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## Fuzzy front-end learning strategies: Exploration of a high-tech company<sup>☆</sup>

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### ABSTRACT

This article investigates the upstream and usually hidden stages of new product/service development projects and aims to provide a set of learning actions that contribute to the reduction in fuzziness during early development stages. Because the fuzzy front end involves high levels of uncertainty, this article first analyzes the dimensions of fuzziness and then describes two in-depth case studies. The rich and contrasted insights into one success and one failure of a high-tech company identify how managers can use learning strategies to reduce fuzziness. Qualitative investigations based on interviews with managers and team members responsible for development projects reveal how the choice of specific learning strategies can address one or all three dimensions of fuzziness. By contrasting successes and failures, the study reveals how specific learning strategies can lead to an efficient reduction in fuzziness during the early stages of development. We identified broad sets of actions, including competencies recruitment, use of guiding visions, use of personal networks to find appropriate solutions, and processes that help connect client expectations with firm solutions. The detailed description of adopted means outlines how managers can succeed in the early stages of development by mastering organizational learning tools.

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### 1. Introduction

Early research identified the fuzzy front end (FFE) stages of product/service development as crucial for successful innovation (Cooper and Kleinschmidt, 1994). Choices made during this stage are of paramount importance because they condition the subsequent stages of development. However, these choices and the decisions based on them have the highest level of fuzziness. Because the decisions taken during the early stages are more economical than those taken in the latter stages of development, any improvements made during the FFE are likely to be more efficient (Shen-Li et al., 2007; Poskela and Martinsuo, 2009; Verworn, 2009), especially when more formal management modes are adopted (Ho and Tsai, 2011; Creusen et al., 2013; Markham and Lee, 2013).

FFE usually involves specific stages of the development process and lies in the so-called pre-phase zero (preliminary opportunity identification, market and technology analysis) of a phase zero (product and concept definition) and phase one (product definition

and planning) (Khurana and Rosenthal, 1997). The FFE stage ends when a go/no-go decision is taken, based on the available information that, in turn, results in the launching of a formal new product development process with well-defined specifications for prototype, manufacturing, and market launch.

During the FFE stage, fuzziness is at its maximum and is linked to customer preference, environment, competitor actions and reactions, technological solutions, and managerial support for new ideas. Given this context, rational decisions are difficult because consequences of the choices made are impossible to anticipate (Lane and Maxfield, 2005). From this perspective, the development involves a process of uncertainty reduction, from maximum uncertainty at the beginning stage to a minimum level after launch (Shil, 2009). Logically, therefore, the reduction of fuzziness is one of the key concerns during the FFE stage.

In this work, we examine three sources of fuzziness during the FFE stage that prior research has identified: uncertainty, equivocality, and complexity (Zack, 2001). In this analysis, we assume that specific learning strategies must be designed, which may further contribute to efficiently reduce fuzziness in the early stage of development. We empirically investigate this assumption through a qualitative survey. Thus, we conducted an in-depth case study to identify the learning strategies adopted by development teams of a high-tech company. Comparisons between successful and failed developments led us to identify the nature, contribution, and efficiency of learning strategies adopted to reduce

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fuzziness. We further identified broad sets of actions, including competencies recruitment, use of guiding visions, use of personal networks to find appropriate solutions, and the processes that helped connect client expectations with firm solutions. The detailed description of adopted means outlines how managers can succeed in the early stages of development by mastering organizational learning tools. We use the empirical observations to enrich the initial and theoretical conclusions.

## 2. Nature of fuzziness and generic learning strategies

### 2.1. Uncertainty

Central to organization theory is the concept of uncertainty. Galbraith (1973) proposed uncertainty as “the difference between the amount of information required to perform a particular task and the amount of information already possessed by the individual”. Following this broadly accepted definition, Milliken (1987) summarized a previous research stream around three perspectives. The first research stream focuses on the impossibility of predicting future events. Therefore, uncertainty reflects the inability to assign probabilities to the likelihood of future events. The second research approach emphasizes the lack of information about cause–effect relationships. Simon (1979) defined the third uncertainty perspective as a state in which individual actors find it impossible to attribute a reasonably definite probability to the expected outcome of their choice. Although these perspectives differ slightly, remedies these authors mention consist of gathering more information and knowledge for the purpose of reducing the level of uncertainty.

Many scholars define new product development as an uncertainty reduction process (Lievens and Moenaert, 2000; Lester and Priore, 2004). Because uncertainty can lead to both positive and negative outcomes, refinements in this initial definition are required for application to project management. Perminova et al. (2008) defined “uncertainty as a context for risks as events having a negative impact on the project’s outcomes, or opportunities, as events that have beneficial impact on project performance”. If uncertainty reflects the difference between the amount of knowledge to perform a task and the amount of knowledge available in the company (Galbraith, 1973), development managers can overcome this gap by increasing available knowledge through multiple means, such as empirical experience, recruitment of new expertise, or processing of information in different ways. From this perspective, collecting enough information during the go/no-go stages until rational decisions can be made will reduce the level of uncertainty (Cooper and Kleinschmidt, 1994; Verworn et al., 2008). For example, research has recommended increased communication between departments, specifically research and development and marketing, or even improvements in the company’s information systems to gather, process, and structure the information (Moenaert et al., 1995; Montoya Weiss and O’Driscoll, 2000; Jiménez-Jiménez and Raquel (2011)).

Although rationality is difficult to achieve when uncertainty exists, learning strategies can contribute to issue identification and then to the adoption of options with the highest probability of success. Knowledge creation processes such as gathering more information, comparing it with existing knowledge, exchanging intensively with other members of the team, and creating scenarios can contribute to the optimization of choices for development teams.

### 2.2. Equivocality

Another source of fuzziness is equivocality. Identifying two epistemological views of the world as either objective or a

construct, March (1994) highlighted the importance of distinguishing between uncertainty and equivocality (or ambiguity) among most decision-making theories. According to March, equivocality refers to the assumption that in a socially constructed world, meanings can be invented and negotiated. The issue here is not to accumulate knowledge or process data but to make sense of it (Zhang and Doll, 2001; Chou et al., 2007; Frishammar et al., 2011). Thus, equivocality refers to a situation when managers are unable to interpret or make sense of events, facts, and data or put inappropriate interpretation frames around specific situations (Weick, 1993).

When two or more possible meaning can describe the same data or information, equivocality results (Daft and Lengel, 1986). This frequently occurs in organizations when different functions or positions produce divergent interpretation frames around similar event or facts. Alam (2006) observed that consumer involvement during early stages of service innovation results in less FFE stages. Reduction of equivocality cannot be achieved by increasing the level of information gathered on a specific topic but rather by using organizational tools as a leverage to consensually align meanings through the adoption of sensible interlocked behaviors (Weick, 1979). Changing interpretation frames by trial and errors or involving people with specific expertise may be an efficient means for reducing the level of ambiguity during innovation. Because organizations and institutions may rigidify interpret frames (Crossan et al., 1999), generic learning strategies may include the transformation of organizational features, such as venture development teams. This means that they should aim to facilitate information exchange between team members and with external actors until convergence in meaning is achieved.

### 2.3. Complexity

Simon (1969), p. 195 argued that complexity occurs when “a large number of parts interact in a non-simple way”. When a number of parts or their intricacy are too large to be processed simply, complexity becomes a challenge for rational decision making. With this first assumption, although a large amount of data are gathered, a decision based on a substantive rational calculation is difficult, if not impossible, to achieve. This usually occurs during development; for example, when a decision on one aspect of a project affects other components, their respective adjustments induce changes in the entire system. Simon (1969) suggested two learning strategies in this case. First, companies should increase their capacity to process complex cause–effects links—using computer models for example. Regarding innovation, the cause–effect link between development options, such as price or product attributes and customer preference, can be tested with different methodologies. Second, complexity can be reduced by separating the project into smaller components. For example, learning about customer preferences through conjoint analysis methods illustrates this kind of learning strategy.

Thus, multiple learning strategies can be implemented to reduce fuzziness. As Table 1 summarizes, four situations are linked to the three sources of fuzziness (i.e., uncertainty, equivocality, and complexity).

The ontological dimensions of uncertainty must be analyzed from the perspective of new product/service development. This requires analyzing in detail the source of fuzziness during the development process.

## 3. Areas of fuzziness during FFE

The contribution of an innovation can be analyzed with two dimensions: newness to the market and newness to the company (Trott, 2008). The first dimension related to market fuzziness

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