

On Some Lessons from Modeling Contexts in Complex Problem Solving in Information Technology

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ABSTRACT

This paper reviews current research on context in problem solving and existing two-dimensional frameworks for expressing project contexts in Systems Thinking and Software Engineering. It makes the case for modeling of context with Problem Structuring Methods. The authors present lessons learnt from applying such methods in the context of their experience with several complex management interventions in Information and Telecommunications Technologies. The paper aims to contribute to the understanding of project contexts in complex problem solving in Information Technology.

Keywords: Complex Problem Solving, Information and Communication Technologies, Problem Structuring Methods, Project Contexts, System of Systems Methodologies, Systems Thinking

INTRODUCTION

Context is “the circumstances that form the setting for an event, statement, or idea” (Compact Oxford English Dictionary of Current English, 2005). It is often unnoticed but it becomes important when we try to model and understand the cognitive and social realms (Edmonds, 2012). Context may be defined as a complex description of shared knowledge about physical, social, historical, or other circumstances within

which an action or event occurs (Brézillon et al. 2004). Brézillon (2011:23) states that “context constrains a focus without intervening in it explicitly’ and adds that as a consequence, (1) context is relative to the focus, (2) as the focus evolves, its context evolves too, and (3) context is highly domain-dependent”. According to Bazirel and Brézillon (2005) it is difficult to find a relevant definition of this notion that is robust enough to satisfy any discipline. They point further that “context is almost a buzzword

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in psychology, as in a number of other areas, such as computer science or linguistics. However, like some words as “concept” or “system”, the word “context” either is not defined or it is possible to find as many definitions (in an ad hoc manner) as authors. A reason is that this word is used supposing that everybody knows its meaning. . . (Bazirel & Brézillon, 2005:31).

Context has been explored extensively in Psychology, Artificial Intelligence and other fields over the last 15 years but relatively little in Information Systems (an exception is a recent conceptual paper by Merali (2012) related to context and organizational intelligence in knowledge management). Systems Thinking (a related field) has contributed an important work on systemic project contexts by Jackson and Keys (1984) which has been applied to project contexts in software development recently (see Petkov, Alter, Petkova and Andrew, 2013). Problem Structuring Methods (Rosenhead & Mingers, 2001, Mingers & Rosenhead, 2004; Rosenhead, 2006) emerged as a strand in Operations Research in the 1970s and 1980s to address the difficulties in solving complex “wicked” or “messy” problems but context is only implicitly treated in that field without references to the growing research on context at the time and recently in other fields.

The paper aims to contribute to a better understanding of ways to explore project contexts in complex problem solving in Information Technology by linking work in software development to research on context in Psychology, Artificial Intelligence, Systems Thinking and Problem Structuring Methods and by providing some practical lessons from the experience of the authors with interventions dealing with representing and understanding context. The paper has three sub-goals: to provide a review of context research in various disciplines and software development and Systems Thinking/ Operations Research; to make the case for using Problem Structuring Methods for understanding the multiple aspects of context in problem solving in Information Technology and to provide some lessons from several cases of mixing methods in large problems in Information and

Communications Technologies (ICT). The paper proceeds with a review of past research on context in problem solving and then explores three two-dimensional frameworks for mapping of project contexts, one in Systems Thinking and the others – in software development. Further research on context definitions and the use of Problem Structuring Methods for context modeling are explored. That is followed by lessons from authors’ experience in uncovering contexts in complex problem solving interventions in software development management and telecommunications and a conclusion.

Review of Past Research on Context in Problem Solving

Research on context in Artificial Intelligence and Psychology became a central topic to those fields around the start of the 21st century while it has been of little interest to Management or Information Technology thus far. According to Cortada (2009:14) in the previous fifty years “too many managers gave the science of management more credit for being mature than the field deserved, based on extensive use of data and information, and not necessarily on more tacit inputs, such as context.” A review of the use of context in problem solving associated with Artificial Intelligence and related disciplines such as Natural Language Processing, Databases and Ontologies, Communication, Electronic Documentation, and Vision is presented in Brézillon (1999). Further related analysis of context definitions in those and other fields like Psychology can be found in Bazirel and Brézillon (2005).

Of interest to Management and Information Technology (IT) is the analysis of contextual issues in multi criteria decision making presented in Brézillon & Pomerol (1998). They conclude that structuring of the knowledge base by means of contextual data enables the problem solver to avoid the risk of intractable search during the decision making process, prevents from focusing on the wrong features of a situation and from acting inappropriately. These authors observed that the contextual

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