E-government and organizational change: reappraising the role of ICT and bureaucracy in public service delivery

The article will appear in a forthcoming issue of *Government Information Quarterly*.
This is a version of the author-accepted manuscript.
Please cite as follows:
Cordella, A., and Tempini, N. 2015. E-government and organizational change: Reappraising the role of ICT and bureaucracy in public service delivery. *Government Information Quarterly,* forthcoming.

E-government and organizational change: Reappraising the role of ICT and bureaucracy in public service delivery

Abstract

There is a substantial literature on e-government that discusses information and communication technology (ICT) as an instrument for reducing the role of bureaucracy in government organizations. The purpose of this paper is to offer a critical discussion of this literature and to provide a complementary argument, which favors the use of ICT in the public sector to support the operations of bureaucratic organizations. Based on the findings of a case study – of the Venice municipality in Italy – the paper discusses how ICT can be used to support rather than eliminate bureaucracy. Using the concepts of e-bureaucracy and functional simplification and closure, the paper proposes evidence and support for the argument that bureaucracy should be preserved and enhanced where e-government policies are concerned. Functional simplification and closure are very valuable concepts for explaining why this should be a viable approach.

1 Introduction

The adoption of Information and Communication Technologies (ICTs) in public sector organizations has been often associated with reform programs aiming at reducing the inefficiencies generated by bureaucratic burden (Osborne and Plastrik 1997; Accounts 2008; Clegg 2007). Governments' investments in public sector information systems are generally

associated with organizational transformations designed to enhance efficiency and policy effectiveness (Fountain 2001; Bellamy and Taylor 1998; Gil-Garcia and Pardo 2005; Gronlund and Horan 2004; Kamarck 2007). In this context ICTs in public sector are deployed to pursue a cluster of ideas and practices that prescribe using private sector and business approaches in the public sector (Hood 1991; Cordella and Iannacci 2010; Cordella and Bonina 2012) to enhance organizational efficiency and effectiveness and hence reduce bureaucratic burden. This paper challenges the vision of public sector ICTs as solutions mainly designed to reduce the span of public bureaucracy, as often proposed by e-government policies informed by the New Public Management (NPM) ideology. The paper offers empirical evidence that ICTs can enable alternative organizational solutions, which make public sector organizations more efficient and effective by supporting the bureaucratic coordination. These alternative solutions are those found in the organizational structures defined by the e-bureaucratic form (Cordella 2007). E-bureaucracies are organizations that follow the procedural logic of a public bureaucracy, to coordinate the execution of organization activities, and hence to deliver services, but rely on ICTs to sustain procedural efficiency. ICTs are used in order to facilitate and support the fundamental organizational functions of coordination and control of bureaucratic organizations. These functions are defined in the legal-normative set of rules designed to standardize the administrative procedure and the delivery of public services. The paper not only provides empirical evidence to describe the functioning e-bureaucracies, but also offers theoretical insights to explain and justify why ICTs can improve the efficiency of bureaucratic organizations. It is here suggested that ICTs can make bureaucratic organizations more valuable for the delivery of public services than the organizational configurations prescribed by the NPM ideology and materialized in the "Contract State" (Cordella and Willcocks 2012; du Gay 1994).

Building on the findings of the case of the Municipality of Venice, the paper will argue that e-government projects can deliver better services by introducing a new inter-organizational layer of bureaucratic coordination. This outcome is discussed and explained by using Mintzberg's (1983) taxonomy of bureaucratic organizations – machinery and professional bureaucracy – in conjunction with theories of technology – functional simplification and closure – as proposed by Luhmann and Kallinikos (Luhmann 2005; Kallinikos 2005).

2 ICT reforms and Bureaucracy

Bureaucracies have historically been conceived as structures aimed at increasing the efficiency in organizational practices and procedures. According to Weber's (1947) theorization, bureaucracy delivers organizational efficiency by following procedures and coordination mechanisms that incorporate rules and instrumental systems designed to rationalize administrative efficiency (Clegg 2007). Weber defines a set of attributes that bureaucratic organizations must have in order to fulfill these goals: a formal and explicit hierarchical structure of authority; a detailed, rationalized division of labor; a set of formal, explicit, comprehensive and stable rules that are impersonally enforced in decision making and lead to predictable and determinate results; and the separation of the functions in the organization from the person entitled to exercise that organizational function. These organizational principles, designed by Weber as instruments for maximizing organizational efficiency, also mediate the relationship between citizens and the state and deliver specific democratic values such as equality and fairness (Peters 2001).

For a long time bureaucracies have successfully – often through struggle – fulfilled the goals of organizing the operation of the administrative apparatus of the state and consistently guaranteed the superior goals of equity and impartiality in public service delivery. More recently, due to the increased areas of public sector interventions – consequence of the expansion of the welfare state –the need for integration within public offices has increased. More integration has fostered the need of producing and exchanging information between citizens, between citizens and the public administration, and among different branches of the public administration, to deliver public services. This has overloaded the bureaucratic organization with information that now needs to be processed in order to provide the services that a more pervasive welfare state has to serve. The increased complexity of administrative processes has dramatically reduced the efficiency of bureaucracy increasing the already evident limitations that bureaucratic organizations have – in their capacity to deliver service consistently and respond to the unpredictable challenges arising in times of higher environmental uncertainty. These failures have generated waves of justified criticisms towards public sector bureaucracies and their ability to fulfill the mandate of delivering efficient and effective services (Heeks 2002).

While these criticisms are founded and justified by the failures of bureaucracies in delivering public services, the solution of eliminating bureaucracies is not necessary the best one for both the state and the citizens. Bureaucratic organizations do in fact enforce organizational principles that deliver two sets of positive values. On the one hand, bureaucracies rationalize administrative procedures making service delivery more efficient (consistently delivering homogeneous outcomes) and effective (outcomes are determined by process structure); on the other, the bureaucratic principle of rule-bounded behavior – which univocally determines the outcome of administrative procedures, and guarantees their predictability according to the

impersonal bureaucratic principle (Kallinikos 2004; Perrow 1986) enforces the democratic values of impartiality, fairness and equality in the delivery of public services.

The adoption of ICTs in the public sector has often been driven by a narrow view which favors non-bureaucratic organizational arrangements rather than questioning whether ICTs can improve the ability of public administrations to deliver efficient and effective services by leveraging bureaucracies' ability to perform their mandate fulfilling the superior goals of impartiality, equality and fairness, along with efficient and effective organizational arrangements. Instead, by following the latter view Cordella (2007) suggests reconsidering the role of ICT in public sector reforms and proposes the thinking of ICT as an instrument to support bureaucratic organizations rather than to eliminate them. He advises that the implementation of ICT to automate existing administrative procedures could improve the administrative system's efficiency and effectiveness without changing its underpinning logic (Nohria and Berkley 1994) which is to grant equal, impartial and fair treatments for every citizen interacting with the bureaucratic organization. The potential of ICTs to support and hence make public bureaucracies more efficient and effective is however not new. It has been well documented in the history of the adoption of ICT in the public sector. Since the 1980s, ICTs have been designed and implemented in order to provide proper and adequate tools and solutions supporting the bureaucratic organization effectively.

Office automation software, database management systems, work flow management systems, automated decision support systems, and more recently web services, e-services and cloud shared systems, are some examples of technology-mediated solutions designed to make bureaucratic organizations more effective and efficient by incorporating into the ICT systems multiple levels of control and standardization of bureaucratic processes. More effective,

efficient and transparent monitoring and controlling mechanisms enabled by ICT technologies can indeed prove valuable solutions for the design and implementation of more functional bureaucratic organizations, increasing the homogeneity and predictability of administrative procedures and their alignment with the normative and legal framework which govern every public sector bureaucracy. ICTs in this context can power functions which are needed by bureaucratic organizations to fulfill their mundane tasks and to increase the flexibility and agility of the organization in responding to changing environmental conditions. These organizations also need to overcome the information processing challenges associated with the expanding domain of public intervention. The expanding complexity and uncertainty of this domain is the reason why public sector bureaucracies have to exchange and process more information, exacerbating their becoming more inefficient and ineffective when adequate action is not taken. Organizations that are able to exploit ICT to support the bureaucratic processes in order to overcome these challenges are good examples of e-bureaucracies (Cordella 2007). The e-bureaucratic form is thus recommended as an e-government policy that helps to improve the effectiveness and efficiency of the action of the public administration while reinforcing the bureaucratic values of equality and impartiality in the state service to citizenship.

In its present formulation, this theory of e-bureaucracy does not account of the different kinds of impact that ICTs can have on bureaucratic organizations, which differ in the nature of the executed tasks, level of uncertainty, and internal coordination mechanisms. To fill this gap, this paper builds on Mintzberg's taxonomy of bureaucratic organizations (1983) which distinguishes machinery bureaucracy from professional bureaucracy on the basis of the nature of the standardization mechanisms used to uniform, rationalize, and coordinate the work procedures and activities involved. Machinery bureaucracies are organizations effective at

executing simple tasks, which by their nature can be fully determined in advance of their execution, and whose solutions can easily be predicted and therefore automated. Professional bureaucracies instead deal with complex tasks. These tasks involve uncertainty and ambiguity, and can only be solved in a semi-standardized way by applying general principles to particular cases. Task solutions cannot be automated but only elaborated through application of human analytical skills. As we will explain through the empirical evidence and mobilizing this taxonomy, ICT can be a powerful ally in the effort for offloading, through streamlining and automation, the burden of machinery bureaucracy operations, in order to refocus organizational resources on the execution of professional bureaucracy tasks, requiring human judgment.

In order to explain how information and communication technologies can embed bureaucratic rationality and operationalize associated values and principles, we will draw from a theoretical framework, that of information technology as functional simplification and closure. In the following section we introduce the framework. In so doing, in this paper we aim at building an account able to counter the dominant view in e-government research, which conceives ICT as solution to eliminate bureaucracies.

3 Functional simplification and closure

While e-government literature has mostly treated ICT artifacts as linear catalysts of transformation of public sector organizations and structures (West 2004; Layne and Lee 2001), we feel there are more nuanced accounts of the properties of technological artifacts that can help to better theorize the role of ICT in e-government reforms. ICTs are not simple

tools that straightforwardly allow to increase organizational productivity (Kallinikos 2005). ICTs encompass properties which enable them to frame the causal connection of the organizational practices, events, and processes they mediate (Kallinikos 2005; Luhmann 2005). ICTs do not simply offer a neutral support to better execute existing organizational activities but rather offer a new way to enframe (Ciborra and Hanseth 1998) and couple pre-defined logical sequences of actions mapping the organizational procedures and practices they intend to mediate (Luhmann 2005). As a result, ICTs construct a new set of structured sequences and interdependences that regulate the way in which organizational procedures and processes are executed. Therefore, ICTs carry regulative properties that structure social and organizational orders, providing stable and standardized means of social interaction (Bovens and Zouridis 2002; Kallinikos 2005) shaped into the technical functionalities of the systems. Work sequences and flows are described into the technological functions, making the reduction of complexity in causal or instrumental relations that are standardized and stabilized in scripts one essential characteristic of information technologies. The design of a system encloses relational causalities as described in the scripts of technology and, at the same time, excludes other possible causalities by not including relational interdependences into the very same scripts. Kallinikos (2005) argues that this is a fundamental characteristic of ICT which results from the combined effects of functional simplification and closure.

These two concepts are powerful analytical devices that provide an understanding of what the essence of an information technology is, when it is contextualized in the social systems within which it is deployed. Functional simplification and closure are the processes by which the automation of an operation or function is constituted in the technology's material substrate. Since technology is necessarily designed to perform certain functions, the concepts of functional simplification and closure help to explain what performative logic is embedded in a

technology, and how the operations of standardization and automation of tasks are modeled to allow for technology to perform the functions it has been designed for. ICTs disambiguate the causal chain connecting select organizational events and the operationalization of tasks by embedment in the artifact. Functional simplification and closure explain the essential character of technology.

Still, the capacity to capture the characteristics of functional simplification and closure that are at the heart of a specific information technology is a different kind of challenge than merely acknowledging that the definition of an information technology is always associated with the functional simplification and closure logics it encompasses. The concept of functional simplification *"coincides with the identification and selection (hence the reduction of complexity) of sets of operations that are thereby instrumented as strict cause-effect couplings in which a particular cause is expected to lead to its specific effects"* (Kallinikos 2006, 22). Functional simplification embodies the operational logic that underpins how a technology defines the problem domain it applies to and the steps that need to be taken in order to solve that problem domain. Functional simplification is the process through which information technology breaks down a task or problem into sets of operations that need to be performed sequentially in order to solve it. Defining functional simplification of a technology implies explaining the segments of operations that the information technology embeds, performs and standardizes. As the information technology standardizes sequences of operations, it attempts to disentangle and disambiguate the operations from the messy and local domains of the social world it is going to apply to. ICT selects, extracts, and isolates from the social world sequences of operations to be performed in order to achieve a specific outcome which satisfies particular requirements (Kallinikos 2006). It attempts to reduce the

complexity of the world by capturing the essential causal chains needed to produce an output into its functionalities.

Functional closure is then the necessary complement to functional simplification. The technology construction process necessarily entails the isolation and black-boxing of the sequential operations, ensuring their execution is protected from external interference. Functional closure *"implies the construction of a kind of protective cocoon (from fences to social practices) that is placed around the selected causal sequences or processes to safeguard undesired interference and ensure their repeatable and reliable operation"* (Kallinikos 2006, 33). An information technology works so that standardized operations are executed in an automatic fashion. The automation of the operations executed by the information technology implies that the operations retain an autonomous character. While the information technology interacts with the user, the computations that are executed as a result of user interaction proceed in isolation until an outcome is produced. Information technology is often responsive to interaction with the user but only at certain steps of the task flow (i.e. data input, command confirmations, etc.), while the operations that occur between one step of interaction and another are black-boxed and independent from the user. In this way the construction of a technology can be described as the construction of a simple, robust world (Berg 1998) unambiguous in its self-referential working, transacting with the outer environment only when reaching one of a limited number of pivotal points (or outcomes). The essence of an information technology is described by the dyad of functional simplification and closure and not by either one of the two alone, since each of the concepts concerns a different and limited aspect of the functional operationalization that an information technology constitutes. Only taken together the two concepts are able to define an information technology in operation.

The process of technology construction through functional simplification and closure has far-reaching consequences for organizational settings. In fact, functional simplification and closure result in a separation of the operation of the technical system form the organizational and social action, processes, and practices that are executed by the same system (Kallinikos 2006, 36). Once organizational procedures and protocols have been delegated to technological automation, the abstraction that functional simplification produces implies that procedures and protocols are, to a degree, isolated from the organizational setting they originated from. Moreover, the technological substrate for the execution of procedures and protocols are open to *"become highly regulated through prescriptions, the specification of skill profiles and requirements and role formation*" (Kallinikos 2006, 34), information technology equating to a regulative regime (Kallinikos 2009) that stabilizes and structures social interaction (Bovens and Zouridis 2002; Kallinikos 2005).

While a technology can embody functional simplification and closure that are more or less aligned with organizational needs, these concepts are not quantitative measures. It would make no sense to say that a technology is more functionally simplified than another, since all technologies embody different configurations of functional simplification and closure. *"Simplified, in this context, does not mean simple*" (Kallinikos 2006, 33). Functional simplification and closure are not directly commensurable to quantification. However, different configurations can perhaps be evaluated and compared in terms of their effects, since different configurations will perform in ways that are more or less aligned with organizational needs.

In this purview, we think that the regulative powers of ICT should be put at the center of the analysis, if we set out to understand the implication of ICTs in e-bureaucratic strategies. Case study research is perhaps the most suitable approach for examining a phenomenon in its natural setting (Benbasat, Goldstein, and Mead 1987) and therefore the ideal vehicle for gaining a deeper understanding of the political, social and technical factors that shape e-government deployments. Moreover, case study is a powerful methodology for investigating alternative frameworks or hypotheses on a topic, for the flexibility it allows to the researcher to start with a broad focus, evaluate the spectrum of expected and unexpected phenomena that the case represents and selectively narrow down on the phenomena that relate to the most important questions. Case study allows then to construct causal chains involving the phenomena of interest, and provides robust devices of theoretical validation in multiple sources of evidence and evidence triangulation (Yin, 2009). To offer the ground needed for this analysis the paper focuses on how the local administration in Venice, Italy has designed an ICT platform called IRIS, which encompasses the ideas presented and discussed in this review.

4 Methodology

We studied the IRIS information system that is part of a major project "Amministrazione 2.0" by the Venice administration. This is a web-based system that leverages the Internet for crowdsourcing from the distributed public of the citizenship the monitoring of the territory of the municipality and the reporting of maintenance and management problems. Data collection relied on a number of different sources. We collected data from open-ended qualitative interviews, questionnaires, direct observation of the system and data mining, and secondary data sources. Secondary sources included legal and government documents, technical

documentation and public press releases. The aim of the research was to understand how the 'Amministrazione 2.0' project was translated into action through a number of ICTs projects, and what role technology was having in shaping the success or failure of these projects. In other words, we set out to understand how the public administration of Venice supported its bureaucratic principles and rationalized its administrative procedures through deployment of solutions based on innovative uses of the ICT.

To start the research and find potential leads for investigation, we conducted four in-depth interviews (duration 45' – 1h15') with the main executives involved in the project. We initially designed the interviews with an adaptive aim. Initially we discussed several different projects all part of the major 'Amministrazione 2.0' initiative. Progressively, the interviews converged on the investigation of IRIS as this system was bearing the most interesting results – in relation to the background of a dominant critique of bureaucracy as in the NPM literature and our interest in the role of technology for bureaucracy. Table 1 below presents a detailed summary of the actors interviewed. We followed a semi-structured approach to the interviews, supporting the data collection process by preparing interview guides, customized for each interviewee, and maintaining a balance between passivity and over-direction (Walsham 1995). The interviews were tape-recorded. Each interview was transcribed into text to ensure a reliable analysis of the relevant data.

Position	**Involvement**
Vice-mayor of Venice	Creator and political sponsor of the "Amministrazione 2.0" project and its children projects

Head of the Information Systems and Digital Citizenship Office of the Local Government	Public administrator and institutional administrator of the IRIS project
Chief Executive of Venis Spa	Software development of IRIS
Supervisor of the IRIS project at the Information Systems and Digital Citizenship Office	Head of the IRIS Rooms

[Table 1]

We enriched our understanding by analyzing a number of essential documents about IRIS, some provided to us by the administration and others collected from publicly available sources. Amongst these were all four versions of the normative agreement, records about the software updates rolled out to IRIS, summaries about personnel training, an application for a ministerial prize for public sector innovation, letters to the citizenship, and internal statistics. All these data sources allowed us to triangulate (Yin 2008) the evidence we have gathered from the case study. In order to integrate our data with a range of differentiated perspectives on the project and defend a neutral standpoint (Walsham 2006), after an initial analysis of the data in our possession we provided a short qualitative questionnaire to the offices participating in IRIS. We collected 17 responses from 38 recipients of the questionnaire. Finally, in order to build our argument we mined the database of requests that is available at the IRIS portal (further explanation will follow in the findings section).

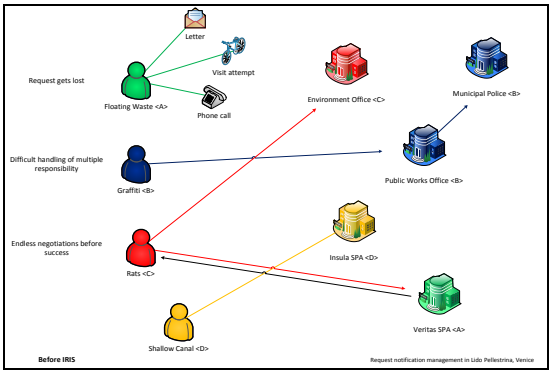
From the initial analysis of the IRIS case data a theme emerged and required explanation. IRIS was apparently a successful system that relieved several previously independent organizations and the public relations offices of the municipality from the burden of administrative work. At the same time, the system was presented as a major success by the administration, which claimed that the public had made sense and adopted the technology. We

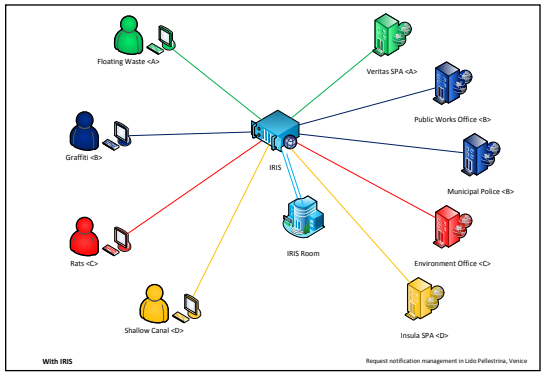
set out to understand how e-government projects can be designed to support bureaucratic organization and coordination rather than just to eliminate or reduce them. To explain our arguments, we built on the notion of e-bureaucracy (Cordella 2007) and looked at a specific case which seems to support the argument for e-government developments which aim to support bureaucratic organizations by making their coordination more efficient. The notion of functional simplification and closure was also introduced to account for the effects of information technologies in streamlining bureaucratic functions.

5 The IRIS platform

5.1 System routine

A citizen, who wants action to be taken about a problem pertaining to the public territory of Venice, be it for instance floating waste, road holes, illegal docking or swarms of mosquitoes, can issue a maintenance request through a digital platform called IRIS (Internet Reporting Information System). This is a public sector ICT solution designed to provide better and quicker solutions to common problems related to the maintenance of the city of Venice. IRIS was launched in late May 2008, as part of the major project "Amministrazione 2.0", in one of the six municipalities of the council of Venice, and finally extended to the whole city in December 2009. To date (February 2015) the system has recorded more than 23,000 requests, leveraged from a large potential user base of 270,000 residents (plus 8.5 million tourists per year). The system was designed to digitize a process that was already in place. The IRIS platform permits citizens to digitally submit requests for intervention to the relevant office of the public administration of Venice. Figure 1 compares the submission processes before and after the implementation of IRIS.





Before IRIS IRIS

[Figure 1]

When a submission is made the user must attribute a geo-reference to the request, either by clicking on the map or searching the toponymic database via a textual search. The user must also assign the request to one problem class, from a list of 19 specific classes, or by selecting the generic ‘Unclassified’. Furthermore, she can attach pictures to better explain the nature of the problem, and any other information which might be useful for the office in addressing the problem. The system stores the request in the database, and makes it instantly available to the public. The user receives email notifications when the request is updated by the organization in charge of the request. Using the comment function, any user can comment on the updates, since the comment function is not restricted to the user who initially made the request. Requests can also be submitted via MMS, although this option has hardly been used. When a request is received by IRIS, the system automatically notifies the responsible organization via e-mail. Since responsibility depends on the nature of the problem and its location, the legitimate recipient of the request is identified according to the class and location indicated by the citizen.

A request has a life cycle that can iterate between five possible statuses. Two working days are initially allowed to the recipient organization to acknowledge the request: then it is given the initial status of “case acknowledged”. Within two more working days, the organization must take an initial decision by submitting information (e.g. request number or plans) to the request's page. The status then changes to “under evaluation”. The third stage will see the request status change to one of three possible concluding outcomes. The request is “closed” if no action is needed (the request is vexatious) or it cannot be solved. Alternatively, it is classified “solved” if and when a solution has been provided. Finally, the case is classified “suspended” if the solution to the problem has to be re-scheduled. This may be the case if budget constraints or major upcoming works impede the intervention. All of the operators execute their actions through the web portal, which they access by logging into the operator area.

Some problem classes have more than one organization of reference, as their solutions require the combined interventions of different actors. However, for every class there is always one organization that takes on the primary responsibility, while others are assigned secondary responsibility. The primary responsibility involves the obligation to give a response to every request in accordance with the agreed terms of operation. The secondary responsibility recognizes the interest of that organization in being kept informed about particular kinds of works. The secondary responsibility organization receives automatic updates from the IRIS system. For instance, a request regarding the public parks will be of primary responsibility for the organization in charge of waste treatment, green areas and water supply, and of secondary responsibility for the local government office for environment conservation.

5.2 IRIS Rooms

At the core of the IRIS system are the IRIS rooms. The IRIS rooms monitor and coordinate the activity of the whole IRIS system. They receive a notification e-mail about every request that is entered in the system and monitor the action taken to manage the requests. Most prominently, they process the events that are entered in the 'Unclassified' field and that the system cannot automatically forward to the competent organization. In these cases, it is the responsibility of the IRIS room operator to allocate the case to the correct organization. Similarly, IRIS rooms' operators have to deal with cases that are rejected by an organization because they were allocated to the wrong class when the submission was made. The staff in the IRIS rooms assigns controversial submissions to the right organization. The IRIS rooms' operators also have the responsibility to delete requests containing offensive content. Finally, the IRIS rooms have to sort out every problem which is not dealt with by one specific organization in a given municipality. There are seven IRIS rooms. Each IRIS room supervises all the requests concerning the jurisdiction of the municipality it belongs to.

Operators in the IRIS rooms were trained to standardize the services delivered to citizens by the different organizations. The IRIS room operators had to learn how to coordinate the activities of the different organizations involved in the delivery of solutions and how to allocate all the problems which did not follow in the predefined classes. The room operators had to be trained to coordinate administrative procedures across different organizations and mediate the technical and administrative complexity involved in the tasks undertaken to solve each problem.

5.3 Normative Agreement

To make the collaboration possible among organizations strictly governed by bureaucratic arrangements, the local government had to produce a normative agreement. The document was intended to enable the coordination mechanisms imposed by the IRIS system, and specifically by the IRIS rooms. The agreement regulates the coordination of the activities of all the organizations involved in IRIS: five independently managed organizations (three of which are controlled by the Venice Municipality, one is a minority participant and one is independently owned), six municipalities and eleven public administration offices, making a total of 39 different participating organizations.

The agreement recognizes that IRIS is implemented to improve the collaboration needed to deliver the service duties of the involved organizations, and that the organizations commit to cooperate in order to provide a better public service. Most importantly, the agreement institutionalizes the role and powers of the IRIS rooms. The agreement specifies that a reason must be given for the refusal of any request made by the rooms, that the rooms will receive notifications about all requests, and that a central IRIS room should be created to support and coordinate the entire system and carry out the locational assignment of MMS requests. Moreover, the agreement specifies the rules needed for the automatic assignment of responsibilities by IRIS on submission of a request. It specifies the primary and the eventual secondary responsibility for each combination of problem class and location, and the e-mail addresses to which each case shall be forwarded. Furthermore, the document defines essential specifications of the system routine, including the deadlines of two working days for reception and two working days for queuing and/or returning an erroneously attributed request back to the room.

These normative arrangements were needed to make possible the deployment of the IRIS system, but not sufficient to make it functional to its scope. During the implementation of the system, some important adjustments had to be made in order to improve the system performance.

5.4 IRIS evolution

Software development before the IRIS launch took two months. The process consisted of rolling out a pilot project to be then updated incrementally. The IRIS pilot was launched in the municipality of Lido Pellestrina, which has 21,500 residents. IRIS was been updated ten times in its first two years of operation. The updates have added new features to improve the functionalities of the system. The most prominent improvement, which had major effects on the performance of the system, was the careful tweaking of the set of problem classes. At the core of IRIS there is the list of essential problem classes, which allow the automatic allocation of the tasks to the responsible organizations. The classes had to provide a clear and unequivocal classification of the problems to reduce to the minimum the use of 'Unclassified' class. This is undertaken to facilitate the automation of the problem allocation process. If too many requests are forwarded to the IRIS rooms for assessment – as it occurs for every request in the 'Unclassified' class – the automation of the system is only partial, leading to administrative inefficiency in the management of the organizational processes.

Quickly, the pilot project highlighted that some adjustments were in need to make the system be sustainable. In the first six months of the pilot project (May – November 2008) 30.4% of requests for intervention were input in the 'Unclassified' class. These requests demanded expensive human evaluation from the IRIS room, before being eventually forwarded to an organization for their solution. Of these 'Unclassified' requests, 29.9% related to problems

directly correlated with pestering animals. To reduce the impact of these requests, a new category was added to the IRIS system in December 2008. The system developers introduced the new class, 'Pestering Animals' (i.e. rats, mosquitoes and cockroaches), in December 2008. The new class offloaded some of the requests in the 'Unclassified' reducing the workload of the IRIS rooms. We studied the effects of this change in the system by comparing the data input of the first six months of system activity (May – November 2008) with the same period in 2009 and 2013 – see Table 2. The data set was analyzed by looking at the problem descriptions provided by the citizens. We have analyzed all the descriptions of the unclassified cases to identify the ones which concerned problems associated with pestilent animals.

The data from May to November 2009 suggest that the introduction of the new class has importantly improved the automated handling of requests. While in 2008 29.9% of the 'Unclassified' requests were related to pestering animals, in 2009 the figure dropped to 1.8%. The IRIS room was successfully relieved of part of its workflow by transferring it to an automated routine. The number of entries in the IRIS system grew by 256% from 2008 to 2009, while the number of unclassified entries grew by only 97%. After the introduction of the class 'Pestering Animals', unclassified entries accounted for just 17.8% of all entries, compared to 30.4% in the previous year. The new class captured 3.5% of the total requests, reducing the amount of requests related to pestering animals in the 'Unclassified' category to 0.31% of the total. The effect continued to 2013. The total number of requests increased by 38% compared to the same period in 2009, but the 'Pestering Animals' class increased by 166% accounting now for 6.86% of total requests. The requests related to animals still in 'Unclassified' dropped to a 0.64% of the class, or 0.04% of the total requests.

Effect of the creation of the class *Pestering Animals* on the unclassified class									
	2008 (27th May - 27th Nov)			2009 (27th May - 27th Nov)			2012 (27th May - 27th Sep)		
	n.	*% of Tot Reqs*	% of *Unclassified*	n.	*% of Tot Reqs*	% of *Unclassified*	n.	*% of Tot Reqs*	% of *Unclass.*
Requests	473			1594 (+256%)			2172 (+38%)		
Class *Unclassified*	144	**30.4**		284 (+97%)	**17.82**		157 (-45%)	**7.23**	
- Animals in *Unclassified*	43	**9.09**	**29.86**	5	**0.31**	**1.76**	1	**0.04**	**0.64**
Class *Pestering Animals*	na	na	na	56	**3.51**		149 (+166%)	**6.86**	

[Table 2]

6 Analysis

IRIS and the IRIS rooms are designed to rationalize the coordination between the different branches of the public administration and the organizations that hold responsibilities in the maintenance of the territory of the Municipality. Interestingly, the case presents a clear instance of an increase in bureaucratic interdependences. IRIS adds an extra bureaucratic layer - the IRIS room - to mediate the interaction among the different organizations, to monitor their processes, and stipulate levels of service. The IRIS room has also been created to monitor and arbitrate exchanges. These two new layers of bureaucratic interdependences can be better analyzed by recalling Mintzberg's (1983) taxonomy of bureaucratic organizations.

IRIS is designed to support the existing bureaucratic organizations, in both their machinery and their professional functions. The design of the automated system based on classes of problems is an example of a system whose aim is the automation of existing routines. In this case, the task executed by the system is in essence rather simple, and can be streamlined through automated channels. IRIS provides a one-stop shop for the collection of maintenance requests, and forwards each problem to the right organization. IRIS embeds, in its procedural logic, the automatic identification of which organization is responsible for a specific kind problem in the territory of Venice. This helps to facilitate the communication between citizens and the administration, and allows for a better and more accurate two-way information exchange process, powered by better and more accurate information. When citizens submit a request for intervention via IRIS the information is automatically directed to the organization whose competences are needed to solve the problem. Similarly, the automated localization of maintenance problems featured in IRIS is another example of automatic brokerage of bureaucratic negotiations. Before the implementation of IRIS, this segment of the negotiation had to be carried out by the citizen. Then, the citizen had to undertake the complex task of discovering the office responsible for solving a particular kind of problem. If the request was forwarded to the wrong organization, the request was usually rejected, leaving citizens dissatisfied with the services offered by the administration and without assistance on how to proceed further. The centralized brokerage and automation of the requests of intervention has made the administrative process more efficient. It has reduced the possibility of human error in discovering the responsible office, and reduced the discretion in the handling of the process. IRIS led to a more homogeneous delivery of public service, reinforcing the bureaucratic principles of standardization, impartiality and fairness of the administrative procedures.

The IRIS rooms are instead a good example of e-government solutions designed in support of professional bureaucracies. The system directs all cases whose identification and classification cannot be automated by the IRIS structured database to the IRIS room. The IRIS room creates and exercises a new function of professional bureaucracy. IRIS room operators decide what organizations are most suitable in providing solution to unclassified problems, and to those problems that have been rejected and contested by the organization initially given responsibility for.

The brokerage function of the IRIS room has developed a layer of bureaucratic communication between the organizations involved in the project. These organizations have trained and assigned roles to technical staff to manage their communications with the IRIS rooms, constructing a stable interface to the bureaucratic structure constituted by IRIS. The IRIS room professional bureaucrats are responsible only for cases that are exceptional and cannot be handled by automated machinery bureaucracy functions. The IRIS room enables the IRIS system as a whole to collect and process any kind of request, making the action of the bureaucratic organization more efficient and effective. The IRIS system provides effective support to the bureaucratic administration by automating the function of the machinery bureaucracy, and by rationalizing and streamlining the work of the professional bureaucracy. In extending bureaucratic responsibilities to technical staff distributed in the participating organizations, IRIS facilitates the allocation of problems to competent personnel, delivering better responses to citizens' requests.

Importantly, the simultaneous achievements of the automation of machinery bureaucracy and the reduction of the workload for the professional bureaucrats are made possible by specific technological performances. They are possible because the developers of the IRIS system

have been able to embed in the system a logic of functional simplification and closure which is aligned with the local context of the Venice municipality. The case highlights that the rationalization of bureaucratic processes into the design of ICTs is a fundamental stage in the deployment of effective e-bureaucratic organizations. Through the analysis that follows, we support the claim that the concepts of functional simplification and closure are powerful analytical tools that can support managers and developers when designing solutions for the public administration aimed at improving its efficacy and effectiveness.

6.1 IRIS: Functional simplification, closure and e-bureaucracy

In the IRIS case, the automation of bureaucratic activities is the result of accurate and specific iterations of the functional simplification and closure adjustments applied through the software development efforts. What the initial development and subsequent updates reflect is a process of accommodation of bureaucratic procedures into an information system. In the IRIS case, most of the organizational activities mediated by bureaucratic procedures, such as the forwarding of requests to responsible operators, can be automated by information technology. This brokerage function is extracted from the analogical procedural sequences embedded in the existing organizational context, and its execution is rendered even more formal and unambiguous when molded in a set of automated operations. To achieve such an outcome, the design of the information system needs to break down the target task into a number of piecemeal subordinate operations (Kallinikos 2006). Moreover, the subordinate operations need to be ordered in an explicit causal chain that is translated into the software code. To automate the brokerage process a number of essential problem classes had to be identified. The system then embeds, in its working logic, an unambiguous relationship between a problem class and one or more responsible organizations. When the citizen selects

a problem class, the system automatically forwards the record to the responsible organizations.

This is the result of a process whereby functional simplification and closure produce a separation between the bureaucratic operations embedded in an information system and the broader organizational and social relations within which the system is itself embedded (Kallinikos 2006). The functional simplification of the requests allocation process was constructed through the selection and abstraction of the operations of machinery bureaucracy from those of professional bureaucracy. The list of problem classes links through a closed, predefined set of relations each maintenance request to the organization responsible for its solution. Because this association is functionally simplified within the logic of IRIS, the system can automate part of the brokerage function. By so doing, in this specific case an ICT solution has contributed to the increase of the overall efficiency and effectiveness of bureaucratic procedures.

For a system to be functionally closed, it does not mean it cannot be changed. The alignment of the technology with the local context underwent iterations of adjustment of the configuration separating machinery bureaucracy from professional bureaucracy operations. As we have shown, the system was revised in December 2008, when the 'Pestering Animals' class was added. This adjustment was aimed at reducing the workload of the professional bureaucracy by reducing the number of requests under 'Unclassified' that have to be processes by the IRIS room. The web-based system was purposefully designed with the aim to guide citizens (cfr. Tempini 2015; Kallinikos and Tempini 2014) to allocate the majority of maintenance requests to a selected number of classes, for enabling automated handling of the cases. Citizens are responsible for classifying the problem that they are reporting but not for

the identification of the organization responsible for its solution. The automatic resolution of this allocation is the core functional simplification operated by the IRIS system. Since the request-to-organization allocation has been translated into an internally unambiguous operational logic, the system is able to abstract and execute it without exception or interference. The automation by the system makes the allocation process also unambiguous, replicable and consistent over time. This is the character of functional closure that is at the core of the IRIS system. IRIS effectively isolates or black-boxes the allocation process in the chain of instructions, whose execution is protected from external interferences such as procedural deviations or errors.

The case of the creation of the new class, 'Pestering Animals', is paramount in showing the implication of the functional simplification process for the automation of machinery bureaucracy functions. The IRIS system is effective in relieving the professional bureaucrats of part of their workload – as long as it does not generate new forms of work pressure. The system working with the initial set of problem classes was not effective in this regard, as it required the extensive involvement of the professional bureaucrats to process and allocate 'Unclassified' requests. While the system was actually being adopted by citizens as a channel through which to report requests, the high number of requests that were reported as 'Unclassified' were being queued by the system to await human processing. The offices responsible for the allocation of these requests, the IRIS rooms, were overloaded. Professional bureaucracy functions were in fact facing additional workload as a result of the insufficient degree of specificity in the system's logic. As we have shown through descriptive statistical data, the creation of the new class 'Pestering Animals' successfully reduced the number of requests falling into 'Unclassified'. This dramatically reduced the need for intervention by

operators in the IRIS room and the vast majority of the requests relating to animals are now dealt with by the automated system.

The IRIS case is an instance of successful alignment of the embedded logic of functional simplification and closure with the desired performance of a system. Showing how small adjustments in data structure can lead to markedly different outcomes explains the critical role that functional simplification and closure hold in determining the success or failures of public sector information system developments within an e-bureaucratic strategy.

7 Conclusions

The present study aims to propose a new theoretical endeavor in e-government research. It proposes an alternative to the dominant approaches, which emphasize the study of ICT implementations in terms of economic outcomes (transactions and services). The concepts of functional simplification and closure, associated with the notion of e-bureaucracy, introduce a toolkit that helps in designing and analyzing e-government solutions. The concepts we have introduced in this paper offer a solid background from which to study how ICT can be used to support and enable bureaucratic practices in favor of government reforms and service delivery improvements.

As the case suggests the process of alignment of functional simplification and closure logics with organizational needs and system purposes is uncertain and non-deterministic, as it is bound to be any attempt at shaping what a technology is about, or the outcomes of technology. Still, the IRIS system has led to a redefinition of the interdependences between public administration offices. The interdependences and functional relationships amongst the

organizations and their staff have been strengthened. This is the result of a new bureaucratic structure, which delivers public services through bureaucratic organizations more efficiently by automating the machinery bureaucratic functions and supporting the work of professional bureaucracy in the participating organizations. These new bureaucratic arrangements are supported by the brokerage affordance of the IRIS system. The system was designed to enforce the new rules and regulations as defined in the inter-organizational normative agreement, and become a single point of reference through which citizens can interact with the administration. This reconfiguration of organizational arrangements is a process of organizational change towards the e-bureaucratic form.

8 References

Accounts, House of Commons Committee of Public. 2008. HM Revenue and Customs: ASPIRE—the re–competition of outsourced IT services. edited by H. o. C. C. o. P. Accounts.

Bellamy, Christine, and John A. Taylor. 1998. *Governing in the information age*, *Public policy and management*. Buckingham ; Bristol, PA, USA: Open University Press.

Benbasat, I., D.K. Goldstein, and M. Mead. 1987. The case research strategy in studies of information systems. *MIS Quarterly* 11 (3):368-386.

Berg, M. 1998. Order(s) and Disorder(s): Of Protocols and Medical Practices. In *Differences in Medicine: Unraveling practices, techniques, and bodies*, edited by M. Berg and A. Mol: Duke University Press.

Bovens, M., and S. Zouridis. 2002. From Street-Level to System-Level Bureaucracies: How Information and Communication Technology Is Transforming Administrative Discretion and Constitutional Control. *Public Administration Review* 62 (2):174-184.

Ciborra, C., and O. Hanseth. 1998. From tool to gestell: Agendas for managing the information infrastructure. *Information Technology & People* 11 (4):305-327.

Clegg, S. 2007. Something is happening here, but you don't know what it is, do you, Mister Jones? In *ICT in the Contemporary World.* Information Systems and Innovation Group, London School of Economics and Political Science.

Cordella, A. 2007. E-government: towards the e-bureaucratic form? *Journal of Information Technology* 22 (3):265-274.

Cordella, A., and C. Bonina. 2012. A Public Value Perspective for ICT Enabled Public Sector Reforms: A theoretical reflection. *Government Information Quarterly* 29 (4):512-520.

Cordella, A., and F. Iannacci. 2010. Information systems in the public sector: The e-Government enactment framework. *The Journal of Strategic Information Systems* 19 (1):52-66.
Cordella, A., and L. Willcocks. 2012. Government Policy, Public Value and IT Outsourcing: The Strategic Case of ASPIRE. *Journal of Strategic Information Systems* 21 (4):295-307.
du Gay, P. 1994. Making up Managers: Bureaucracy, enterprise and the liberal art of separation. *The British Journal of Sociology* 45 (4):655-674.
Fountain, J.E. 2001. *Building the virtual state: Information technology and institutional change*. Washington, DC: Brookings Institution Press.
Gil-Garcia, J. R., and T. A. Pardo. 2005. E-government success factors: Mapping practical tools to theoretical foundations. *Government Information Quarterly* 22 (2):187-216.
Gronlund, A., and T. Horan. 2004. Introducing e-Gov: History, Definitions, and Issues. *Communications of the AIS* 15:713-729.
Heeks, R. 2002. Reinventing Government in the Information Age. In *Reinventing Government in the Information Age - International practice in IT-enabled public sector reform*, edited by R. Heeks. London: Routledge.
Hood, C. 1991. A public management for all the seasons?. *Public Administration* 69:3-19.
Kallinikos, J. 2004. The Social Foundations of the Bureaucratic Order. *Organization* 11 (1):13-36.
Kallinikos, J. 2005. The order of technology: complexity and control in a connected world. *Accounting, management, and information technologies* 15 (3):185-202.
Kallinikos, J. 2006. *The Consequences of Information: Institutional Implications of Technological Change*. Cheltenham: Edward Elgar.
Kallinikos, J. 2009. Institutional complexity and functional simplification: the case of money claim online service in England and Wales. In *ICT and innovation in the public sector; European perspectives in the making of e-government*, edited by G. Lanzara and F. Contini. Basingstoke: Palgrave Macmillan.
Kallinikos, J., and N. Tempini. 2014. Patient Data as Medical Facts: Social Media Practices as a Foundation for Medical Knowledge Creation. *Information Systems Research* 25(4) 817–833.
Kamarck, Elaine C. 2007. *The End of Government . . . As We Know It: Making Public Policy Work*. Edited by L. R. Publishers. Boulder, CO.
Layne, K., and J. W. Lee. 2001. Developing fully functional E-government: A four stage model. *Government Information Quarterly* 18 (2):122-136.
Luhmann, N. 2005. *Risk: a sociological theory*. New Brunswick, New Jersy: Transaction Publishers.
Mintzberg, H. 1983. *Structure in Fives: Designing Effective Organizations*. Englewood
Cliffs, NJ: . Prentice-Hall.
Nohria, N., and J.D. Berkley. 1994. The virtual organization (Bureaucracy, technology and the implosion of control). In *The post-bureaucratic organization*, edited by C. Heckscher and A. Dennelon: Sage.
Osborne, D., and P Plastrik. 1997. *Banishing Bureaucracy: The Five Strategies for Reinventing Government*. Reading, Mass.: Addison Wesley.
Perrow, C. 1986. *Complex Organizations*. 3rd ed. New York: McGraw-Hill.
Peters, B. Guy. 2001. *The politics of bureaucracy*. 5th ed. London ; New York: Routledge.
Tempini, N. 2015. Governing PatientsLikeMe: information production and research through an open, distributed and data-based social media network. *The Information Society* 31(2).

Walsham, G. 1995. Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems* 4:74-81.
Walsham, G. 2006. Doing interpretive research. *European Journal of Information Systems* 15:320-330.
Weber, M. 1947. *Theory of Social adn Economic Organization*. London: Free Press.
West, D. 2004. E-Government and the Transformation of Service Delivery and Citizen Attitudes. *Public Administration Review* 64 (1):15-27.
Yin, R.K. 2008. *Case Study Research: Design and Methods* SAGE Publications Inc.