The Effects of Technology Convergence on Markets

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Executive Summary

Technology Convergence is more than a buzz word. Technology Convergence is the combining of two or more different technologies or services to create a new product offering that can disrupt established markets or create new markets when it successfully occurs. A classical example of technology convergence is the automobile, which was created by convergence of a horse carriage with the internal combustion/steam engine to create the horseless carriage and displaced more than the horseless carriage.

The paper is a descriptive study that covers the technology convergence in many market segments including effect in current convergence in Digital Photography and Portable Music Players. The paper also describes examples Medicine, Sports and Commercial segments. It concludes with the observation that it is critically important for firms' future existence to focus some efforts on technology convergence.

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Introduction

What is a technology converge? In this context, it is combining of two or more different technologies or services to create a new product offering. (Wind) With a technology converged new product offering a new market is developed which will require a new or revised market strategy. The innovation has caused the user to change their behavior. Within Moore's model of Innovation Types, "Disruptive Innovation" is the very early in the front-end of the model. (See Figure 1.)

Many times when two or more technologies converge a new market comes into existence. When this occurs, a firm needs to recognize the changes in its markets and adapt its strategies or be adversely affected. Convergence can also create a merged market were a product was once considered a commercial product is now blurred into a consumer/commercial product. For example the personal computer (PC) is now both a consumer product and a commercial product. At the lower-end of its price/performance curve is focused on the home PC market and the higher-end is focused on commercial products like servers and workstations.

At a minimum, if a firm does not focus time and effort on following the changes in technology development and convergence within the broad domain of its market sectors then, as history has repeated shown, company will become obsolete. This observation is the bases Clayton Christensen's book titled "The Innovator's Dilemma." Once a firm becomes obsolete, it is reduced to a marginal player and over time, go out of business.

Technology convergence has been going on for a very long time. The modern automobile is a highly innovated product that is an example of technology convergence that initially occurred well over 100 years old. The initial automobile was created by convergence of a horse carriage with the internal combustion/steam engine to create the horseless carriage. As time progressed, the automobile and its infrastructure were established. The automobile replaced the horse and carriage as a main method of on-demand transportation and there is no longer a significant carriage and buggy industry. (See Figure 2.)

The Effects of Technology Convergence on Markets

In Theodore Levitt's classical Harvard Business Review article from 1960 titled "Marketing Myopia", he reminds the reader how in the late 1800's the "American railroads enjoyed fierce loyalty among for investments from the European monarchs and Wall Street investors." At the time, there was no other form of transportation that had the agility of the railroads. The railroads had speed, durability, economy and growth potential.

After the automobiles and airplanes were developed, the railroad owners were still confident their mode of transportation was the best and would remain dominate. By the 1930's the markets had changed to the point the railroads were broke and requesting government subsidies to survive.

Within Michael E. Porter's Five Competitive Forces model of the competitive forces that shape industries and market, technology convergence can be classified as a "Threat of Substitutes" (Porter). Why? Technology convergence is the development of an alternative product with improved performance for the same purpose. The development of the horseless carriage was a substitute product that replaced the horse carriage and evolved into a dominate economic development force.

There are many examples of companies have successfully defined and developed the product, but have failed because of barriers to adoption. (Yadav) Apple Computer's Newton PDA is a classic example of a technology convergence that failed. The failure is attributed to the premature product introduction because of competitive pressure. (See Table 1)

Current examples:

Digital Photography

Digital Photography is a disruptive technology which is the merging of film based camera technology with digital image acquisition. This convergence has taken many years to evolve. The initial cameras had low quality pictures, short battery life, were cumbersome and expensive. Over a series of iterations and many years, the picture quality vastly improved as the digital image acquisition sensor improved. A combination of new battery technology and more efficient

electronics extended the battery life. Market specific designed micro-electronics help reduce the size and cost of the cameras.

This market was also vastly help with the advent of the low-cost PC and low-cost color ink jet printer. This permitted photographer to print very good quality pictures at the home. Both the PC manufactures and ink jet printer manufactures had revised their pricing model, which made them affordable to many more households.

This change in market dynamics marginalized both instant photography and film photography. It affected many companies which were once common house-hold names such as Polaroid, Kodak, Konica, Minolta and Fuji Film. The one of the first companies to significantly experience effects was Polaroid in the instant film business. Polaroid went into bankruptcy because of the significant loss of business attributed to its failing to transition to the new market paradigm. Kodak and Fuji Film had to redefine themselves to order to survive. Thru Kodak's long history they had migrated from cameras to film, which is a classic value-migration strategy. The film products moved from an enabler to the primary revenue generator for Kodak. (Moore) The 100 year old film market is going thru a major shift because of digital photography. Kodak has been experiencing 20-plus percent yearly of year decreasing revenues in the film business of the last several years. The decrease has been directly attributed to the speed which consumers and professional photographers have moved to digital photography. (Guerrera) If a company stayed strictly focused on value-migration products because of the amount of revenue generated, then it would lack the awareness to revise their strategy is a new technology convergence and may not be able to shift their focus in time to be effective in the new market.

Konica was the 3rd largest film manufacturer. In 2003, because of the significant changes in the business model, Konica merged with Minolta and repositioned the merged company to focus on the major office equipment. All the companies that were focused on instant or film photography have had to massively restructure including closing film, photographic paper product facilities and discontinue manufacturing film based camera.

Portable Music Players

The portable consumer music players are a repeating example of technology convergence causing market disruption. The portable cassette player established the market niche for a portable music player which the user could select what music to play and when. This was different from a portable transistor radio, because the user now had an on-demand portable music player. The convergence was between the magnetic tape recording and microelectronics to create devices like the Sony Walkman cassette player. It was then followed on and disrupted by portable Compact Disk (CD) Player. One of it significant benefit was the CD was less susceptible to damage and had a better quality, longer lasting recording. The CD was also the first mass digitization of audio sound. Sony is currently experiencing a difficult finical period, which can be partial attributed to the fact it has yet to achieve a strong market position in MP3 player arena.

The next convergence which has significantly disturbed the markets for the portable cassette player and the portable CD player is the MP3 player. An MP3 player is the convergence of specially developed software algorithms and microelectronics to store and play back music files. The low-cost PC was a strong enabler for this market.

The MP3/iPod player market is also having an effect on the automotive industry. Because of the players have had such a societal impact, it is estimated that greater than 70% of the 2007 model year automobiles in North America and Europe will be equipped with specialized connectors to accommodate an MP3/iPod player. The automotive industry is considering it is entering a new "infotainment" era. (Wards)

Apple Computer was not the originator of the MP3 player category, but of several market changing approaches to portable music player market. One of the market changing approaches was the use of multi-side markets, where Apple has successfully developed iPod/ iTunes combination to provide the hardware and the service. As it developed the iPod, it also worked with the music publishing industry to gain licensing to sell the music to the customers. This permitted Apple to control the format and pricing to the customer along with a continued revenue stream once the player was sold. (Silverthorne)

Another one of Apple's market changing approaches was the addition of video to it iPod. This addition with the use of enhancement innovations, Apple has moved the player from strictly a music player to a device which can be used to play videos and is work with the movie studios on agreements for film downloads.

Technology Convergence in Medicine

The medical products industry has repetitively experienced technology convergence. The convergences have included some diagnostics imaging tools such as X-Ray technology, Ultrasonic imaging, and Magnetic Resonance Imaging to the more recently developed Quantum Dot Imaging. Point of care devices like blood test strips, optical blood glucose meters, followed by portable blood glucose meters are additional examples of medical products technology convergence. (Wilkinson)

One of the product families created by the convergence of piezoelectric material science, microelectronics and computer image processing was ink jet printing, another was ultrasonic imaging. Ultrasonic imaging is an excellent example of technology convergence which has benefited the human and animal health. It is a non-invasive method at investigate various soft tissue organs such as the heart, liver, gallbladder and kidneys.

Ultrasonic imaging is most commonly associated with obstetric where it is used as a tool for monitoring and evaluating pregnancies. Early in a pregnancy, it is used for diagnostics and confirmation. As the pregnancy continues it is used determine gestational age and assess the fetal size. It is also used to detect multiple pregnancy and fetal malformations. One of its more controversial uses has been for gender selection, where individuals deciding to continue or terminate the pregnancy based on the fetal gender. As a new technology convergence comes into existence, society faces new ethical dilemma.

Technology Convergence in Sports

Technology convergence has also created changes in sports. Some of the changes have been sublet, some have been more dramatic. With the combination of microelectronics and wireless

communications has made it common for football quarterbacks to have a wireless communications receiver embedded in their helmets.

It has also affected the sports fan. If they are going to be out for a night they have several options, they can record on a TiVo, VCR, or DVR. If they are going to out of their local area they can catch the Webcast of the game or listen to it a satellite radio station.

The convergence is also effecting the design of a proposed new baseball stadium for Oakland A's. The proposed stadium would be built in conjunction with Cisco Systems, a dominate company in network technology. Some of the concepts for the new stadium are based on using a wireless Personal-Area-Network (PAN) to provided addition services to sports fans attending the game. One of the proposed technologies is enabling game-day video to be viewed on a fan's mobile phone. The combination of a network technology company with a sports team to build a new stadium will affect the fan's experience at the stadium.

Apple's iPod Video has also developed an unexpected use within sports. Besides being used to play music while traveling or working out, within baseball they are being used as a tool for players to review scouting information. Pitchers are using them to review footage of opposing hitters prior to their next start against the hitter.

The Sporting Goods Manufacturers Association (SGMA) has recognized the effects which technology convergence is having on sports that the SGMA had its first conference that focused exclusively on sports and technology convergence in October of 2006. A focal area of the conference was how technology will create new opportunities in creating, producing, distributing and promoting sporting goods.

Technology Convergence in Industry

Although not as glamorous as other marketing sectors, technology convergence has been a driving competitive force in the industrial sector. Within this sector, the term: "machine vision" is used to describe the uses of digital image acquisition with computation analysis to dynamically decide processing steps for production. The convergence of machine vision and robots has

enable robots to be used in application which were once considered to variable to be done with robots.

The convergence has expanded the use of robots from strictly repetitive tasks as transferring parts from point A to point B to more flexible tasks such as de-flashing a variety of parts coming off of different molding machines in a high product mix environment. When the injected-molded part comes out of a mold, it has excess plastic at the seam of where the parts of the mold are joined. In a high product mix environment, it has traditionally been done with a cutting operation followed by a final grinding to remove the last bits of the excess plastic. Because of high product mix, it was not conducive to automation. (Zens) By integrating a robot and machine vision system with the water-jet cutter, the process was able to be automated and also address the high product mix. Some of the benefits of the convergence have been improved reliability, reduce cost and reduced variation.

Some markets on the verge of disruption

An emerging technology convergence in the consumer market is High-definition Digital (HD) radio. It is the typical analog radio converged with the digital techniques similar to the ones used in high-definition TV. The current market is considered in its infancy. In May of 2006, it was estimated that there was only tens of thousand of installed radios in the market. (Winter)

A mature market, which people in the more economical developed countries take for granted, is the light bulb. The lighting industry is on the verge of a disruption from at least 2 technologies. One is the Compact Fluorescent Light bulb (CFL); the other is Light Emitting Diodes (LED). The two technologies are significantly more energy efficient and have a life 10 times longer than the current light bulb. As the two technologies are adopted, the demand for the basic screw-base light bulb will diminish as it moves to a declining technology. In these markets it is important for the manufacture to move to developing products based on the emerging technologies.

When looking at it from a classic markets verse product strategy matrix, most firms are very comfortable working in the domains of existing and new segments of the matrix, but are reluctant

to venture in the emerging segments of the matrix. (See Table 2: Markets verse Product Strategy) Technology Convergence is in the Emerging/New segments of the matrix.

Conclusion

History has repeatedly shown it is vital for firms to focus some efforts on technology convergence and if a firm does not focus some of its efforts in this area, that the firm may not exist after a period of time. The time period could a few years to a decade or more if the market has a high amount of infrastructure requirements.

The converging technology will cause a threat of product substitutes to a firm. As the railroads experienced with the advent of the automobile and airplane or the film photography experienced with the advent of the digital camera. The longer the existing product has been around, the more entrenched the firm is with the product and it increase the difficulty in the firm moving to the new technology. These factors can be attributed to difficulties in financially justify initiating the move while the current market is mature but financially strong. It will become more difficulty for the firm the move once the market is in decline and the revenues to make the transition are no longer viable. It is critical for a firms' future existence to focus some efforts on technology convergence.

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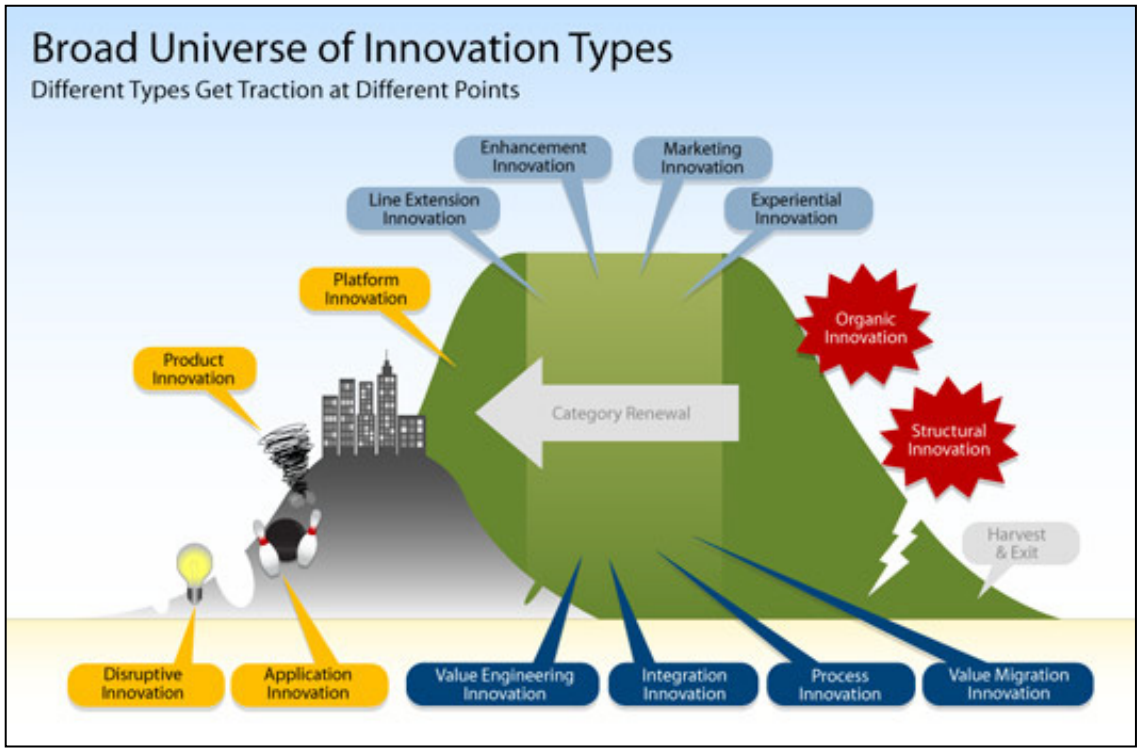


Figure 1 – (Source: Moore - 2005)

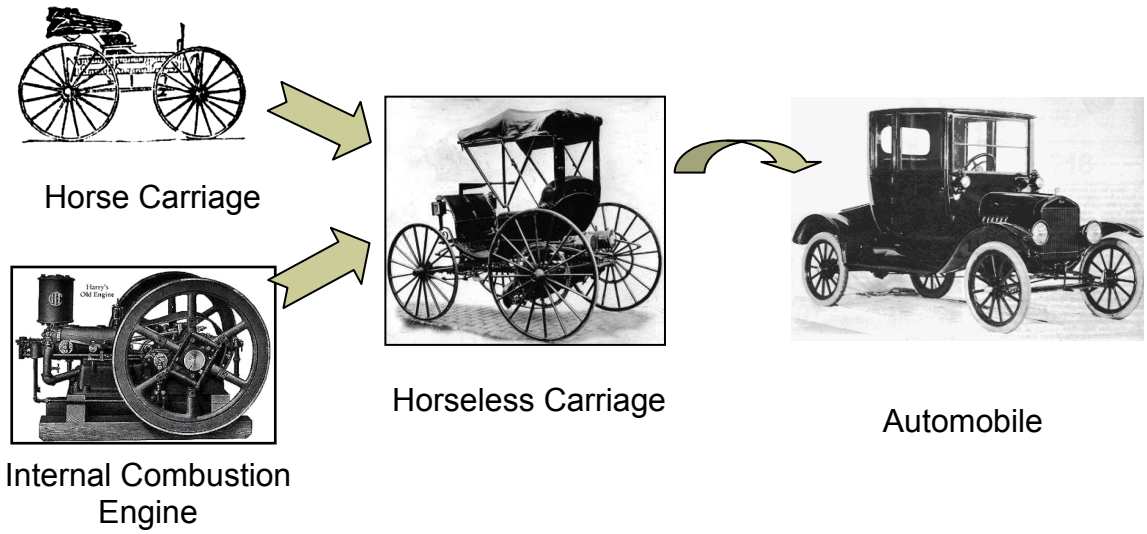
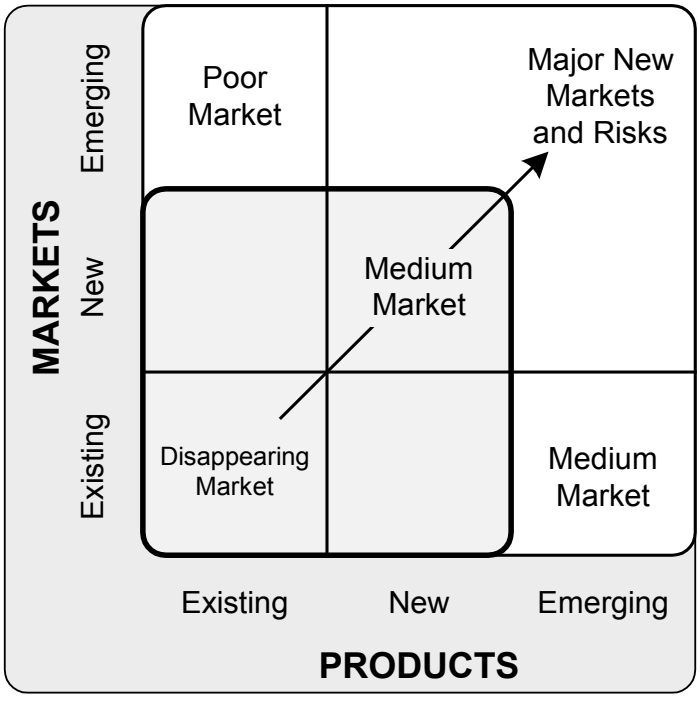


Figure 2

Converging Technologies	Disruptive Technology	Marginalized Technology
Film-based Photography	Digital Photography	Instant & Film-based Photography
Digital Image Acquisition		
Piezoelectric Material Science	Ultrasound Imaging	***-New Market-***
Microelectronics		
Computer Image Processing		
Machine Vision	Variable Process Automation	Manual Work
Robotics		

Table 1



Emerging Market Risk

Table 2: Markets verse Product Strategy