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Examining decision characteristics & challenges for agile software development

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ABSTRACT

Although agile software development is often associated with improved decision making, existing studies tend to focus on narrow aspects of decision making in such environments. There is a lack of clarity on how teams make and evaluate a myriad of decisions from software feature inception to product delivery and refinement. Indeed there is relatively little known about a) the decision characteristics related to agile values, and b) the challenges they present for decision making on agile teams. We present an in-depth exploratory case study based on a pluralistic approach comprising semi-structured interviews, focus groups, team meeting observations, and document analysis. The study identifies failings of decision making in an agile setting. Explicitly considering the decision process, information intelligence used in decision making, and decision quality, the key contribution of this paper is the development of an over-arching framework of agile decision making, which identifies particular decision characteristics across 4 key agile values and the related challenges for agile team decision making. It provides a framework for researchers and practitioners to evaluate the decision challenges of an agile software development team and to improve decision quality.

1. Introduction

Agile software development (ASD) emerged in the late 1990s to address the uncertainty of customer requirements, technology evolution, and changing business environments. Agile approaches rejected the highly-formalised thinking of the time in favour of dynamic, user-centric methods characterised by short development cycle iterations, continuous releases, and rapidly evolving requirements, dynamic underlying data, and reflection (Fowler and Highsmith, 2001; Schwaber and Beedle, 2002).

There are many characteristics of ASD that affect decision making, including its fast-paced iterative and incremental nature, its organic and flexible developer roles, and its emphasis on self-management (Austin and Devin, 2009; Moe and Aurum, 2008; Zannier et al., 2007; Zannier and Maurer, 2006,2007). Differentiating features of decision making in ASD merit significant research. No research to date has attempted to identify in a holistic, structured manner, an over-arching set of ASD characteristics that affect decision making. This is concerning given that agility fundamentally affects software development decision making through a number of key characteristics; there is a need to understand the challenges to decision making that these over-arching ASD characteristics present (Henderson-Sellers and Serour, 2005). It is important to contextually research these characteristics and map them to challenges for decisions so that we can provide a framework for both researchers and practitioners to better evaluate decision making in ASD teams. Therefore the objectives of this research are to:

1. Identify contextually specific decision characteristics present in ASD.
2. Describe the challenges such characteristics pose for decision making for ASD teams.

We conducted an in-depth case study to examine these research objectives. This case study included 18 individual interviews, 2 focus groups, and observation of 21 team meetings with supplementary project documentation. We then used these data to create a framework to illustrate the decision challenges for each decision characteristic identified.

In the sections that follow, we present a background to decision making and contextualise it for ASD. To provide a structure for the identification of decision characteristics and related challenges, we

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first discuss ASD, followed by decision processes, decision intelligence, and decision quality. We then outline our research method to describe our case study. Finally, we present our findings, discussion, and conclusions.

2. Related work

2.1. Agile software development

There are 2 dominant perspectives in the agility literature in terms of the enablement and evaluation of agility: (i) a method adherence-based view and (ii) a principle or value-based perspective. Many studies adopt the former, measuring agility by the number of XP or Scrum practices that are used (Dybå and Dingsøyr, 2008). However, there are 2 limitations of this narrow focus. First, agility is a vague and multi-faceted concept given that agile is practised in so many different ways: it is polymorphous, multi-dimensional, and highly exposed to diverse interpretation and application (Conboy, 2009). Second, methods are rarely, if ever, applied in textbook formats and often applied as a hybrid of agile methodologies (Gale, 2012). Studying the specific practices of a particular method is less useful when we know it is unlikely that practices will be used in this original format. Therefore, this study takes a broader view of agility, encapsulated by the following 4 core values, listed in the agile manifesto (Fowler and Highsmith, 2001):

- Value individuals and interactions over processes
- Value working software over documentation
- Value customer collaboration over contract negotiation
- Adapt to change over following a plan

These 4 agile values present inherent obstacles and challenges to decision making with which development teams grapple. While some research outlined below has examined decision making related to these 4 values, there is still much we do not know.

The first value's focus on individuals and interactions means that the ASD team structure is regarded as "organic and flexible" rather than "mechanistic, bureaucratic and formalised" (Nerur et al., 2005, pg. 75). Specialised roles can hinder decision making at the operational level on agile teams (Moe and Aurum, 2008) and so developers are not confined to specialised roles and typically self-organise, interchange, and blend roles (Nerur et al., 2005). Decisions can be made outside of members' traditional skill areas and include changing requirements, which may occur daily; problems identified that require a resolution; and new ideas that are generated which need to be explored (Austin and Devin, 2009). But we do not know whether an ASD team's organic structure follows a compensatory or non-compensatory decision process for these or other decisions, meaning we do not know how much information they seek and use to make decisions.

As the second value states, ASD deprioritises documentation in favour of product to spend less time documenting tasks and features to aid in the speedy delivery of working software (Fowler and Highsmith, 2001), with agile teams' reduced documentation associated with a less rational approach to decision making (Zannier and Maurer, 2007). Ironically, more structured design problems have been found to use more rational approaches to decision making, whereas less structured design problems tend to use more naturalistic decision making (Zannier et al., 2007). What we do not know is whether communication methods help the ASD team make decisions when there is less documentation on which to rely.

The third value focuses on collaboration with the customer. The project manager's role as a decision-maker is greatly reduced and more akin to that of a facilitator or coordinator (Alleman, 2002; Lindstrom and Jeffries, 2004; Nerur et al., 2005) who works with the customer and the team. The team makes most decisions, creating a "pluralist decision making environment" (Nerur et al., 2005, pg. 76) due to the diverse backgrounds, attitudes, goals, and cognitive dispositions of the team members, including the customer (Chin, 2004; Cockburn and Highsmith, 2001; Highsmith, 2004). There is less focus on contract negotiation. Yet it remains unclear whether all team members and customer participate in decision making or whether decisions are driven by a few key team members.

The fourth value of adapting to change means that the iterative, incremental nature of ASD with frequent product releases enables teams to adapt and respond quickly (Dybå and Dingsøyr, 2008). To date, existing research has focused on the alignment of decisions over time in ASD and the alignment of decisions on a strategic, tactical, and operational level (Moe and Aurum, 2008). However, it remains unclear whether these time pressures necessitate more frequent, short-term and potentially pressurised decision making based on inaccurate or incomplete information for other types of decisions related to planning and on-going development besides the initial design decisions researchers have examined (Zannier et al., 2007; Zannier and Maurer, 2006, 2007).

Thus, while some have researched decision making related to these 4 values, there is still an absence of an over-arching decision making paradigm in ASD environments (Austin and Devin, 2009; Moe and Aurum, 2008; Zannier et al., 2007; Zannier and Maurer, 2006, 2007). The inner-workings of these decisions - their component characteristics and challenges posed for their decision process, decision intelligence used, and their potential impact on decision quality - receive little or no attention in ASD practice. These are the focus of this study and are described in more detail below.

2.2. Decision process

Long before ASD, researchers found that using particular decision strategies is dynamic (Häubl and Trifts, 2000; Johnson and Payne, 1985; Kuo et al., 2004; Moldafsky and Kwon, 1994; Payne, 1976). Further, in scenarios where there are many decision alternatives with a number of variables, decision strategies tend to be either compensatory or non-compensatory (Payne, 1976; Tversky, 1972). A compensatory strategy is based on a knowledge of, and trade-off between, values of the relevant variables to a particular decision. Here, suboptimal information on one or more variables can compensate for preferential values on one or more other variables. A non-compensatory strategy considers variables on a threshold value level and eliminates any decision choice that does not meet that variable's threshold. Non-compensatory strategies are easier but typically of lower quality because they do not examine all available information as the threshold level automatically eliminates possible decision choices whose variable(s) do not make the threshold cut-off. The choice to use a particular strategy depends on many factors, including the decision maker's cognitive ability, behavioural characteristics, experience, and the availability and accuracy of information. The nature of the decision making task also leads to particular strategies: the use of accurate but more effortful strategies arises in tasks where the decision outcome has great importance and decision making time is secondary to outcome (Payne et al., 1988).

Non-compensatory decision strategies reduce the amount of information processed for decisions by using cut-off levels for variables and establishing the most important variables. An example of ASD teams using non-compensatory strategies is not creating contingency plans or examining alternatives to information presented and decisions because of prior team success (McAvoy and Butler, 2009). There is an effort-accuracy trade-off between taking the time to access, examine, and evaluate all relevant intelligence to design possible solutions and make a decision or in the interest of