

Deer in the Headlights: Response of Incumbent Firms to Profit Destroying Innovations

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Abstract

Scholars and managers consider innovation a holy grail because it allows firms to sustain or enhance performance. However, contrary to the common perception, sometimes innovations go rogue and threaten to destroy incumbents' profits. Since innovation literature has largely underemphasized such innovations, this paper takes the first step in examining these innovations through a study of three industries. The paper shows that existing literature predicts two opposite reactions of incumbents to such innovations. Rationality literature suggests that incumbents would embrace such innovations whereas behavioral decision making literature suggest that incumbents would avoid such innovations. This research finds that, in the main, incumbents avoid such innovations in line with behavioral decision making literature. As a result, incumbents often suffer a loss of profits and loss of market share. This paper not only fills an important gap in innovation literature but also paves the way for future research on several unanswered questions about profit destroying innovations. It also documents some key learnings for managers dealing with such innovations.

Keywords: Profit-destroying innovation, innovation decision making, incumbent response, cognitive biases

1. Introduction

Scholars have long pursued greater understanding of innovation and their enthusiasm is mirrored by that of managers who allocate enormous resources in pursuit of innovation. This enthusiasm is justified because successful innovation leads to business success. If we observe leading firms in any industry, it becomes clear that these firms became leaders due to innovation. Sometimes innovators are pioneers whereas at other times they are fast followers (Methe, Swaminathan, & Mitchell, 1996). While innovators reap the rewards of innovation, those incumbents that fail to innovate lose market share and die (Banbury & Mitchell, 1995). The fact that competitive advantage of a firm cannot be sustained over long time periods (Wiggins & Ruefli, 2002), makes innovation an imperative. In short, innovation is the vital fluid of a business without which firms cannot survive for long and pursuit of innovation promises profits and success.

In light of this obvious fact that innovations are desirable because they enhance firm performance, it comes as a surprise that some innovations, instead of enhancing profits for incumbents, threaten to destroy profits even when incumbents succeed at such innovations. For example, the emerging innovation of LED lights in the lighting industry will destroy incumbent profits even if they succeed in the innovation of LED lighting (Sullivan, 2008, 2009). The life span of LED light is 25 times that of an incandescent bulb; if LED technology replaces incandescent technology, the total annual demand of light bulbs will diminish in a significant manner. Since the market is not able to price LED lights at 25 times the price of incandescent lights, an average incumbent would see a drastic reduction in its profits even if they were pioneers or fast followers in this technology. This would ensue because the bulb demand will decline by over 50% and competition in the industry will significantly increase due to dozens of new entrants. Unlike normal innovations, such as those of cellular phone service or flat screen televisions, where if incumbents successfully embrace the innovation, they witness an increase in performance, in the case of LED, the incumbents would witness a decrease in profits even when they succeed in innovating in LED technology. Since such innovations threaten to destroy profits of incumbents, this paper calls them profit destroying innovations. Several industries have witnessed a similar phenomenon of profit destroying innovations. For example, cultured pearls destroyed profits of pearl divers by making pearl supply abundant (Wong, 2005). Similarly, voice over IP (VOIP) destroyed profits for wireline telecommunications incumbents (Reinhardt, 2004). MP3 played the role of profit destroyer in music label industry (Goel, Miesing, & Chandra, 2010).

In spite of the fact that this phenomenon of profit destroying innovations is neither new nor rare, it has been underemphasized in the literature. As a result, we have little understanding of such innovations. We do not know where such innovations come from and how they destroy profits. We do not know whether firms find it challenging to deal with such innovations or whether firms just take them in their stride. We also do not know if the

prescription from innovation literature applies to such innovations. This is a critical gap in our understanding of innovation. Furthermore, due to a lack of systemic study of this phenomenon, managers are not aware of effective ways of dealing with such innovations.

This paper takes the first step in examining this phenomenon of profit destroying innovations. It first establishes that the phenomenon exists and explores various aspects of such innovations. It shows that our prior knowledge of decision-making literature predicts two opposite reactions of incumbents to such innovation. Using data from three industries, it examines the reaction of incumbents facing a profit destroying innovation. As a result, it not only fills an important gap in the literature but also finds some effective and ineffective ways of dealing with such innovations.

2. The Phenomenon

Contrary to normal innovations that help improve profits and market position (share), profit-destroying innovations do exactly the opposite. Strictly speaking, *a profit destroying innovation is an innovation that ex-ante threatens to reduce an incumbent's total profits if the incumbent successfully embraces the innovation and maintains market share in the industry.*

Such innovations threaten to reduce profits because they either lower profits margins without a commensurate increase in revenues or they lower revenues without a commensurate increase in profits or both. It is important to note that the definition removes the impact of market share on profits by assuming the market share of the incumbent remains the same although in reality market shares will and do change. This assumption is placed only to make the phenomenon clear. Furthermore, although innovation literature acknowledges the risks and uncertainties involved with innovation, this paper focuses on the scenario when the innovation in question would succeed because profit destroying innovations differ from profit enhancing innovations only when the innovation succeeds. This is also done to focus on the core differences between profit destroying innovations and profit enhancing innovations.

2.1 Some commonly seen profit destroying innovations

Custody services incumbents witnessed a decline in total profits when the industry moved from paper based certificates to electronic certificates. Custody services firms provide several back office services to mutual fund houses. During the era of paper-based stock certificates, custodians made money by fulfilling the trades and safekeeping the stocks of fund houses. When the markets moved from paper based certificates to electronic certificates, custodians no longer needed vaults and logistics resources but continued to need the information processing services (Rao, 2004). As the need for several core services disappeared, the prices of custodial services declined by over 80%. Although move to electronic stock led to higher trading volume, this increase in trading volume did not compensate custodians for a decline in prices. The drop in prices for custody services was so large that the incumbents witnessed a decline in their business profits.

Voice over IP (VOIP) technology also illustrates the same phenomenon. When VOIP technology emerged, it threatened to reduce profits of the wireline business incumbents through free and virtually free phone call services. Prior to the VOIP technology, firms owned their private telecommunications networks which acted as high entry barriers to the business. However, VOIP eliminated the need for an exclusive telecom network and allowed new entrants to offer wireless services using the internet infrastructure. This resulted in higher competition and a drop in prices thereby reducing the profits of wire line incumbents. The loss of exclusivity of telecom network threatened the profits here(Reinhardt, 2004).

In the music distribution industry, MP3 format for digital music was a profit destroying innovation(Goel et al., 2010). Music labels such as EMI make profits by selling music of various artists. They pay artists an advance and have to sell a minimum volume to break even on that advance. Sales above break-even volume provide surplus profits to music labels. MP3 format allowed users to freely copy music and consume it without paying for the music. Peer to peer file sharing services such as Napster allowed large scale music piracy over the internet. This led to significant reduction in the music sales making several albums unprofitable. Even after courts shut down such services, the MP3 format changed the industry significantly. It allowed unbundling of the music albums and sale of singles. The overall effect of the innovation was a reduction in sales, revenues and profits of the music labels.

These three profit destroying innovations behaved differently from the normal innovations that enhance profits when incumbents successfully embrace them. These innovations reduced profits of incumbent even if the incumbents embraced such innovation and maintained market share. These examples illustrate an intriguing phenomenon that needs further examination.

2.2 Profit destroying innovations are ex-ante profit destroying

Although profit destroying innovations could be an ex-ante or an ex-post phenomenon, this paper focuses on ex-ante profit destroying innovations. An ex-post profit destroying innovation would be one that we know destroyed profits only after such innovations became successful. An ex-ante profit destroying innovation would be one where we can predict profit destruction, as is the case of LED lighting. This paper focuses on ex-ante profit destroying innovations because if incumbents cannot differentiate between a profit destroying and a profit enhancing innovations upfront, they would demonstrate no difference in their reactions to these two different types of innovations. As a result such research would neither help predict the response of incumbents nor provide effective ways to deal with such innovations.

2.3 Profit destroying innovations are different from natural evolution of industries

A general trend across most products is that profits tend to fall over time due to competition and other factors. Incumbent firms innovate essentially to prevent profit erosion over time. For example, when Apple succeeded with iPod, Microsoft entered the market with its own media player Zune. If Apple had not innovated, it would have been forced to reduce

prices to compete with lower priced Zune. Such actions would have lowered the profits for Apple. However, it innovated with a touch screen iPod and the iPhone to enhance profits and its position in the mobile media player market.

Whereas industries experience pressures on profits over time, profit destroying innovations forces profit destruction in a rather short period. In this sense, such innovations are distinct points in the evolutionary trajectory of an industry and a distinct phenomenon. Furthermore, industries tend towards lower profits because incumbents are unable to innovate enough to compensate for increased competition. However, profit destroying innovations threaten to lower profits of incumbents even when incumbents aggressively embrace the innovation. For example, in the wireline telephony industry, although huge entry barriers (due to proprietary telecom networks) prevented competition from new entrants, an inability to innovate fast against other incumbents was pressurizing profits of the incumbents. However, with the emergence of VOIP (Voice over IP), even non incumbents could enter the telecom industry without having to build large scale telecom networks. VOIP allowed a firm to use the internet infrastructure to provide telephone services. Since the wireline market was saturated, an increase in competition and lower prices could not have increased sales volumes. As a result, at the time of emergence of VOIP, it was apparent that such a technology would destroy profits of incumbents irrespective of whether the incumbents embrace the innovation or not.

Another fact of industry evolution is the phenomenon of price cutting at various times in industry history. Such price cutting maneuvers, whether they reduce prices temporarily or permanently, are not a part of the phenomenon of profit-destroying Innovations. Incumbents or new comers sometimes cut prices to gain market share. Recently, when Barnes and Nobel introduced a new E-book reader Nook, it entered the market with a significant price drop compared to Amazon's Kindle. This move has probably reduced the prices of single purpose E-book readers permanently. Nook involved no major innovation that would account for a reduction in prices of e-readers. Consequently, it would reduce the margins of competitors. At other times, companies reduce prices and take a profit hit with a view to expand the industry. When such pricing decisions involve expected revenues and market share decisions and do not involve any innovation that would account for a profit decline, this does not represent a profit destroying innovation. Other than the fact that such price cuts do not involve any innovation, the fact that incumbents can overcome such a challenge with many profit enhancing innovations keep such price cuts out of the purview of profit destroying innovations.

2.4 Profit destroying innovations are distinct from product cannibalization

Although profit-destroying innovations may appear similar to product cannibalization, it is a broader phenomenon. Marketing scholars care about product cannibalization (Guiltinan, 1993; Mason & Milne, 1994; Mazumdar, Sivakumar, & Wilemon, 1996; Sundara Raghavan,

Sreeram, & Scott, 2005) as it has direct implications for several marketing decisions. The term cannibalization refers to eating of one's own kind and is often used in this context. For example, when a firm such as Gillette launches a 5 blade razor after being successful in a three blade razor, some customers of 3 blade razor start purchasing 5 blade razors. In this sense, the 5 blade razor cannibalizes other razor blades of the same firm. When a product introduction takes away market share of products of other firms, it is not called cannibalization. Consequently, cannibalization literature has focused on brand and product extensions rather than the broader phenomenon of profit destroying innovations. At times the term is also used for one channel of distribution cannibalizing another channel (Barbara, Inge, Katrijn, & Marnik, 2002). However, such cannibalization research has not focused on innovations across product categories and technologies to examine the profit destroying innovations.

2.5 Profit destroying innovations are defined from incumbent's perspective

A profit destroying innovation is defined from an average incumbent's perspective and assumes that incumbent will maintain market share. Although some incumbents may dramatically increase their market share and show greater profits, the outcome for a single incumbent does not change the nature of innovation. To avoid any confusion arising from changes in market share, the definition includes a no change in market share clause for an average incumbent.

Furthermore, it is important to note that profit destroying innovations are different from profit enhancing innovations because they lead to different business performance when the incumbent and the innovation succeed. If the incumbent fails to innovate and the innovation is successful, the incumbents are expected to lose share and profits irrespective of what kind of innovation the incumbent faces (Banbury & Mitchell, 1995). As a result, the definition focuses on the impact of innovation when the incumbent succeeds in innovation and the innovation succeeds in the marketplace.

3. Profit Destroying Innovations in the Context of Innovation Literature

This section shows the linkages between profit destroying innovations and radical and disruptive innovations. Such a comparison allows us to view profit destroying innovation in the light of existing innovation types. It highlights several important but unanswered questions regarding profit destroying innovations.

3.1 Profit destroying innovations versus radical innovations

Innovation literature distinguishes between radical and incremental innovations and has used this distinction for several decades. The key difference between radical and incremental innovations is the degree of change in technology involved with the innovation. Radical innovation involves large scale changes in technology whereas incremental innovation involves minor changes in technology.

Early work by Cooper and Schendel (1976) found that such innovations came from outside the industry and led to significant position loss for incumbents. Tushman and Anderson (1986) found that incumbents introduced incremental innovations that built on their previous capabilities whereas new comers and outsiders introduced innovations that used different capabilities from those of incumbents. In effect, newcomers introduced innovations that made the competencies of incumbents irrelevant. Utterback (1996) strengthened the distinction between radical and incremental innovations through his research. Abernathy and Clark (1985) further distinguished innovations based on whether an innovation destroyed marketing capabilities or technical capabilities or both.

Although early studies found that radical innovations come from outside an industry and displaced the incumbents (Hill & Rothaermel, 2003), later studies found contrary evidence. Methé, Swaminathan, and Mitchell (1996) found that sometimes incumbents were responsible for major innovations in an industry, and at other times, incumbents could quickly incorporate radical innovations in their product offerings. Moreover, Banbury and Mitchell (1995) showed that sometimes even incremental innovations resulted in displacement of incumbents when incumbents failed to innovate. In short, radical innovations pose some major challenges to incumbents by destroying the source of their competitive advantage but incumbents sometimes overcome this challenge.

While radical innovations always involve a radically new technology, profit destroying innovations may or may not involve a radical technology. On the other hand, while profit destroying innovations threatens to destroy profits of incumbents if the innovation succeeds, a radical innovation may enhance or destroy profits of an incumbent.

Figure 1 differentiates eleven distinct innovations based on the radicalness of innovation and profit destruction potential of the innovation. It shows that sometimes innovations could be both radical and profit destroying whereas at other times they could be profit enhancing and radical or profit destroying and incremental.

FIGURE 1

Profit destroying innovations versus Radical innovations

		Radicalness of innovation	
		Incremental	Radical
Profit impact of innovation	Profit Enhancing	Higher resolution HDTVs (720p to 1080i) Faster routers iPhone 3G	HDTV (over CRT) Cellular Phones CT scanners
	Profit Destroying	Custodial services Google docs Index Funds	Digital Cameras Quartz Watches

3.2 Profit destroying innovations versus disruptive innovations

Clayton Christensen and his colleagues (Adner, 2002; Christensen, 1997; Christensen & Bower, 1996; Christensen, Suarez, & Utterback, 1998) examined another class of innovations that Christensen termed disruptive innovations. Unlike the earlier innovation classes that focused on changes in technology involved with products and services, such innovations involved a change in the purchase criteria of customers. Christensen found that when such innovations appeared on the horizon, they were inferior to mainstream technologies on the key customer purchase criteria and thus did not appeal to the mainstream customers. As these innovations did not appeal to the mainstream customers but to a small segment of peripheral customers, the incumbents did not invest in these technologies. Although such innovations began as inferior technology on the key purchase criteria of mainstream customers, they eventually surpassed the mainstream technology on the key customer criteria. Once disruptive innovations surpassed the mainstream technology, they not only provide parity performance with the mainstream technology but also provided a new benefit. As a result, the mainstream customers began to value a new attribute that the disruptive innovation provided. Since the incumbents failed to invest in disruptive technologies, they were unable to match the new comers and were displaced by them.

Christensen (1997) found that disruptive innovations were of two kinds – one that targeted underserved customers while the other that targeted over served customers. The disruptive innovations that targeted over served customers provided a stripped down version of product or service to the customers at lower cost. He also argued that since the incumbents could not pare down their cost structure, they could not compete with the newcomers. Clearly, these types of innovations that stripped down the existing products would often destroy profits of incumbents if they do not result in a commensurate increase in demand. However, not all profit-destroying innovations are disruptive in nature and not all profit destroying innovations use this mechanism of profit destruction.

The key distinction between disruptive and profit destroying innovation rests on the fact that all profit destroying innovations threaten to destroy profits whereas all disruptive innovations potentially change purchase criteria of customers. The examples in figure 2 shows how profit destroying innovations and disruptive innovations are two distinct types of innovations that can sometimes occur together. The table shows examples to compare disruptiveness of an innovation with profit impact of an innovation.

		Disruptiveness of innovation	
		Sustaining	Disruptive
Profit impact of innovation	Profit Enhancing	Faster Routers Faster, more powerful computers	Cellular Phones CT Scanners HDTVs
	Profit Destroying	Cultured pearls Index funds Quartz watches Cultured diamonds	Digital Cameras MP3 versus CD

FIGURE 2 Profit destroying innovations versus Disruptive innovations

3.3 Choice architecture for incumbents facing profit-destroying innovations

Incumbents facing a profit destroying innovation face a distinctly different choice set than incumbents facing a profit enhancing innovation.

Figure 3: Decisions sets associated with profit destroying versus profit enhancing innovations.

Figure 3a – Profit enhancing innovations

Response of firm

		Embrace innovation	Avoid innovation
		Failure	Loss of resources allocated to innovation (Olestra)
Success	Profit increase (GE in CT Scanner)	Profit/ position /opportunity loss (Disk Drive makers)	

Figure 3a shows the choices that incumbents face when dealing with a profit enhancing innovation. Literature has recognized this choice set (Mitchell, 1991) because the literature focused mainly on the profit enhancing innovations. The figure shows that incumbent firms have two options when faced with an emerging innovation – embrace it or avoid it. At the same time, the innovation itself could succeed or fail in the market. If the firm avoids the innovation and the innovation fails, the firm loses nothing; however, if the innovation succeeds, the firm may go out of business or lose significant market position (Christensen, 1997). Craft or Unilever did not imitate P&G’s innovation of fat free oil and as a result, when the innovation failed, these firms were spared the waste of resources that P&G suffered. On the other hand, the disk drive makers (Christensen et al., 1998; King & Tucci, 2002) avoided the innovation for too long and thus lost position in the market. If the firm embraces an innovation and the innovation fails in the market, the incumbent firm loses the resources expended on this innovation activity; however if the innovation succeeds, the firm stands to benefit from supposedly more profitable technology. Procter & Gamble spent enormous resources on fat free oil Olestra but the technology did not succeed in the market due to which P&G lost the resources it used on this major innovation (Canedy, 1999). On the other hand, when GE embraced the CT scanner innovation, it improved its profits when the technology succeeded in the market (Teece, 1986).

Due to the uncertainty associated with innovations in early stage, incumbents are best served when they pursue a fast second mover strategy (Christensen et al., 1998; Mitchell, 1991). This strategy prevents excessive upfront costs associated with testing the innovation concept and allows incumbents to build on the early successes of first movers. When firms fail in the face of a radical or disruptive innovation, it is usually because they were unsuccessful in being a fast second mover.

In short, incumbents facing profit enhancing innovations try to balance between upfront innovation costs and total cost of market entry.

FIGURE 3B – Profit destroying innovations

		Response of firm	
		Embrace innovation	Avoid innovation
Fate of innovation	Failure	Loss of resources allocated to innovation	Prevent wasteful resource allocation
	Success	Reduction in profits	Eventual Loss of position / demise

Figure 3b shows how the choices associated with a profit destroying innovation are different from the choices associated with profit enhancing innovations. One point that stands out in figure 3b is that unlike incumbents facing profit enhancing innovations, who see improvement in profits when they successfully embrace innovation, incumbents facing profit destroying innovations expect a drop in profits when they succeed in embracing the innovation. Furthermore, incumbents facing profit destroying innovations would also legitimize the innovation and perhaps accelerate the success of the innovation, thereby accelerating their profit destruction. However, if they avoid the innovation, they could lose market position or face exit from the industry if the innovation succeeds. This is because the innovation could potentially make the incumbents obsolete.

A comparison between figure 3a and 3b shows that profit destruction potential of an innovation changes the set of choices facing incumbents and their implications in a meaningful manner. The challenge of a profit enhancing innovation is often to embrace the

innovation and incumbents sometimes find it difficult to do so rapidly enough. However, if they succeed in embracing the innovation, they witness an increase in profits. On the other hand, incumbents facing a profit destroying innovation face only downsides and no upside. If they succeed in embracing the innovation, their profits would decline but if they avoid the innovation and the innovation succeeds, they could be driven out of market.

In short, incumbents facing profit-destroying innovations face much more challenging choices compared to incumbents facing profit-enhancing innovations. While literature has shed light on the choices facing profit enhancing innovations we do not know much about the choices facing profit destroying innovations and how these choices impact incumbent behavior.

3.4 A compelling need to understand Profit Destroying Innovations

Literature review and the comparison between profit destroying innovations and radical or disruptive innovations show several important gaps in the literature.

The literature has focused almost entirely on profit enhancing innovations and underemphasized the role of profit destroying innovations. As a result, although we understand radical and disruptive innovations well, we do not understand profit-destroying innovations much. The choices associated with profit destroying innovations appear challenging for managers. Decision making literature provides us with two reasonable but opposite predictions about incumbent response to profit destroying innovations.

The literature on rationality (Goldstein & Hogarth, 1997; Payne, Bettman, & Johnson, 1993; Shafir & LeBoeuf, 2002) suggests that decision makers are rational beings who not only estimate the probability of success of an innovation but also take the path leading to greatest performance. Such decision makers would break a decision tree into options and apply probabilities to the various chance nodes in a decision tree. Based on probability weighted returns of the various options, such decision makers would choose the option with highest probability adjusted returns. In light of this view, incumbents would tend to embrace a potentially successful profit destroying innovation because it is much better to survive with lower profits than to exit the industry.

However, behavioral decision theory literature would predict that irrespective of what a rational choice may be, firms facing a profit destroying innovation would tend to choose the opposite course of action. It predicts that incumbents would avoid the innovation as discussed below.

Incumbents facing a profit destroying innovation face two choices both of which leave them worse off. If incumbents embrace the innovation they would witness reduction in profits. However, if they avoid the innovation they may have to exit the industry when the innovation succeeds. Scholars have found that when decision makers face two choices, both of which leave a decision maker worse off than status quo, the decision maker tends to avoid making such a decision (Anderson, 2003; Dhar & Simonson, 2003; Luce, 1998). Consequently, this

research would predict that such an incumbent would avoid making the decision and thus would appear to choose “avoid profit destroying innovation”.

Another vein of decision making literature provides more support for the avoidant response of incumbent. According to prospect theory (Camerer, 2000; Hastie, 2001; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), when a decision maker faces a choice between a probabilistic loss and a sure loss, the decision maker systematically underestimates the probability associated with a probabilistic loss. Incumbents facing a profit destroying innovation also face a choice between a probabilistic loss and a sure loss. Embracing a profit destroying innovation is akin to a definite loss because this course of action involves voluntarily lowering own profits. Ignoring or trying to prevent the innovation is akin to choosing a probabilistic loss because if the innovation fails, the incumbent would not lose much but if the innovation succeeds, the incumbent may lose its entire business. Consequently, prospect theory would suggest that the incumbents would systematically underestimate the probability of success of a profit destroying innovation. This systematic overestimation of probability of failure of the innovation would make incumbents more risk prone and make incumbents choose an avoidant response to a profit destroying innovation.

Furthermore, some organizational forces could prevent incumbents from freely going after the rational path of embracing an innovation even if it appears likely to succeed. Power in the organization lies with the leaders of the largest businesses, and leaders maintain that power due to their business success (Pfeffer, 1981). If the business performance declines, business leaders would lose credibility and power. Consequently, embracing a profit destroying innovation would not only decrease the business performance, it would also reduce the power of the business leaders. Thus, these business leaders would actively avoid embracing such innovations. Research results (Puffer & Weintrop, 1991) and empirical evidence (Lubin, 2009) show how CEOs lose their jobs when they do not deliver expected results. These results also show how difficult it is for management to take a rational path of embracing such innovations when they lead to loss of power.

In short, although a long held belief of rational behavior among decision makers predicts that incumbents would embrace a profit destroying innovation when the innovation is likely to succeed, literature on behavioral decision theory and power in organizations predicts that incumbents would avoid embracing the profit destroying innovation.

In summary, although scholars have looked at innovation by incumbents and new comers in significant detail, they have often focused on innovations that would lead to higher profits or have not addressed the question of profit destroying innovation. As a result, the literature is almost mute on whether some innovations may be bad for incumbents even when incumbents succeed in imitating the innovation. Given that literature does not sufficiently inform us about innovations that destroy or threaten to destroy profitability of incumbents, there is a compelling need to understand these innovations better. Our inability to predict the

response of incumbents facing such innovations highlights the major gap in our understanding. Table 4 highlights several gaps in our understanding of profit destroying innovations by comparing our state of knowledge about radical and disruptive innovations with our state of knowledge about profit destroying innovations. This paper fills this important gap in the literature through a cross industry study detailed in next section.

	Profit Destroying innovations	Radical Innovations	Disruptive innovations
Definition	An innovation that would destroy profits of incumbents if it succeeds in the market, even when incumbent maintains position.	An innovation that uses a significantly different knowledge base from the existing technology.	An innovation that would change the purchase criteria of the customers if it succeeds in the market.
Impact on profits of incumbents if incumbents successfully commercialize the innovation	Decrease profits of incumbents 1. Quartz wrist watches 2. Cultured diamonds 3. Farm grown pearls 4. Blogs over newspapers 5. Index funds 6. MP3 versus CD 7. Digital photography	May increase or decrease profits Some Increase profits 1. Plasma TVs 2. CT scanners 3. Hi-Fi systems Some Decrease profits 1. Quartz watches 2. Digital photography	May increase or decrease profits Some increase profits 1. Cell phones over land phones 2. Film roll over glass plate technology in photography 3. CT scanners over X-rays 4. Laptop over desktop Some decrease profits 1. MP3 over CD 2. Digital Cameras
Options as viewed by incumbents	Invest in an innovation that would reduce profits or prevent /ignore the innovation in the hope it would not succeed.	Invest in new technologies or wait until the technology proves itself	Invest in current business (known / proven opportunity) or divert investment to a potential opportunity that appears small.
Common response of incumbents	Not known	Sometimes wait and sometimes proactively invest in new technologies.	Often ignore the innovation and thus get blindsided by the innovation
Drivers of incumbent response	Not Known	The opportunity cost of investment in new unproven technologies make the incumbent wait	Mainstream customers do not want it but want incremental innovations in existing technologies
Common outcome for incumbents	Not Known	Sometimes incumbents succeed but often fail to be good fast followers	Often get displaced by newcomers
Solution prescribed by the literature	None	Invest in new technologies and use external methods to acquire knowledge	Create a separate business unit that will not have to fight for resources with the mainstream business. This will enable firm to commercialize the innovation

FIGURE 4: Comparison of Innovation classes

4. Data and Methods

As the research question in this study involved a lesser known phenomenon, it suggested the use of qualitative methods (Yin, 1994; Yin, 1981). As this research involved understanding the sequencing of events, emergence of new information over time and reaction of incumbents to such information, it was imperative to reconstruct the sequence of events in a reliable manner. Such research involves penetrating the specifics of a time and place so that findings are generalizable in an analytical rather than statistical sense (Eisenhardt, 1989).

As a first step, this research involved casting a wide net over several industries to identify some innovations that incumbents could have perceived as profit destroying innovations. This search led to a list of a dozen innovations. Furthermore, a quick and dirty research on these innovations was carried out to understand the nature of data availability and to understand whether there were strong reasons to believe ex-ante that the innovation was perceived as profit destroying.

The first list of a dozen profit destroying innovations included cultured pearls, custodial services, cultured diamonds, LED lights, wireless electricity, laser based hair removal devices, consumer cameras, mutual funds, quartz watches, free software, software solution in tax preparation, and music labels. From this list, three industries were chosen based on three criteria. First, the innovation should have occurred in the past and the reaction of incumbents should have been documented. This ruled out emerging profit destroying innovations such as LED, wireless electricity, software as a service, laser based hair removal devices, tax preparation software and cultured diamonds. Second, the innovation should have a mix of disruptive, sustaining, radical and incremental innovations. Third, extensive data should have been available on the industry and its incumbents. This ruled out cultured pearls and custodial services as data on these two industries was sparse at best. The four industries that met the criteria were digital camera, mutual funds, music labels and wrist watches. Out of these four, digital cameras, mutual funds, and music labels were selected to contain the amount of data collection involved in a single study. Furthermore, data on CT scanner innovation was also collected to use as a control case where the innovation was profit enhancing in nature. However, due to space constraints, data on CT scanners is not shared in this paper.

As a next step, a massive data gathering effort was undertaken for digital camera industry. It involved iterative searches for terms including “digital camera”, “film camera”, and several other related terms in lexis nexis academic universe database for time period 1979 to 2005. Since the first digital camera was announced in early 1980s, this time period would have captured all the events related to digital camera. This yielded over 3000 articles in the publications across various searches. Based on a quick review of article title and metadata, relevant articles were put aside for deeper review. Along with these articles, all available 10-K reports, industry reports, existing case studies and web based searches to

better understand lesser understood terms and events were used for carefully reconstructing the history of the industry. At times, some data made it imperative to go further back prior to the initially selected dates. This data collection effort took place between 2006 and 2008. Camera industry research demonstrated that data closer to the emergence of the innovation provided the most valuable sources and data temporally distant from the innovation was significantly less relevant. This insight was used to collect data on watches and mutual funds industry where a similar method was used but the dates for collecting information was reduced to 1 year prior to the innovation and 10 years after the innovation.

Based on the various data sources, a detailed timeline of events was reconstructed for each industry. Since data was used from several sources, it ensured increased reliability and validity of the findings. Furthermore, since the data was used to reconstruct the history in a way to provide a contemporaneous feel of the events, it reduced the likelihood of retrospective bias. By preserving the chronological flow of events, the detailed timeline of the events provided a rich dataset that enabled deeper understanding of the phenomenon and any other issues related with profit destroying innovations. The narrative distilled from the dataset and the implications are presented in the next section.

5. Analysis of Incumbent Response in Three Industries

5.1 Incumbent responses in Photographic Equipment Industry

The photographic equipment industry refers to the group of firms that produced cameras, film, photofinishing services and accessories. Over the last 130 years, this industry witnessed two major innovations. The first involved the invention of film roll that led to a rapid expansion of the industry in the early twentieth century. The second involved the transition from film camera to digital camera in the early twenty first century. Prior to the film roll, the technology involved a cumbersome technique in which a coated glass plate was exposed to capture the image. Due to the cumbersome methodology, professional photographers were the core customers of the industry.

Kodak pioneered the film roll technology that replaced the glass plate technology. Due to its technological and marketing efforts, Kodak became a dominant player in the industry by the middle of the century. Its innovation effort focused on making the camera easier to use and in improving the picture quality. By 1950s, it eliminated virtually all competition from the industry and in 1970s Kodak had a 90% market share in film and 85% market share in cameras in the US market. Its photofinishing technology had become the industry standard. Its position outside the United States was also strong but not as strong as at home; in 1976, it had \$2bn in global sales compared with \$2.8 billion global sales of all other competitors. Not only did Kodak have a dominant position, but the business itself was very lucrative also. By many accounts, the gross margin of the business was upwards of 50% (Porter, 1983).

Polaroid was the other major player in the industry with complete dominance in the instant photography segment, a segment that it pioneered. Its technological lead and dominance in instant photography allowed it to grow at over 25% p.a. for 30 years from 1945 to 1975. Polaroid's innovation efforts aimed to improve the image quality and to reduce the time between capturing the image and obtaining the finished photo. Although Kodak entered this segment in 1970s, it was driven away from the segment by Polaroid's lawsuits.

Canon, Nikon, Fuji Photo, and Agfa were other important players in the industry globally. Canon and Nikon made cameras while Fuji and Agfa also made film. Although Fuji entered the US market in 1970s and slowly nibbled at Kodak's market share through its low cost offerings, reaching a 20% share by the end of the century, Kodak remained the dominant market leader.

Throughout the century, innovations emanating from the industry enabled firms to enhance their profits. Color photos, faster and better quality film, and superior photofinishing allowed firms to maintain or increase profits. At one point DuPont, the chemicals major, tried to enter the industry in the film segment with better quality film roll. At that time, Kodak moved swiftly to beat DuPont in the technological race initiated by DuPont. Each subsequent product launch showed Kodak's superiority over DuPont. DuPont left the industry shortly after. This episode showed the significant capabilities and market power of Kodak and was an example of an incumbent reacting to a profit enhancing innovation in this industry.

In 1981, Sony, the consumer electronics major introduced a digital camera called Mavica that required no film. It was a sophisticated piece of consumer electronics compared to the ordinary \$50 film cameras then sold across the United States. Both Polaroid and Kodak began investing in developing a wide range of capabilities needed to compete in the digital camera domain. Kodak set up a laboratory in Japan to learn consumer electronics technologies and over the next 10 years invested over \$5 billion in digital technologies. Both Kodak and Polaroid set up digital technology teams that amassed capabilities in microelectronics, IC design, image processing and software design. Kodak launched the world's first image sensor in 1986 that became the industry standard. By 1989, Kodak had launched over 50 products related to digital image capture or conversion.

The reaction of Kodak and Polaroid to Sony's digital camera allowed the firms to build impressive digital capabilities within the next 10 years. There was absolutely no hesitation or feet dragging by these firms in developing new technological capabilities and producing digital products. Eventually the senior management realized that the innovation was a profit destroying innovation as the launch date approached. Digital camera decreased profitability by eliminating the film and photofinishing services on the one hand and by increasing competition from consumer electronics firms on the other hand. The margins were significantly lower in the digital world.

When the managements at Kodak and Polaroid realized that the digital camera was a profit destroying innovation, they began to resist the commercialization efforts. Many news reports and other industry observers noted that managers were resisting the digital technologies. A senior manager at Polaroid said “Why 38%? I can get 70% in film. Why do I want to do this?” upon realizing that the innovation was profit destroying (Tripsas & Gavetti, 2000). Similarly, Kodak’s managers also lamented at the profit destroying nature of the innovation. A senior vice president and director at Kodak said “We’re moving into an information based company, but it’s very hard to find anything [with profits margins] like color photography that is legal”. Even the new CEO, George Fisher, found significant resistance from the traditional film business and had to merge the two divisions to end the war between digital and film based businesses.

Feet dragging by Kodak and Polaroid had significant detrimental effect on their market positions. Kodak lost its dominant position in the industry. Polaroid, on the other hand became a non-player. In 2001, it filed for chapter 11 bankruptcy and its assets were sold off to another company who continued the business under Polaroid’s name. In 2007, it decided to exit the instant photography market. In the case of cameras, the innovation was a profit destroying innovation as the firms expected it to be. Fuji’s profits declined from 13% in 1990s to 7% in 2005 and Kodak’s gross margins declined from 46% in 1998 to 32% in 2005.

Canon and Nikon, on the other hand used this opportunity of digital cameras to promote digital single reflex cameras (DSLR) which is a more lucrative market segment. SLR cameras allow users to change the lens and provide significant flexibility in photo capture. Point and shoot (P&S) cameras replaced SLR cameras a long time back because of their ease of use. With the ability to get instant results in a digital camera, a user can see the result of various features in a SLR camera instantly. As a result, the SLR segment began expanding due to efforts of Canon and Nikon. Due to its SLR strategy, Canon, which was a peripheral player in the industry, became one of the major competitors in the digital arena.

The photographic equipment industry showed that the most dominant incumbents dragged their feet in the face of a profit destroying innovations while commercializing the innovation. However, when the same incumbents faced a profit enhancing innovation, they aggressively defended their turf. Furthermore, peripheral players were better able to deal with the profit destroying innovation than the dominant players. Finally, firms like Kodak and Polaroid that relied heavily on the industry for their profits had a more difficult time dealing with profit destroying innovations than firms such as Canon who depended less on the industry for their profits.

5.2 Incumbent responses in Swiss Wristwatch industry

Just as Kodak and Polaroid dominated the photography equipment industry for the entire century, the Swiss watchmakers dominated the global watch industry up to early 1970s. “Made in Switzerland” stood for excellence in wristwatch making due to centuries of

superior artisanship. All watches in the world up to 1957 were mechanical watches that consisted of more than 100 small components and required fine artisanship to keep accurate time. Accuracy in time keeping was the core benefit of watches and Swiss watches provided the highest accuracy.

Post World War II, Swiss watchmakers accounted for 80% of the world watch production and the industry employed 80000 people in 2500 firms. Over 95% of the Swiss watches were exported and these exports accounted for 10% of GNP. These watches were jewelry items sold at jewelers and provided watchmakers with over 50% gross margins. During 1950s and 60s, cheaper watches of inferior quality from Japan and United States nibbled away some of the market share of Swiss watch makers. Nevertheless, even by 1970, Swiss watch makers dominated the global industry with a 50% market share.

Quartz technology heralded a major change in the industry in 1970s. Quartz crystal could be used to keep time without a need for over 100 small components that a mechanical watch needed. Quartz watches were as accurate as the best Swiss watches, and were significantly cheaper. Originally, the Swiss incumbents created the technology. This invention was a result of a research consortium set up by Swiss watchmakers in response to an electric watch that appeared in the industry in 1950s. However, the firms decided not to commercialize the quartz technology. This was because moving to quartz would have eroded the 20% premium that Swiss watches commanded over other watches; although Swiss artisanship was difficult to copy, quartz technology was difficult to differentiate.

Japanese and American watchmakers led the way in commercializing the quartz watch category. During the 1970s, Quartz watch sales increased throughout the decade and beyond. In 1975, only 3% of the watches sold worldwide were quartz watches but by 1979, this share of quartz segment increased to 31% and by 1984, 75% of all watches sold globally were quartz watches. Since the Japanese and the American watchmakers led the way, they gained significant market share in quartz segment. For example, Seiko, a major Japanese watchmaker shifted its production of quartz watches from 20% in 1975 to 72% in 1977. Timex, a major American watchmaker introduced its first quartz watch in 1971 and priced it at 60% discount to the least expensive watch sold in the United States. The rapid expansion in the industry lured many companies to the watch industry. Over 50 companies entered the industry in 1970s including Texas Instruments and National Semiconductors.

Since the technology required to produce quartz watches was significantly different from the technology required to produce mechanical watches, the innovation was a radical innovation. Furthermore, the key purchase criteria or benefit from a watch did not change. Consumers valued the accuracy of watches as the most important attribute to choose a watch, and they continued to value accuracy even in a quartz world. Since innovation classes are ex-ante descriptions, quartz innovation was a radical and sustaining innovation.

Quartz technology reduced barriers to entry in the industry, barriers that were earlier based on superior artisanship of the Swiss watchmakers. Due to lower barriers to entry in the industry, the profitability of the incumbents was expected to drop as competition would lower prices. The Swiss firms saw the profit destroying potential of quartz watches clearly. One industry observer noted, “Many doubted there was any profit to be made in selling inexpensive watches”. Hayek, the man responsible for the eventual resurrection of Swiss watch industry, said about the Swiss mindset “Why should we compete with Japan and Hong Kong? They make junk and then give it away. We have no margin there”.

The most pervasive response of Swiss firms was no response to Quartz competition. Instead, they ceded territory across the world in mid and low priced segments. By 1985, the global revenue share of Swiss watch makers had declined to 30% and the volume share had declined to 10%. Its total exports of mechanical watches declined from 40 million units in 1973 to 3 million units in 1983. During this period, from 1970 to 1985, the total number of Swiss watch makers declined from 2250 to a little over 750 and the number of employees in the industry declined from 65000 to less than 30000.

Swiss firms had the technology to introduce the watches but did not commercialize the technology. They watched a slow motion train wreck and did nothing for over a decade and a half. These firms behaved just as deer in the headlights – frozen without a response. This provides further evidence to support the finding in camera industry that incumbents behaved in line with behavior decision theory prediction and not in line with rationality view prediction.

The Swiss watch industry also shows an example of a firm which successfully dealt with a profit destroying innovation. Instead of following the Japanese in making watches an everyday item, Swatch repositioned the wristwatch from being a jewelry item to being a fashion accessory. It used its Swiss origins to demand a premium and used design skills to create watches for different moods, clothes, occasions and events. This provides more evidence that irrespective of whether the innovation is eventually profit destroying or not, the incumbents behave as deer in headlights when they perceive the innovation as profit destroying. Moreover, it shows that some incumbent firms can respond to profit destroying innovations effectively.

5.3 Incumbent responses in Mutual funds industry in the United States

The common theme between Digital camera innovation and quartz innovation was that they both involved a radical technology needing significantly new knowledge. However, the innovation in the mutual fund industry involved no new technology and thus mutual fund industry is a welcome addition to the data set used for this research.

Mutual fund industry is a part of the broader financial services industry and plays an important role in providing investment products with different risk profiles and liquidity. Three major categories of mutual funds are equities, bonds, and money market funds. A

mutual fund takes money from investors and uses it to buy and sell financial instruments to generate returns in line with the fund's objectives. The fund company makes money by charging for investment management and sometimes takes a cut from the profits. The key drivers of profitability in the industry are the size of assets under management and the management fee.

Up to 1976, all mutual funds were actively managed funds. Managers of such funds buy and sell instruments such as equities to beat a benchmark index such as S&P 500 index. Funds managers of active funds use research staff, and incur enormous expenditures on buying and selling financial instruments. Such funds charge close to 1.5-2% of assets under management as management fee from the investors. History shows that more than 50% of all funds underperform their benchmark index.

In 1976, Vanguard introduced the first index fund called Vanguard trust 500. Unlike actively traded funds, such a fund is a passive fund that replicates the benchmark index and undertakes no buying and selling except when the index composition changes or to honor fund redemptions. However, it guarantees index performance that is at least as good a performance of the universe of all actively managed funds. Such a fund also charges significantly lower management fee compared to actively managed funds; Vanguard's fees are estimated to be almost a sixth of the fee charged by equivalent active funds.

Index funds were incremental on radicalness of innovations and sustaining on disruptiveness of innovations. Since the knowledge required to create, launch and manage an index fund was already present with the fund houses, the innovation was incremental in nature. At the same time, the key purchase criteria of the customers buying a mutual fund did not change with index funds, these products were sustaining in nature. Investors valued the returns and the management fee of the funds and continued to do so even when buying index funds.

Index funds were a profit destroying innovation for the mutual fund incumbents because it reduced the management fee significantly. In fact, if all assets moved to index funds, the overall management fee charged by all funds would reduce by over 80%. Irrespective of how profitable the index fund business could be, with a 80% reduction in revenues, the incumbents would see a reduction in profits. As a result, mutual fund houses realized easily that this innovation would destroy profits. The industry participants believed that such an innovation would not succeed as no one would want to get mediocre performance. Vanguard was even criticized for being un-American for providing mediocre returns. However, the innovation succeeded. By 1990, 2% of the assets under management in equity funds belonged to index category and by 1998, it increased to 7.3%. By 1998, 33% of funds flowing to equity mutual funds went to index fund category.

Fidelity, the market leader, did not respond to this threat for over 15 years during which time Vanguard played in a largely uncontested field. Moreover, even when Fidelity and

Dreyfus launched their funds they did not promote these funds in a meaningful manner. As a result, more funds continued to flow to Vanguard index funds than to Fidelity and Dreyfus. Due to this delayed reaction by incumbents, Vanguard's market share of the mutual fund industry increased to 5.5% by 1992. From 1987 to 1992, while Fidelity's share of direct marketing assets declined from 30.5% to 28%, and Dreyfus's share of this asset class fell from 13.9% to 10.6%, Vanguard's share increased from 15% to 20.7%. By 2007, Vanguard had become a clear leader of the index fund category with 46% market share - a remarkable achievement in a fragmented industry.

The mutual fund industry did not need new technology to launch index funds. In fact, any fund house could have launched such a fund in a very short period because they had all knowledge needed to do so. Nevertheless, the incumbents did not respond even when large amounts of new assets were flowing to Vanguard.

A key difference between the outcomes for mutual fund incumbents and incumbents in the industries covered earlier was that in this industry, Fidelity was not displaced by Vanguard. In fact, Fidelity's overall market share did not decline in a meaningful manner due to the rise of Vanguard. Why did Fidelity not lose its leadership position even when it demonstrated a weak and indecisive response to the threat? The answer lies in the fact that Mutual fund incumbents had significantly stickier client relationships than incumbents in camera or watch industry had. In pension plans category, employers often administer the plan wherein they choose a menu of funds to be provided to employees to invest their retirement savings. These plans tend not to change very often. Similarly, for self-directed IRAs, investors had to open new account relationships with a fund family that is a switching barrier. Moreover, financial advisors who advise clients on which funds to add to their portfolio are often paid by active funds where as they do not get sales commission on index funds. Finally, selling and buying in taxable accounts has a tax implication that may make such moves expensive. Overall, these barriers in the mutual fund industry made it hard for assets to switch from actively managed funds to index funds but did not prevent new funds from flowing to index funds.

In 1993, the mutual fund industry witnessed a second profit destroying innovation that competed directly with the index funds. American stock exchange launched the first exchange-traded fund (ETF) which is similar to an index fund but costs even less and provides several advantages over index funds. The lower cost of such funds is a result of less administrative work required to run such funds. As a result, an ETF is an index fund with lower costs because of elimination of some value activities. Barclays, a non-player in the mutual funds industry provided a major commercialization impetus to this product category. The ETF category increased to over \$422 billion by 2006. From year 2000 onwards, the total flow of assets to ETFs surpassed the share of funds flowing to non-ETF index funds. The rise of ETFs was akin to the rise of index funds.

While other players in the mutual fund industry including Merrill Lynch and State Street moved into ETFs, Vanguard, the leader of index funds showed the same behavior as Fidelity demonstrated in response to index funds. In fact, when Vanguard Managing Director Gus Sauter proposed that Vanguard should launch ETFs, the chief executive of Vanguard Jack Brennan responded, “I think that’s the worst idea you have ever had”. Vanguard had become the deer in the headlights in response to a profit destroying innovation. It finally responded in 2001 with its first ETFs but did not advertise those ETFs much. In this sense, its response was no different from Polaroid’s commercialization efforts of its digital cameras. Just as Vanguard rose to prominence with a profit destroying innovation, Barclays also succeeded with ETFs. By November 2007, Barclay’s had a 57% share of the ETF segment; State Street had a 21% share, while Vanguard had a mere 7% share.

The fact that financial services firms that can quickly imitate any new product took 15 years to respond to a profit destroying innovation provides further evidence that in the face of profit destroying innovation, incumbents tend to behave as a deer in the headlights does. This finding is similar to the finding in previous two industries.

6. Synthesis of Findings from this Research

A common theme emerging across all profit destroying innovations described above is that the incumbents behaved as deer in headlights do when faced with a profit destroying innovation. They continued this avoidant response even in presence of significant evidence that the innovation would succeed. The evidence suggests that the mechanism proposed by behavioral decision theory research is working rather than the mechanism proposed by rationality theory. On the other hand, in the case of a profit enhancing innovation, incumbents spurred into action, as was shown by the response of Kodak to DuPont.

The incumbents in digital camera industry did not hesitate to invest aggressively behind the radically new technology but did not demonstrate the same force when commercializing the innovation. Similarly, the Swiss watch incumbents and the mutual funds incumbents continued to avoid the innovation in the face of mounting evidence that the innovation was succeeding.

Figure 5 summarizes the results across the three industries studied in this paper.

FIGURE 5: Summary of results from analysis of four industries

Industry / Innovation	Profit Destroying ¹	Disruptive ²	Radical ³	Common Incumbent response	Impact on Incumbents
Mutual Funds / Index Funds	Yes	No	No	Delayed and indecisive reaction	Rise of Vanguard / No incumbent displacement
Mutual Funds / Exchange traded Funds	Yes	No	No	Delayed and indecisive reaction	Rise of ETF players / insignificant displacement
Camera / Digital Camera	Yes	Yes	Yes	Spurred into action when investing in technology.	Significant Market share loss and exit

Industry / Innovation	Profit Destroying ¹	Disruptive ²	Radical ³	Common Incumbent response	Impact on Incumbents
				Dragged feet when commercializing	of dominant incumbents
Wristwatches / Quartz Watches	Yes	No	Yes	Ceded territory to quartz players/ delayed action on quartz	Loss of profits/ market share, exit of many players
Camera / Film roll innovations (faster, color)	No	No	No	Spurred into action when faced with better film innovation	Improved position / profits. Drove out challenger

1. An innovation was deemed profit destroying if it threatened to destroy profits of incumbents even if incumbent succeeded in embracing the innovation and maintained its market position
2. An innovation was deemed disruptive if it changed purchase criteria of customers if it succeeded in the market eventually (Christensen, 1997)
3. An innovation was deemed radical if it involved significantly different knowledge domain than the mainstream technology (Hill & Rothaermel, 2003)

7. Discussion and Lessons for Managers

When we ask senior managers how would they respond if they were faced with a profit destroying innovation, we are told that they would rather survive with lower profits than exit while trying to maintain profits in a losing scenario. However, this research shows that even very successful firms fail to make this choice. The incumbents in this study behaved as deer in headlights do when faced with profit destroying innovations. These incumbents did not miss the innovation facing them; they did not refuse to invest in the technology. However, when it came to commercializing it, they just dragged their feet; not commercializing the product fast enough, doing it tentatively, and behaving in a self-destructive manner. On the other hand, when the innovation was profit enhancing, the incumbents spurred into action.

The rational approach of incumbents would have been to assess the probability of success of the innovation and then make an investment decision based on the risk adjusted net present value of the investment. Although the uncertainty associated with an innovation is very high early on (Mitchell, 1991), it is still possible for firms to take a real options approach (McGrath, 1999). While wristwatch makers and camera makers did this because the technology was radical, mutual funds incumbents did not have to take a real option approach in the technology as it was not new.

The literature mentions about several factors that contribute to incumbents reacting to innovation at a slower pace than needed. However, none of those traditional factors were at work here. First, the speed at which innovation displaced mainstream technology was not an issue (Christensen, 1997). In all three industries the innovations took between 15 to 25 years to displace the mainstream products. As a result, lack of time is not a reasonable explanation for incumbent's response. Second, a lack of cash flows and resources also do not explain this

anomaly because the incumbents had significant resources at their disposal (Tripsas, 1997). Third, degree of technological change does not explain the behavior because photography equipment incumbents spent enormous amounts of money and Swiss watchmakers had all systems ready to go to produce and commercialize the innovation (Anderson & Tushman, 1990; Tushman & Anderson, 1986). Fourth, the blind spot argument that incumbents did not see it coming also does not work because of the long time over which incumbents witnessed a displacement of their position (Christensen, 1997).

Tripsas and Gavetti (2000) have examined Polaroid and suggested that Polaroid suffered from the inertia of dominant logic due to which the firm did not aggressively commercialize its capabilities. Although dominant logic (Bettis & Prahalad, 1995; Prahalad & Bettis, 1986) clearly played a role in Polaroid's failure, this was not the case in other situations because in mutual funds and wrist watches the business model didn't change much. Furthermore, within the photographic equipment industry itself, other incumbents behaved somewhat differently from Polaroid as we saw earlier.

This research provided evidence that the mechanisms proposed by behavioral decision theory rather than rationality theory were at work when incumbents faced profit destroying innovations. Not only did the incumbents behave as deer in the headlights, the more central incumbents behaved more in this way. Kodak and Polaroid continued to drag their feet on commercializing the technology but a peripheral player like canon aggressively moved in with SLR technology to claim a larger market share. It stands to reason that deer in the headlight response would be strongest for the most dominant players in the industry because the leaders of such firms would have most to lose. It appears that the stronger the market position of an incumbent facing a profit destroying innovation, the more such a firm would stand to lose by embracing the innovation. On the same lines, when Vanguard dragged its feet on embracing ETF, smaller index fund players moved aggressively towards the ETF market. Similarly, Japanese and American watchmakers, peripheral players in the global watch industry, embraced the innovation aggressively while Swiss watch makers ceded territory to these firms.

This research also suggests that the more a firm depends on the industry facing a profit destroying innovation, the more it behaves as a deer in headlights. Firms such as Canon had revenue sources from several industries whereas Kodak and Polaroid were completely dependent on the camera and film industry. Vanguard was dependent on index funds market for its revenues whereas Fidelity and others had several actively managed products. Again, this shows that firms tend towards a more rational approach when they are less dependent on an industry for profits and revenues. Such firms can cover their decreased performance in one industry with enhanced performance in another industry. On the other hand a firm entirely dependent on one industry may find it risky and difficult to create new sources of revenues in other industries. In short, not only did incumbents behave as deer in headlights do, the most

dominant incumbents and those most dependent on the industry behaved most like deer in headlights do. As a result, they lost position or had to exit the industry.

This research provides some key lessons to managers dealing with innovation decisions

1. Some Innovations can destroy profits instead of enhancing profits: A key lesson for managers is to not view all innovation as good. It urges managers to examine their own innovation pipeline and assess if some innovations in their pipeline may potentially be profit destroying innovation. At the same time, it shows peripheral firms the opportunity to use a profit destroying innovations the way Vanguard did.
2. Watch out for decision making biases in innovation decisions: Decision making for innovation takes the decision makers into the realm of high uncertainty and sometimes in loss domains as shown in this paper. The fact that decision makers assess uncertainty and probability differently when in gain domains than when in loss domains is a key reason why they sometimes fall into decision traps. Not being aware of this cognitive bias may lead decision makers to make the same mistakes that managers facing profit destroying innovations maker. Although an awareness of decision making biases would help decision makers in many situations, Vanguard's response to ETFs showed that mere experience may not be sufficient for decision makers to avoid cognitive biases.
3. Don't envision the future from a rosy lens of current capabilities: A key mistake firms often make when facing such innovations is that they view the future from the rosy lens of their current capabilities and consumer understanding. Kodak believed that the future of photography was a convergence between chemical science and microelectronics. As a result, it created dozens of products that would help customers in the converged end state. These products involved expensive photo CD players (priced at \$500) and Kodak CD to convert film to digital pictures. Polaroid, on the other hand, believed that the future of photography involved a need of small printers on top of digital cameras. As a result, it spent enormous resources developing such printer and camera combo. Similarly, Swiss watch firms believed that the consumers would loathe cheap watches that didn't include fine Swiss artisanship. They perhaps thought the market for cheap watches will remain separate from the market for fine watches and didn't imagine that the segment boundaries would blur. All these firms were deluding themselves to a great extent. They were creating a future from the rosy lens of current capabilities and thus missing out on the greatest threat to their existence. To some extent one can understand that firms can get into the trap of believing what made them successful will continue to make them successful. One way to overcome this challenge is to deliberately avoid envisioning the future from the lens of current capabilities. This would force managers to envision challenging future end states and ways to deal with them.
4. Don't miss out on major and minor trends in the industry and its adjacent spaces: In hindsight one can question as to why these firms didn't do some obvious things. Why

did Kodak not notice the significant penetration of personal computers and the rise of the internet? Why did camera incumbents not attempt to dominate image manipulation software, online picture manipulation and sharing, social networking around images and online printing? Why did Swiss watch firms not come up with the idea of watch as a fashion accessory before most of the firms exited? Why did mutual fund firms not come up with active ETFs as a way to deal with vanguard's plain vanilla index funds? This line of questioning hides the fact that firms miss the key trends since they do not look out for them. Firms can create several opportunities if they focus on these minor and major trends.

5. Create an option C: All the firms that succeeded in dealing with profit destroying innovations did so by getting out of the false dichotomy of embracing or avoiding the innovation. Swatch transformed the watch as a product to create an option C. Canon brought back the idea of SLR camera and rapidly created a prosumer segment of SLR camera. Unfortunately, some of the firms that failed also attempted to create option C. Kodak thought that convergence products would create option C. Firms such as mutual fund incumbents tried to create the option C by repositioning the index fund category as a low payoff category. This was not very different from how diamond incumbent Debeers has been dealing with the threat of cultured diamonds. So far, Debeers has been successful in creating an image that cultured diamonds are inferior to natural diamonds. This brings out the key challenge of a profit destroying innovation – not all option C's will be successful. As a result, firms need to have a portfolio of option Cs to deal with profit destroying innovations.

This research took an important first step in understanding a class of innovation that is not only counter intuitive and challenging for firms, but also one that innovation literature has underemphasized. Since this is the first step in uncovering the details of such an innovation, this research used qualitative method. Scholars have proposed that when examining a relatively less understood and less studied phenomenon, qualitative methods are very powerful (Eisenhardt, 1989). This research paves way for quantitative research in the future.

Although this is a small step in greater understanding of this phenomenon, it shows there is a rich set of possibilities for research in this direction. Therefore, this paper is also a call to scholars to investigate profit destroying innovations in more detail. A logical question from this research is “what are the mechanisms used by profit destroying innovations to destroy profits?” It is clear that there does not seem to be one single pattern used by profit destroying innovation. The answer would help us understand these innovations better.

This research not only fills a gap in the literature but also helps practitioners deal with such innovations. As many industries are facing such innovations today or will soon face them, this research would greatly benefit managers. Microsoft has been facing this innovation

from Google in the office productive software market. Similarly, music industry faced a profit destroying innovation from a new format called MP3 format and Newspapers are facing it from Blogs and other informational sources on the internet. In near future, it is likely that shaving industry and chemical based hair removal industry will face this innovation in the form of laser based permanent hair removal technology. Similarly, alkaline battery industry will probably face this type of innovation in the form of wireless electricity. Practitioners can learn from the lessons from this study and not only become aware of the challenge ahead but also use these learnings to handle these innovations better. Thus, this research would not only advance literature but also help practitioners in a meaningful manner.

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