

## Chapter 2

# Enhancing Data Management in E-Government Using Data Categorization and Visualization Techniques

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### ABSTRACT

*Modern information and communication systems can process massive amounts of data automatically and efficiently, but human beings have a limited cognitive capacity. Organizations that handle data on a larger scale need to adjust and streamline their operations in order to cope with this complexity. The e-Government information systems present problems that are on an entirely different scale, with communication streams between citizens and government easily dwarfing those in the private sectors. The information flows in e-Government are further constrained by established processes and practices that are hard to change and strict privacy concerns. A solution to problems of complexity and inefficiency of data manipulation in e-Government is needed. This chapter analyzes models and techniques of data categorization and visualization that can be employed in the context of e-Government. Methods of categorization, metadata, and ontologies in particular are explored for use in such an environment. A simple government ontology framework is developed as a starting point for introduction of ontologies into the e-Government context and the information is structured in such a way to allow easy correlation and navigation between concepts. A simple but intuitive visual representation of information and their relations is developed to facilitate better understanding of complex topics.*

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## INTRODUCTION

One of the key issues in the internal work of any organization that deals with internal and external information flows are the difficulties with manipulating, processing, analyzing, and understanding the information in the system. This is an issue for both the humans and the machines that take part in the process. For the machines, it manifests itself as a problem of interoperability and understanding data in different formats, while for the humans the issue becomes the availability of right information at the right time and choosing the appropriate representation of said information. This is especially significant in an e-Government context. Every government represents a complex, all-encompassing system, composed out of a number of hierarchically ordered entities that communicate between themselves and with citizens, private organizations, companies, foreign institutions, etc. Modern technologies have also contributed to an increase in the amount of citizen-government communication, leading to a significant upsurge in the complexity and volume of information in e-Government systems.

E-Governments attempt to improve their efficiency by introducing new technologies and digitalizing and virtualizing existing processes. This can engender problems typical for environments that experience rapid introduction of new technologies without a general plan – problems relating to the standardization of protocols, processes, data, centralization of services, and integration and interoperability of diverse systems.

Interoperability is a critical requirement in this context, and it refers to a property that enables different systems and organizations to work together in order to achieve common goals. Interoperability is achieved by applying common standards and work practices in existing processes or restructuring them to comply with external requirements in order to enable exchange of information and knowledge (Interoperability Solutions for European Public Administrations,

2010). Interoperability requires a certain level of compatibility between systems that take part in the exchange of information in order to assure its proper interpretation. Technological diversity often makes this difficult and required compatibility can be achieved by applying abstractions to hide complexities and implementation details.

A number of constraints that influence government integration and interoperability are defined in (Scholl & Klischewski, 2007) and include constitutional/legal, jurisdictional, collaborative, organizational, informational, managerial, cost, technological, and performance constraints. A similar, but more specific list of barriers to achieving interoperability on a wider scale using modern information systems and technologies is presented in (Landsbergen Jr. & Wolken Jr., 2001) and includes:

- **Political:** Citizen privacy concerns, agency statutory authority ambiguities, and openness to public scrutiny.
- **Organizational:** Lack of mutual trust between agencies, lack of experience in developing interoperable systems, and lack of awareness of possibilities for data sharing.
- **Economic:** Lack of resources and “low-bid” procurement methods that favour approaches which are cost-effective in the short run.
- **Technical:** Hardware/software incompatibility, reliance on private contractors, and data-sharing standards.

Although interoperability depends on a number of factors, the core of the problem is the standardization of underlying data formats and developing methods for data management, interlinking, access authorization and presentation appropriate to entities or individuals utilizing the data. The solution applied to this problem will define other, higher-level technical, economic, organizational and political problems and barriers to introducing interoperability.

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