Chapter 16
Information Technology Industry Dynamics:
Impact of Disruptive Innovation Strategy

Nicholas C. Georgantzas
Fordham University Business Schools, USA

Evangelos Katsamakas
Fordham University Business Schools, USA

ABSTRACT

This chapter combines disruptive innovation strategy (DIS) theory with the system dynamics (SD) modeling method. It presents a simulation model of the hard-disk (HD) maker population overshoot and collapse dynamics, showing that DIS can crucially affect the dynamics of the IT industry. Data from the HD maker industry help calibrate the parameters of the SD model and replicate the HD makers' overshoot and collapse dynamics, which DIS allegedly caused from 1973 through 1993. SD model analysis entails articulating exactly how the structure of feedback relations among variables in a system determines its performance through time. The HD maker population model analysis shows that, over five distinct time phases, four different feedback loops might have been most prominent in generating the HD maker population dynamics. The chapter shows the benefits of using SD modeling software, such as iThink®, and SD model analysis software, such as Digest®. The latter helps detect exactly how changes in loop polarity and prominence determine system performance through time. Strategic scenarios computed with the model also show the relevance of using SD for information system management and research in areas where dynamic complexity rules.

INTRODUCTION

In challenging business environments, where even the best thought-of and executed strategies can fail dramatically (Raynor, 2007), disruptive innovation is emerging as a mainstream strategy that firms use first to create and subsequently to sustain growth in many industries (Bower & Christensen, 1995; Christensen, 1997; Christensen, et al 2002; Christensen & Raynor, 2003).

Honda's small off-road motorcycles of the 60s, for example, personal computers and Intuit's accounting software initially under-performed established product offers. But such innovations bring new value propositions to new users, who do not need all the performance incumbent firms offer. After establishing themselves in a simple application or user niche, potentially disruptive products (goods or services) improve until they "change the game" (Gharajedaghi, 1999), driving incumbent firms to the sidelines.

Christensen and Raynor (2003) see disruptive innovation strategy (DIS) not as the product of random events, but as a repeatable process that managers can design and replicate with sufficient regularity and success, once they understand the circumstances associated with the genesis and distinct dynamics a DIS entails. Similarly, Christensen et al (2002, p. 42) urge technology managers, adept in developing new business processes, to design robust, replicable DIS for creating and nurturing new growth business areas. In so doing, they must (a) seek to balance resources that sustain short-term profit and investments in high-growth opportunities and (b) use both separate screening processes and separate criteria for judging sustaining and disruptive innovation projects.

DIS can crucially affect the dynamics of IT, causing turbulence and industry shake-outs. Anthony and Christensen (2004) and Christensen *et al.* (2002) argue that is extremely important for technology managers to understand DIS. To help them make it so, this chapter shows a system dynamics (SD) model that replicates Christensen's (1992) data on hard-disk (HD) maker population dynamics. The model draws on archetypal SD overshoot and collapse work (Alfeld & Graham, 1974; Mojtahedzadeh, Andersen & Richardson 2004), which covers SD models in many areas with similarities in the structure of causal processes.

Cast as a methodological IS industry case, the chapter also shows the use and benefits of model analysis with Mojtahedzadeh's (1996) pathway participation metric (PPM), implemented in his *Digest*® software (Mojtahedzadeh et al, 2004). Shown here is a small part of a modeling project that combined DIS theory with SD to answer specific client concerns about the dynamic consequences of implementing disruptive innovation strategies in established high-technology markets, which contain over- and under-served (current and potential) users.

By definition, DIS is a dynamic process. Any model that purports to explain the evolution of a dynamic process also defines a dynamic system either explicitly or implicitly (Repenning, 2002). A crucial aspect of model building in any domain is that any claim a model makes about the nature and structure of relations among variables in a system must follow as a logical consequence of its assumptions about the system. And attaining logical consistency requires checking if the dynamic system the model defines can generate the real-life performance of the dynamic process the model tries to explain.

But most existing DIS models are merely textual and diagrammatic in nature. Given a particular disruptive innovation situation, in order to determine if a prescribed DIS idea can generate superior performance, which only 'systemic leverage' endows (Georgantzas & Ritchie-Dunham, 2003), managers must mentally solve a complex system of differential or difference equations. Alas, relying on intuition for testing logical consistency in dynamic business processes might contrast sharply with the long-certified human cognitive limits (Morecroft, 1985; Paich & Sterman 1993; Sterman 1989; Sastry 1997).

Aware of these limits, the chapter makes multiple contributions. *One* is the culmination of the early disruptive innovation literature into a generic model of the hard-disk makers' overshoot and collapse. Using a generic structure from prior SD overshoot and collapse work, the model contains assumptions common to seemingly diverse theories in economics, epidemiology, marketing and sociology. *Two* is the translation of these

Related Content

Threatening the Cloud: Securing Services and Data by Continuous, Model-Driven Negative Security Testing
Philipp Zech, Philipp Kalb, Michael Feldererand Ruth Breu (2013). *Software Testing in the Cloud: Perspectives on an Emerging Discipline (pp. 280-304).*
www.irma-international.org/chapter/threatening-cloud-securing-services-data/72236

AI-Powered Parallel Computing Architecture and Its Applications
J. Aswini, K. Sudha, Gowri Ganesh, Siva Subramanianand George Ghinea (2024). *The Convergence of Self-Sustaining Systems With AI and IoT (pp. 23-39).*
www.irma-international.org/chapter/ai-powered-parallel-computing-architecture-and-its-applications/345504

Automated Software Testing
Paula Donegan, Liane Bandeira, Cristina Matos, Paula Luciana da Cunhaand Camila Maia (2009). *Software Applications: Concepts, Methodologies, Tools, and Applications (pp. 152-171).*
www.irma-international.org/chapter/automated-software-testing/29387

Risk Centric Activities in Secure Software Development in Public Organisations
Inger Anne Tøndel, Martin Gilje Jaatun, Daniela Soares Cruzesand Nils Brede Moe (2017). *International Journal of Secure Software Engineering (pp. 1-30).*
www.irma-international.org/article/risk-centric-activities-in-secure-software-development-in-public-organisations/204522

An Integrated Framework for More Efficient Web Services Selection Using an Improved Fuzzy AHP
Abdelaziz Ouadah (2022). *International Journal of Systems and Service-Oriented Engineering (pp. 1-24).*
www.irma-international.org/article/an-integrated-framework-for-more-efficient-web-services-selection-using-an-improved-fuzzy-ahp/304364