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Competitive dynamics in face of technological discontinuity: a framework for action

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Abstract

Following radical technological discontinuities, several equally plausible designs are often seen competing for dominance in a particular industry. How the industry comes to evolve along one of the many possible trajectories is a question that has puzzled researchers for some time. This article addresses the question: How do some designs and technologies attain dominance, even when they are considered ‘inferior’ in many respects, and become the basis for a sustainable competitive advantage for their proponents? Using examples from practice, we build on existing knowledge of technology evolution to provide a conceptual framework that explains this evolutionary process. We argue that during the era of ferment, competing designs represent mere claims. Each design or claim is mired in numerous controversies. As firms strategize to provide closure to these controversies, their particular design is gradually ‘factualized’. Finally, firms are able to retain control over their designs and hence, make it a basis for a sustainable competitive advantage only when the design is positioned as an obligatory passage point. We believe that managers equipped with a better understanding of this process would be in a position to make more informed decisions regarding choice of technologies, adoption of particular standards, or selection of alliance-partners.

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1. Introduction

The importance of technological innovation cannot be overemphasized in today's world. It is the central determinant of long-run success or failure of organizations. It allows organizations to enter new markets, revitalize existing product lines, and keep up with rapid technological developments in the environment. In order to be successful, however, new products need to integrate customer needs with technological capability (Clark & Fujimoto, 1991; Dougherty, 1996). The product's function, structure, and 'semantics' must fit the customer's objectives, values, production system, lifestyle, use-pattern, and self-identity (Clark & Fujimoto, 1991, p. 30). Thus, understanding customer needs is essential to product success.

However, much research has shown recently that following radical technological discontinuities, traditional methods for assessing customer needs are rendered useless (Christensen, 1997; Christensen & Bower, 1996; Schilling, 1998). In such situations, consumer expectations are largely unspecified, ambiguous, and constructed within the existing technological paradigm. Thus, not only is an assessment of consumer expectations exceedingly difficult, it can also be highly misleading (Christensen & Bower, 1996). As technology evolves, so do customers' needs and expectations. Debates rage in the industry as to which of the available technological designs meets customer needs best. The uncertainty that characterizes eras of ferment differentiates these periods from more stable, postdominant design periods. While the latter usually exhibit a somewhat clearly recognizable set of competitors, stakes, and rules, eras of ferment require managers to make guesses as to who their competitors are, what the stakes are, and which rules will apply in the emerging industry.

As these periods marked with uncertainty draw to a close, designs that might not be the most advanced, technologically, may begin to chalk up more sales than their performance/price ratio warrants. What makes matters worse for the losing firms is that winning technologies carry increasing returns to adoption (Arthur, 1989). Once a technology is adopted, it becomes increasingly attractive to new users because of learning by using, birth of positive externalities, and scale economies in production (Arthur, 1989). The organization that cannot ensure a market for its design right in the beginning faces a losing battle. A related case is that of organizations which are able to come out with highly advanced and successful technologies but remain unable to profit from their innovations. For example, firms such as Apple (PCs) and EMI (CAT scanners) were unable to sustain the competitive advantage that their technological innovation provided them with. Thus, the goal before radical innovators is not limited to integrating customer needs with technological capability, but includes generating acceptance for their particular technology in the market and maintaining their grip on successful designs.

This article provides a conceptual understanding of the process through which dominant designs emerge. Specifically, we ask: In situations where more than one design claims to meet customer expectations or in situations where customer needs are still undefined or difficult to predict, how are successful designs selected in the market and how may managers influence this process? Using illustrative examples, we propose that a sustainable competitive advantage is in fact developed around technological innovations through a process that

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