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The impact of stakeholder heterogeneity on risk perceptions in technological innovation

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ABSTRACT

Managing risk has been widely acknowledged as a crucial managerial task in the development of new technology. More recently, the acceptance of new technologies has increasingly been influenced by secondary stakeholders, some of which are difficult to identify, or whose concerns are not easily reconciled. This paper develops a conceptual framework based on the management of technology and research & development literature, stakeholder theory, risk and social judgment to describe how traditional approaches based on reducing uncertainties through estimating probabilities may not work for social uncertainties; different heuristics are needed to understand and resolve such heterogeneous stakeholder perspectives. We contribute to the discourse by describing how risk perceptions among stakeholders vary, and how this may change over time. The framework suggests that the perception of primary stakeholder towards a specific innovation is 'Standard' when information is well known, but becomes riskier when information is unclear. For secondary stakeholders, when there is a low degree of imperfect information, the stakeholder relationship is an 'Irritant' but becomes increasingly 'Dangerous' when information becomes ambiguous. We conclude with implications for management and future research.

1. Introduction

It has been widely acknowledged that managing risk is a crucial element of technological innovation (Freeman and Soete, 1997; Penrose, 1959; Schumpeter, 1934) since such innovations may involve new science, technology, processes, markets, industrial structures and regulatory frameworks (Ansoff, 1957; Maine et al., 2012; Martin, 1994; Utterback, 1994). More recently, the role of various stakeholders has been recognized as an influential factor in whether a technology succeeds or fails (Abbassi et al., 2014; Elias et al., 2002; Hall and Martin, 2005; Klerkx and Aarts, 2013; Sarpong and Maclean, 2012). For example, Monsanto's development of transgenic seed technology, although offering technological and commercial benefits to users, was hampered by NGO (Non Government Organizations) protests and advocacy groups (Hall and Martin, 2005; Shapiro, 2000). Stem cell research has similarly undergone major scrutiny for what would otherwise be a promising technology for the health care industry (Caulfield et al., 2006; Herder and Brian, 2008).

In this paper, we suggest that stakeholder heterogeneity is an increasingly important dynamic affecting new technology development. More specifically, we argue that different stakeholders perceive risk differently, depending on the nature of their relationship with the innovating firm and the degree of imperfect information. Primary stakeholders, i.e. those with a vested interest such as customers, suppliers and complementary innovators, will often see risk as an investment, with the potential to gain or lose, whereas secondary stakeholders, such as advocacy groups and NGOs, typically focus only on the potential hazards. This subtle distinction in risk perception has important implications for how technological innovators manage their relationships with various stakeholders, and is particularly important at early phases of technology development, when managers have the greatest ability to influence the direction and outcome of such development (Clark and Wheelwright, 1993; Kihlander and Ritzen, 2012).

Secondary stakeholder concerns have been widely discussed in the corporate social responsibility (CSR) literature and the business press (Barkemeyer et al., 2009). For example, the 'triple bottom line' (TBL) approach expands reporting from purely economic factors to include social and environmental performance (Elkington, 1997). Wilburn and Wilburn (2011) argue that firms should identify and classify stakeholders as either vested or non-vested stakeholders, and then align norms and values within this relationship. Indeed, greater awareness of NGO and shareholder pressures to be more responsive to CSR has been widely discussed in the literature (cf., Porter and Kramer, 2006; Vogel, 2005). In the 2011 Sustainability and Global Executive Study (MIT Sloan Management Review and the Boston Consulting Group) (Kiron et al.,

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2012) found that "some 70 percent of respondents … have put sustainability on the management agenda and… have done so in the last six years". However, while awareness for CSR and concerns from a wide range of stakeholders may have increased, what remains unclear is how these issues impact the uncertainties of innovation. Our proposed framework thus is focused on stakeholder's risk perception for technological innovation and hence complements the academic discourse on CSR and TBL by deepening our understanding of stakeholder heterogeneity.

We develop a conceptual model based on the management of technology and research & development (R&D) literature, stakeholder theory and risk. To date, this scholarly discourse has not adequately emphasized the importance of heterogeneous stakeholder risk perspectives to technologies that otherwise have potentially promising commercial attributes. We contribute by describing how traditional approaches based on reducing uncertainties through estimating probabilities may not work for social uncertainties, and that different heuristics are needed to understand and resolve such variances. In addition, we contribute to stakeholder theory and the risk literature by describing how risk perceptions of a specific technological innovation vary by type of stakeholder, where some assess it using cost-benefit approaches, whereas others see it only as a potential hazard. Understanding these differences in heuristics can allow for more effective stakeholder management, and ultimately improve the technology's diffusion.

In the next section, we provide a brief overview of the challenges of new technology development, and specifically some of the political, socioeconomic and environmental uncertainties, henceforth referred to as social uncertainties, that have become increasingly important challenges for firms. This is followed by a review of stakeholder theory, risk and social judgment to deepen our understanding of these uncertainties. We then present a conceptual model illustrated with vignettes that were selected to show how degrees of imperfect information and differences in stakeholder risk perception can shape the development of the technology into different trajectories. The paper concludes with implications for managers and further research.

2. Theoretical development

2.1. Challenges of new product development

Societal attitudes after WW II were generally favorable towards scientific advances and industrial innovation, where "science and technology were seen to have the potential for solving society's greatest ills" (Rothwell, 1994: p 8). Technology commercialization was generally perceived as a linear process that started with scientific discovery, progressing through technological development in firms and ultimately into the marketplace. Such technology development may involve new science with competency destroying characteristics (Tushman and Anderson, 1986), creating new markets, industrial structures and regulatory frameworks (Ansoff, 1957; Martin, 1994; Utterback, 1994). Firms grew from the increased economic prosperity, and became increasingly competitive, resulting in a greater focus on strategic marketing. Perceptions of the innovation process shifted towards 'market-pull' with a more integrated perspective, where interactions among technological capabilities and market-needs were recognized (Rothwell, 1992a).

According to Clark and Wheelwright (1993), this transition towards a market-pull orientation was a response to problems with earlier approaches to new product development that often lacked integration between technical and marketing knowledge, particularly in early phases of technology development. They suggest earlier phases are the most effective time to influence the outcome development, and delaying the knowledge from marketing until later phases result in ineffective management activity at the commercialization stages, when any revisions are costly and potentially prohibitive. As a response, Clark and Wheelwright (1993) proposed the now seminal 'Development Funnel' that draws on a broad range of technical and marketing inputs at the earliest stages. The Development Funnel thus decreases the level of uncertainty by gradually refining, selecting and reducing the number of concepts that ultimately result in a small number of development projects that can then be pushed to rapid development and market introduction.

Rothwell (1992a) expanded the scope of stakeholders in new product development by emphasizing the importance of integration and parallel technology development among buyers, suppliers, collaborators and scientific institutions among others, that is facilitated in part by more efficient communications technologies and manufacturing processes such as lean production. However, the underlying goal remains consistent with the Development Funnel: to move an idea from concept to reality by incorporating insights at an early stage from a number of perspectives that ultimately converges to a specific product that can economically meet a market need.

These more integrated approaches to technology development, as well as a number of empirical studies on which they were based (e.g., Cooper, 1984; Cooper and Kleinschmidt, 1986; Maidique and Zirger, 1984), primarily focused on inter-firm communication and coordination and later with external primary stakeholders, such as leading edge users, suppliers and complementary innovators, through efficient intra-firm communication and data sharing. Rothwell (1994) termed these changes to the new product development process the '5th Generation' Innovation Process. According to Simon (1969), the challenge presented by such recognition of the expanded nature of parties included in the development process increases the complex nature of innovation, making such innovations increasingly difficult for managers to find optimal solutions. He suggests that managers employ the use of heuristics, experience-based techniques for problem solving, learning, and discovery, which can be used to find satisfactory solutions to problems where complexities prohibit an exhaustive search for an optimal solution. Tversky and Kahneman (1974) argue that that people rely on a limited number of heuristic principles that simplifies complexity and allows for assessing probabilities and predicting values. However, they also caution that using limited or overly simplistic heuristics sometimes leads to severe and systematic errors. External linkages that facilitate rapid product development are primarily focused on those with a vested interest in the technology, i.e. potential users, suppliers or complementary innovators and developers within the trading relationship. For example, Afuah's (1998) 'innovation value added chain' emphasizes the need to minimize competency destruction on such stakeholders with a vested interest.

These approaches to innovation management however only provide part of the story, as 'social uncertainty', which includes the unintended and detrimental consequences of the new technology, is becoming an increasingly important issue for firms (Freeman, 1982; Martin, 1994; Rothwell, 1992b). Decision-making approaches such as the Development Funnel, 5th Generation Innovation Process and Innovation Value-added Chain focus only on stakeholders with a vested financial interest, but not those stakeholders outside of the trading relationship. However, environmental complexity encompasses the processing of heterogeneous information (Pérez-Luño and Cambra, 2013), and following Hall et al. (2011), we argue the decision making processes for understanding social uncertainties is very different for these additional stakeholders that may still impact or be impacted by the technology when compared to those with a vested interest.

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