

Exploring Factors Influencing Incumbents' Response to Disruptive Innovation

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This paper explores how certain incumbent characteristics influence an established firm's response to disruptive innovation. More specifically, it looks at the challenges a middle size, top segment company faced and how this affected its reaction to the disruptive threat. This is done by conducting an in-depth case study of Hasselblad, a manufacturer of professional cameras. It can be seen in this case study that Hasselblad's limited resources and its niche strategy affected how it managed the transition from analogue to digital camera technology. These characteristics made it difficult to allow experimentation with digital imaging in the main business since the available resources were severely limited and this initially inferior technology could harm the brand image. Instead, Hasselblad pursued collaborations and eventually launched a hybrid camera, which was compatible both with film and digital backs but did not become the expected success. Being close to bankruptcy, the digital resources needed were acquired and the company eventually survived the disruption. In conclusion, this paper argues that the managerial challenges and solutions to the innovator's dilemma depend upon the particular characteristics of incumbents and that this heterogeneity has not been sufficiently captured by previous literature. It also suggests that medium size, top segment firms can survive disruptive innovation through collaboration and acquisitions.

Introduction

The concept of disruptive innovation (Christensen, 1997) has received much attention from both academics and practitioners. Nevertheless, there are several areas that have not so far received sufficient attention. One such aspect is the heterogeneity of incumbents. While the literature on disruptive innovation has proved that incumbents frequently fail in the transition from a sustaining to a disruptive technology, it has so far shown limited interest in the differences between established firms. In the discourse regarding disruptive innovation, incumbents are often treated as one population vis-à-vis entrants rather than as many populations with different resources, market positions and strategies. Contrary to this, it appears reasonable that the capacity to respond to disruptive innovations depends largely on the characteristics of the incumbent

and consequently that the managerial solutions proposed need to take these differences into consideration.

This paper investigates how certain incumbent characteristics influence the response to disruptive innovation. In particular, using an in-depth case study approach, it explores the challenges and managerial solutions for a medium size established firm in the high-end segment of its industry. The firm in question is Hasselblad, a manufacturer of professional cameras. Based on the observations made, it is argued that the managerial challenges and solutions to the innovator's dilemma depend upon the particular characteristics of an incumbent and that this term needs to be nuanced further. Moreover, the article suggests that a medium size company in a high market segment can survive disruptive innovation through collaboration and acquisitions.

This paper is organized as follows. The next section reviews the literature on disruptive

innovation and entrant-incumbent dynamics. The subsequent section contains a description of the methods used in this paper. Then the case study about Hasselblad is presented in order to illustrate how a particular incumbent firm encountered severe problems, but eventually survived the disruption. The firm provides a particularly compelling example in that, despite early investment and recognition of the disruptiveness of digital imaging, it encountered problems in the transition to the new technology. The final section contains an analysis of the case study and a discussion about its theoretical and managerial implications.

Theoretical Exposition

It is well documented that many established firms find it hard to adapt to changes in the technologies they employ. Frequently, incumbent firms do not manage the shift to the new technology, they lose market share and the successful firms are found among the new entrants (Cooper & Schendel, 1976; Tushman & Anderson, 1986; Utterback, 1994). Christensen (1997) brought a new perspective to this issue by drawing upon resource dependency theory (Pfeffer & Salancik, 1978). This theory suggests that a firm's freedom of action is in fact controlled by actors outside the boundaries of the company, e.g., customers and investors. Hence, resource dependency theory posits that a firm's freedom of action is in fact limited to satisfying the demands of those actors that provide the resources it needs in order to survive.

By making a distinction between sustaining and disruptive technologies, Christensen explained the recurrent pattern of incumbent failure in technological shifts. Sustaining technologies have in common that they improve the performance of established products along the dimensions that mainstream customers demand. Disruptive technologies, on the other hand, initially underperform along these dimensions. The lower traditional performance and the ancillary performance attributes create a large market uncertainty around the disruptive innovation. At the same time established firms find it irrational to abandon their current, profitable customers in order to aim for a new, initially small market and an inferior technology. As the performance of the disruptive innovation increases it begins to attract customers from the sustaining technology and eventually displaces the old technology. Through his studies of the disk drive industry, Christensen showed that incumbents usually win sustaining battles

whereas entrants succeed in disruptive battles. Hence, a key determinant of the probability of success for an innovation is the extent to which it addresses the needs of actors in an incumbent's current value network.

Christensen also derives a number of managerial solutions which have been further developed (Christensen & Raynor, 2003). It is argued that managers in incumbent firms basically have three options, they can *change the processes and values of the current organization*, *create an independent organization*, or *acquire a different organization*.

Firms that try to *change the current organization* in order to adapt to the disruptive innovation have a weak track record (Christensen, 1997). The main reasons for this are related to the resource dependence that the innovator's dilemma originates from.

An *independent organization* can be regarded as a structure in which an organization develops new resources that are different and separate from the rest of the firm. It has objectives that are largely independent from and outside the current operations of the firm. As the new technology evolves within the organization, the required processes and values are also developed (Macher & Richman, 2004). This is one of Christensen's most influential recommendations for how to manage disruptive innovations.

When firms are not able to develop disruptive innovations, they can adapt by *acquiring* companies that possess the resources that are needed for developing the new technology. By doing so, the competencies needed for developing disruptive innovations can be incorporated into the organization rather than developed.

Though the problems and solutions described above are well elaborated, they suffer from some drawbacks mainly due to a lack of clarity in the terminology used. In the discourse regarding disruptive innovation, incumbents are treated as one population vis-à-vis entrants, rather than as many populations with different resources, market positions and strategies. However, the forces of resource dependency should arguably vary depending upon the specific characteristics of an incumbent firm. For instance, firms operating in a high-end segment are likely to face different challenges from those faced by a company in the low-end of the market. This implies that there could also be a substantial amount of heterogeneity among the solutions to the innovator's dilemma or that the most suitable means of action actually depend upon the characteristics of the incumbent. Consequently, the managerial solutions can potentially be improved further by exploring how

the properties of an incumbent affect its response to a disruptive threat.

Moreover, given that disruption is a process and not a discrete event (Christensen & Raynor, 2003), it should strike at different points for different firms depending on the segment in which the firm is operating. Adner (2002) pointed out that the structure of demand needs to be addressed in order to clarify the nature and effect of disruptive innovations. Using the notion of thresholds, Adner also defined critical performance levels that must be met. The functional threshold of a product is the minimum performance that the customer can accept whereas the net utility threshold also takes price into consideration. The point in time when the net utility threshold is met by the disruptive technology should arguably depend upon which customer segment the incumbent operates in.

Furthermore, Danneels (2004) suggested that future research should investigate alternative routes for incumbents to access disruptive technologies, looking into the possibilities for using alliances, acquisitions and internal development in more detail. This paper will address some of these issues by exploring how certain incumbent characteristics influence its response to disruptive innovation. More specifically, it will look at the particular challenges encountered by a medium size established firm operating in the high-end of the camera market.

Methods Used

The case study below illustrates how Hasselblad failed to develop capabilities in digital imaging on its own and then survived through collaborations and an acquisition. This firm was targeted since it does not possess the characteristics of most incumbents that are studied in the field of disruptive innovation. The firm is operating in the high-end segment of the camera market, targeting professional photographers with a high demand on performance. An additional reason for studying Hasselblad is that it was possible to conduct interviews with current and former high-level managers of the company.

Though the authors have no past experience of working with Hasselblad, extensive amounts of information have been accessed. Since this paper focuses on corporate strategy and the implementation challenges that confront managers, senior managers who played a substantial role in forming the strategy were primarily interviewed. Managers of R&D have also been accessed in order to understand the specific challenges they

faced when shifting from analogue to digital imaging. In total, more than 50 hours of interviews were performed and recorded with 11 people. Follow-up interviews were also conducted in order to ensure an accurate interpretation of the information. All field research interviews began with general open-ended questions, asking managers how they perceived the challenges posed by the disruptive technology and how they tried to deal with them. The same questions were asked to at least two senior managers from one era. In order to ensure the accuracy of this information, it was compared with a large amount of secondary data such as annual reports, media articles, old mail conversations between managers and book chapters written by former managers. In addition to this, all minutes from the board meetings during the period 1989–94 were accessed.

The description of this case emerged when all these sources of data had been analysed. In those cases when the written material that was accessed diverged from the interview data, follow-up interviews were performed. The gathered data has thus been triangulated by looking at several independent sources and making sure that these sources were mutually consistent. Moreover, the most important material has been read, accessed or discussed by several researchers in order to ensure an accurate interpretation.

Case Description

Hasselblad is a small niche player in the camera industry. The firm had for a long time about 500 employees in total and annual revenues of around SEK600 million. It has for decades been one of the leading camera manufacturers and has sometimes been referred to as the 'Rolls Royce' of the camera industry. The company received global recognition in 1969 when the first photos of Neil Armstrong on the moon were taken with a Hasselblad camera. During the following decades, a series of high-performing cameras for professional photographers were developed. This case study will focus on the late 1980s to 2005, which is the era when Hasselblad's analogue cameras were disrupted by digital imaging.

In 1981, the camera industry was shaken when Sony introduced the first camera that was not using film, the Sony Mavica. Given the poor picture quality of the Mavica, the CEO of Hasselblad at that time, Jerry Öster, concluded that the firm should wait and instead learn more about digital imaging by developing other applications. Öster thought that Hasselblad was too small to make the investments in

R&D required in order to overcome the weaknesses of the new technology and that it would take time before the technology would disrupt Hasselblad.

Attempts to Develop a New Camera System

During the late 1980s, Hasselblad became increasingly aware of the drawbacks of its analogue camera system. Cameras are not only about electronics or precise mechanics. There are many features which are related to optics and Hasselblad lagged behind in those areas. Therefore some R&D managers thought that the company needed to develop a completely new camera system with modern functions such as autofocus. Some proposals were made to the board but the project, which was called Nova, was never launched on a full scale. The main reason for this was that management thought Hasselblad was too small to afford such a project.

The Development of a Digital Studio Camera

The firm instead moved further into digital imaging in the early 1990s. A new CEO was recruited who had a background in electrical engineering and believed in the potential of digital imaging. In 1994, the company started the development of a digital camera. During this time digital and analogue photography were competing for the same resources. One member of the product board recalls that 'we had one budget in the product board and money had to go to either the digital camera system or the mechanical camera system'. It was eventually decided to move further into digital imaging.

When the development of a digital camera had started, it soon became apparent that this technology had some properties that made it fundamentally different from an analogue camera. The photo quality was lower at this point than with an analogue Hasselblad camera. Along other performance dimensions, digital photography had many attributes that made it attractive. Photos could be replicated, manipulated and sent at a much lower cost and much more conveniently than with analogue imaging. Thus, the business utility of digital technology was in fact very large at this point, yet different from what Hasselblad had offered previously.

With these properties in mind, the manager in charge of digital development, Lennart Stålfors, thought that the best thing to do was to develop a camera for studio photography. This customer segment would hopefully be willing to trade off some photo quality for the oppor-

tunity to take many photos, make copies and sending the photos in an easier way.

The development of the digital camera took place both in-house and in various collaborations. One of the largest projects was undertaken together with Philips. Among other things, this resulted in a sensor for digital cameras. 'Many large companies were willing to co-operate with us despite the fact that we were so small, our strong brand helped us a lot', Lennart Stålfors recalls.

A Change in Strategy

Partly as a consequence of having focused on digital imaging, Hasselblad lagged behind with its mainstream products. This was one of the reasons why the new owner, the Union Bank of Switzerland (UBS), in 1996 decided to cut off digital development. Moreover, UBS had a short-term scope of ownership and did not want to make investments that would be beneficial in the more distant future. An additional reason was that some managers, primarily in the marketing department, thought that the inferior quality of digital imaging would damage Hasselblad's brand. Others argued that the firm was too small to develop a digital camera on its own. Stefan Arvidsson, member of the board, says: 'In the long run we would not have been able to keep up with the others. Compare us to what the huge Japanese companies spend on development. I still think stopping the project was the right thing to do.' However, many people thought that this decision was a disaster. For instance, the Chief Finance Officer (CFO) at that time, Bengt Ahlgren said: 'Hasselblad did not have to develop everything on its own. Throughout the years our reputation had made us an attractive partner for collaborations.'

Instead of continuing with digital imaging, the new owner decided to develop a completely new camera system. As was mentioned before, this project had been considered in the late 1980s but had never been realized since it would have been very expensive for a small firm like Hasselblad. The new strategy was to pursue some collaboration and thereby follow the digital development, while focusing Hasselblad's own resources on analogue technology.

The development of Hasselblad's new camera system, the H11, was initiated in 1998. The camera was developed in collaboration with Fuji, who actually funded almost 50 per cent of the camera. The idea was to create a camera which was analogue but also compatible with digital backs, thereby facilitating the transition from analogue to digital imaging.

However, this project was heavily delayed and the product was not launched until late 2002, many years after what had been planned originally. Moreover, it had run SEK150 million over budget and did not have all the features that were originally intended. This delay turned out to be critical since the technological shift started to affect the company during those years. One member of the development team notes that: 'if the H1 would have been launched in 1998, we would have had four good years of revenue from it. When the H1 was finally launched it was a fantastic product, but that did not matter since most cameras were completely digital then.'

The H1 system was a hybrid, which could use both digital backs and conventional film. The digital backs were initially delivered by Kodak and PhaseOne. Since Hasselblad did not manufacture their own digital backs this meant that they could not deliver a complete digital camera themselves. At the same time, the performance of digital cameras had increased to the extent that Hasselblad's position was threatened by actors that had not even been their competitors before. One of Hasselblad's most profitable segments, wedding photography, had for decades been a market that was protected from competition. But within a few years, Hasselblad lost this market to Canon due to the shift from analogue to digital technology. Digital backs are very expensive and thus, a fully digital Hasselblad camera cost SEK100,000 more than Canon's similar products. The firm now experienced a severe drop in revenues. As the market for digital cameras expanded rapidly, Hasselblad encountered further problems being caught with a technology that was essentially analogue.

In early 2003, the company was bought by the Shriro Group, a Chinese firm which had been Hasselblad's distributor for more than 40 years. The new owner sold off all subsidiaries of Hasselblad, downsized the firm and had to bring more money into the company several times in order to avoid bankruptcy. Hasselblad now had to develop a complete digital camera system, which included digital backs. Given that the firm was close to bankruptcy, had suffered severe layoffs and had cut off all digital capabilities in the mid 1990s, the situation was desperate.

Shriro thought that it would be impossible under these conditions to develop a digital back and therefore started to look for potential acquisitions. Given that the new Hasselblad camera was compatible with digital backs, the synergies from buying a manufacturer of those backs seemed obvious. In order to avoid bankruptcy, Shriro had to invest extensively in the

acquisition of Imacon, a Danish firm manufacturing digital backs. Imacon and Hasselblad were merged together and Hasselblad could now sell a complete digital camera system.

After having been close to bankruptcy in 2003–4, the company recovered financially and since then it has been profitable in manufacturing digital cameras for professional photographers. However, Hasselblad is still paying back a lot of debt to the owner for whom the acquisition of Hasselblad turned out to be far more expensive than anticipated. A long and dramatic journey for Hasselblad had been made, or as the CEO Lars Papilla expressed it in May 2004, 'the shift to digital technology was much more dramatic than we had expected.'

Analysis and Discussion

The case study of Hasselblad can indeed be regarded as an illustrative example of the innovator's dilemma. It clearly shows that the digital cameras were disruptive. While initially having a lower performance along traditional measures such as photo quality, it had other attributes such as the possibility to store, replicate, send and manipulate photos more easily and at a lower cost.

Despite recognizing the future importance of digital technology at an early point, Hasselblad encountered great difficulties in this technological shift. Resource dependency theory seems to provide one explanation for why this happened, as suggested by Christensen (1997). The continuous demand from investors to focus on profitability and therefore downsizing disruptive initiatives can be regarded as one example of this. Moreover, the particular characteristics of Hasselblad affected how the firm handled the disruptive threat from digital imaging. The company was relatively small and had a limited and demanding customer base. These properties imposed constraints on how Hasselblad could handle the innovator's dilemma.

Focus on the High-End Segment – An Obstacle for Experimentation?

It can be seen in the case study above that Hasselblad's niche strategy affected how the firm managed the transition to digital imaging. Digital cameras could not initially provide the superior performance that was demanded in the high-end segment where Hasselblad had established a unique position. The net utility threshold (Adner, 2002) was much higher for a firm like Hasselblad than for a company

operating in the amateur segment. In addition to this, Hasselblad's customers associated the brand with quality and superior performance and this image could have been damaged by experimenting with an initially inferior technology. The strong brand was one of Hasselblad's greatest assets and this seems to have created a large hostility against digital technology, particularly in the marketing department. The protected market position and the brand were probably two of the main reasons why the new owner decided in 1996 to cut off digital development and focus more on analogue imaging.

In this respect, companies in the lower segments had better possibilities for early experimentation and learning since they could sell digital cameras to amateurs with low demands on photo quality. The values associated with the Hasselblad brand implied that a transition to a lower performing technology was deemed to be very risky and, thus, the forces of resource dependency seem to have worked strongly in favour of the sustaining technology. Based upon a history of landmark events such as the photos taken on the moon, a dominant logic (Prahalad & Bettis, 1986) emphasizing extreme performance had emerged within the firm and this further implied that moving into digital technology was difficult. Clearly, the firm's core capabilities in the mechanical technology in this sense turned into core rigidities when facing the disruptive technology (Leonard-Barton, 1992).

Firm Size Limiting the Possibilities to Keep Options Open

The case study also illustrates how being a medium size company affected Hasselblad's response to the disruptive technology. When management decided not to develop a new camera system in the late 1980s it was largely a consequence of the limited resources of the firm. Moreover, the fact that much of the digital development in the early 1990s occurred in various collaborations such as the one with Philips illustrates how firm size affected the way Hasselblad handled the disruptive threat.

During the mid 1990s the firm continuously moved away from digital imaging and instead embraced the sustaining technology that had proven to be successful for so many decades. When the new owner decided to focus solely upon conventional camera technology and pursue only minor collaborations in the digital technology area, another step in this direction was taken. It appears that this decision was also affected by the firm's size and its available resources. It can be argued that the limited size

of Hasselblad accentuated the difficulties involved in meeting the disruptive innovation as the company ended up in an either-or situation, due to its financial constraints.

Hence, the forces of resource dependency were very strong for a firm like Hasselblad. It would have been expensive for the company to pursue development in both the new and the established technology fields simultaneously. Hasselblad tried to keep the option of developing a digital camera open through collaborations and instead focus on a hybrid camera, but lost valuable time and resources in doing so. The fact that the new camera system launched in 2002 was to a large extent financed by Fuji also illustrates how the size of the firm affected its way of managing the technological shift. During this long and costly project, Hasselblad never had the resources or strategic focus needed to develop digital backs. When Shriro acquired Hasselblad and the firm was close to bankruptcy, it could eventually survive through an acquisition of Imacon, thereby providing a fully digital camera system.

Whether the outcome of this strategy should be regarded as a success or not is a subject that is open to interpretation. If the new owner hadn't brought additional funding to the company it would most likely not have survived, and it is still paying off debts to Shriro. On the other hand, empirical evidence from both other industries and the camera industry (e.g., Christensen, 1997; Tripsas & Gavetti, 2000) suggest that few companies survive disruptive innovation and therefore survival may here be regarded as some form of modest success.

An additional factor that seems to have affected how Hasselblad handled the disruptive threat seems to be ownership and the willingness to make long-term investments. An owner such as UBS who had a short-term scope of ownership was hostile towards investing in digital imaging and instead developed a hybrid camera. The takeover by Shriro seems to have enabled the kind of investment that was needed. Therefore, it appears that the various ownership changes created a strategic inconsistency over time that augmented the problems Hasselblad encountered, but the accessed data does not enable us to draw further conclusions about this.

Summarizing the above, it is seen that Hasselblad's size and strategy affected its response to the disruptive technology. For a firm like Hasselblad, the relative cost of pursuing digital technology was higher than for a larger incumbent and, hence, the inertia seems to be very strong in this setting. It can be seen in the case study how this forced Hasselblad to

handle the disruptive innovation through various collaborations and through an acquisition of digital capabilities.

Moreover, digital cameras could initially not satisfy the demands that Hasselblad's high-end segment required. In contrast to this, larger camera manufacturers such as Canon and Nikon could develop capabilities in digital photography while they were still producing conventional cameras. These firms had the sizeable resources that were needed in order to undertake these kinds of ventures. Furthermore, they were operating in the amateur segment for cameras, which could tolerate the lower performance that the disruptive technology initially provided.

However, it should be emphasized here that there are several examples of large incumbents in the low-end segment of the camera industry that encountered problems despite having larger R&D budgets. One such example is Polaroid (Tripsas & Gavetti, 2000) which initially sought to develop digital cameras and complementary assets but failed and after that focused on conventional cameras. Since this pattern is to some extent similar to what happened to Hasselblad, incumbent size and strategy can clearly not be the only factors that affect how established firms handle disruptive threats. This paper does not argue that these are the only, nor the most important determinants; rather, it claims that the particular characteristics of an incumbent affect the challenges in a disruptive shift and that they consequently also need to be considered when looking for managerial solutions to the innovator's dilemma.

Conclusions and Managerial Implications

This paper has explored how certain incumbent characteristics influence the way an established firm responds to disruptive innovation. In particular, it has looked at the challenges a medium size, top segment company faces, and possible ways of handling them. It can be seen in this case study that Hasselblad's limited size and its niche strategy made the firm highly vulnerable to the innovator's dilemma despite the fact that the disruptive effects of digital imaging were recognized and dealt with at an early point. Having a small and demanding customer base implied that Hasselblad became highly dependent on these customers and also

lacked the resources to pursue extensive internal development projects.

Moreover, the case illustrates how the managerial solutions to the innovator's dilemma are affected by the particular characteristics of an incumbent. A relatively small niche player like Hasselblad could eventually survive the disruption through collaborations and an acquisition. This finding suggests that the heterogeneity of incumbents has been downplayed by the previous literature and it calls for further investigations to allow for the development of a more nuanced view of how established firms can respond to disruptive innovations.

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