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Abstract

This study addresses, in a qualitative method, the explanation of how technical artifacts are socially constructed, providing IT flexibility, allowing operational capacity to generate public value. One of the premises of the Public Value Operational Capacity points out that flexibility is a fundamental aspect for success in government agencies. The study consists of a qualitative analysis of the revealing single-case study method. A preliminary analysis indicates a deficiency in the social constructions of IT artifacts, considering that the objectives in government organization are constantly changing due to changes in public policy. As a result, this study helps bridge the gap through a theoretical perspective on IT flexibility by providing an intuitive approach to IT management and public value management. From a practical point of view, we believe the results of this study will offer several management implications for IT and public policy managers.

Keywords: RBV, Dynamic Capabilities, Public Value, Operational Capabilities, e-Government

1.0 Introduction

Value in public policies has different dimensions, such as operational capacity, legitimacy and perceived public value. In this context, flexibility is considered an important factor in public policy management, since public objectives are constantly changing, implying the need to design public entities as relatively flexible instruments to be used in order to achieve these objectives (Moore, 1995, p. 29).

When it comes to IT, flexibility can be interpreted as the ability to create value from technical artifacts and personal skills, based on the interrelationships provided by technical artifacts and their uses, as advocated by Orlikowski (1992) in "theory of IT structuring" and DeSanctis and Poole (1994) in "theory of adaptive structuring".

In this context, the nature and role of interpretive flexibility in IT in public administration remains a relatively under-researched concept, and it is necessary to explicitly address the constraints imposed by the technological artifact and the mechanisms by which different realities can be shaped and sustained within these constraints.

Among the various applications of the public value model, this paper aims to evaluate a government agency from the perspective of the flexibility of IT operations provided by the human and physical IT infrastructure relationship. The purpose of this study is to address how technical artifacts are socially constructed in government agencies, providing IT flexibility. The research method will be the case study composed by exploratory interviews directed to professionals responsible for the articulation of physical IT assets.

This study helps bridge the gap by using an existing theory to study human relationships in IT flexibility by examining their role in the operational capacity to build public value. Although other studies consider flexibility in the public sector, there is a lack of attention to explain how technical artifacts are socially constructed in government agencies providing operational capacity in public value. From a theoretical standpoint, IT flexibility offers an intuitive approach to IT management and public value. From a practical standpoint, we believe the results of this study will have implications for IT public policy managers.

The theoretical aspects of this study will be presented in section 2. In section 3, we will present the methodology used to prepare a case study in the IT government agency, considering the concepts presented and in section 4 the conclusions and preliminary results.

2.0   Theoretical Framework

Professionals and academics are increasingly interested in the idea of public value as a way of understanding government activity, of seeing what public sector organizations and public managers really do, informing policy making in building and providing services. In part, this represents a response to concerns about 'new public management' where broader notions of public value have been marginalized in the pursuit of efficiency (Stoker, 2006; Cordella; Willcocks, 2012; Paletti, 2018).

Policy and management go hand in hand with a system of dialogue and exchange, in a manner that so many stakeholders need to be involved to make good decisions and control delivery and implementation. The dilemma for public value management stems from the expectation built into it for managers to manage democracy (Stoker, 2006).

In this context, an ICT-mediated production is being practiced in a common way in the public sector and among which diverse perspectives are hampered by public managers who understand which organizational issues are considered to plan a strategy. According to Paletti (2018), in the first stage of building public value, public managers interact with a political sphere to understand what public value should be delivered through a service. Politicians formally determine and authorize public value that must be delivered through policies and regulations that address and limit action by public managers. Once individualized the service that should be delivered and selected as the most appropriate way to produce the service, public managers move to a second dimension of organizational strategy, which considers the investments used to produce material or service. Public managers need to provide the funds needed to finance the service, the number of employees, the skills, and the technologies needed to produce the service. The third dimension is an assessment of public value. After production of the service, public managers must evaluate the service delivered public value, where public managers along with politicians set certain goals or KPIs to assess whether or not the service is satisfactory.

Thus, in order for public policies to be implemented in this dialectical game between politics and management, there must be a set of operational capacities (both physical and human) available to public managers for their implementation, or even, it must offer an appropriate range of functions and capabilities which can be tailored to the users' needs from their active engagement. The concept of IT flexibility can be interpreted as analyzing the ability to create value from technology artifacts and personnel skills based on the interrelationships provided by information technology and its uses, as argued by Orlikowski (1992) in "interpretive flexibility", addressing the constraints imposed by the technological artifact and the mechanisms by which different realities can be shaped and sustained within these constraints (Doherty, Coombs and Loan-Clarke, 2006). As Byrd and Turner (2000) complement the duality

of IT as shared resources composed of two main components - technical (hardware, software, communication technologies, data and main applications) and human infrastructure (skills, knowledge, commitments, values and standards).

Therefore, operational capacity-supported e-gov initiatives can be seen as the flexibility that comes from aligning IT with the policy makers (Moore, 1995; Orlikowski, 1992, 2000; Poole and DeSanctis, 2004).

2.1 IT Artifacts and their Uses - Human IT Infrastructure

Public value management offers a new paradigm and narrative that resides in redefining how to address the challenges of efficiency, equity and a motivational force that does not depend on rules or incentives to drive public service reform (Stoker, 2006).

Orlikowski (1996) argue that individuals use the institutional structures of signification, legitimation, and domination to make sense of technology, gather the resources needed to embed it in work processes, business activities, and strategies, and take the necessary improvisation actions to assimilate the technology, referred to as structuring actions. They also argue that top management can manipulate institutional structures of meaning, legitimation, and domination and thereby influence, guide, motivate, or alter individual structuring actions.

In order to address the different dimensions in human perspective, managing these structures providing public value, the relevant skills to which IT staff have and experience to efficiently perform, their activities can be interpreted as IT Personnel Competency (Chanopas, A., Krairit, D., and Khang, 2006; Masa'deh, 2013). In addition, the skills and articulations of knowledge developed during the articulation between IT and business can support business-oriented choices in IT management, design and implementation. Thus, IT managers can govern the evolution of business and IT through a set of positive interactions between IT and Business (Zardini et al., 2016). Finally, the service climate is an important predictor of service quality in IT, and can be evaluated from three dimensions: service leadership, service vision, service evaluation (Jia and Reich, 2013; Schneider et al., 1998).

The summary of the constructs related to the uses of IT artifacts, or Human IT Infrastructure, are listed in Table 1.

Construct	Description
Service Leadership (Jia and Reich, 2013)	To what extent IT managers take actions to guide the provision of quality services.
Service Vision (Jia and Reich, 2013)	The degree of satisfaction of the client's needs, the demonstration of flexibility and the establishment of communication are emphasized.
Service Evaluation (Jia and Reich, 2013)	Measure in which the assessment of IT professionals is linked to the performance of the service.
Competence of IT staff (CHANOPAS et al., 2006; MASA'deh, 2013)	The extent to which IT staff have the relevant skills and experience to effectively execute IT activities.
Partnership between business and IT (ZARDINI et al., 2016)	One of the determinants of success in the relationship between infrastructure quality and IT's strategic contribution.

Table 1.Human Infrastructure constructs - IT artifacts and their uses

2.2 IT artifacts and their values - Physical IT Infrastructure

Mesquita et al. (2008) reinforce that the relational view may be more important to explain the superior performance when considering the resources in Information Technology. The concept is that flexibility indirectly impacts competitive advantage by assuming a relationship between organizational responsiveness and competitive advantage, identifying superior performance through resource relational aspects to understand appropriate resources and especially which relationships lead to key results (Bhatt, Emdad, Roberts and Grover, 2010; Deng, Mao and Wang, 2013).

As alternative, a possible **infrastructure flexibility** construction may involve elements such as connectivity, compatibility, modularity, and, in an extended version, scalability, continuity, rapidity, facility and modernity (Chanopas, A., Krairit, D., and Khang, 2006; Masa'deh, 2013).

Considering also the increasing interest in applying a resource-based view and its relationships in service management (Ceric, D'Alessandro, Soutar and Johnson, 2015), this study also appropriates the analysis derived from the Resource Based View (RBV) in order to proceed analysis of the **quality of infrastructure** in a bottom-up proposal (Zardini, Rossignoli and Ricciardi, 2016).

Table 2 identifies the physical infrastructure evaluation constructs and the relationship between these elements used in this study.

Construct	Description
IT Scalability (SC) (Masa'deh, 2013)	The degree to which hardware / software can be scaled and upgraded in existing infrastructure.
IT Continuity (CT) (Masa'deh, 2013)	The degree to which the hardware / software / data / IT team can perfectly serve users in an organization without interruptions.
IT Compatibility (CM) (Chanopas, A., Krairit, D., and Khang, 2006)	The degree to which the hardware / software can share any type of information inside and outside the organization.
IT Connectivity (CN) (Chanopas, A., Krairit, D., and Khang, 2006)	The degree to which the hardware / software can connect to other people inside and outside the organization.
IT Rapidity (RP) (Masa'deh, 2013)	The degree to which the hardware / software can provide information whenever necessary.
IT Modularity (MD) (Chanopas, A., Krairit, D., and Khang, 2006)	The degree to which hardware / software / data can be separated and recombined to support the development of new systems.
IT Facility (FC) (Masa'deh, 2013)	The degree to which the hardware / software can be used with ease.
IT Modernity (MR) (Masa'deh, 2013)	The degree to which hardware / software is based on well-known technological products and trends.
Quality of (physical) Infrastructure (ZARDINI et al., 2016)	Infrastructure Quality as a formative scale predictor for strategic contribution.

Table 2.Physical infrastructure constructs – IT artifacts

3.0 Methodology

This study began with a systematic review of the literature, highlighting the need to address theories of Interpretive Flexibility (Orlikowski, 1992) and Public Value (Moore, 1995) in government agencies from an explanatory research approach - to say what it is, how, why, when and where things happened (Gregor, 2006). The case study strategy was used to deeply analyze the phenomenon from the perspective of the people involved, using data collection through semi-structured interviews for recording, analyzing and interpreting the facts and their causes (Yin, 2009). The decision to adopt a single case study was based on gaining a deep understanding of the complex relationship between different archetypes of social construction of IT and how they can influence IT operational capacity, address social constructs that improve or mitigate opportunities for exploitation of public value, and an attempt to demonstrate how IT operational capacity is subsidized by IT flexibility.

For the proposed objective of the present work it is necessary to understand how the human IT infrastructure affects the exploitation of physical resources in IT to provide operational capacity to the public value in a governmental agency and, for this reason, the research uses a two stages for data collection. The main data collection tool for this first stage is the semi-structured interview on an individual basis (Kennedy, 2006; Myers and Newman, 2007), since it allows to collect data, analyze and draw conclusions based on the specific context empirically, allowing the exploration of the social construction of physical IT where existing knowledge is limited (Cavaye, 1996). In the second step, the main results of the initial interviews will be used to develop a quantitative survey administered to the entire group of professionals responsible for implementing public policies from IT. The application of a research tool will allow an assessment of the archetypes of IT flexibility and the behavior of these groups in the exploitation of public value using Minitab software for data analysis. The use of qualitative and quantitative methods aims to strengthen the validity of the results resulting from the case study. The application of these techniques will allow the analysis with greater explanatory power of the influence of IT flexibility, as well as a strong evidence base to explain the nature of the relationship between IT flexibility and public value.

As this study has as main reference the vertical of government, a governmental agency responsible for the implementation of public policies in IT was chosen for analysis under the municipal government of Sao Paulo, the largest city in Brazil. Brazil is the seventh global IT market (USA, 2017), and government vertical ranked 5th in the national market behind only Services, Telecom, Finance, Industry and Commerce (ABES, 2017). In this context, the Technology Company of Sao Paulo (PRODAM) stands out as a strategic integrator of information and communication technology solutions promoting and encouraging applied technological research in the development of new products, services or processes of public interest (Sao Paulo City Hall, 2017, PRODAM, 2018).

The first stage of research interviews all professionals in a saturation method in the area of Operation Management of IT services of PRODAM, responsible for assessing the technical feasibility of new services and management of the Service Catalog. The selected profile is for professionals whose goal is to ensure the planning of

infrastructure services, coordinating and aligning business requirements with the operation of the IT infrastructure, so that current and future capacity and performance are delivered in a timely and cost-effective manner. The semi-structured interview format will be adopted to allow the informants to express their points of view, still guided by the theoretical aspects. Interviews occur through a prior appointment via telephone contact or email informing them of the general objective of the research, ranging from 45 to 75 minutes and are recorded with the consent of the interviewees, transcribed and stored in a repository along with the data of the interview. NVivo software is used to facilitate the coding of data and analyses, as well as providing a database for viewing and reviewing documents. Dubé and Paré (2003) analyzed the positivist research with explanatory case studies like this one, and found in the analysis of state of the art data the coding of uncoded data (including the coding model and its validation), thus the transcribed interviews are later coded using the "process", "in vivo", "holistic" and "hypotheses" methods proposed by Saldaña (2009).

4.0 Preliminary Findings and Further Work

The script was pre-tested with one of the most experienced professionals of department to obtain criticism about its validity in the proposed context, understand and adjust the data collection instrument, and provide insights of infrastructure flexibility or human flexibility archetypes on IT, which resulted in some revisions until arriving at the model reproduced in Annex A (IT Physical Infrastructure quality script) and in Annex B (IT Human Infrastructure quality script). The initial participant (identified by a pseudonym, Luis) is responsible for managing the operation and deployment of new services, which means that the management of IT assets and the relationship with IT professionals, users and customers permeates much of their normal daily functions.

As a determining factor, the literature suggests that an important part of IT flexibility can be supported by a scalable and flexible physical infrastructure to allow interaction across the Human Infrastructure. For example, Luis identifies scalable and flexible infrastructure in a limited way:

> *"Today, in our situation I see that it has this scalability, but limited, I must admit we have finite resources and I still have not seen if we will acquire the resources in clouds, because apparently hire we will not hire anything else, buy more anything."*

In terms of human infrastructure when asked, however, to indicate how people deal with the evolution of knowledge and new IT learning, Luis identified a posture of conformism, but himself expressed confidence in the initiative of small self-motivated groups:

> *"it seems that there are some people in the company and this is the negative point, because it is not us as a company, some people, from what I understand, at this stage are people who came from outside and are trying to deploy something again in this way"*

In an attempt to speculate a probable explanation for heterogeneous behaviors in the articulation between the physical and human infrastructure, the interviewee identified the attributions in different departments from the articulation between IT and business:

> *"business people here claim that they do not understand much of technology and in return some people of the technology part also do not want to say what they have there, at least in practice, as a standard for business"*

and in the same department at different hierarchical levels:

> *"the high management from what I've seen, he likes to interfere a lot in the business part, but I see that not always he brings his team with him, to at least give his tip of what he wants to show for the business part"*

A number of works on IT flexibility have been presented in the past, however, there is a need for further research on IT flexibility in public administration, especially in organizations that have this end. Through the research until now, it is possible to discover a research gap that exists in the bibliography, regarding the effect of the constancy of the public policies and its effect in the conservation of the flexibility in IT. Our study is focused specifically on this area.

However, this research has limitations, first the interview measures are known to include personal bias. Another limitation of the research is that we have adopted measures from different sources to assess the flexibility of the physical and human IT infrastructure, and the absence of its relations with public policies. Despite the restriction of the initial theoretical model, this issue was evidenced in the statements made in the pilot interview in the positive perception of the service, where Luis relativized the issue considering public policies:

> *"I think that for some clients, yes, and this will bump into our issue of the political sphere, the political scenario, depending on which client is and who is in this customer politically speaking"*

or the contracting format in the organization, also derived from the governmental management model:

> *"I understand that they are not so homogeneous due to the biddings, then come older telecommunications equipment that end up not being discarded and there they start to have an interaction with new equipment"*

To cover the limitations of the model, we intend to corroborate our findings based on the analysis from several participants. This reinforces the intention of conducting interviews with other members responsible for the articulation of human assets and physical infrastructure, providing robustness to the analysis model also in the second stage of the study. In this next step, the main results of the interviews will be used to develop from the Public Value literatures the quantitative research in the group responsible for the implementation of public policies from the IT.

The current study is expected to make important contributions both to theory and practice, first by exploring the interpretive flexibility in IT from physical assets, thus contributing to operational capacity in public value. From the theoretical point of view, it is expected that important contribution to the debate in the operationalization of the concept of operational capacity of Public Value for actions involving IT, or the so-called e-government.

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Annex A - Interview Script: Physical Infrastructure Quality

Semi-structured questions	Probe/Detail
Modularity (MD) - How does Infrastructure support legacy systems? (reverse side)	Probe: In what situations cannot it? Identify: - separation of data and applications; -involvement of legacy systems in the development of new applications (identify if there is restriction); -reuse of data and applications with subsystems (for example, the login module reused in applications).
IT Rapidity (RP) - How is the standardization of IT components (eg, hardware, software, database) in the organization? - How fast is communication across IT networks?	Identify whether it is satisfactory for internal users.
IT Scalability (SC) - How is the infrastructure scalability? (identify if it's customizable)	Identify ease of upgrade; Identify whether hardware and software can be easily scalable (adding, modifying, or removing existing IT infrastructure) and standard's needs (identify if there are no major global effects).
IT Compatibility (CM) - How is the infrastructure compatible with the web, does the organization provide multiple interfaces (for example, website, call center) and various data types for sharing?	Probe: In what way is the infrastructure compatible or not with the web? Identify: - Whether data can be shared between departments and organizational boundaries; - Different types of data: (eg text, voice, multimedia).
IT Facility (FC) - How is technology standardization?	Identify if Hardware / software is based on known products and current technological trends.
IT Connectivity (CN) - Is there infrastructure integration?	Probe: Which components do you consider to be integrable? Identify access to data authorized by internal users and third parties through IT networks; Identify whether all units and departments and external parties (eg customers, suppliers) are connected electronically through IT networks.
IT Continuity (CT) - How is Infrastructure reliability in terms of disaster recovery, maintenance, and backup maintenance? - How is the movement of IT staff?	Probe: Are there contingency / redundancy plans? Identify if any position can be easily replaced.

Annex B - Interview Script: Human Infrastructure Quality

Semi-structured questions	Probe/Detail
Service Climate: Leadership - How is the performance monitoring in customer service?	Identify performance goals at work; See if it contributes to user performance;
Service Climate: Vision - How is the perception of providing excellent service to users, and perception of the customer? - Could you comment a bit on dealing with customer perspective (external/city hall)?	Try to note if there is this effort in the unit Identify whether the customer's view of your unit is a respected partner. Probe: Do you feel that there is effort in this regard?
Service Climate: Evaluation - How is recognition for providing excellent service to our customers, is Customer Service reflected in performance appraisal? - How was the most recent performance review?	Identify whether it was evaluated on how well it served customers; Probe: Do you feel appreciated for the service provided? Identify if it is an important criterion in the formal evaluation of performance; Probe: Do you consider that quality of service is reflected in the evaluation?
Competence of IT staff: - How is the participation of IT staff in the company's policies and goals, in technological planning and project leadership, and in business problems for the development of technical solutions? - How is IT staff learning and applying new technologies? - How is IT staff working with users on a multifunctional team? - What is the specialization of IT staff?	Identify if there is anxiety of IT staff to learn new technologies (probe); Identify if it is cooperative (probe); Identify whether there is expertise in various technologies and tools (for example, programming languages, operating systems).
Partnership between business and IT: - How are the Interactions between IT managers and senior management team? What is your vision of CIO involvement in strategic decisions? - How are the Interactions between IT Managers and IT suppliers distributors / customers of the company (citizen) ?	Identify if they are effective.