

Anderson, P., & Tushman, M. (1991). Managing through cycles of technological change. *Research Technology Management*, 34(3), 26-31.

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Date: February 23, 2015

In this article, the authors present four lessons learned from technological innovation cycles resulting from discontinuities in older technologies and the emergence of new technologies. In what has been coined “the age of discontinuity” by Peter Drucker, many new technologies have emerged giving rise to new and innovative products and processes. The emerging technologies have overturned “established industry structures” (p. 26) and created conditions that are difficult manage. The authors conclude that technology progression is cyclical in nature, and that it is centered on technological discontinuities and the emergence of new designs.

Technology Cycles

Technology cycles begin with technological discontinuities, the innovations that support that advancement of industries. The first phase of the cycle is the *era of ferment*, distinguished by an *era of substitution* when, “new technology displaces its predecessor” (p.27) and an *era of design competition* when several competitive designs emerge. An era of *incremental change* emerges once a dominant design materializes. The standardization of the new technology establishes a path for future progress, until it is eventually overturned by a new technological discontinuity.

Influence of Competences

The authors argue that the technology cycle is dramatically affected by competences. A *competence-destroying* discontinuing innovation is one that renders existing knowledge and capabilities relating to a product or process obsolete. A *competence-enhancing* discontinuing innovation builds on and enhances existing knowledge and capabilities instead of making it obsolete. The authors also note that, “product innovations normally affect more links in the value chain than do process innovations,” while “process innovations usually make the product better and cheaper without necessarily disrupting the upstream and downstream linkages” (p. 28).

Characterizing the Technology Cycle

It is claimed that discontinuities are uncommon, but every industry studied by the authors has seen at least one technology discontinuity since 1960 (p. 27). They also describe how a single dominant design always emerged following a discontinuity, however it was never the first discontinuous innovation that became the adopted standard. There is also discussion on how it takes longer for a dominant design to take hold if it was a competence-destroying rather than competence-enhancing discontinuity.

Patterns of Discontinuous and Dominant Designs and Creative Destruction

The authors claim that veterans, rather than newcomers, are often on the forefront of pioneering breakthrough innovations. While it is noted that newcomers are often the initial innovator, it is usually a veteran that will launch a fully developed technological discontinuity. Though it seems conflicting, in cases of competence-destroying discontinuities, veterans often have the ability to leverage their knowledge and capabilities to overcome any obsolescence created by the innovation. The authors argue that “dominant designs are seldom state-of-the art...industry experience is needed to understand what the market needs in a standard” (p. 30).

Creative destruction occurs during periods of “shakeout,” or unusually high failure rates. The authors’ studies have shown that this typically happens during the era of ferment rather than times of economic hardships.

Implications for Managers

The following model is presented as a way for managers to develop “a language of talking about and directing technology” (Foster, p. 30):

1. Expect discontinuities.
2. When a discontinuity appears, expect an era of ferment culminating in a single dominant design.
3. Realize that technological revolutions may be introduced by an industry newcomer, but the group of firms that adopt it earliest typically include a majority of veterans.
4. Consider the implications of the finding that technological change, not downturns in demand, is associated with shakeouts

Discussion Questions

1. On page 27, the authors write, “Though Foster argues that new technologies appear only when the old technology reaches its technical limits, often the older technology improves markedly in response to the competitive threat.” If this is true, and older technologies do improve due to threats from new technologies, is it worth the continued support and investment in older technologies? Does doing so inhibit the adoption and/or diffusion of newer innovations?
2. On page 29, the authors argue that veterans rather than newcomers are more likely to pioneer breakthrough innovations. Is this the case in today’s world? What impacts are newcomers making and are they positively or negatively impacting innovation?
3. This study is specific to industry, so it is applicable to technological innovations in organizations with a knowledge-based workforce?
4. This article was published nearly 24 years ago. Has the face of innovation changed enough since then to warrant a follow up study?