COIS 6215
Spring 2016
Technology Innovation and Diffusion Models --Review

CONTROL REVOLUTION (Crisis in Control) - Beniger

Beniger traces the causes of change from the middle to late nineteenth century -- to a crisis of control -- generated by the industrial revolution in manufacturing and transportation. The response to this crisis amounted to a revolution in societal control. Initially this control was in the form of bureaucracy, but after WWII it has shifted toward computer technology. But such technologies are best seen not as causes but as consequences of societal change, as natural extensions of the Control Revolution already in progress.

"Because both the activities of information processing and communication are inseparable components of the control function, a society's ability to maintain control-- at all levels from interpersonal to international relations -- will be directly proportional to the development of its information technologies".

Durkheim noted that as society moved from local segmented markets to higher levels organization, it brought with it a need for greater information flow, a growing interestedness of society. His anomie resulted from a breakdown of communication across increasingly isolated sectors.

Bureaucracy was the first big answer to this crisis of control and information. It is a control technology in itself. Weber identified another control technology he called rationalization. "Weber's writing... are subsumed by one essential idea -- control can be increased not only by increasing the capability to process information but also by decreasing the amount of information to be processed".

"Perhaps the most pervasive of all rationalization is the increasing tendency of modern society to regulate interpersonal relationships in terms of a formal set of impersonal and objective criteria... By means of rationalization it is possible to maintain large-scale, complex social systems that would be overwhelmed by a rising tide of information they could not process were it necessary to govern by particularistic considerations of family and kin that characterize preindustrial societies."

Control technologies permitted bigger production, distribution, and consumption of goods and services in society. One major result of the control revolution has been the creation of the Information Society. Agricultural society has been replaced by knowledge workers.

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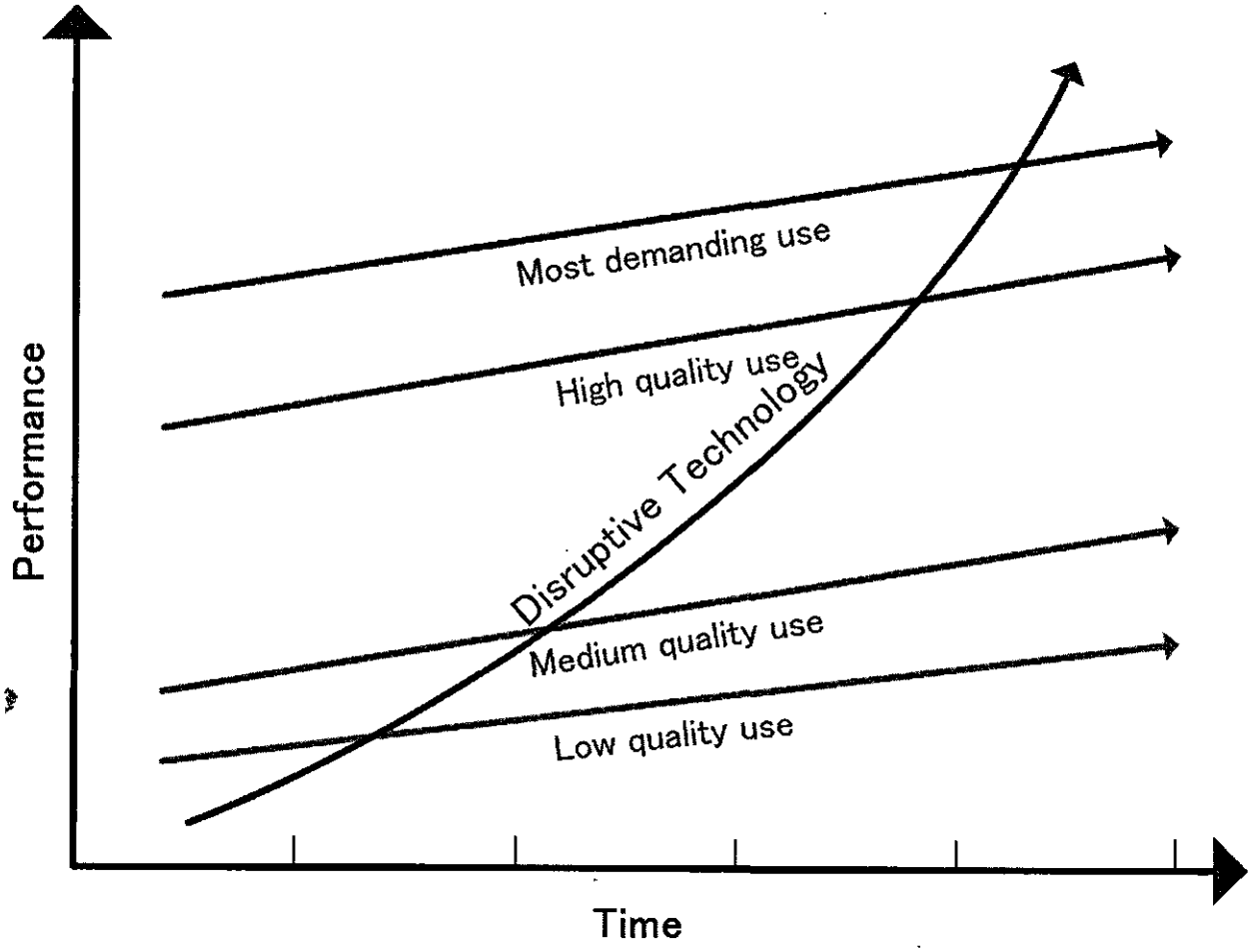
Disruptive Technology—Christensen



Technology Acceptance Model –Davis

Davis - 1999

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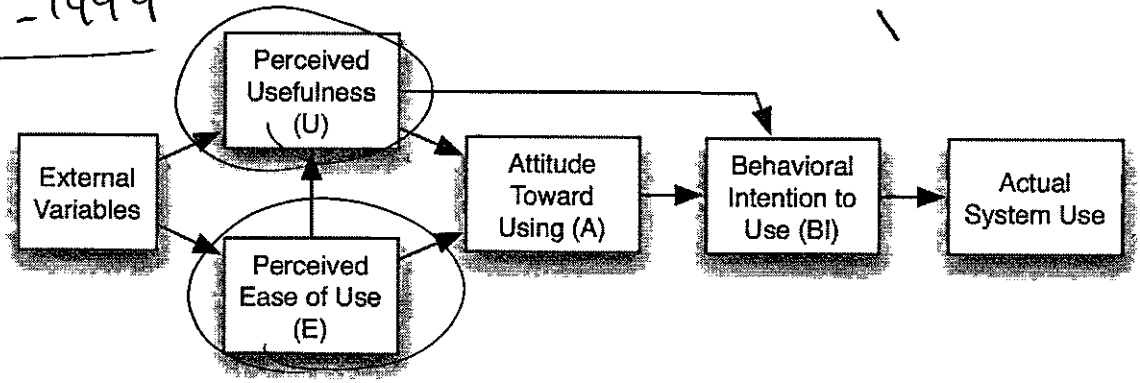
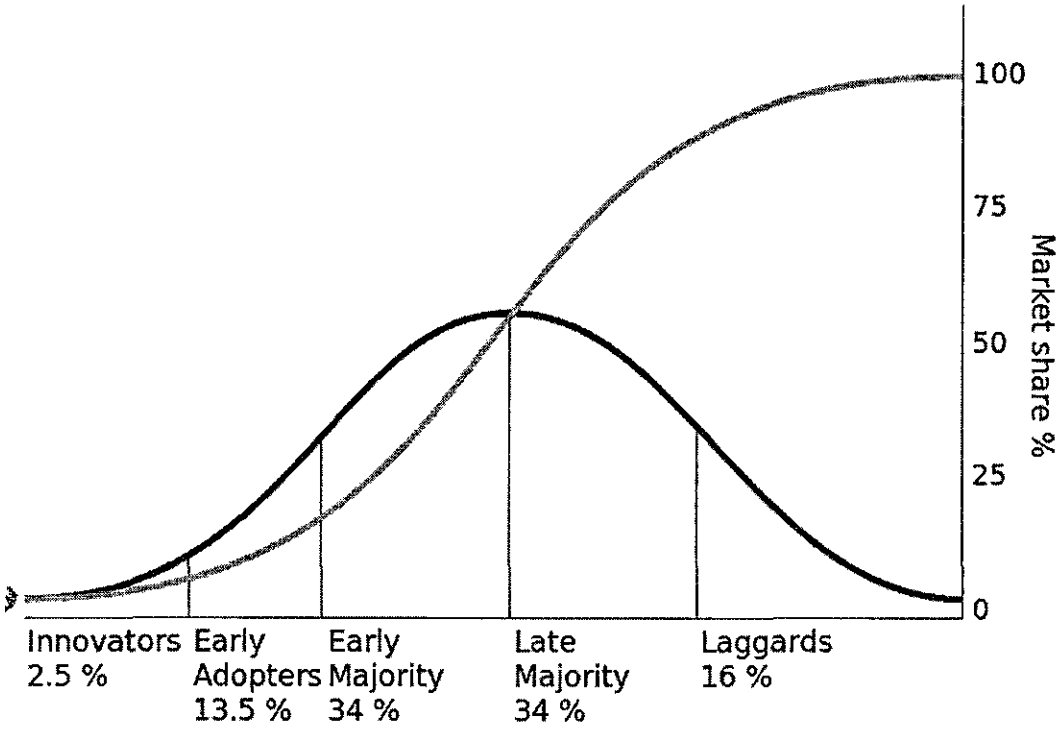


Technological Innovation and Diffusion--Rogers



Rate of adoption

The rate of adoption is defined as the relative speed at which participants adopt an innovation. Rate is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation.[38] The rates of adoption for innovations are determined by an individual's adopter category. In general, individuals who first adopt an innovation require a shorter adoption period (adoption process) when compared to late adopters.

Within the adoption curve at some point the innovation reaches critical mass. This is when the number of individual adopters ensures that the innovation is self-sustaining.

Adoption strategies

Rogers outlines several strategies in order to help an innovation reach this stage, including when an innovation adopted by a highly respected individual within a social network and creating an instinctive desire for a specific innovation. Another strategy includes injecting an innovation into a group of individuals who would readily use said technology, as well as providing positive reactions and benefits for early adopters.

Diffusion vs adoption]

Adoption is an individual process detailing the series of stages one undergoes from first hearing about a product to finally adopting it. Diffusion signifies a group phenomenon, which suggests how an innovation spreads.

Adopter categories

Rogers defines an adopter category as a classification of individuals within a social system on the basis of innovativeness. In the book *Diffusion of Innovations*, Rogers suggests a total of five categories of adopters in order to standardize the usage of adopter categories in diffusion research. The adoption of an innovation follows an S curve when plotted over a length of time.[39]The categories of adopters are: innovators, early adopters, early majority, late majority and laggards [2] In addition to the gatekeepers and opinion leaders who exist within a given community, change agents may come from outside the community. Change agents bring innovations to new communities– first through the gatekeepers, then through the opinion leaders, and so on through the community.

Adopter category	Definition
Innovators	Innovators are willing to take risks, have the highest social status, have financial liquidity, are social and have closest contact to scientific sources and interaction with other innovators. Their risk tolerance allows them to adopt technologies that may ultimately fail. Financial resources help absorb these failures. [40]
Early adopters	These individuals have the highest degree of opinion leadership among the adopter categories. Early adopters have a higher social status, financial liquidity, advanced education and are more socially forward than late adopters. They are more discreet in adoption choices than innovators. They use judicious choice of adoption to help them maintain a central communication position.[41]
Early Majority	They adopt an innovation after a varying degree of time that is significantly longer than the innovators and early adopters. Early Majority have above average social status, contact with early adopters and seldom hold positions of opinion leadership in a system (Rogers 1962, p. 283)

Late Majority	They adopt an innovation after the average participant. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Late Majority are typically skeptical about an innovation, have below average social status, little financial liquidity, in contact with others in late majority and early majority and little opinion leadership.
Laggards	They are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents. Laggards typically tend to be focused on "traditions", lowest social status, lowest financial liquidity, oldest among adopters, and in contact with only family and close friends.

Failed diffusion

Failed diffusion does not mean that the technology was adopted by no one. Rather, failed diffusion often refers to diffusion that does not reach or approach 100% adoption due to its own weaknesses, competition from other innovations, or simply a lack of awareness. From a social networks perspective, a failed diffusion might be widely adopted within certain clusters but fail to make an impact on more distantly related people. Networks that are over-connected might suffer from a rigidity that prevents the changes an innovation might bring, as well.[42][43]Sometimes, some innovations also fail as a result of lack of local involvement and community participation.

For example, Rogers discussed a situation in Peru involving the implementation of boiling drinking water to improve health and wellness levels in the village of Los Molinas. The residents had no knowledge of the link between sanitation and illness. The campaign worked with the villagers to try to teach them to boil water, burn their garbage, install latrines and report cases of illness to local health agencies. In Los Molinas, a stigma was linked to boiled water as something that only the "unwell" consumed, and thus, the idea of healthy residents boiling water prior to consumption was frowned upon. The two-year educational campaign was considered to be largely unsuccessful. This failure exemplified the importance of the roles of the communication channels that are involved in such a campaign for social change. An examination of diffusion in El Salvador determined that there can be more than one social network at play as innovations are communicated. One network carries information and the other carries influence. While people might hear of an innovation's uses, in Rogers' Los Molinas sanitation case, a network of influence and status prevented adoption.

Dominant Design-- Utterback

Origins of the theory

Utterback and Abernathy first introduced the concept of 'dominant design' in 1975.[7] They proposed that the emergence of a dominant design is a major milestone in an industry evolution and changed the way firms compete in an industry and thus, the type of organizations that succeed and prevail. A dominant design can be a new technology, product or a set of key features incorporated from different distinct technological innovations introduced independently in prior product variants.

Dominance process

The process by which a specific design achieves dominance consists of a few characteristic milestones:[8]

1. A pioneer firm or research organization begins conducting R&D with the intention of creating a new commercial product or improving an existing design.
2. The first working prototype of the new product/ technology is introduced, sending a signal to competitors to review the feasibility of their research programs.
3. The first commercial product is launched, connecting consumers to this new architecture for the first time. It is usually directed at a small group of customers. This milestone acts as a "last minute call" for competitors to review and speed up their research efforts.
4. A clear front-runner emerges from the early market. For example, in the personal computer industry, Apple Computers dominated after the introduction of their Apple I in 1976.
5. Finally, at some point in time, a particular technological trajectory achieves dominance and this marks the final milestone in the dominance process.

Evidence and examples

Dominant design milestones have been identified in many product lines. The emergence of a dominant design typically coincides with the point at which the number of firms competing in the industry peaks. Once it emerges, it implicitly sends a message to producers and consumers that its key features is a "must have" by future products. Examples of a dominant design include the simple four function calculator and the iPod and iPhone. Other examples include:

- War of Currents between AC power and direct current electricity in the late 1800s.
- The videotape format war between Betamax and VHS, when VHS became the de facto video tape standard.
- Microsoft Windows became the dominant design in PC operating systems.

- A review of the Samsung Z5 MP3 player articulated the Apple/iPod dominant design, David Pogue, "Almost iPod, but in the End a Samsung", The New York Times, March 9, 2006. [1]
- Many industry examples are included in Utterback's book Mastering the dynamics of innovation (see references below)
- DC-3 Peter Senge book The fifth discipline on p. 6 cited the DC-3 as a dominant design consisting of variable-pitch propeller, retractable landing gear, monocoque, radial air-cooled engine, and wing flaps.
- Philips Ambient Health Experience is one of the appropriate examples in the healthcare industry

Implications for innovation and competitive dynamics

Utterback and Suarez propose that once a dominant design emerges, it can have a profound impact on both the direction of further technical advance, on the rate of that advance, and on the resulting industry structure and competitive dynamics. Prior to the creation of the dominant design, firms are constantly experimenting and therefore cannot enjoy economies of scale. After the emergence of the dominant design, some firms accumulate complementary assets and exploit possible economies of scale, which in turn raises entry and mobility barriers in the industry. Firms that enter the industry during a period of experimentation risk choosing the wrong technological path, but have high upside if they choose the right one. Pre-dominant design entrants have been shown to have a higher chance of survival than those that enter after the emergence of the dominant design.[9] Utterback and Kim (1985) and Anderson and Tushman(1990) considered the effect of a disruption that invades a mature industry and thus starts a new cycle. In each cycle, the number of firms increases in the early ("fluid" or "ferment") period, reaches a peak with the emergence of the dominant design, decreases until a few firms dominate the industry, and then restarts again when a disruption creates the conditions for a new wave of entry and the re-enactment of the industry life cycle.

COMPETING on the EDGE—Eisenstadt and Brown

OLD RULES	NEW RULES
Advantage is sustainable	Advantage is temporary
Strategy is enduring	Strategy is surprising
Time is forgotten	Time is critical
Strategy then structure	Structure then strategy
Value through fit and efficiency	Value through reinvention
Be bureaucratic or organic	Be improvisational
Stuck in the past	Evolve from the past
Plan in the future	Experiment into the future
Make a few, big moves	Time pace a mix of moves
Assemble strategy	Grow strategy
Business boundaries are fixed	Business boundaries evolve
Corporate dictates strategy	Individual businesses reign