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Governing Asset Management Data Infrastructures

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Abstract

Organizations are increasingly looking to trusted data to drive their decision making process. Trusted data has a clear, defined and consistent quality which meets the expectations of the user. Data infrastructures which produce trusted data and provide organizations with the capability to make the right decisions at the right time are socio-technical networks, consisting of technical infrastructures and actor networks, and as such they are often complex and adaptive. Critical issues, challenges, and dilemmas can be identified while looking at data infrastructures as a socio-technical systems. This paper explores conditions and factors for effective and sustainable development of data infrastructures in organizations and suggests that the inherent complexity of data infrastructures requires a multi-faceted way of data governance. Several predefined components of data infrastructures which contain the behavior of agents through various coordination mechanisms have been developed to model the effect of data governance on data infrastructures. These components can be further customized to model an empirical situation more closely. Finally, the paper suggests institutionalization of data governance within an organization as a unifying concept towards the effectiveness and sustainability of data infrastructures, recognizing their inherent complexities. The approach is illustrated with a case study in the asset management domain.

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1. Introduction

Asset managers have found it difficult to develop information systems which produce data they can trust, and asset data is regularly observed to be lacking in intrinsic quality, lost within significant amounts of meaningless data, or, conversely, to be missing the required detail[1]. Data governance may support data-driven decision-making by contributing to the improvement of data quality[2]. The objective of this study is to evaluate how data governance supports data-driven decision-making in asset management organizations. This requires looking at the entire data infrastructure and taking an holistic approach to data infrastructures[3] which describes the sociological as well as the technological components. Using a complex adaptive system (CAS) lens can help us to identify and better understand the key elements of data infrastructures and data governance. The organization of data infrastructures occurs through data governance[4]. Data governance specifies the framework for decision rights and accountabilities to encourage desirable behavior in the use of data[16], ensures that data is aligned to the needs of the organization[11], monitors and enforces compliancy to policy[33], and ensures a common understanding of the data throughout the organization [23]. This research takes place in the asset management (AM) domain of physical infrastructure. We follow Mohseni's [5] (2003) definition of AM as being a discipline for optimizing and applying strategies related to work planning decisions in order to effectively and efficiently meet the desired objective.

AM is often regarded as an essential business process [6]. Quality data is regarded as being essential to driving the decision-making process within AM [7]. In this paper we investigate the impact of data governance on data quality within AM data infrastructures and, as such, the impact of data governance on data-driven decision-making in an AM setting. This study is centered on the AM process of determining current and future asset conditions, critical for assessing the remaining service life of assets and to prevent the risk of failure of assets. In the following section we describe the methods used in this research. In section three, we discuss, on the basis of a review of literature, the factors for effective and sustainable data governance. We describe the results of the case study in section four. In section five we describe a quasi-experiment which quantifies relationships between data governance and improvements in asset management decision-making using an agent-based conceptual model which has been derived from the results of the literature review and the case study. As the experiment is yet to be conducted, discussing the results of the experiment is outside the scope of this article. In section six we discuss the model and the limitations of the quasi-experiment and, finally, we draw conclusions in section seven.

2. Method

The literature review in this research follows the method proposed by Webster & Watson[8] (2002) and Levy & Ellis[9] (2006) and attempts to methodologically analyze and synthesize literature in order to describe key elements of data governance. In November, 2015, the keywords: "data governance", and "principles", returned 17 hits within the databases Scopus, Web of Science, IEEE explore, and JSTOR. 8 hits were journal articles, 6 were conference papers, 2 were books and 1 hit was an article in the press. Of these articles, only 1 article, 10, was directly related to e-governance. We found that most articles covered data governance in general, but few articles included an explicit list of key elements of data governance. We then filtered these results and performed a forward and backward search to select relevant articles based on the criteria that they included a theoretical discussion on what data governance is or does. Based on this forward and backward search, 35 journal articles, conference proceedings and books were selected. Practical sources were only used when the authors provided factual evidence for their assertions.

The case study method used in this research follows the methods proposed by Yin[11] (2009).The case under study was that of asset management within the Directorate General of Public Works and Water Management of the Netherlands. The Directorate General of Public Works and Water Management of the Netherlands is commonly known within The Netherlands as "Rijkswaterstaat", often abbreviated to "RWS", and is referred to as such within this research. The case study was explorative in method and descriptive in nature. Unstructured interviews were held with managers, subject matter experts, and internal consultants. Internal documentation concerned with the description of the data infrastructure of the RWS was studied.

The quasi-experiment described in this paper uses gaming as a tool to simulate data governance in data-driven decision making in an asset management setting. The quasi-experiment follows a pretest-posttest structure. According to Bekebrede [12] (2010), serious gaming can be a useful tool to simulate complex socio-technical

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