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Procedia Computer Science 112 (2017) 1871–1880

Procedia Computer Science

www.elsevier.com/locate/procedia

International Conference on Knowledge Based and Intelligent Information and Engineering Systems, KES2017, 6-8 September 2017, Marseille, France

Big Data Guided Design Science Information System (DSIS) Development for Sustainability Management and Accounting

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Abstract

S*ustainability* is a dynamic, complex and composite data relationship among geographically distributed human and environment ecosystems. The ecosystems may have strong interactions among their elements and processes, but with dynamic implicit boundaries. Multi-scalable and multidimensional ecosystems have significance based on a commonality of basic structural units and domains. We intend to develop a holistic information system for managing different ecosystems within a sustainability framework/context, using an empirical qualitative and quantitative interpretation and analysis of the measured observations. Design Science Research (DSR) approach is aimed at developing an information system using the volumes of unstructured Big Data observations. Collaborating multiple domains, interpreting and evaluating the commonality, uncovering the connectivity among multiple systems are key aspects of the study. The Design Science Information System (DSIS), evolved from DSR approach is used in solving the ecosystem issues associated with multiple domains, in which the *sustainability* challenges manifest. In this context, we propose a human-environment-economic ecosystem (HEES) framework consisting of human, environment and economic elements and processes. In broad terms, human, environment and economic domains are conceptualized as different players/agents that operate within a range of *sustainability* scenarios. This approach recognizes the existing constraints of the systems as well as the emerging knowledge of the boundaries of ecosystems and their connectivity. The connectivity and interaction among the systems are analyzed by data mining, visualization and interpretation artefacts within a sustainability policy framework.

Peer-review under responsibility of KES International

Keywords: Design Science; Digital Ecosystem; Sustainability; Multidimensional Artefacts; Data Interpretation;

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Peer-review under responsibility of KES International
10.1016/j.procs.2017.08.233

1. Introduction

Within a sustainability scenario, as long as the symbiotic conditions exist, the human ecosystems survive. Human activities exist in multidimensional contexts and domains; in particular within environmental ecosystems. Human survival and well-being depend either directly or indirectly in ways in which natural assets and resources are nurtured, protected, used and managed in our biophysical and sociocultural environment. There is growing concern about the emergent social, environmental and economic risks surrounding the existing progress, attained through a variety of commonly intertwined modernization processes[2]. Sustainability describes the surroundings in which the human and environment entities work together with the creative and active symbiosis, permitting and satisfying the cultural, social and economic necessities of present and future generations, including the legacies of past wastefulness and exploitation of natural resources. We propose a structure HEES, in which human activities are conceptualized as an ecosystem, comprising of cultural, social, economic and political systems. Each participant of an ecosystem has potential to contribute to or detract from the sustainability of the system of which they are subset[10] as demonstrated in Fig. 1. The dataflow is shown as arrows(↔) among various ecosystems. The human, environment and economic domains/ecosystems are emphasized as entities from which the connectivity can be established through an integrated framework, simulating amenable artefacts.

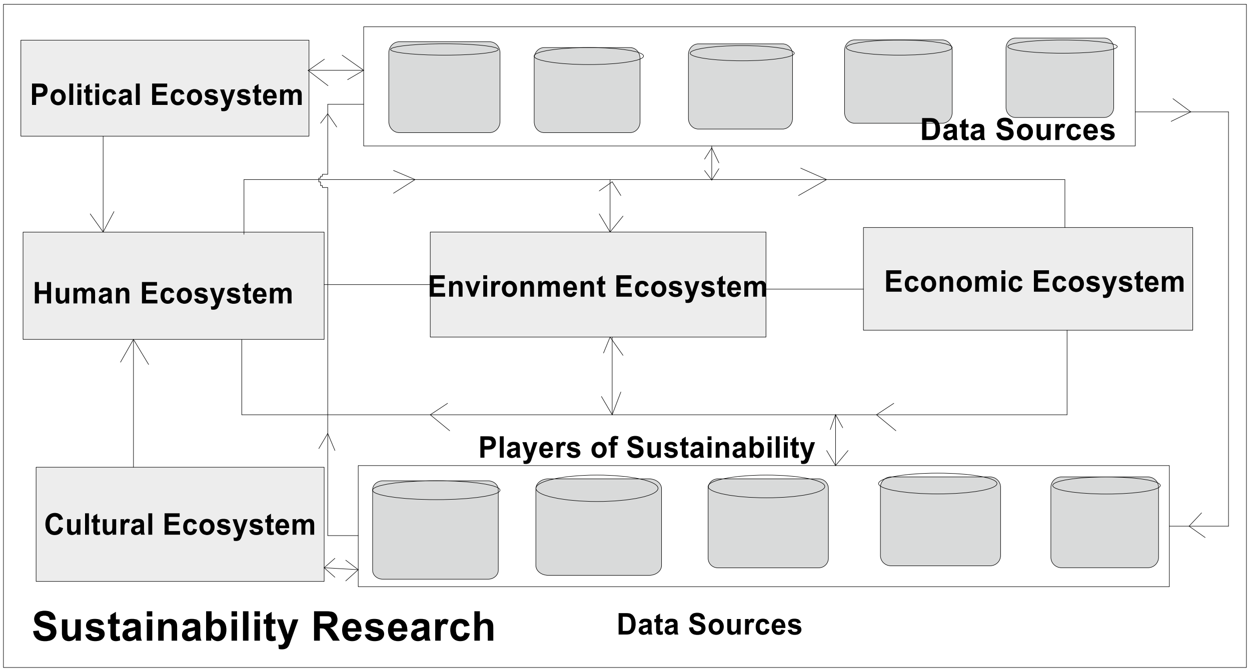

Fig. 1: *Sustainability* and its players in the HEES structure[10]

For the purpose of integrating domain ontologies with multifaceted dimensions, the data warehouse approach is adopted. However, various challenges encountered in data integration tasks are analyzed for envisaging multiple domains in ecosystems' research that embraces the conceptualization and contextualization values. For broader geographically varying data sources, multidimensionality and heterogeneity contexts need comprehensive and more generic data solutions. The data may be from a variety of sources, such a laboratory or a field project and specific types, from decisive repositories, such as a particular demography or environment category. The conceptualization and contextualization with more specialized ontologies or semantics complicate the methodological integration in a single warehouse repository. The data designs and access methods evolve and often change over time. The data source representing a system may have an intensive and fortuitous impacts on other systems that may cause the integration to fail on new formats. As our understanding of interconnectedness among elements and processes of the ecosystems develops, with increasing complexity of data structure, even with subtle changes in variables may have big impacts