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Abstract. Within the public sector, conflicts of interest challenge the objectivity of public officials, threaten the outcome of public decisions, and create opportunities for corruption. Governments worldwide use various types of artifacts to address this problem: laws and regulations, the political market, and more recently, information system artifacts. Even though these types of artifacts have been in place for many years in various countries, the conflict of interest problem has intensified. The problem has recently been recognized as a worldwide governance problem. Disclosure Systems are a mainstream instrument to address the conflict of interest problem. Public officials are obliged by law to disclose information regarding their assets, sources of income, outside activities, participation in firms, debts, gifts, among other interests. This information is collected, registered, and verified by official monitoring bodies. Besides these traditional artifacts, a new wave of Information System Artifacts is arising, triggered by the advancement of IT tools. Our PhD research project regards the use, design, and effectiveness of such Information System artifacts to address the conflict of interest problem.

Keywords: Design theory, Information systems design, Conflicts of interest

1 Research Question

The research question we address in our research project is: How to design improved Information System Artifacts that effectively address the conflict-of-interest-problem in the public sector? We address the research question through the following Research Goals (RG):

- RG1: To identify the characteristics of the conflict of interest problem, relevant in the design of Information System Artifacts.
- RG2: To describe Information System Artifacts currently used to address the conflict of interest problem.
- RG3: To suggest a Design Theory for improved Information Systems capable to effectively address the conflict of interest problem.
- RG4: To suggest an expository instantiation based on the proposed Design Theory.

2 Significant Problems in the Research Field

As suggested by Herbert Simon, artifacts are built to satisfy human goals and purposes (Simon, 1996). Whenever our artifacts do not serve them, we have good reasons to consider re-design or re-engineer such artifacts, improving their effectiveness to reach their intended purpose. Our concern regards the use and design of Information Systems as an effective kind of artifact to address the conflict of interest problem. Accordingly, we found out both little information and not-convincing evidence regarding traditional Information Systems' effectiveness, plenty of literature pointing out at their limitations, and limited literature regarding the use and design of such systems. We also find that novel Information Systems are not overcoming such limitations.

We argue that both traditional and novel Information Systems are not sufficiently grounded in theory, which impacts on their effectiveness to address the problem they are supposed to alleviate. First, there is little information available regarding the way these information systems are constructed, so the underlying theory, if any, cannot be analyzed. Second, the operation of these Information Systems has continuously been criticized precisely on theoretical grounds. Behavioral studies for example, have suggested that conflicted agents face psychological impediments to identify and disclose their own conflicting interests (Thagard, 2007). Third, these Information Systems have traditionally been analyzed as policy interventions, mainly through economic or policy analysis, but not according to their inherent nature of Information Systems. We argue that these theoretical limitations impact these systems' effectiveness to address the conflict of interest problem.

One of the main goals pursued within novel Information Systems is the automatic identification of conflicts of interest, in which the modeling and representation of conflicts play a crucial role. A very strict representation of these conflicts would be counterproductive, as many conflicts of interest would not be identified. On the other hand, a very broad representation would make the identification of conflicting interest unworkable, expensive, and inefficient. We argue that these problems can be addressed through Design Theory.

3 Current Status of the Problem Domain and Related Solutions

Disclosure Systems are considered the most important instruments to address the conflict of interest problem (Villoria Mendieta, 2007). Nowadays laws in more than 120 countries require public officials to disclose information about their assets, sources of income, outside activities, participation in firms, debts, gifts, among other interests (OECD, 2015). Disclosed information is collected, registered, and, depending on the jurisdiction, verified on completeness and accuracy by a monitoring body, which is also in charge of identifying potential conflict of interest situations (Villoria-Mendieta, 2007).

Several criticisms have been made to these Disclosure Systems. Scholars have pointed out that these systems are often too simplistic or easily avoided by public officials stating: "nothing to declare" (Demmke, 2007). Verification of disclosed in-

formation has been considered unrealistic, especially in systems monitoring a high number of public officials (Villoria-Mendieta, 2007). Other criticisms rely on the basis that disclosure systems have rarely been used as evidence for prosecution and that sanctions are rare (Villoria-Mendieta, 2007). A main limitation of the declaration system is its focus in the disclosed information, rather than in determining the existence of potential conflicts of interest in specific detail. Conflicting interests are sought by monitoring bodies in the abstract, while such conflicts are highly context-sensitive. Therefore, experts have questioned the usefulness of these systems, arguing that they involve a waste of public resources and creation of costly and ineffective bureaucracy (Anechiarico, 1996). Despite these criticisms, disclosure laws keep expanding worldwide.

Research on these traditional Information Systems is quite limited. Most literature regards these disclosure systems as policy or legal interventions. These systems are mainly subject of policy and economic analysis. Moreover, there is limited information regarding the effectiveness of these systems. Even in such cases, the evaluation of the systems is inconclusive, delivering considerable caveats and limitations (Gokcekus 2006; Vargas, 2016). We argue that disclosure systems are indeed Information Systems, therefore researchable through the lens of information and information sciences. To our best knowledge, there are no studies carried out according to such a scope.

A new wave of Information System Artifacts to address the Conflict of Interest problem has arisen, triggered mainly by the advancement of Information Technology tools: Monitoring bodies are commissioning the design of Information Systems to identify conflicts of interest in public procurement settings; Governments like the ones in France and Chile have recently decided to publish public officials' disclosed information in open data format; very interesting and challenging applications of semantic and network analysis tools have been used to automatically identify conflicts of interest in the setting of peer review in academic journals (Aleman-Meza, 2006; Wu, 2017). Our research project will provide a characterization on these innovative artifacts, including the representation and modelling of conflicts of interest.

Depending on the type of Information System, we find more or less information regarding their use, design, and effectiveness. This depends mainly on the body undertaking the development of these artifacts. When these tasks are conducted by governments, these efforts tend to replicate what the law says. When these systems are contracted out by the government to external companies, there is not much information available. When these systems are carried out as part of research projects there is valuable explanation on these systems contained in journal articles. For what we have observed so far, we find very little theory around these novel Information Systems, which again might have an impact on their effectiveness.

4 Preliminary Ideas, Research Approach and Results

We undertake this research project having in mind the improvement of Information Systems to effectively address the conflict of interest problem. The Design Science

Research methodology is suitable for our research, as its purpose is to create purposeful artifacts designed to address unsolved and important problems (Peffers, 2007). As we have argued before current interventions based on laws and regulations, the political market, and information systems have not been able to address the conflict of interest problem. We argue that Information Systems can be useful to address the problem, especially when special attention is put into their design.

Design Science Research requires the design of Information System Artifacts, typically taking the shape of constructs, models, frameworks, architectures, design principles, methods and instantiations (Lee, 2015). Our research project will contribute with Design Theory, defined as "a prescriptive set of statements on how to do something to achieve certain objective" (Vaishnavy, 2015). Defining the objective of these artifacts will be part of our Design Theory approach since we will analyze and design the relevant processes to address the conflict of interest problem. So far, most artifacts have been focusing in the disclosed information and in identifying potential conflicting interest in certain situations. We seek to describe a wide array of applications for this kind of artifacts according to our Design Theory.

Implementing Information Systems for complex tasks is not an easy nor trivial endeavor. These systems have proven to be useful when supporting structured processes, but not so much within complex intellectual processes or when trying to automate people's higher cognitive functions (Markus, 2002). This point is clearly exemplified on Todd and Benbasat's research:

> "IT has successfully supported only the problem-solving tasks associated with decision-making. But problem finding— including the tasks of uncovering the underlying decision problem, gathering relevant information about it, and diagnosing it— is "fuzzy, difficult, and not amenable to technical support." (Markus, 2000).

This is precisely the essence of conflicts of interest! These conflicts are fuzzy, complex, even confusing for monitoring bodies (Oficina Antifrau de Catalunya, 2017). Moreover, the gathering, diagnosis of relevant information and appropriate solution of the situation, makes conflict of interest such a difficult field to grasp. As explained by Whitton, identifying and resolving a conflict of interest requires to distinguish relevant facts, law and policy, which involves technical skill and a good understanding of the many issues involved in the conflicting situation (Whitton, 2005).

As demonstrated by Markus, Design Theory can be used to create Information Systems tailored to address the unique characteristics of a complex problem, supporting even its most intellectual, knowledge intensive aspects (Markus, 2002). Design Theory is key as it relies on scientific theory behind the problem to be solved, technical information regarding the artifact, and imagination to devise how an Information System can be feasibly and effectively carried out (Walls, 1992). Design comes to be not only valuable or convenient, but as determinant, since design is indeed the way to find and implement solutions to any given problem (McKay, 2012).

Following the Design Science Research approach, we start our research project with a descriptive approach to identify the main characteristics of the conflict of interest problem in the public sector, focusing on its nature, manifestations, behavior and effects. There is a great amount of disperse qualitative literature regarding this problem within the public sector, but also regarding conflicts of interest happening in oth-

er fields. Characterizing the problem will give us a good grasp of the challenges to be addressed by the resulting artifacts object of our Design Theory.

We continue with a second descriptive phase addressing the use and design of traditional Information System artifacts to address the conflict of interest problem. This will allow us to identify the opportunities and limitations of these artifacts, as well as suggesting improvements for further development. Additionally, we will analyze novel Information Systems to identify similarities and differences between both the traditional and the novel models. Particularly, we are considering focusing on systems based on open and linked data technologies.

After we conclude the descriptive phase, we will use the information obtained at this stage to undertake a prescriptive analytical phase of our research project regarding how to design improved artifacts to address the conflict of interest problem. For this purpose, we will develop a Design Theory tailored to the characteristics of the problem and the state of the art regarding current artifacts. To build up the Design Theory we will identify the appropriate kernel theories as the basis to sustain the effectiveness and development of improved systems (Kuechler, 2012). Such kernel theories are based on information and information system theory, public administration and governance studies. The main criteria orientating our prescriptive design has to do with determining relevance on conflict of interest cases: what procedures, stakeholders, and information are relevant to effectively address the conflict of interest problem.

Lastly, we will explore the possibilities for designing improved artifacts based on our resulting Design Theory and relevant technologies available. We seek to illustrate the array of Information System Artifacts that could be built up according to relevant conflict of interest procedures, relevant information technology tools, and to devise an expository instantiation of the Design Theory.

5 Research Methodology

To achieve our Research Goal 1, we undertake a descriptive analysis to identify the main characteristics of the Conflict of Interest Problem. First, we characterize the problem according to agency theory as done by Susan Shapiro (Shapiro, 2005). This characterization allows us to identify the role of relevant stakeholders in conflict of interest settings: principals and agents. Accordingly, a conflict of interest is defined as situations in which an individual (an agent) can exploit an official capacity for personal benefit (Mungiu-Pippidi, 2017) naturally affecting the principal (citizens). Distinguishing between agent and principals is not trivial, since the development of current artifacts to address the problem is highly dependent on whether we focus on one or other stakeholder as the focus of the artifact. Second, we characterize the problem as a behavioral one, a problem that affects the public official's decision making or judgment process (Kinander, 2016). This characterization is relevant since it allows us to perceive the difficulty to identify the existence of a conflict of interest situation. Third, we consider it is important to characterize the problem as one that can occur within the whole spectrum of the policymaking process, involving a huge amount of

transactions and legal operations. Finally, we will briefly describe how the current legal and market interventions have not been able to address the conflict of interest problem, calling for the emergence of new effective artifacts designed to address the problem effectively.

To achieve Research Goal 2, we will undertake a descriptive analysis regarding the traditional Disclosure Systems to address the conflict of interest problem. We seek to analyze them as Information System Artifacts. In order to do so, we seek to analyze them by using the updated DeLone and McLean model on Information System success, encompassing a review on information quality, system quality, service quality usability, user satisfaction and net benefits provided by such Information System artifacts (DeLone, 2003). This review will allow us to identify among other information, the system's functions and attributes (Ein-Dor, 1993) and the system's usability according to the type of stakeholder that we had previously identified on the Research Goal 1. This analysis will provide us a good characterization of these artifacts, as well as the opportunities and limitations that they face. Afterwards, we will carry a review on selected novel Information System artifacts, compared with the traditional Information System Artifacts as a benchmark. We will be able to compare these information systems analyzing what are the additional functions and attributes, and how they overcome the limitations found in the traditional systems. We will opt for Information Systems based in open data and the ones based in linked data. We seek to analyze these artifacts improved features and analyze what are the opportunities or challenges that they require in order to bring an improvement to existing artifacts.

To achieve Research Goal 3, we will develop the structural components of an Information System Design Theory as proposed by Gregor (Gregor, 2007), encompassing purpose and scope, constructs, principles of form and function, artifact mutability, testable propositions, justificatory knowledge, principles of implementation and an expository instantiation. Accordingly, the nature of the resulting Design Theory will be prescriptive, i.e. proposing how the artifacts of a kind should be constructed (Gregor, 2007). We will devise a Design Theory encompassing Information Systems to address the conflict of interest problem. One of the main concerns that we have when developing the Design Theory, will be to take into consideration the diversity of stakeholders. One of the advantages of describing the conflict of interest problem as an agency problem, is the possibility to focus our attention in the role of principals, i.e. the citizens as clients for the design of novel artifacts. Using open data for making available public official's disclosed information is a good suggestion that the artifacts object of our study need to be citizen friendly and provide them with a good deal of information regarding their agents, their interests and the possible conflicting situations in which they might be involved.

Among other relevant Design Theory components, we will pay significant attention for providing the purpose and scope of these artifacts, i.e. the set of meta-requirements for the type of systems encompassed by the theory. This will allow us to show the multiplicity of artifacts that can be used to address the problem, according to the relevant procedures grounded in theory to address our problem. As opposed to the current artifacts, we will show that multiple artifacts should be built not only to identify conflicting interest, but also to bring a solution to potential conflicting situations.

Also important in this stage will be the identification of the constructs we will be using to derive our Design Theory. It is relevant to mention that we seek to move away from the mere identification of interest, to the situations in which those interest actually conflict with other values, processes, or decisions, i.e. the representation of conflicts of interest. We seek to clarify by constructs the appropriate unit of conflicts of interest that we can pursue. This will be especially relevant while considering the opportunity presented by open and linked data tools, since they allow us to compare the disclosed interest with relevant public transactions, actions, or decisions.

To achieve Research Goal 4, and as the final stage of our research project we seek to suggest specific guidelines for designing an instantiation based on our newly developed Design Theory by proposing an expository instantiation of the Design Theory. We will seek to focus on relevant processes, using relevant information taking citizens as the main users of the resulting artifacts.

6 Contributions

The main contribution of this research project will be the Design Theory itself, useful in terms of knowledge and its application to devise improved artifacts. First, a Design Theory applicable to conflicts of interest in the public sector will bring a very much needed knowledge contribution to theory within the e-governance field, one that has been described as heavily under-theorized and over-dependent on descriptive case studies (Bannister, 2015). Making explicit the design of conflict of interest artifacts will be valuable to promote the analysis and discussion of existing artifacts, including laws and regulations, the political market, and more recently, information system artifacts. Moreover, an explicit Design Theory would be useful as a theoretical framework promoting transparency and increased information regarding the technologies employed to improve public governance.

Second, we expect that the Design Theory will be considered by institutions, researchers, and practitioners to devise, design, and implement improvements and major innovations for conflict of interest artifacts. We can foresee that relevant implementations of the Design Theory can be applied to devise a wide arrange of artifacts to prevent, detect, manage, investigate, and deliver judgements on conflicts of interest cases. We seek to contribute in the development of meta-requirements, representation, and justificatory knowledge for a new generation of integrity machines that effectively address conflicts of interest in the public sector.

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