organizing logic for data application and infrastructure aiming to achieve a desired level of business and technical standardization and integration. IT infrastructure is the foundation of shared capabilities (both technical and human). Business application needs includes decisions about specific needs that directly generate value. IT investment and prioritization consist of choosing which initiatives to fund and how much to spend on them.

IT Governance Archetypes: they describe the combination of people or roles who have decision rights or who provide the input for one or several decision domains described above. Weill and Ross define six archetypes: Business Monarchy, IT Monarchy, Feudal, Federal, IT Duopoly and Anarchy. Except Anarchy, the archetypes strongly rely on the hierarchical structure of the organization (and its IT), requiring the involvement of CxO, BU leaders. They also imply that the decisions in main IT areas will be done within the organizational boundary and will not involve external stakeholders (e.g., partners, clients, government, employees). Besides the two “monarchy” archetypes that refer to a centralized organization already in their name, the three “non-monarchy” archetypes (i.e., federal, feudal, duopoly) also rely on leaders (business or IT) of the organization and do not specify further decentralization. The anarchy archetype specifies that the input will be provided or decision will be made by the business unit that owns the business process, by the project team or by the end users, supporting no structure or control. This is the reason why the anarchy archetype is rarely adopted by organizations. This corroborates with the empirical data collected by Weill and Ross and many other sources in the literature.

Implementation Mechanisms: The approach provides three categories of mechanisms to specify how the decisions made by the identified individuals (or groups) will be enacted: decision-making structures, alignment processes and communication approaches.

Decision-making structures clarify who is responsible and accountable for decisions. Examples of these structures are committees (IT project, IT security, Architecture, steering committee), executive teams, business unit leaders, IT leaders, heads of functional areas, key business process owners. Alignment processes ensure effective input to decision makers and implementation of their decisions. Examples of these processes are formal IT performance measurements, service-level agreements (SLAs), KPI, knowledge management. Communication

approaches allow for disseminating governance processes and responsibilities to concerned actors. Examples of these approaches are CIO announcements, web portals, focused groups meetings, co-location, cross-training.

The implementation mechanisms reflect and fit the governance style defined by the archetypes. Thus, not much support for decentralized decision making and open innovation is defined.

2.3 IT Governance in Public Organizations

Public organizations deliver services that can be considered as a public good, or that are established by a government policy. Whereas for private organizations, value translates into the client satisfaction, public organizations are interested in achieving social outcomes, which are not always associated with client satisfaction (e.g., law enforcement, tax collection, etc.). The client of a public or governmental organization becomes a mean to an end rather than an end in itself (as for private organizations) (Moore and Khagram 2004). In both (Weill and Ross 2004) and (Moore and Khagram 2004) the authors recognize the following challenges of public organizations that need to be addressed when designing ITG:

Measuring performance and value from IT: the value from IT does not translate into revenues or customer satisfaction. Measurement of concrete outputs and activities (e.g., a number of customers visiting a web page, a number of submitted/closed demands etc.) is often used as an alternative but inefficient. Organizations need to study and measure *social outcomes from the IT*. This measurement requires continuous communication with beneficiaries (citizens) and their engagement into both setting up the objectives for the IT as well as for evaluation of the results.

Funding and prioritization of IT programs: Funding and prioritization decisions about IT programs are challenging as they can hardly rely on performance measurement due to above. Moreover, funding decisions are often made by political power holders who may not directly benefit from the program or service. To prioritize the investments into IT infrastructure and services, the analysis of their aimed value and their beneficiaries is required.

Interoperability and partner engagement: To create and to benefit from co-production opportunities, public organizations need to develop and promote interoperability. The main challenge is how to encourage external co-producers to participate in standard creation and to invest in standard compliant systems and processes? Strong engagement with partner organization is required.

More recently, dFogIT governance framework (CIPFA and IFAC 2014) which is based on the ISO/IEC 38500 emphasized the key principles of governance in public organizations - *commitment to integrity and ethical values* and *openness and comprehensive stakeholders' engagement*; followed as well by the need for outcomes in terms of economic, social and environmental benefits, management of risks and performances, implementing good practices, etc. The work presented in (Juiz et al 2014) utilized this framework to illustrate a way to implement the

ISO/IEC 38500 standard in a public high-education sector to assess maturity of organization's IT governance, as well as to and further refine the principles of governance in the public sector as suggested in dFogIT framework. In (Janahi et al 2015) the authors have proposed a conceptual approach to the management of ITG in the public sector, where *strategic/organizational objectives*, *human resources*, *IT resources* and *processes and activities* are seen as the main concepts having well defined interconnection relations between them. When proposing our capability-oriented ITG patterns we took in the consideration both the outlined principles and the concepts as it can be well seen in section 3.2.

2.4 Organizational Structures and Decentralization

The terms centralization and decentralization often refer to the power over the decisions made in the organization. According to (Mintzberg 1979), when *all the power* for decision making rests *at a single point* in the organization - the structure should be called *centralized*; to the extent that the power is dispersed *among many entities*, the structure should be called *decentralized*.

Military organizations are typically examples of centralized organizations. They have an explicit hierarchy, with responsibilities and decision making power clearly defined and fixed for the positions within this hierarchy. Many public organizations have a hierarchical structure with federated decision making, where decisions are made by a group of individuals (a board or committee) appointed by the authority or government. This also applies to their IT.

Centralized and Federated organizations are very stable and robust but they cannot respond easily to change and are slow to act (Mintzberg 1979).

Information flow in these organizations is also an issue: once the organization grows, all the decisions cannot be understood in one center (Mintzberg 1979). People who see new opportunities and who understand what needs to be done to adapt, are not always sitting at the top of the organization according to (Morgan 2014). Following (Mintzberg 1979) and (Morgan 2014) we summarize the following reasons for decentralization in IT:

- Decision-making powers need to be shared. Power has to be placed where the knowledge is.
- Innovation through IT requires an extreme agility from organizations. Making decisions locally improves agility and reduces time needed to address the issue.
- Creative people require considerable room for maneuver. Resistance to new technologies due to the lack of understanding or fear to put at risk the existing position often comes from the center and jeopardizes new opportunities.

2.4.1. Decentralized Decision Making

A number of organizational structures supporting decentralized decision making have recently emerged and became used. These structures are often addressed as "post-modern" organizations. These organizations are often grounded on the principles of social P2P (Bauwens 2005), implementing *peer-production*, *peer-*

trust, *peer-review*, and *peer-vote* mechanisms for decentralized communication and decision making. The examples of post-modern organizations include *Collaborative Network (CN)*, *Virtual Organization*, *Coopetitions*, and *Sociocratic* organizations. They distinguish from both centrally and federally governed organizations and from anarchies.

Collaborative Network (CN) and *Virtual Organization* both refer to a group of independent business entities (or complete organizations) that share resources and skills to achieve their goals (Camarinha-Matos and Afsarmanesh 2005). *Coopetition* describes a complex relationship between two or more organizations that simultaneously are in competition and cooperate together (Bengtsson and Kock 2000).

Sociocracy is a method for governance *used by public, private, non-profit, and community organizations and associations*. It represents an alternative to the traditional organizational structure based on cybernetic principles (i.e., as a system with feedback loops) (Buck and Villines 2007). The decision-making power is distributed within the organization (Romme 2016). Three fundamental principles of sociocracy include: (1) Decisions are made when there is a consent from all participants (i.e., no objections); (2) A sociocratic organization is composed of a hierarchy of semi-autonomous circles; (3) Each circle is linked to one above and to one below via individuals acting as links functioning as full members in the decision-making of both (*double-linking*) (Endenburg 1998a), (Endenburg 1998b). Compared to a regular committee or board, a sociocratic circle is self-managed. While committee members might be appointed by an authority, individuals are elected to roles in sociocracy circles in open discussion using the same consent criteria used for other policy decisions.

Currently sociocracy is used by public, private, non-profit, and community organizations and associations. It represents an alternative to the traditional organizational structure based on hierarchy on one hand and to the flat management on the other hand. New branches that incorporate some of Endenburg's principles of sociocracy include holacracy. The examples of holacratic organizations include Sun Hydraulics, Valve, GitHub, Zappos.

Among the core principles behind the post-modern organizations are *self-organization* and *peer-to-peer (P2P)* that were extensively studied in the literature.

The idea of a process based on *self-organization* of equipotent participants was proposed in computing: Peer-to-peer is a distributed application architecture where peers make a portion of their resources, such as processing power, disk storage or network bandwidth, directly available to other network participants, without the need for central coordination by servers or stable hosts (Schollmeier 2002).

Peer-to-peer architecture was also explored by social science, where the concept of commons-based peer-production (or social production) was proposed as an alternative mode of socioeconomic production (Benkler 2006). According to this principle, a large number of people work cooperatively, in contrast to

traditional firm production, where the tasks are delegated by some central authority. (Bauwens 2005) describes P2P as “a template of human relationships”, a "relational dynamic" which is springing up throughout the social fields. The dynamics is based on free participation of equipotent partners, engaged in the production of common resources, without recourse to monetary compensation as key motivating factor. Social P2P does not deny 'authority', but only fixed forced hierarchy, and therefore accepts authority based on expertise.

Related concepts include *open innovation*. It is a paradigm that assumes that looking to advance in their technologies, organizations should use external ideas as well as internal ideas, and internal and external paths to market (Chesbrough 2003).

To conclude, we would like to illustrate organizational decentralization with examples of decisions that can be made in some of the five main IT domains defined by the IT governance framework of Weill and Ross (see section 2.2 for details).

- Examples of *IT principles* supported by a decentralized organization can include: knowledge management, technology-supported open innovation, use of open standards/ co-creation of standards, interoperability, compliance with (industry) standards.
- Examples of *IT architecture* decisions include: distributed (P2P) architecture, data integration, standard interfaces for communication, high cohesion/low coupling, SOA.
- Examples of *IT infrastructure* decisions include: use of cloud computing, grid computing; public infrastructure (e.g., the Internet, telecom networks); shared standard applications (ERP, CRM, SCM, etc.), shared standard application for communication and coordination (social networks, knowledge sharing platforms, groupware, VOIP etc.)

2.5 Capability-Driven Approach

The capability notion originates from competence-based management and military frameworks, further advancing the traditional enterprise modeling approaches *by representing organizational designs from a result-based perspective*.

From the business perspective, a capability describes what the business does that creates value for customers. It represents a design from a result-based perspective including various dimensions including organizational values, goals, processes, people, and resources. The notion has a growing presence in the current business and IT alignment frameworks starting from more business-oriented such as Business Architecture and Business Modeling, towards the alignment-oriented represented by Enterprise Architecture (EA), and Enterprise Modeling (EM). In brief, the emergence of the use of the capability notion seems having the following motivations:

(a) in the context of business planning, it is becoming recognized as a fundamental component to describe what a core business does and, in particular,

as an ability for delivering value, beneath the business strategy (Ulrich and Rosen 2011);

(b) it supports configurability of operations on a higher level than services and process, and according to changes in operational business context (Bērziša et al 2015).

Following the above, *we consider IT Governance capabilities as abilities and capacities of an organization to ensure maximum value from its IT in a given context*. We further define ITG capability patterns to provide guidelines for practical adoption of the governance styles (centralized, federated and decentralized) in public organizations.

3 ITG Capability for Public Organizations

3.1 Decentralization in IT Governance

Following (Weill and Ross 2004), we consider three distinctive IT governance styles: Centralized (C), Decentralized (D) and Federated (F).

- Centralized ITG relies on Business or IT monarchies in most of decision areas. This governance style is relevant when the high degree of standardization is required and cost-efficiency is one of the primary value sources.
- Federated ITG relies on duopolies and federal governance structures. This style can be beneficial for organizations seeking for cost-efficient use of the assets and IT-enabled innovation.
- Decentralized ITG fits to organizations focusing on innovation and time to market and with the tendency to delegate decision making from the center to local units or project teams.

Weill and Ross relate the ITG to the value an organization seeks to create from IT, but it does not provide an explicit link to the organization's environment where this value will be created. A modern public organization can be seen as a part of dynamic ecosystem, where it maintains the relationships of different nature with the other organizations and individuals (Fig.2). In order to successfully achieve its goals in this complex environment, the organization needs to master different governance styles and use them according to the *context*.

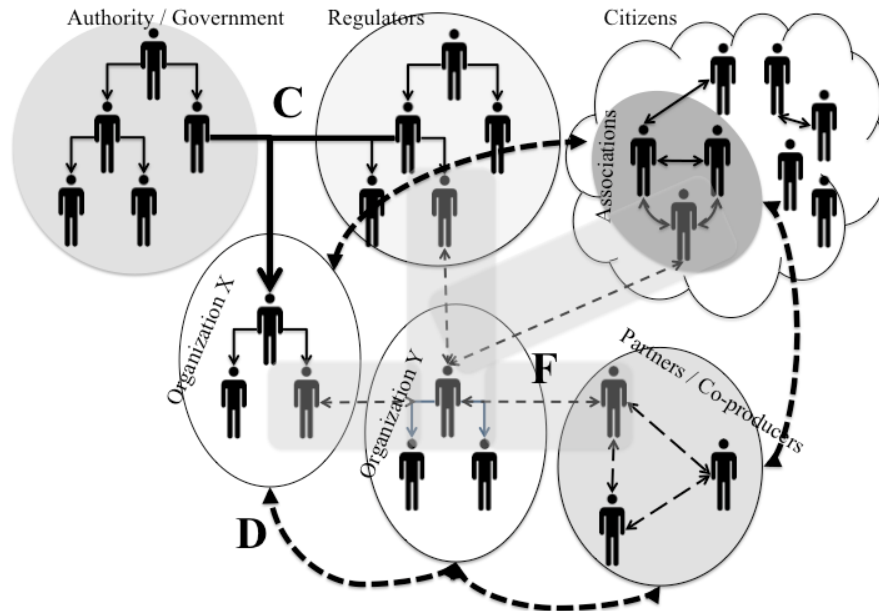


Fig. 2. Organizational ecosystem. C (centralized), D (decentralized) and F (federated) characterize the relationships between the organization and the other parts of its environment.

3.1.1 Applying the Theory of Public Value for Defining the ITG context

In order to identify the context for public organizations, we adopt the theory of Public Value proposed in (Moore and Khagram 2004) identifying three main characteristics of public organizations: *public value*, *authorizing environment providing legitimacy and support*, and *core organizational capabilities (internal and external)* required to produce this value.

Public value describes the value that an organization contributes to society. Value for the public is a result of evaluations about how basic needs of individuals, groups and the society as a whole are influenced in relationships involving the public (Meynhardt 2009). Whereas private value is associated with satisfying individual desires, public value is mostly focused on achieving social outcomes.

The Center for Technology in Government published a report, where they studied five U.S. and international governments, examining the full value of government IT investments (Cresswell et al 2006). The results of this research demonstrate that the IT investments generate public value of two distinctive types: value from improvement of internal government operations and processes (e.g., improving quality of service, cost reduction) and value from broader political and social outcomes (enabling new services, creating working places,

contributing to individual and community well-being). We generalize these findings and propose to distinguish between:

1. *Value from delivering specific benefits directly to citizens*
2. *Value from improving the organization itself as a public asset*

Each of these value types can be associated with one or multiple *value sources*: cost saving, increase in quality of service, enabling new services, and intrinsic enhancements (i.e., changing environment providing political, social, cultural impact, improving general quality of life of an individual or a group).

Legitimacy (and support). Public organizations are not free to choose their market - they are *authorized* to provide their services by their environment that comprises government, customers, employees, suppliers, local communities, citizens, policy makers, controlling organizations etc. The authorizing environment provides the organizations with legitimacy and support and may vary depending on the scope of the IT project and its aimed value. For example, public organizations can be mandated by their authorizing environment to deliver a specific service, ensuring compliance with regulations, recommendations and standards. In return, they benefit from their support (financial and legislative) while providing their services.

Required core capabilities. Public organizations need to develop and manage their *core* capabilities (functionalities) in order to deliver results. Compared to private organizations, much of capacity required to produce public value lay outside the public organization and thus not under its direct control. To succeed in their missions, public organizations need not only to develop internal capabilities controlled by the organization itself, but also to explore co-production opportunities with external partners (e.g., other public and private organizations, volunteers, associations etc.) by means of external capabilities.

We examine the three elements above (public value, legitimacy, and core capabilities) in order to define the ITG context asking the questions:

1. What is the important public value you are seeking to produce with the IT?
2. What sources of legitimacy and support authorize the agency, or wider system, to take action and provide resources to create that value?
3. What core capabilities does the agency and service provider require to deliver this result?

We propose a model (Fig. 3) that represents four different situations (value-creation contexts) for ITG in public organizations and links them to the three ITG styles (C- Centralized, D- Decentralized, and F- Federated). We define the contexts based on two parameters: type of aimed public value (horizontal axis) and type of required core capabilities (vertical axis). The four models of value creation context are depicted as four quadrants on the plane separated by the dashed lines. For each of these four context models we give an example of a value source and a source of legitimacy and support:

Context Model 1 (bottom left): IT programs aiming at improving the organization through cost saving and/or efficiency of their services (ex.: electronic registration for residence permit, marriage certificate) are receiving legitimacy and

support from authority (controlling organizations and government). Authorizing organizations also can be main clients/requestors of such programs and provide funding for them. The organization in this case has to focus on compliance with regulations and standards. It creates foundation for internal operational capabilities. Full value may comprise the increased transparency of the organization and improved reputation.

Context Model 2 (top left): IT programs aiming at improving the organization through enabling new services (ex.: on-line real time transport schedule and route planner) are receiving legitimacy and support from both authority (controlling organizations and government) and employees and external suppliers. Organization creates foundation for internal and external operational capabilities using co-production. Organization enables new capabilities both internally and externally (for community, co-producers etc.). Full value from the program can expand the organizational boundaries having an impact on society.

Required core capabilities

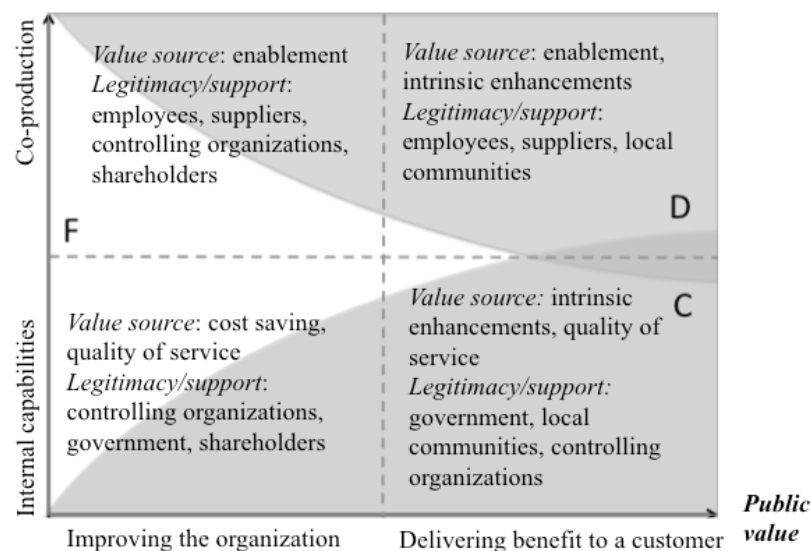


Fig. 3. A model that links the ITG context to the ITG style

Context Model 3 (top right): IT programs aiming at delivering benefits to a customer through co-creation of value with external partners (ex.: MOOC) are receiving legitimacy and support from local communities. Organization creates foundation for shared operational capabilities using co-production. Intrinsic enhancements and enabling new services for communities is the main focus.

Context Model 4 (bottom right): IT programs aiming at delivering benefits to a customer through enhancing local capabilities (ex.: eTax, FATCA) are receiving legitimacy and support from authority (controlling organizations and government).

Authorizing organizations typically are the main requestors (mandated services). Intrinsic enhancements and quality of service are the main focus.

The three ITG styles (C, D and F) correspond to the areas below, above and between the solid curves accordingly. These areas are overlapping and covering more than a single quadrant: this indicates that the same governance style can be appropriate in different context models in order to encourage some desired behavior in using IT. One can interpret the figure as follows: Context model 3 requires mostly decentralized ITG; Context model 4 requires mostly centralized ITG since high control is required and resources are provided by the authority. Context model 1 requires Centralized or Federated ITG. Context model 2 - Federated or Decentralized ITG.

Whereas Centralized and Federated ITG are widely addressed in the literature and supported by empirical study in (Weill and Ross 2004), governance arrangements, and mechanisms for Decentralized ITG are only gaining attention. As discussed in Section 2.2, the ITG framework proposed by Weill and Ross relies on (mostly) centralized governance archetypes. Considering the increasing interest of organizations in decentralized decision making, open innovation and co-creation of value, we find it justified to extend the list of governance archetypes proposed in (Weill and Ross 2004) to cover the gap between monarchy, feudal, federal and anarchy archetypes.

3.1.2 Decentralized decision making: Extending the list of governance archetypes

Public organizations benefit from stability and robustness embedded into their centralized or federated structures. However, to meet the reality of a modern society where they are operating, public organizations need to master governance styles that overcome the shortcomings of centralized decision making.

Collaboration and innovation opportunities are driving factors for modern organizations. To foster the innovation, modern public organizations need to encourage different behaviors with respect to the IT by exploiting a wide range of IT governance structures. In particular, the archetypes surmounting hierarchical structures and supporting decentralized decision making are of a great interest.

Dismantling the (fixed) hierarchies does not necessarily lead to anarchy or absolute lack of control (Bauwens 2005). We introduce a sociocracy (Endenburg 1998) governance archetype and consider that it can cover the gap between centralized (or monarchy-based) archetypes and anarchy.

In sociocracy, the inputs for the decisions can be provided by various stakeholders including project leaders, IT and domain experts, customers, employees, suppliers, local communities, representatives of controlling/regulating organizations, policy makers. Governance archetypes defined in (Weill and Ross 2004) specify the decision making rights either as *appointed* to the specific (fixed) positions in the organization (ex.: C-level executives, business process owners) or *undefined*, where all the user can do as they please (anarchy archetype). Sociocracy specifies another way, where the stakeholders are *self-appointed* or

peer-appointed (peer-voted) to provide the input or participate in the decision-making.

We consider that representatives of the controlling organizations play mostly advisory role providing an input for all the areas. The project teams, in contrast, can provide the input and make the decisions in all the areas. Partners and co-producers provide the input and can make decisions regarding IT architecture, infrastructure and business application needs. We consider that all the stakeholders can provide the input for the business application needs area and can participate in decision making regarding prioritization and funding.

3.1.3 Distributed decision making and P2P: Extending the list of governance implementation mechanisms

Following the identification of decisions and the specification of input and/or decision rights, an organization must decide on detailed decision responsibility and accountability, how alignment will occur, and how information will be communicated throughout the organization.

To support decentralized ITG arrangements, specific alignment processes and communication approaches that go beyond traditional organizational structure need to be defined. For example, responsible/accountable relations formally defined by hierarchical organizations might need to be replaced with principles of self-organization and relations based on trust and reputation. P2P provides a foundation for governance mechanisms supporting decentralized decision making.

Practical implementation of sociocracy relies on the use of technology: application for cooperation, social software, groupware, and social networks are an integrated part of it. For example, to provide the input and facilitate the decision making in the business application needs area, an organization might need to create innovation labs (Magadley and Birdi 2009), define peer-review, peer-trust, peer-voting, and crowdsourcing (Howe 2006) processes.

We consider the decentralized ITG as relying upon decentralized structures and adopting P2P principles for decision making at least for one IT area where decision should be made. Business applications and IT funding and prioritization are primary candidates. Sociocracy describes the decentralized structures and P2P provides foundation for the mechanisms. Based on the context, federal, duopoly and IT monarchy archetypes can be used for decision making regarding IT principles, architecture and infrastructure.

In the next section, we explain how an organization can design its ITG capabilities by following three generic capability patterns reflecting the centralized, federated and decentralized IT governance.

3.2 ITG Capability Patterns

The idea behind ITG capabilities is to specify what a public organization should be able to do to ensure viability and adopt its IT Governance strategies.

We propose capability as a high-level functional concept (i.e. ability and capacity, Section 2.5), ensuring a set of organizational values which in turn determine a context, as well as set of goals realized by processes and resources. We have formalized the outlined concepts and relationships in a model (Figure 4)

- *Context*: it represents the information that can be used to characterize the situational environment of a public organization. The context of an ITG capability is defined by analyzing the *public value* the organization aims to create, its sources of *legitimacy and support* and *core capabilities* (Section 3.1.1), which eventually lead to the goals to be achieved and the processes and resources to support the goals.

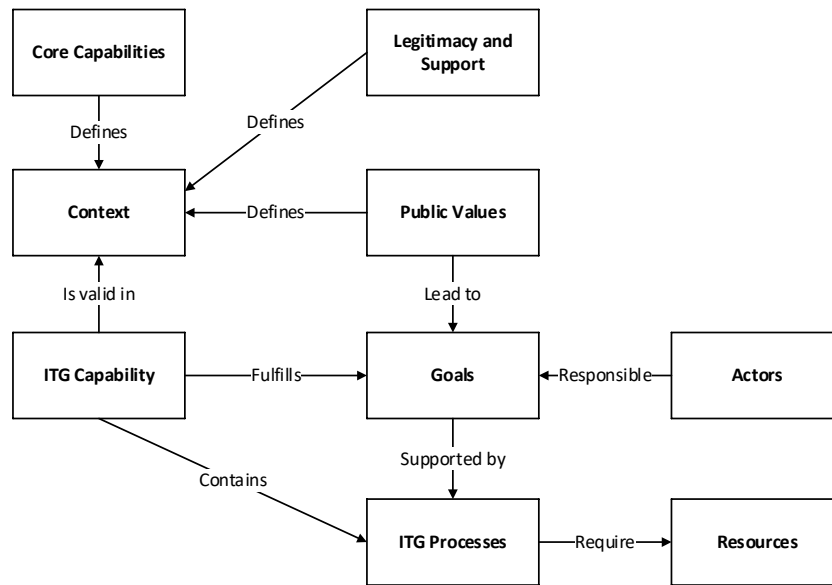


Fig. 4. A model for IT Governance using capability based on organizational values and context

- *Goal*: it is a desired state of affairs that needs to be attained to realize established value(s). Goals can be refined into sub-goals forming a goal model refining desired behaviors in using IT, such as cost-effective use of IT, or effective use of IT for growth; and effective use of IT for business flexibility.
- *Actor*: it is a person or even a part of the organization holding the responsibility for the achievement of a goal; for ITG, these actors may be organization's executives, IT decision makers, etc.
- *Process*: it is a series of actions that are performed in order to support one or more of the established goals. In the ITG domain the processes concern decision making about IT, coordination of IT processes, IT monitoring, performance management and other.

- *Resource*: When initiated, a process is perceived to engage or consume resources - people, materials, software. ITG processes rely for example on the actors involved in IT decision-making enactment and monitoring, as well as on the needed entities – technology and infrastructure supporting processes’ execution, as well as coordination and communication between involved actors.

We formalize ITG capability patterns that specify the elements from the model in Fig. 4 following centralized, federated and decentralized ITG styles. Based on a vision of its public value (i.e., improving the organization or direct delivering of benefit to a customer), sources of legitimacy and support and required core capabilities (i.e., internal or co-production), a public organization could specify the context, goals, actors, processes and resources required to define its ITG (Section 3.1).

Table 1. Capability pattern: *Centralized IT Governance, public sector*

Context	<p><i>Using IT for delivering direct benefit to a customer or to a community</i>: value sources may range from improving user experience from the existing public services, to providing new services unavailable before, and to broader impact on the society via intrinsic enhancements (e.g., improving quality of life, ecology, economic growth, sustainability)</p> <p><i>Using IT for improving the organization</i> (i.e., organizational business processes, applications, infrastructure): value comes from improving efficiency and effectiveness of the organization itself, resulting in the reputation and public opinion.</p> <p>Government, controlling organizations and policy makers are the main funding source and the main client of the program/project. They authorize the program/project and support it in a form of appropriate recommendations, laws, directives, standards Example: mobile and radio communication standards, regulations on privacy/security.</p> <p>Partner organizations can provide some capacities for “non-core” operations</p> <p>For achieving the broader social impacts, individual citizens become “a means to an end”; customer satisfaction is not always a priority.</p>
Goals	<p><i>Cost-effective use of IT; Compliance with the provided business and technology standards; High process standardization and/or high process integration; Centralized data management; Centralized change management and exception handling</i></p>
Actor	<p>IT governance structures follow monarchy, feudal, federal archetypes – the relevant actors are <i>C-level executives, Representatives from authority, Corporate IT and/or unit IT leaders, Heads of functional areas, Key business process owners</i>.</p>
Process	<p><i>IT performance measurement based on KPIs, IT portfolio management, SLAs, formal communication/coordination processes based on hierarchy (steering committees and boards).</i></p>

Resource	<i>Actors</i> (see above), <i>enterprise-wide standard solutions providing centralized reporting, Business Intelligence, ERP, CRM, SCM.</i>
ITG Capability	Organizational IT plays the role of a <i>backend</i> in the integrated value-creating system, supporting the business logic. The organization creates the foundation for its internal core capabilities.

Table 2. Capability Pattern: *Federated IT Governance, public sector*

Context	<p><i>Using IT for improving the organization:</i> value comes from improving efficiency and effectiveness of the organization itself (e.g., cost saving, improved processes, enabling new internal services), resulting in reputation and public opinion.</p> <p><i>Using IT for delivering direct benefit to a customer or to a community:</i> value sources include improving user experience from the existing services, enabling new services for citizens, enabling cooperation opportunities and partnerships for other organizations, and broader impact on the society via intrinsic enhancements.</p> <p><i>Government,</i> controlling organizations and <i>policy makers</i> are the main client of the program/project. They authorize the program/project and support it in a form of appropriate recommendations, laws, directives, standards Example: mobile and radio communication standards, regulations on privacy/security.</p> <p><i>Communities and citizens</i> indirectly evaluate the outcomes expressing their opinion about the organization as a whole.</p>
Goals	<i>Cost-effective use of IT; Effective use of IT for asset utilization; Effective use of IT for growth; High process integration; Centralized data management</i>
Actors	IT governance structures follow duopoly, feudal and federated archetypes – the relevant actors are: <i>C-level executives, Representatives from authority, Project Leaders (internal and external), IT and domain experts (internal and external), Representatives from controlling organizations</i>
Processes	<i>IT performance measurement based on KPIs, SLAs, Processes for conflict resolution between local control (at co-producers) and global control (organization and authority), Coordination between the central and local production, Semi-formal processes for communication and coordination on the horizontal level (focused groups, discussions, communities of practice) supported by technology.</i>
Resources	<i>Internal production and co-production based on shared resources (knowledge, technology, infrastructure, services); Infrastructure and solutions supporting coordination within and between levels (i.e., groupware, social networks); Standard solutions providing centralized reporting, Business Intelligence, ERP, CRM, SCM.</i>

ITG Capability	Organizational IT plays the role of a mediator (service bus), coordinating and controlling the inter-organizational processes between partners. The organization itself provides the standards to ensure coordination/communication between co-producers. It also links the co-producers with the end users (citizens).
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Table 3. Capability Pattern: *Decentralized IT Governance, public sector*

Context	<p><i>Using IT for delivering direct benefit to a community:</i> value sources may range from enabling new capabilities (co-production and cooperation opportunities, innovative ways to service delivery) to broader impact on the society via intrinsic enhancements (e.g., improving quality of life, ecology, economic growth, sustainability).</p> <p><i>Using IT for improving the organization</i> (i.e., organizational business processes, applications, infrastructure): value comes from improving communication and knowledge sharing in the organization itself and within the extended organizational environment (e.g., organizational learning, communities of practice, social networks), resulting in increased creativity, motivation and commitment of individual employees.</p> <p>Government, controlling organizations and policy makers authorize the program/project and support it in a form of appropriate recommendations, laws, directives, standards. Example: mobile and radio communication standards, regulations on privacy/security.</p> <p>In value creation, an organization cannot rely uniquely upon its internal operational capabilities (e.g., it cannot respond to the demand or it does not have required expertise). <i>Partner</i> (public and private) organizations, community, individual citizens or associations provide (external) operational capabilities and expertise required to (co)produce value (e.g., IT service providers, mobile service providers, other non-IT organizations etc.)</p> <p><i>Communities and individual citizens</i> participate in evaluation of the program/project (i.e., providing their opinion, feedback, “liking”, “sharing”, discussing, browsing, using etc) and its evolution.</p>
Goals	<i>Effective use of IT for growth and business flexibility; Distributed data management; Interoperability and (open) technology standards; Peer-production, Support for open innovation</i>
Actors	IT governance structures follow federated and sociocracy archetypes – the relevant actors are: <i>Project teams or their representatives, Representatives from controlling organizations, C-level executives, IT and domain experts</i> (internal and external).
Processes	Focus is on decentralized decision making mechanisms (P2P based) and efficient communication and collaboration processes (supported by technology). Processes include: <i>Peer-voting, Peer-trust management, Peer-review.</i>

Resources	Co-production based on <i>shared resources</i> (knowledge, technology, infrastructure, services): <i>Infrastructure and solutions supporting cooperation</i> (i.e., groupware, social networks);
ITG Capability	Organizational IT plays the role of a frontend providing the means for information, knowledge and service discovery and sharing for the stakeholders defined by the context. Organization creates foundation for internal and external core capabilities based on P2P. It promotes interoperability and supports co-creation of standards, innovation in technology (internally and externally); as well as Open innovation.

ITG capability patterns presented above provide organizations with the practical guidelines and support configurability of their ITG structures, processes and relational mechanisms on a higher level. To efficiently design and adopt ITG mechanisms, an organization needs to:

1. Define its IT governance context using the context models shown in 3
2. Define its fitting governance style (C, F or D)
3. Adapt the IT governance design (specify “more centralized” or “more decentralized” governance structures and mechanisms)
4. Enact the IT governance by instantiating the IT governance pattern (fill in values and context from; determine goals/actors and processes and resources based on the generic types from Table 1-3).

The ITG capability patterns defined above are meant to provide guidelines and facilitate the application of ITG mechanisms. Whereas some elements vary strongly between patterns, some can remain very similar. For example, the need to respect regulations or follow standards (radio, telecom, IT development etc.) can be present in all three patterns, whereas the way these regulations will be met and the compliance control can be totally different.

4 Study of the Results

Over the last few years’ higher education in Sweden was analyzed in (Zdravkovic et al 2015). The objective was to observe the alignment between the organizational structure and governance rules in use. As common, universities include a number of entities - faculties, faculty departments, and units. Nowadays, the entities are becoming more independent than before, due to geographical dislocation, decentralization of management and because of formal as well as informal communication patterns in use. Universities therefore show an obvious need to adjust governance of their IT according to the organizational structure and decision-making in place. *Providing education and conducting research activities* are two core missions where university creates (public) value. The following three cases illustrate how the ITG capability patterns from the previous section can be instantiated to support the first mission – *Education*:

Case 1: Improving education management with IT

A Swedish university delivers a standard education service to its students. IT infrastructure and systems for managing student subscription for the university, their curriculum, results are typical examples of IT investments in the university. The aimed public value from the IT in this case can be expressed as *improving the quality of educational service* as well as *intrinsic improvements* for the community (i.e., social, cultural, financial impacts are envisaged). This corresponds to the *Context Model 1 (bottom left)* in Fig. 3.

The government and high education policy makers on the country level can be considered as an authorizing environment issuing directives related to learning objectives, degrees, and quality requirements. Local communities and professionals can provide directions indicating the skills “most needed”. The university develops internal capabilities in order to create the aimed value. According to this context, *the centralized ITG* (Fig.3) is relevant.

This implies the instantiation of the centralized ITG capability pattern presented in Table 1. Here *organizational IT takes the role of a backend, supporting a more effective management of studies and the followed documentation*. As for the IT-related goals, nowadays they target a cost-effective use of IT through centralization and standardization of software platforms and centralized data management, analytics and reporting. The actors at this level are the rector and a group of high-level administration officers centrally managing activities and making decisions which are then spread to faculties and departments. This corresponds to Business monarchy archetype. The processes and the resources supporting the main service are standardized, and controlled from the top of the organization, such as IT performance measurement based on KPIs, or IT portfolio management.

Case 2: Enabling student mobility with IT

Another example illustrates the use of *federated ITG capabilities*. Universities in Sweden are actively involved in national and international programs that support mobility of undergraduate, graduate and doctoral students and faculty members: joint master programs, Erasmus exchange programs etc. The aimed public value is to improve service quality and to enable new capabilities for universities, students and communities. Co-creation of value with partners from another organizations (universities) is required in this context. To ensure comparable, compatible and coherent systems of higher education, the partners (co-producers) need to comply with Bologna Process (Wikipedia/Bologna Process 2016). This compliance requires significant changes in the organizational IT. Therefore, the sources of legitimacy and support in this context include university authorities and policy makers on the country and European level (for Bologna Process). This corresponds to the *Context Model 2 (top left)* in Fig. 3. The *federated ITG* is relevant.

This implies the instantiation of the federated ITG capability pattern (Table 2). Here *organizational IT plays the role of a mediator, coordinating and controlling the inter-organizational processes between partners*. It also links the (partner)

universities with the students. Data integration between universities and standards for data exchange are of the main interest. The actors include university international office, head of faculties, program managers, faculty members, IT department. This corresponds to duopoly and federal archetypes. The processes and the resources supporting the main service are standardized, and controlled by the European representatives and university authorities in order to ensure the compliance. Examples of processes: SLAs, formal transformation of local grades to Bologna grading systems etc.

Case 3: Personalized educational program for everybody

Our last example illustrates the use of *decentralized ITG capability*. The concept of open education (Wikipedia/Open Education 2016) describes “institutional practices and programmatic initiatives that broaden access to the learning and training traditionally offered through formal education systems”. Open education programs include distant learning, e-Learning, MOOC. Adoption of technologies and processes for developing these programs is a strategic goal for many universities.

The aimed public value is to provide a wider access to education. This is a direct service for customers. This implies an important social impact and intrinsic improvements. The source of legitimacy and support comprises communities and individual citizen willing to benefit from the program. Co-creation of capabilities is required. This corresponds to the *Context Model 3 (top right)* in Fig. 3. According to the context, we consider that the *decentralized ITG* is relevant.

This implies the instantiation of the decentralized ITG capability pattern (Table 3). Here the organizational IT can play the role of a frontend: OpenCourseWare (OCW) is an example where the courses and supporting materials created at universities and published for free via the Internet. Interoperability is the main focus. A university needs to use some open standard or co-create a standard with other universities for on-line course delivery (ex.: <https://studyinsweden.se/news/moocs-at-swedish-universities/> is a MOOC platform for Swedish HE). Organization creates foundation for internal and external operational capabilities based on P2P, e.g., peer-review, social platforms for discussions. Actors can include faculty teams creating the content and collaborating with web designers and IT experts; students, university authorities. Federal and sociocracy archetypes can be used for ITG. The processes and the resources supporting the main service are standardized. Compared to the previous example, the standards are not provided but peer-voted or co-created by the participants.

5 Conclusions

Values created by public organizations and their IT in particular, expand the boundaries of these organizations. Therefore, modern public organizations need to be seen as a part of dynamic ecosystem, where it maintains the relationships of

different nature with individuals and other organizations. To fulfill their goals, public organizations need to adapt to their context, exhibiting as consequence various behavior in using IT. In this study we proposed a value-driven solution for IT governance in public organizations distinguishing from centralized and federated, to decentralized structures.

Whereas centralized and federated governance structures are well covered by a palette of governance archetypes proposed in (Weill and Ross 2004), we observed a lack of decentralized governance structures - only *anarchy* is mentioned and, as empirical studies demonstrate, very rarely used by the organizations. To narrow the gap between the business and IT monarchy, feudal, duopoly, federal archetypes and anarchy, we defined a *sociocracy* governance archetype. Sociocracy and its variants (e.g., holacracy) are used by public and private organizations, some examples are Valve, W. L. Gore, Morning Star, GitHub, Zappos. Sociocracy supports self-organization and decentralized decision making.

Next, the organization needs to examine its *context*: what public value it desires to provide, what its authorizing environment is (i.e., who will authorize and support the value provisioning, who will benefit from it), and, eventually, what kind of core organizational capabilities will be required. These elements are interrelated and provide an understanding of a context where the IT governance will be enacted. We suggested that the *model of IT governance* can become “more centralized” or “more decentralized” according to this context. We considered IT governance as an organizational capability and defined three *ITG capability patterns* that reflect centralized, decentralized and federated ITG styles accordingly.

An ITG capability pattern can be seen as a guideline on how to define IT governance to support desired public values driving different context situations. We illustrated how the IT governance patterns can be instantiated on the case of the Higher Education public sector in Sweden.

Our motivating assumption was that public organizations need to master a wide range of ITG mechanisms and to deploy them depending on their value-creation context. In particular, we identified and discussed such mechanisms for decentralized ITG. We consider that our findings can be interesting for the organizations (public or private) that already experienced negative effects of centralized IT governance and decision making (e.g., project failures due to lack of commitment, poor adoption, bad user experience, etc.). This work can also interest the organizations that explicitly move towards decentralization in their IT and are seeking to adjust their ITG.

The model proposed in Fig. 4 provides an organizing logic that can help organizations to position, justify and govern their IT projects in a consistent way, based on the public value concept. However, we deliberately show that the ITG styles are not mutually exclusive and that several styles can be used in the same value-creation context. We plan to elaborate the guidelines and recommendations in the future, by conducting multiple empirical studies and collaborating with practitioners. The ITG capability patterns presented in tables 1 - 3 are intended to

facilitate the application of ITG mechanisms. They provide a general idea; the concrete “recipe” has to be elaborated for each particular organization.

In our future work, we envisage to design an approach for measurement of efficiency of ITG with respect to the ITG style. Relevant KPIs can be integrated into ITG capability patterns presented in this work.

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