Government Information Quarterly 31 (2014) S84–S92

Contents lists available at ScienceDirect

Government Information Quarterly

journal homepage: www.elsevier.com/locate/govinf

Reconceptualizing measuring, benchmarking for improving interoperability in smart ecosystems: The effect of ubiquitous data and crowdsourcing

Devender Maheshwari, Marijn Janssen

Delft University of Technology, Jaffalaan 5, 2628 BX Delft, The Netherlands

ARTICLE INFO

Available online 2 May 2014

Keywords:
Measurement
Benchmarking
Crowdsourcing
Smart government
Organizational interoperability
Design
Development
Improvement

ABSTRACT

There is a fundamental shift in measuring and benchmarking due to the ability to use a large variety of data sources and virtually anybody can be involved. Interoperability is the ability of entities to work together covering aspects ranging from the technical to the organizational level. In smarter government, interoperability becomes increasingly important as relationships are subject to continuous changes and organizations operate within organizational ecosystems. In this paper interoperability measurement, benchmarking and improvement are reconceptualized in the light of the effects of big and open data and crowdsourcing in smarter government. Organizational and technical interoperability is decomposed into measurement constructs. A case study is presented showing the applicability and usefulness of the model. Using data sources inside and outside the organization the level of interoperability was measured and suggestions for improvements were identified by making use of experts and the crowd.

1. Introduction

In smart government organizations need to be able to continue to adapt and collaborate with other organizations to take advantages of new opportunities. Interoperability is a key requirement to be able to collaborate and is the ability of disparate systems to work together. In smarter government there is often a smaller government which is focusing on managing and orchestrating interactions with public and private stakeholders in an open ecosystem (Janssen & Estevez, 2013). Often temporary organizational arrangements are created to tackle contemporary societal problems. This results in an ecosystem requiring interoperable systems which can be operated by public and private organizations. Harrison, Pardo, and Cook (2012, p-900) view an ecosystem as "an interdependent social system of actors, organizations, material infrastructures, and symbolic resources". Collaborating and dealing with interdependencies among players in such an ecosystem require interoperability. Interoperability is a necessity for the advancement of organizational processes and procedures and to provide effective service provision to the citizens (Kubicek & Cimander, 2009; Lueders, 2005; Pardo & Burke, 2008, 2009). Many definitions of interoperability can be found in literature (e.g. Commission, 2002; IEEE, 1990, 2000; Moen, 2000; Scholl & Klischewski, 2007). Interoperability shapes the condition for two or more entities to be able to collaborate by exchanging information and communicating with each other. Interoperability requires the fulfillment of conditions ranging from technology to the organizational level.

In smarter government ecosystems both technical as well as organizational capabilities are needed to enable organizations and their systems to interoperate (Hjort-Madsen, 2006; Pardo & Burke, 2009; Tolk, Turnitsa, Diallo, & Winters, 2006). Although organizational interoperability is essential for smarter government ecosystems to interoperate, majority of the existing research focuses on creating technical, syntactical, and semantic interoperability. At the same time measuring, benchmarking and improvement (MB&I) process is changing. Developments such as use of social media (Bertot, Jaeger, & Grimes, 2010), availability of large amounts of open data (Napoli & Karaganis, 2010), visualization of performance indicators using dashboard (Maheshwari & Janssen, 2013), and crowdsourcing of improvement ideas (Surowiecki, 2004) are reshaping traditional performance measurement and improvement processes. Measurement can be done based on open data and user-generated content. Citizens might express their experiences with government interactions on social media, or rate an organization on a certain comparison website. The opening of data can make organizations transparent and this enables the public to make improvement suggestions. In MB&I process, the relationships between citizens and government are fundamentally changing as more and more citizens are being involved in the process.

E-mail addresses: d.maheshwari@tudelft.nl (D. Maheshwari), m.f.w.h.a.janssen@tudelft.nl (M. Janssen).

http://dx.doi.org/10.1016/j.giq.2014.01.009
0740-624X/

- *Measuring*: citizens provide feedback based on their experience on social media, using surveys and so on. They can discuss what went good or bad, resulting in a wide variety of user-generated data sources that can be used as an input for benchmarking.
- *Benchmarking*: traditionally experts, policy-makers, and managers perform benchmarking to compare countries or organizations with each other to analyze and assess the performance. By opening this information, citizens can more easily view the performance, compare organizations with each other, and can come up with arguments to improve the situation.
- *Improving*: As the measurement results are opening almost anyone can gain access, analyze the results, and provide suggestions for improvement. Whereas in the past experts within the government were solely responsible for these activities, now the public can get involved in the improvement process. The results of the experiences can be published and shared. This enables easy comparison and identification of improvement suggestions.

This paper reconceptualized the MB&I process in the light of these developments. Section 2 describes interoperability measurement instrument combining technical and organizational interoperability (2.1), discusses interoperability in public–private ecosystem (2.2), and describes the reconceptualized MB&I process (2.3). Section 3 derives the measurement constructs for both technical and organizational interoperability layers. In Section 4, we discuss a case study conducted at the Population Welfare Department (PWD), Government of Sindh, Pakistan using the reconceptualized MB&I process to test the interoperability measurement instrument and the constructs. Finally, we discuss the results of the outcome of case study in Section 5 and conclusions in Section 6.

2. Reconceptualizing the measuring, benchmarking and improving process

2.1. Technical and organizational interoperability

In smarter government interoperability is a prerequisite to ensure that organizations can collaborate with each other in changing constellations. Interoperability can be defined in various ways (e.g. Commission, 2002; IEEE, 1990, 2000; Moen, 2000; Scholl & Klischewski, 2007). For example IEEE defines interoperability as "the ability of two or more systems or components to exchange information and to use the information that has been exchanged" (IEEE, 1990), whereas Scholl and Klischewski view (2007) interoperability as "a property referring to the ability of diverse systems and organizations to work together". In essence interoperability is the ability of disparate systems to work together.

Hjort-Madsen (2006) argues that the complexity of organizational aspects of interoperability may surpass the technical as the public organizations move towards inter-organizational governance. Van der Veer and Wiles (2008, p-6) describe the organizational interoperability as "the ability of organizations to effectively communicate and transfer (meaningful) data even though they may be using a variety of different information systems over widely different infrastructures, possibly across different geographic regions and cultures". Similarly, the European Interoperability Framework IDABC (2004, p-16) describes organizational interoperability as "defining business processes and bringing about the collaboration of administrations that wish to exchange information and may have different internal structures as well as aspects related to requirements of the user community".

Van der Veer and Wiles (2008) argue that the successful implementation of technical, syntactical, and semantic interoperability is necessary for organizational interoperability, whereas others suggest that both organizational as well as technical interoperability can be implemented independently (e.g. Janssen & Scholl, 2007; Maheshwari, Veenstra, & Janssen, 2011). Many interoperability maturity models described in literature focus primarily on the technical aspects (ATHENA, 2004; Clark & Jones, 1999; Tolk & Muguira, 2003; Turnitsa, 2005). Only a handful of maturity models address aspects of organizational interoperability (Goldkuhl, 2009; IDABC, 2004, 2008; Scholl & Klischewski, 2007). The maturity of technical interoperability is achievable due to the availability of well-established standards, technologies, systems and capabilities, but the aspects of organizational interoperability are less clear. Organizational interoperability contains aspects like organizational strategies and policies, business processes, cost, collaborative work, communication structures etc. which are often difficult to define and measure. For each organization, they can be different and ambition levels might vary resulting in different yardsticks.

Goldkuhl (2009) describes the need to conceptualize organizational aspects of the interoperability as they are equally important and crucial for organizational development. Aspects of organizational interoperability can be measured within an organization, between two or more information systems, or between different organizations with multiple information systems. Scholl and Klischewski (2007) describe that the assessment of interoperability is unclear, faces many organizational challenges, and measurement methods need to be investigated properly. They identify nine major constraints that affect the interoperability i.e. constitutional, jurisdictional, collaborative, organizational, informational, managerial, technological, cost, and performance. Some of these constraints reflect the organizational aspects of interoperability and need to be included in interoperability measurement process.

In conclusion, interoperability is a combination of technical and organizational aspects which can be developed independent of each other. By combining these elements a matrix containing both organizational and technical interoperability can be used to benchmark the situation of organizations as shown in Fig. 1. If organizational and technical interoperability is achieved, we label this as full interoperability. Only technical interoperability is labeled as connectivity, whereas only organizational interoperability is called collaboration. Improvement strategies for interoperability can follow three different paths.

1) Technical interoperability strategy, first adopting standards, using interoperability technologies, defining interfaces, and defining semantics before addressing organizational issue.
2) Organizational interoperability strategy, first by focusing on collaboration, procedures, and processes before developing the technology needed for supporting organizational interoperability.
3) Joint strategy, which focuses on realizing technical and organizational interoperability at the same time.

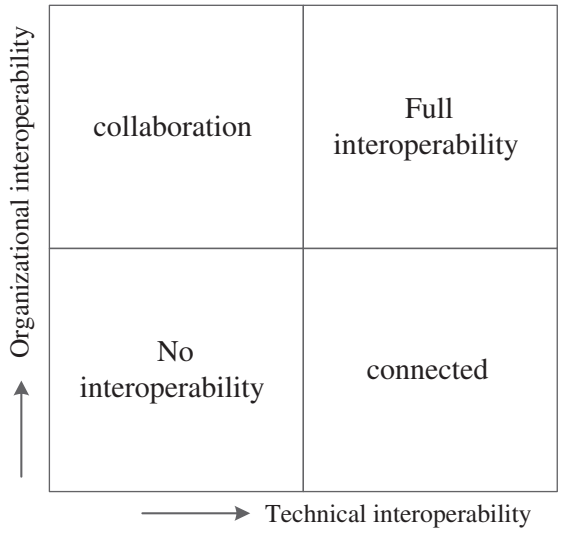

Fig. 1. Interoperability measurement instrument.