
Disruptive Technology: Approaches to Escape a Discontinuous Environment

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Abstract:

Disruptive technologies have erased and continue to extinct previously successful industries. Scholars' studies consider ICT as a major cause for various industries, as, e.g., analogue photography, typewriters, VHS-cassettes and so on. They have become obsolete as its effect. Despite the creation of new industries at the same time, the environment for old industries results frequently in obsolescence. Especially, as research tends to hold, impact on organisations increases, when new technologies effectuate an additional shift in consumer behaviour. Opportunities for established firms become likely discontinuous then.

The replication industry of optical discs is a specific industry sector within the wider Home Entertainment Industry manufacturing the present dominant design of the physical mass product, DVD and CD. However, ICT-based dematerialised, virtual products threaten the replication industry's future, which may become obsolete, since more and more consumers adopt virtual downloads as their preference.

This paper studies the approaches of selected industry's incumbents to be innovative themselves to escape their emergent disruptive environment. Based on primary and secondary research, it addresses their adopted opportunities of accessing new growth paths through extended technology management and the development of a future-oriented direction by additional technologies and augmented services to escape the environment of decline and exit. The purpose of the underlying long-term research is to study, how do replicators (as an example for declining industries) respond to the threat of disruptive innovation and whether their (strategic) behaviour may serve as a model for other industries facing similar scenarios. This research is undertaken qualitatively using a single case study from which excerpts are presented.

The present findings provide evidence that after a long time of reluctance, replicators have started to develop further resources and capacities to identify new and additional ways supporting them in their struggle for survival. But these findings show as well a pattern that approaches to future orientation may not be sufficient, since

1. They do not resolve the dilemma of competing with products and services committed to the physical place against a shifting consumer behaviour pattern addressing the virtual space.
2. Constraints, like e.g., staff, physical facilities, skills and path-dependent reasons further marginal, or in Abernathy et al.'s understanding regular innovation or re-engineering fighting against radical innovation by both, technological impact and market linkages (1983, 1984).
3. The established customer-supplier relationships may be of disadvantage, since hindering replicators to have direct access to the point of consumption.

These indicators suggest that disruptive innovation will be stronger in the end and many present efforts may be in vain.

Keywords: Disruptive innovation; discontinuous environment; virtual products; dematerialisation; dominant design; market linkages; creative destruction; replication industry; consumer behaviour; decline

1 Introduction

The replication industry of optical discs is a specific industry sector within the habitat of the wider Home Entertainment Industry (Cassia et al. 2006). Presently it manufactures the dominant design of the physical mass product, DVD and CD, which the Home Entertainment segments music, film and electronic games offer on the worldwide markets. However, ICT-based dematerialised, virtual products threaten the replication industry's future immensely (Bénavent. 2008, Benghozi. 2005, Benghozi et al. 2005, 2006, 2000). Researching this industry is of particular interest, since it is one of the earlier industries facing three major threats, which are proposed as being out of their control:

1. The easiness to dematerialise the content of physical products into virtual services.
2. The shift of their clients – owners of the content they replicate – finally responding to the different market expectations and leaving established long-term supplier-client relationships sooner or later.
3. Consumer behaviour favours easiness and cheaper price of virtual downloads.

In this understanding, it is suggested to consider music downloads more as a service, than a product. The reason is that download platforms do not deliver any physical goods, have no physical chain of distribution, but provide a service: The point of sales (POS) then becomes a point of access (POA). Despite the massive objection and resistance especially of the music and the movie industry, IFPI, the international professional body of the music industry, has responded to the shift, by recommending its members to reflect on a strategy of access (2009a).

Researching the replication industry offers a field, which is small, globally represented and highly concentrated proposing useful insights, how incumbents of a threatened industry deal with a scenario, which, with some right, may be considered as an endgame situation requesting specific strategies (Harrigan. 2003, 1980, Harrigan et al. 1983, Oliver. 1991). But threats may result also in innovative approaches, which allow certain firms to change their odds into a more favourable outcome in comparison to others. Since ICT-related innovation is expected to develop rapidly further, it is expected that other industries may face similar situations soon. Anderson supports this expectation, e.g., by his reference to the 3-D Laser printer (2007).

So far, the initial focus is on a line of technology (cause) towards the product (effect). But further effects have to be noticed, too, being suggested as a line, where technology is an origin enabling new "products" (downloads) causing a different consumption pattern, which turns against prior dominant formats. Utterback's extensive explanation of the dominant design, as the features, both parts of the market have agreed on, translated to the case of DVD and CD shows already a substantial through-crack. As Anderson, Kusek and Kusek et al. report, consumption of the physical product, here especially music CD, declines significantly, while music consumption grows rapidly (2007, 2006, 2009). If tendencies of declining demand of physical DVD and CD will continue, for which good evidence exists, it can be assumed that downloads will become the future dominant design, cutting the replication industry, which is mass product oriented, from the majority of its existing market linkages off.

To continue with the cause and effect logic, this consumer pattern causes permanently reducing manufacturing figures and confronts the replication industry suffering due to extensive overcapacities from a high degree of rivalry in its internal industry boundaries already, in its core business and manufacturing model with little options for internal renewal. Applying Christensen et al.'s. resources processes and values theory (RPV) suggests that replicators' RPV are oriented towards physical products and are not favouring virtual services (2004). By a market understanding this means that everything, which replicators produce, addresses the physical place, but not the virtual space (Kotler et al. 2002).

Incremental innovation, such as the latest Blu-ray disc format or the holographic disc (in preparation), whose innovative grade is yet unknown, tries to keep pace with radical developments, or, as Christensen et al. tend to hold, established industries flee upmarket, when threatened by radical new entrants (2004). With regard to industrial renewal, it is important to understand that the vast majority of this industry's participants suffer from being licensees of the major manufacturing technology, which restricts options in the field of core competencies due to strict prescriptions of licensors. I.e., the majority of replicators cannot alter or extend the core product DVD and CD significantly, since licence agreements restrict their options. These license agreements are in the hands of two groups known as 3C and 6C to which adds the MPEG LA license (Renaud. 2008).

For a potential explanation it would be oversimplifying to remain in a single-layered approach: ICT creates virtualised products, downloads, using MP3 and similar compression technology and consumers then buy a

service instead of a product. In this environment, consumers, but artists and producers as well, have developed new and different business models, too, known as c2c and P2P. These models cause further effects on the distribution chain and beyond, since music is frequently exchanged free of cost avoiding or circumventing organisational offers (Oestreicher et al. 2009, Oestreicher. 2009a).

Therefore it is suggested that the present situation of the replication industry is offering a picture, which is disadvantageous and likely to become discontinuous for those participants being unable or unwilling to change their ways of doing business sufficiently radical. Finally, this environment raises questions about the extent and the opportunities to which it is possible to continue with established strategies. This industry's overall situation tends to show a pattern, which adds to Schumpeter's path-breaking theory of the wind of creative destruction (1950, Utterback. 1996).

2 The Research

The research presented is part of a long-term and ongoing study, which is not yet finished. It adopted a single case study approach for a particular industry using qualitative methods. Permanent contacts to senior industry members by formal and informal conversations and interviews are combined with secondary research using publications of the replication industry, its professional bodies and relevant academic and other literature. To these add more than two decades of the researcher's personal participation as a member of the board of various multinational companies and a trust. This approach allows a back-forward process and triangulation, which supports reliability and validity of findings. Any theory building needs a robust categorisation (Christensen et al. 2004). Therefore the industry was carefully divided into four categories (table 1).

Table 1. Classification of the replication industry

Top-range of participants with global representation	Huge capacities and extensive services around the manufacturing of discs, hence reaching Hollywood Studios and the so-called majors of the music and games industry as customers
Replicators with multinational presence	Big capacities and a wide variety of additional services reaching important film studios, music labels and game producers
Replicators with one national factory	Significant capacity and satisfying services. These may have sales representatives in further countries, too. Their client portfolio consists of important and more specialised national customers with regular orders of adequate size
Small replicators	Small capacity and services, hence depending relatively strong on day-to-day business and relatively unreliable links to customers

A further differentiation could be added by dividing replicators into those, which only produce CD or DVD and those manufacturing both formats. The proposition is that such further division is not forward leading, since despite a high degree of rivalry, this industry's dynamics have created collaboration between competitors. A competitor, frequently without customers' knowledge, supplies any format missing. With further regard to market linkages, such collaboration also balances missing capacities in peak times to a certain extent. Therefore this differentiation is considered as being of less importance.

In the main focus of the entire research are especially participants of the second and third group of this industry. The underlying reason is that within the years of the research evidence could be collected that major incumbents are difficult to approach and this type of companies is very reluctant to provide information. They build an inner circle, which is frequently acting as a separate group, since they perfectly know that their customer portfolio is out of the reach to the vast majority of their smaller competitors, due to the international representation, huge capacities and extensive services their customers require. Further, some information of these major players showed incoherence with findings from other corporations, which proved to be either internally trust-influenced or in an understanding to protect their customers' sensible interest. This evaluation of organisational bias is reducing the value of those findings substantially and bears dangers for the whole research.

Mid-sized companies of national or international reach and scope show more openness and trust in sharing information about their corporate planning and progress. Most times independent from trust-policies, owned by single shareholders or a small group, they are acting in ways, which are more industry-oriented, than big firms likely dealing in the interest of a bigger picture of trusts with various activities. Overall, validity and reliability of information proved to be of higher value in these sectors. Furthermore, their relatively big number shapes the industrial behaviour actively. Small replicators instead, have little power and influence on the progress of the

whole industry, are less frequently represented in its professional bodies and, as some research indicated, are more driven by developments, than having an opportunity to drive them. Additionally, in the past, they were opened and closed rather rapidly. Reasons were under-financing, insufficient knowledge about the industry's terms and conditions and major difficulties to attract sufficiently reliable customers to assure survival even in the mid-term.

This focus represents a consciously accepted limitation of the research. Of further limitation is the spectrum considering only European replicators or those having operations in Europe. But, the population of the sample is sufficiently big, multinational and represents by total figures of a significant power and rivalry among each other.

This paper will present a few firms and their approaches to cope with the dynamic environment of decline. These firms have been carefully selected. They are part of a bigger number of comparable findings among corporations of this industry. The reason to adopt them here is that they provide some explanatory insights in how and why they act in their individual way. Both, their quantity and the way they were selected by the researcher are affecting validity and reliability and cannot exclude the researcher's individual view.

3 The Replication Industry & Decline

Schumpeter's historical view of the wind of creative destruction addresses a major problem of economic developments (1950). New technologies are one of the major drivers of this wind, which destroys existing industries and creates new ones at the same time. Nevertheless the phenomenon of revolution needs careful application, since most revolutions tend to be more an evolution, by effect and impact. Freeman tends to hold that only five revolutions took place in modern times (2007):

Table 2. The Five Industrial Revolutions of Modern Times (Freeman, 2007)

Popular Name	Country of Origin	Initial Factor of Revolution
1. The industrial revolution	Britain	Arkwright's mill opens in Cromford, 1771
2. Age of steam and railways	Britain, then Europe, then USA	Test of the Rocket steam engine for the Liverpool-Manchester railway, 1829
3. Age of steel, electricity and heavy engineering	USA and Germany forging ahead and overtaking Great Britain	The Carnegie Bessemer steel plant opens in Pittsburgh, USA, 1875
4. Age of oil, automobile and mass production	USA, Germany vying for world leadership, later Europe	First Ford Model-T plant in Detroit, USA, 1908
5. Age of information and telecommunication (ICT)	USA, then Europe and Asia	In 1971, the first Intel microprocessor is presented in Santa Clara, California

Any of these revolutions had its implications for existing industries and shifted ways, how consumers behaved, e.g. from inconvenient stagecoach travelling to the benefits of the railroad. But as well, it needs to be considered that there are far more steps in between these revolutions, providing the character of an evolution, which are suggested then, applying the transilience map, of being regular or niche innovations (Abernathy et al. 1983, 1984, Oestreicher. 2009b).

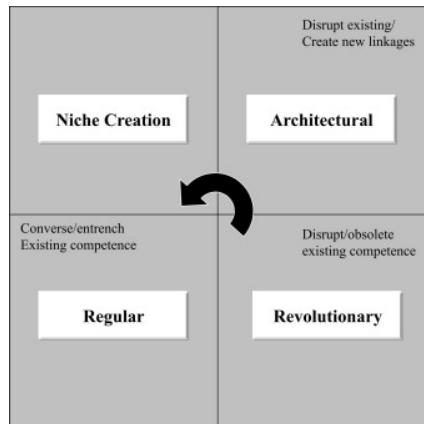


Figure 1. The Transilience Map (Abernathy et al. 1983, 1984)

When today's consumers turn towards immaterial downloads of music and movies, then a similar effect to the shift from stagecoach to railway is assumed, the easiness of consumption. It is far more comfortable to access desired music or films from home and virtual products are permanently available. But with reference to the replication industry's physical core product, one further decisive advantage needs to be stated. For more than 100 years, consumers were forced to purchase such music, which content owners prescribed via pre-recorded and pre-manufactured media. Whether vinyl records or discs, the content is fixed. Downloads offer the opportunity to select precisely, which content is desired and reduces cost for consumers decisively, since any unwanted tracks are simply not purchased. With reference to consumers' freedom of selection this is considered as a (small) 'revolution' within innovation's second stream, market linkages (Abernathy et al. 1983, 1984). On the other hand, with reference to industrial decline, such pattern of freedom reduces institutional power and is expected to have an impact on revenue streams and total quantities of a product sold (Kusek et al. 2006).

Therefore, the proposition is that comfort and ease are both drivers of innovations' effects developing power to shift consumer behaviour and augmenting the speed of decline at the same time. For the replication industry the dilemma is even worse. As Hettler of CDA replication factory, stated, they consider themselves as a toll manufacturer, i.e., they have little or no power to influence their customers' product strategies and decisions (2005). When the content owners, replicators' customers, make product decisions, which are not in favour of what Johnson et al. consider as meeting the expectations of turbulent markets, then, despite or even due to indirect linkages to consumers, direct impacts on replicators' welfare are very likely (2008).

A second criterion to be considered is that the fifth revolution, ICT, has accelerated processes, by which change takes place (Freeman. 2007). The proposition is that two major criteria are of importance:

- Organisations' time to either adapt to a changing environment or to adopt new strategies are much shorter now than before.
- Opportunities to find alternative routes to new and different ways of doing business require a higher portion of pro-active observation of the business environment (Utterback. 1996).

Christensen et al.'s disruptive innovation theory proposes that organisations threatened by emergent disruptive technologies tend to flee upwards, i.e., they respond to disruptive threats by marginal improvements (2004, 2003). Fleeing upmarket by technologically marginal improvement has a significant impact on market linkages, since it reduces the mere quantity of customers, which Christensen et al. explain by their two different customer trajectories of lower and upper market expectations (2004). At the trajectory of the upper end, where exclusive expectations dominate, markets' nature provides quantitatively less customers being against this industry's concept of mass production.

The parallel model of the replication industry is their latest innovation, Blu-ray discs, the high definition format. Initially more expensive discs, requiring further investment in the hardware of the periphery are attributes, which are only of interest to those being prepared and able to accept higher prices and being interested in such high quality offers. The difference of quality between DVD and Blu-ray exists, but the dilemma for replicators is that their low margins still require mass production. Hence, ROI is only given, when a huge number of such discs finds market acceptance, since the manufacturing needs demand high quantitative output. Furthermore, replicators have to make high investments in the new manufacturing equipment, since Blu-ray cannot be

manufactured on standard DVD-lines. This results in a paradox position: Fleeing up-market reduces quantities of consumers, but the need to sell masses of products remains unchanged. Such equation is rather likely to fail. So it is not surprising that Blu-ray discs are already under high pressure and their prices have come rather close to those of a standard DVD. At the same time sales figures in DVD, too, are nevertheless declining further.

This leaves the replication industry in an uncomfortable environment and provides insights into the problems of the habitat, especially when a product, a technology and an industry are in decline (Cassia et al. 2006). Following the chosen product and overall corporate perspectives too far, and being much too dependent – held captive by customers – may result in running into a similar unfavourable situation like, e.g., IBM, when relying too long on mainframe computers, while desktop computers replaced this old technology (Christensen. 2003). Considering that sales opportunities of physical discs are rapidly declining for content owners may result in a situation, where market expectations will force them to turn extensively towards virtual dissemination of content, hence creating a discontinuity for physical products. Consequently their market linkages with their suppliers (replicators) will not be needed any longer. The publicly available market data show strong evidence for such decline in physical products and ongoing strong acceleration of download quantities (RIAA. 2005, 2006, 2007, 2008, IFPI. 2009b, Kusek. 2009, Anderson. 2007). Further indicator for the decline is the permanently increasing degree of rivalry over a longer period of time, especially with regard to manufacturing prices, as replicators like CDA, IMS, SK Compact Disc or kdg-mediatech reported (Killer Korff. 2007, dello Ijojo. 2004, Manke. 2007, Eras. 2008).

As Harrigan suggests, even when participants of the same industry are affected by the same decline, they differ in their behaviour and their attitude to tackle with the effects of the decline (1980). The replication industry's behaviour supports Harrigan's theory at various levels, from early exit (divestment) to re-investment, e.g., in Blu-ray manufacturing equipment, to extension of services in adjacencies. This pattern can be applied to different types of companies in this industry, across size, type of ownership, and whether of national or multinational structure. Some have divested completely, others adapted capacities by closing factories, while a third group maintained their status quo and tries to find means of rationalisation for cost cutting. Others have started to search opportunities outside the existing industrial boundaries, but met overcrowded and fierce competition there as well, making the environment difficult to enter.

Harrigan's finding that some declining industries do not provide market niches to enter or to develop seems appropriate for this industry. E.g., replicator CDA has been the major manufacturer of discs for car navigation. This replicator has developed its niche there and supplied the various system owners relatively uncontested by competitors. This represented a small, but profitable niche. Meanwhile the much cheaper and – once again easier to handle and update – portable navigation systems have taken a good part of the business away (Killer-Korff. 2008). Additionally, the once profitable CD-ROM business, serving especially customers of industrial outside Home Entertainment, for manuals, technical documentation and so on, was more or less lost for this industry, too, since easiness, speed and accessibility by downloads increased, and not to forget, it is for industrial customers much cheaper, easier and quicker to maintain and update on their own websites. The paradigm of access and ease applies once more.

This suggests that despite a download's totally different 'manufacturing' of the finished product, there is a close technological relationship between replicators' physical discs and ICT-based service structures. This proximity has some commonality with juxtaposition, but frequently resulting in diverse outcomes: The more ICT-opportunities develop, the less business opportunities in the replication business remain; the more ICT-opportunities forge ahead, the less different groups of customers remain in the reach of this industry. If these two relationships prove to be reliable, it must be assumed, that opportunities to find new growth and continuity within this industry's main product, the optical disc, are significantly reduced. This assumption may be connected to Utterback's phases of innovation (1996). In the mid 80s of the 20th century, when optical discs started to replace the previous dominant design, vinyl records, the features of the new product were fixed by Philips' specification. Therefore, little search for features and specification from both ends of the market took place. The product developments signifying an industry's first phase emerged later and created over two decades two families of optical discs, those of the CD and those of the DVD. This represents phase I, product innovation (Utterback. 1996). Such product innovation happened at a time, when ICT was either not publicly available, too unreliable or uncomfortable with regard to the amount of data to be downloaded.

For the CD earlier and the DVD (major market entry in 1997) later product development gave room for phase II, process innovation (Utterback. 1996). At its very early stage, different steps of manufacturing were combined in one machine (mono-liner), but moulding times were reduced to a fraction of the original times, too. Lower cost, higher output and finally cheaper consumer prices were the consequence. At the same time the

manufacturing process was stabilised further, supporting the new, more refined DVD-manufacturing as well. Based on Abernathy et al., Utterback describes the third phase as the “specific phase” in which product and process innovation reduce (1983, 1996). The proposition is to take the early years of the 21st century as this specific phase. Processes and products showed no major developments, except the Blu-ray format and its meanwhile abandoned rival, Toshiba’s HD DVD. Despite a new approach to innovative technology and highly refined manufacturing processes, Blu-ray is a regular innovation, since still depending on the same major technology and using very similar manufacturing processes and is of the same (physical) consumption pattern.

For this research and the earlier assumptions expressed, this offers some insights. The new format Blu-ray could neither stop the decline of the present dominant design and the growth of the virtual product at the same time, nor could it find an inroad as a mass product to markets yet. Insiders to this industry raised much scepticism about Blu-ray’s long-term success shortly after market introduction, the media provides a plenitude of relevant news, and consumers’ adoption rate is far below forecasted expectations resulting in a not favourable investment climate of replication factories. Evidence provides the news about the low and disappointing performance of the major manufacturer for Blu-ray manufacturing lines, Singulus (IT-Times 2009). This is supported by various, strictly confidential information received within this research. The frequently reported figures about ‘huge’ increases of Blu-ray sales need to be put into the right frame, since they are related to earlier rather low figures. Hence, they are considered much more as publicity, than a sustainable new path for growth by the innovation of physical Blu-ray discs. These arguments support the assumption that there is a correlation for future orientation between options in physical markets and those based online. I.e., replicators may struggle with finding new ways of growth and sustainability in their present industrial boundaries, since the true, real battle is between the physical place and the virtual space in which, returning to the concept of habitat, the fight of product versus service (access) is an effect (Cassia et al. 2006).

Additionally and as a consequence, it is argued that due to the replication industry’s adopted habitat resulting in a high dependency on content owners, its options inside its present industrial self-understanding, especially when seeing oneself as a toll manufacturer, are rather restricted (Cassia et al. 2006). Extending the previous discussion of Blu-ray means then: When content owners, as the direct link to consumption, cannot achieve that the mass of consumers adopts the high-definition format, then manufacturing orders for these special discs remain relatively low. Relatively low replication orders do not justify a high investment of several million \$ into new machinery, since the ROI is on risk. This closes a circle then, since what is left over is the status quo again, manufacturing of the old formats in an increasingly and probably accelerating declining phase of the industrial and product life cycle. This suggests that the established habitat of the replication industry forces it into a more passive, than active role of shaping developments and as Utterback states, the dominant design of a market and firm survival have (among others) one decisive commonality, “most threatening challenges are often those that come from outside the traditional definition of the industry and its products” (Cassia et al. 2006, 1996). If the dominant design switches fully to the virtual space, the outcome for this mass product oriented industry may follow Schumpeter’s wind of creative destruction and may force the majority of its participants to exit the industry, disinvestments of the one way or the other.

Overall, the suggested conclusion is that in the environment outlined here, regular physical innovation competes against architectural or within its specific field even revolutionary, virtual innovation, which attracted in the researched pattern of disruptive innovation new market entrants (Apple, MSN, Yahoo, etc.) from outside the industry, makes a manufacturing process obsolete and puts market linkages on stake, while consumer behaviour shifts significantly towards an enhancing level of potential industry discontinuity (Kusek et al. 2006, Anderson. 2007, Christensen et al. 2003, 2004, Christensen. 2003, Utterback. 1996, Oestreicher. 2009a, 2009b). This impacts on a high number of developed organisational resources and capabilities largely.

Endgame Strategies

For undepreciated endgame business assets endgame strategies need to reflect on the market, which is dynamic and could deteriorate rapidly (Harrigan. 2003). An industrial controversy exists, whether the market is simply declining and could recover at a later date, or whether it is an endgame scenario. Due to his scholarly research, Bénavent states that determinants are sufficiently clear to speak about an endgame (2008). The industry itself, represented by its professional body, the DVD Forum, is convinced that the right innovative approach will allow to recover and maintain at least the DVD as the dominant design and a mass product (Renaud. 2008). It is not surprising that this industry is hoping to continue its present business by maintaining the optical disc as the market’s standard format. This industry position is even more understandable, when considering the behaviour of its client portfolio from which its survival depends in the first instance. Content owners could easily switch

from physical product to virtual service of access, since the basic product, the content, is already digitised. However, they also have their RPV physically oriented (Christensen et al. 2004). It is not only about warehouses and handling, a decisive incentive and key driver is their distribution chain as a major source of revenues. Furthermore, consumers' attitude to circumvent institutional product offering by P2P offerings and artists' and producers' new freedom to interact with consumers directly increases fears for their own organisational welfare (Benghozi et al. 2000, Benghozi. 2005). Therefore, content owners, too, are interested in defending their status quo, fuelling some confidence for their suppliers in the replication industry. But, the market pressure erodes this attitude. Content owners' download platforms exist or are in preparation and a secondary group of this segment, TV-channels, as well replicators' clients, have already created their POA, e.g., BBC's iPlayer¹.

With regard to potentially applicable strategies, it is suggested that a difference exists, whether the replication industry faces an endgame or a long-term crisis. If it is a real endgame, then strong reflections will need concentration on divesting in the best possible way or to find radical new ways to achieve organisational survival. If it is a long-term crisis, then, with regard to developed RPV, strategic thinking may be more advantageous, when it reflects, e.g., on reducing capacities and cost to survive best possibly for the day, when market skies will clear up again. However, the latter scenario would depend strongly on finding the right innovation as a catalyst for a restart. This creates a next dilemma for the vast majority of replicators. Being dependant on licenses for manufacturing, having organised RPV on manufacturing and not on major activities in R&D, not being significantly necessary within rigid license agreements, R&C are probably not supporting major invention and innovation around the core product for the vast majority of industry participants. In short words, this means that the core product cannot be altered easily without breaching agreements in place and frequently missing R&D capabilities are creating a further hurdle. This is a double bind effect: Constraints by satisfying the customer portfolio plus constraints by license agreements. The assumption is that this creates a major obstacle for innovation of a higher grade. Abernathy et al's concept of dematurity of an industry, a renaissance may not happen due to these circumstances and since it is an industry already in decline (1984).

This suggests, from the innovative point, that it is in this industrial pattern very important to consider the market linkages as probably decisive, whether a new technology and product in the reach and range of the replication industry may be able to restart its important mass product business. In an unstructured survey among members of the XING² social community, about reasons to download music instead of purchasing, this resulted in three core answers: (1) Ease of access, (2) cheaper and (3) purchasing only those tracks, which are really wanted. The consequent proposition then, is that if this industry wishes to continue in its selected habitat, it will need to develop ways, which correspond to these expressed needs. Firstly, none of these primarily mentioned criteria is part of its core business. Secondly, making individually selected tracks for consumer mobile was already done by recordable discs resulting in a next, additional battle of substitute rivalry. An optical disc has either a diameter of eight or twelve centimetres, i.e., any player can only be reduced in size to a certain extent. Further, to the disadvantage of size against USB or memory cards adds the easiness of exchanging content and the option of multiple devices on which such music can be played. An optical disc can be played on one device only. This proposes that it is rather difficult, if not unlikely, to find a solution to re-attract consumers, when the focus is on optical discs. In addition, it should not be forgotten that the race of convergent technologies and the high rate of innovation and emphasis on mobile content decreases opportunities further. I.e., if a majority of consumers will not find sufficient reasons to return to this industry's market offers, the question where mass consumption should come from remains unanswered.

Synthesising the arguments presented means that there is evidence for an endgame. Despite that presently DVD declines much slower, CD is in sharp fall. The assumed reason is that the VoD-market and Video-downloads are just beginning to shape their market. Additionally, downloading a movie of GB-size is still less uncomfortable than a music track in MB. The assumption of an endgame is as well supported by an extensive sample of quantitative and qualitative data, such as said negative market developments, firms going out of business, increasingly fierce competition, huge overcapacities, but as well an immense augmentation of downloads, which goes through all segments of age and social classes and creates new customer segments (RIAA. 2008, Doane. 2006, Burkart et al. 2004). Obsolescence is a fate, which is rather near to this industry and

¹ <http://www.bbc.co.uk/iplayer>

² www.xing.com

a good number of parallels to the photographic industry is quite obvious.

4 Inside or Outside Industrial Boundaries

Addressing threats of becoming obsolete in a declining environment offers various opportunities. One is selecting an appropriate exit strategy, as Harrigan has researched (1983). In fact a number of incumbents have decided to exit the replication industry. To these count EMI, Warner Bros. and Deluxe Media Services. EMI sold its replication factories either to the Dutch company Media Motion or accepted a management buyout, e.g. IMS in Italy. It is of contextual interest that Media Motion went out of business after its purchase of the EMI factories, a fate shared by ODS in 2007, which had purchased all Deluxe operations in Europe and abroad. Just recently contacts to IMS have also been interrupted, without that information about the company's present situation could be gained. Warner Bros. sold its factories to the Canadian company Cinram and offered, like EMI to IMS, a seven-year guarantee for manufacturing all its titles (dello Ijo. 2004). The three selling firms have a pattern in common: Manufacturing was only part of their business activities. EMI's major activity is music production, Warner Bros' film, and Deluxe Media Services belongs to the British Rank Corporation, whose major activities are in various other industries. For Deluxe it needs to be stated further that the organisation itself continued other operations as a service company to the film industry. These findings suggest two statements:

1. It seems to be easier to deal with threats of decline, when other operational activities allow a continuum of the whole corporation. An exit strategy may be a more likely option then.
2. Even when the exit strategy is successful for the seller, there is no guarantee for survival, as the examples of EMI – Media Motion or Deluxe – ODS demonstrate.

A further finding supports this explanation indirectly. Bertelsmann's factory was on sale for a long time, too (Bertelsmann as book publisher with BMG music and film producer). As Bertelsmann could not find a buyer, the manufacturing was merged with Sony DADC. I.e., an approach to exit was made, but due to failure resulted in a merger, as no other option was taken into consideration. Critically reflected it needs to be stated that the far smaller French-based MPO looked for a buyer, too, a company not having other activities in place, but failed as well in finding a buyer, hence it continued its manufacturing until today, but is reported to struggle (Casselman. 2007). This example is in opposition to the pattern proposed, but meets still Harrigan's model of different exit strategies (1983). In these exit strategies of divestment other replicators fit as well, like, e.g., Cinram or Austria's kdg-mediatech, having closed factories being not sufficiently profitable and to adapt existing (over)capacities better to declining demand. This pattern is as well supported by Utterback's research in different industries that decline parallels with a number of exits (1996).

Other organisations wishing to continue their operations can select an alternating macro-approach, i.e., either staying within the close boundaries of their industry or adopting a strategy, which goes beyond these. This requires to define what the core product is and hence the core competencies of a replicator. In 2005, the author undertook an unstructured focus group interview consisting of sales managers and customer service staff of Germany's replicator CDA Datenträger Albrechts GmbH. The interview took place in the factory without probably influencing participation any manager and lasted for several hours. The objective of was to identify, what interviewees focus as the firm's core product. Generally a replicator offers three fields: pre-production services, disc manufacturing including printing of the labels on discs, and packaging services of discs into marketable products. After a short while of controversial discussion the participants of this focus group agreed that the core product itself is the manufacturing of the bare disc. Label printing was already considered as an additional service, but inseparably connected with the core product. The two other areas of activities, pre-production services and packaging was for the interviewees definitely an expansion into adjacencies, a marketing service to customers. Reliability and validity of this focus group's evaluation could be achieved by further interviews with the sales director of kdg-media-tech and the purchasing manager of Germany's Digicon and a packaging supplier of this industry, Belgium BDMO (Eras. 2008, Grellmann. 2007, Casselman. 2007). This suggests that

1. The industry's boundaries lie within the manufacturing of bare discs, but label printing needs to be added, since inseparable from discs.
2. A micro-field of extended activities is given by marketing services comprising pre-manufacturing services and packaging, which provides an extension to the industrial boundaries, when potentially looking for renewal within this extended perspective.
3. A macro-field is opened, when looking for new areas of activities beyond the boundaries of 1. and 2.

As the following findings will demonstrate, replicators extended both, their micro and macro field. The outline of the micro-field of activities will need to be re-considered as a consequence then. In short words, replicators have started to expand their resources and capabilities beyond original core competencies, exceeding what Kim et al. call existing industrial borders (1998). Four fields are detected (table 3), which, with specific regard to Abernathy et al.'s transilience map, represent different impact of innovation for potential renewal (1983, 1984).

Table 3. Opportunities of extending replicators' R&C

Technology plus technology	E.g., converging technologies of optical discs with RFId chips. Previously unrelated technologies are combined (for a b2b environment).
Technology plus marketing	E.g., optical discs as add ons for marketing campaigns
Technology plus adjacencies	E.g., the extension of own R&Cs by additional market-oriented services as distribution for customers, incl. vendor managed inventory (VMI) and direct IT-connections to customers' clients guaranteeing permanent availability of customers' discs at the points of sales. This suggests that boundaries of the micro-field (2. above) may be extended further, if activities being directly linked to the core product and connected services around it are added.
Leaving given industrial boundaries	E.g., addressing the innovative online challenge directly and developing resources and capabilities (R&C) by a radical approach beyond established business activities.

These fields add different technologies and R&C to replicators' established processes and/or extend previous activities. They require developing new R&C and may lead to further investment, such as software for VMI, various applications of EDI or similar technology, enlarged warehouses, packaging equipment, etc. This strategic corporate behaviour finds support in the value chain evolution theory, e.g. adapting further to clients needs and beating competitors by (extended) functionality (Christensen et al. 2004). It is suggested to consider this as improvement of innovative developments within technology, by renewing market linkages and by added values in the field of marketing and market services through the development of new resources and capabilities creating new revenue streams and shaping an edge in competition against those replicators not offering these services. As the decline of optical discs as a mass medium is ongoing, a decisive question is, how sustainable those different approaches may be in the mid- or long-term, when remaining inside industrial boundaries, i.e. being mainly oriented towards the established physical product.

5 Searching New Growth and Development

Surrounded by numerous constraints, the industrial climate becomes increasingly disadvantageous. After a long time of modest and marginal developments by certain firms, inertia by others looking more on daily order fulfilments, a good number of replicators have started to reflect more intensively on new pathways.

In the past major approaches were marketing-oriented. Dutch-based Docdata looks back on a good number of such innovative approaches. In 2008 Meszaros of the firm's German-based factory presented the marketing gag of an eight cm CD inserted into a beer mat. Despite applying the notion innovation in this context raises some scepticism, this example is of some importance to the innovative understanding of especially mid-sized participants. With regard to the presented constraints in relation to core product, replicators approached new forms of presentation and tried to attract customers by such gimmicks. E.g., CDA created in the middle of the last decade the Brilliant Look label printing, the disc itself is untouched, but provides a silver printing on silver surface or copper printing on copper surface (holographic look). CDA and a few others created as well a retro-look (figure 2), which showed a label printing in form of a vinyl disc. An undisclosed replicator inserted an eight cm disc into the lid of a baby-food glass, which represented for the customer, Germany's Alete, a rather successful marketing campaign (Leipold. 2004). One further marketing oriented approach was the *shape disc* (figure 2). A laser cuts pieces out of a disc for fancy shapes reducing the size of data such disc can store. The process of disc shaping is usually made by an external partner and not part of a replicator's activities.



Figure 2. Left hand: Retro-design¹ “vinyl look” - right hand: Shape Disc² (CDA. no year., SK Compact Disc. no year)

- These approaches of innovation are suggested as being of modest degree using existing technology plus marketing. In addition, competitors can copy them easily.
- The proposition is that this type of innovation offers short-term marketing effects and little opportunities for sustainable growth. As evidence it is suggested that many such developments had most times one-off or rather short-term application, with most times limited quantities not comparable to permanent standard mass production.
- Multiple forms can be found across firms of the replication industry.

Developments of luxury packaging (technology plus marketing) are permanently taking place, but use R&C of specialised packaging manufacturers like, e.g., Belgium-French specialist BDMO S.A. These activities are usually not generating new business and their innovative degree is placed in the transilience maps niche quadrant, since addressing a high-end niche market. Further, such hi-end packaging is usually accompanied by a cheaper parallel version using standard packaging. Such innovation takes place with each specific product and is changing from product to product. Frequently new material technologies, part of business partners' R&C, are used to manufacture the specific packaging model (Figure 3).



Figure 3. Special packaging using replicator's and business partner's core competency (BDMO. 2009)

A first expression of extended activity is presenting Austria's kdg-mediatech. This company created a new position with the Head of Strategic Solutions at the end of 2009 (Eras. 2009). Furthermore, the firm renamed itself as a ‘general enterprise for the media industry’. As this process has only recently taken place, it is at present not possible to underpin this rather unspecified approach leading to many questions about its tangible meaning and underlying activities. The according company’s release to the press³ remains vague, too, only explaining that the new position is committed to develop specific customer oriented solution packages (2009). This is a generic approach presently offering only a marketing oriented novelty, likely touching adjacencies and by application of the innovation scale probably of modest degree. By its expression it does not address new customers. This evaluation will need revision, as soon as developments will allow further insights.

- kdg-mediatech uses (assumption) existing technological R&C plus marketing/adjacency development

Germany’s CDA has a rather long track record of ongoing, marginal improvements around the product. Three findings are suggested being innovative beyond many competitors’ developments. The first is the application of the Braille font, used on both, label printing on discs and disc packaging⁴. This is a technological novelty supporting blind people and those with substantial visual defects. Within the transilience map this addresses the niche quadrant. The assumption is that it enters a persistent niche and one, which targets human beings facing many online disadvantages. As Kuzma’s research outlines, a huge number of websites and online services fails to respect the needs of handicapped persons (2009). Therefore such individuals may favour a product more than online services.

More significant, involving a high degree of innovative power is the combination of an optical disc with RFID technology. This combination addresses a b2b environment. It was, for example, successfully applied for sports event tickets (Killer-Korff. 2008). Since RFID technology is expected to replace much of the present bar code system, this innovation is likely to have some power for further development and may become sustainable. In

¹ www.cda.de

² <http://www.sk-cd.de>

³ <http://www.kdg-ht.com>

⁴ <http://www.cda.de>

contrast to the industry's present orientation on manufacturing best huge masses of one and the same product, this combined technology is probably producing lower quantities per run, but could create a niche in which some extension of the core product's (disc) life cycle can be shaped. For this product CDA adds to its own R&C those of its partner Brooks. Technologically interesting is, in contrast to the usually fixed disc content, that the RFId tag can be rewritten again. As its general application areas are indicated copy protection, identification, follow up, individualisation, and logistics. This opens a variety of fields and bears a number of opportunities to attract customers from different industries and businesses.

A third recent innovation is what dvd-intelligence states as the world's first managed copy solution on DVD enabling DVD-Video clients to add dynamic format transcoding (2009a). The patented system is called LiveDigitalCopy and was developed with R&C of the partner Protect Software. It performs a 'managed copy' by dynamically transcoding the actual DVD content transferring it to a wide variety of devices. LiveDigitalCopy allows content owners to apply rights management optionally to the target devices and to limit the number of allowed copies. Despite the fact that this is a significant innovative development it again needs to be considered that it does not address new fields outside existing industry boundaries.

- After initial modest and marginal improvements, CDA has developed a significantly higher degree of innovative power using mainly technology plus technology, now.

SK Compact Disc GmbH & Co. KG, Germany, has developed specific skills in using and applying successfully a strategy of survivor. With reference to Harrigan et al.'s strategic outlines, this company must have developed "competitive strengths for remaining demand pockets" (1980, Harrigan. 2003). The evidence for this assumption is seen in the firm's two times successful establishment as survivor of dying industries. Its strategy worked out to be a last manufacturer of both, floppy discs and blank VHS Cassettes. Non-existing competition and a remaining demand able to fill available capacities gave this firm a profitable business of stability and continuity in both fields of previous core activities using established R&C beyond the industry life cycle.

Hargadon argues that an innovation is rarely the work of one single origin (2003). This also counts for SK's VCD HD format. This is a significant evolutionary step of product development introduced in late 2007 (Manke. 2007). The size of a disc and many other specifications remain unchanged, but a standard DVD consists of two layers of discs, while the VCD HD has only one disc and even here the usage of raw material is reduced by 40% resulting in a thickness of only 0.6 cm. The disc becomes flexible and is by manufacturing more a CD than a DVD. This has a significant environmental impact, too. SK has assured the rights of exclusive manufacturing and distribution for various European countries using the technology of the Dutch-based company Trix (Manke. 2007). Nevertheless, the argument is that this product addresses the physical market, too, needs to be purchased by the consumer with pre-recorded, hence unchangeable content. Market success is unknown yet, but the assumption is that it is a product format addressing more a niche, than the mass of the market place. Furthermore, SK is not a unique player of this format. Previous competitor ODS, which went out of business in October 2007, offered the same technology under the label of EcoDisc and there is some evidence existing that the EcoDisc itself is still offered on the market.

- SK used successfully a strategic approach as remaining survivor of dying industries. This behaviour was not outlined in table 3, since it is strategic and not innovative per se.
- The firm uses as well technology plus technology, as the example of the VCD HD demonstrates.

QOL is a comparably young French replicator, which entered the industry relatively late. With regard to the three different product strategies suggested, the proposition is that QOL's latest progress is a slightly different approach. Since a very long time QOL signifies itself as a laboratory. In April 2009, QOL opened its test centre for Blu-ray discs (dvd-intelligence. 2009b). As QOL states, their test equipment allows the check of these high-definition discs directly at the replication lines enabling them to inform the product owners about potential problems¹. Global giants as Philips, Panasonic, Sony and Samsung are collaborating with QOL in this sector. The explicitly expressed self-understanding of being a laboratory and being a manufacturer, like many competitors, at the same time, proposes that QOL positions itself in some form of a hybrid-positioning.

- QOL uses technology plus technology. Due to its special positioning between laboratory and replicator it goes beyond the original industry boundaries, but serves the industry in its boundaries nevertheless by offering specific services to competitors. It has developed significant R&C in both areas of activities.

As stated, a frequent approach found in the field of replicators is the expansion into distribution services. This may be a basic warehouse service and bulk shipment to specific distribution hubs of a replicator's customers using external forwarding companies, but this may reach up to rather specific fine distribution of picking and

¹ <http://www.qol.fr>

packing orders from retailers on behalf of a replicator's customers and can include direct contacts to retailers and their subsidiaries. These adjacency services may include shipments by own forwarding, VMI, invoicing and financial handling and management of returned goods. British replicator VDC Group has adopted such a service strategy, extending the replicator's value chain offering additional streams of revenues. Highly specific in this field of business activities are as well two replication firms, Optimal and OK Media. Both these German companies have highly specialised in a niche market. They are acknowledged partners of the games industry. These links, based on specific R&C, between supplier and customer proved to be so strong that customers of these two replicators usually refuse other replicators' offers, even when cheaper. As a side note it is remarked that extensive fine distribution services are a pre-requisite of Hollywood Studios and music majors. Their expectation is that only those replication partners are accepted, which can provide such service offers on a multinational base excluding most replicators nearly immediately.

- These replicators use technology plus adjacency. Within these adjacencies new and different R&C are required, which, with regard to the core R&C, Bénavent considers as a radical development beyond R&C based on the core product (2008).

Docdata is one of the very first independent companies, which puts e-solutions as a core centre of new activities¹. Within their scholarly studies Christensen, Christensen et al. and Utterback have provided evidence that those companies achieved an easier transformation into the next era of business, which separated new business developments from their established operations (2003, 2004, 2003, 1996). Docdata follows this pattern explicitly. Having its headquarter in the Netherlands, the firm has split operations into two legally separate companies in Germany: Docdata e-solution in Münster, Germany, and its manufacturing operation, now Docdata media, in Berlin, where the company was located before. This separation is further coherent, since two different websites were established. Such an approach is considered as an important step to addressing continuity and future orientation in a destabilised industrial environment of decline. The separation line suggests an outsourced re-engineering process, going radically beyond prior gained R&C. The e-solutions market offering addresses customers, like, e.g., food companies, the beverage industry, cosmetics, textile, and so on. While competitors still think in terms of their industry boundaries, Docdata provides a rather different depth of understanding future trends and their management. This is suggested as evidence for what Kim et al. have symbolised by their question, organisations should permanently ask "what would we do, if we start anew?" and explain by their value innovation logic, strategic thinking going beyond existing borderlines (1998).

In comparison, their media branch does not show extensive innovative activities. Besides the already stated developments, its other activities, like perfume CD, etc. are rather old. More important to the aforesaid is that Docdata has sold its UK manufacturing operation in early 2009 (dvd-intelligence. 2009c). Both, little media activity and reduction of capacities, adds more evidence that a shift of organisational self-understanding is taking over.

- Docdata provides evidence that it is consciously and strategically leaving the industry boundaries and undertakes an architectural re-engineering into new business fields addressing new customers. This radical process offers limited opportunities to address existing R&C, which may frequently not be more than first experiences for a starting point. The process requires achieving different R&C, new processes and new values (Christensen et al. 2004). The proposition is that Docdata fits to category four of the pattern of table 3.

It needs to be stated that a good number of replicators have added the service of USB duplication to their product portfolio. This customer service uses imported USB-sticks and either own docking stations or outsourcing the complete process (Killer-Korff. 2008, Manke. 2008, Renaud. 2009). Therefore this is suggested as being no innovation per se and not sustainably helping this industry in its struggle for survival.

The sample represented here consists of a careful selection of findings within the ongoing research. It is neither representative, nor specifically valid and reliable in an academic understanding, since small. Nevertheless, the findings consist of specific key behaviours of this industry. Other firms show different attitudes and approaches in detail, but do not differ substantially with reference to their adopted strategy leading to similar or parallel outcomes. Despite their reluctance to provide information, of further specific interest will be, how market leaders, like, e.g., Technicolor or Cinram will act or react in the further declining environment.

¹ <http://www.docdata.com>

5 Different Behaviours in an Environment of Decline

This industry's participants possess highly specific manufacturing tools and a relatively narrow product use. Its R&C are (a) closely connected to the core product optical disc and (b) more advanced as soon as the periphery, e.g. label printing and the common packaging services, is concerned. Finding new growth and sustainability within an environment of decline means creating sustainable solutions to escape the competition against the radical innovative impact of the disruptive innovation virtual download with its likely discontinuous scenario. Relating on statistics, trend reports and a good number of industry publications, the major market development continues ongoing to go virtual. Market linkages shift from place to space. Putting the IFPI recommendation to reflect on an access strategy as a central point, then a contradiction becomes rather obvious (2009). While the trend and major market growth targets online distribution and virtual consumption, the behaviour and developments of those firms presented act and circle around innovation and extended services of the established physical product.

Whether this concerns a new specialised format like the VCD HD, or proposes extended distribution services to customers, it is all about the physical place (Kotler et al. 2002). There is little doubt that much innovation takes place and that modern economic concepts, like, the networking economy, find useful application by adding external technologies to the own product and extend replicators' R&C decisively beyond the existing inner industry boundaries. But they tend not to go beyond them, i.e., in a way leaving the industry's extended borderlines of the physical product. Taking Kim et al.'s value innovation logic as another centre, the proposition is that this way, sustainability for growth and stability is likely to be denied by the future market developments (1998). This may result in a comparable situation to IBM earlier – being held captive by customers until it is too late (Christensen. 2003). The only exception within the examples presented is Netherlands's Docdata.

A further suggestion is that most of the innovation is too modest to shape a sustainable edge in the competition against dematerialised products and c2c and P2P business models. It is reminded here that the industry is the manufacturer of a mass product, which became a commodity. Developments like VCD HD, retro look (vinyl-like label printing), Braille font on discs and even Blu-ray tend to be niche products of limited market reach. Expressing this in the terms of the transilience map, they are regular innovations addressing a niche. But, once again, they are all physically oriented and not addressing the virtual space of increasingly dematerialised distribution and consumption. Addressing this point of dematerialised products and increasingly virtual dissemination means that extended distribution services are set on risk, too, since the market shifts away and distribution will be discontinuous, too (Benghozi. 2005, Benghozi et al. 2005, 2006, 2000).

Taking this argumentation into consideration and with reference to the inequality of power, regular versus radical/architectural innovation, sustainability and options for organisational survival are therefore challenged. It is suggested that the replication industry will not find solutions for sustainability and new growth within regular innovation as being not strong enough to compete against radical and architectural substitutes, which is supported by Porter and his five forces assessment [power of substitutes] (2004, Wilson et al. 2008). On the other hand, long-term developed R&C cannot be excluded; they are at hand and ready to be exploited further. In this understanding, resource-based theory suggests that the corporate resources are a path-dependant phenomenon (Barney et al. 2007). Therefore, path-dependency is probably a further behavioural explanation. This may count for organisational, but as well managerial implications. Pavitt suggests that "increasing specialisation in the production of artefacts, and their underlying knowledge bases, has made processes increasingly path-dependent" (2005:109). Fagerberg adds that even innovative firms need to consider the problems that path-dependency create meaning that the best strategy may be stuck by a particular path (2005). The proposition is then that due to path-dependence the relatively single-oriented product use may reduce openness for developing a bigger picture, how stronger innovative approaches may go beyond the original product-orientation.

Operation barriers are proposed as another problem zone driving decision processes. As O'Sullivan et al. argue, manufacturing, sales and service are often incapable of producing and marketing a radical new product (2009). When firms, like OK Media, VDC or Optimal adopt warehousing and distribution services, this is – as Bénavent suggested – requiring a radical extension of prior existing R&C (2008). But these services can be added on top and leave the manufacturing processes of the original core product untouched. Necessary skills, facilities and software can be bought from the market and extend the value chain additionally (Porter. 2004).

While one major organisational pillar remains stable, a second one is added, which is expected to be of particular interest to the potential (Home Entertainment) customers' desire of outsourcing activities outside their core domain. This may explain approaches to what table 3 proposes as technology plus adjacency. It is likely that kdg-mediatech's approach of a 'general entrepreneurship to the media industry' fits into this paradigm, but it would presently mean speculation as to the exact extent. The developments in the near future are expected to provide more clarification.

The application of technology plus technology may have two origins. SK Compact Disc is part of a larger group, whose ownership has successfully teamed up with other major corporations in the field of innovative battery manufacturing. Instead of expecting to control all aspects of a new product, a collaborative network is used (Goffin et al. 2005). This implicit expression of path-dependency may explain that a successful collaboration in another business unit was an initiator for searching for and finding progressive alliance partner in the field of replication. As Goffin et al. tend to hold further, the automotive industry offers successful patterns of such strategic alliances. CDA and, e.g., its optical disc plus RFId, fit into this model, since Hettler, CDA's managing director, has strong professional roots in the automotive industry and is experienced in this industry's field as well (2005).

A different perspective needs further consideration, the obvious and the non-obvious. Docdata is re-engineering its business radically whereas CDA puts much effort in innovative solutions extending its core product's use extensively. The obvious shows a significant difference. But probably more important is the non-obvious, which may help to explain and understand the different behaviour. While Docdata is a completely private business, CDA belongs to the investment bank of Thuringia's Federal States Bank. Thuringia, part of the former German Democratic Republic, still suffers today from an extremely high unemployment rate. An interview with its Commercial Director in 2004 showed the constraints in which this firm must operate. As CDA's owner is government-controlled, one of the major concerns was to keep the employment rate in this company at the highest size. Turning away from the optical disc manufacturing, especially towards e-solutions, would not only reduce the firm's overall employment of around 200 co-workers, it would make many of the present workers redundant, since their skills become obsolete being against the political target of the government, the actual owner. This means that any solution, which hurts the employment rate is politically not accepted. This may be underpinned further by CDA's extension to in-house printing of standard paper products added to the CD and DVD packaging: An additional service – an adjacency – expanding R&C beyond prior boundaries, and creating a couple of new jobs. Such restrictions reduce the choice of strategic options at various strategy levels considerably, a situation which has not significantly changed for CDA since. Docdata instead is relatively free to make decisions, which may contribute best to organisational survival, while CDA needs to bridge market and political expectations best possibly. This suggests that some underlying form of a publicly hidden agenda may control the strategic decision making process and influence opportunities of development.

Fighting against Obsolescence – Escaping a Declining Environment

This discussion offers some explanation, which respect resource-based theory, especially by consideration that each organisation is a unique set of R&C, Harrigan's explanation that in decline various firms are acting differently, and as well the theory of path-dependence (Barney et al. 2007, Harrigan. 1980, Pavitt. 2005). Overall, the majority of these replicators remain close around the core product, add additional technologies to it and/or extend services. They develop new R&C, manage strategic partnerships and to a certain extent address new potential customers. Docdata undertakes the most radical progress: Closure of its UK premises and creation of a re-engineering in e-business, while separating its 'old' business from the new one to the greatest possible extent at the same time. Overall these and further findings in the entire research undertaken support Wolpert's statement that "[w]hen disruptive changes in the competitive landscape come, companies are caught flat-footed (2003). Addressing sustainable innovation requires different approaches going beyond isolated projects and they must become part of the ongoing business development, or follow the new shifted ways of doing business (Wolpert. 2003). To this argument adds Stalk et al's statement that, when searching for [new] growth, companies breaking compromise can be a powerful principle (1998).

Such argumentation suggests additionally that conventional logic, determined by path-dependence and accepting resource-based constraints will not support this industry's survival and will not result in a beneficial outcome of its participants. A transmission of this argumentation onto firms like OK Media, Optimal, SK, CDA, kdg-mediatech and VDC would mean that the compromise of their presently adopted strategy may help

to protract their organisational lives, but will likely be too weak to fight successfully against the disruptive technology of dematerialised products becoming a service of access and continues ongoing to establish a discontinuous economic environment. The evidence in other industries, which Utterback, Christensen, Christensen et al. have demonstrated, supports this evaluation (1996, 2003, 2003, 2004).

Kelly argues that firms need to give up the perfectly known and embrace the unknown (1997). This means that the industry of replication has to exchange certainty against uncertainty, i.e. a path, which Docdata follows. Parts of existing R&C, especially in manufacturing would consequently need to be given up and those R&C beyond the core product of the optical disc, like frequently implemented services of warehousing and distribution may be further useful. An implication is the shift from manufacturer to service provider. But with regard to the arguments presented here, replicators must go beyond the established product and address a new customer base outside the Home Entertainment Industry. This requires new R&C, adoption of new and extended technologies and will meet a different competitive environment, since new competitors have already shaped a strong profile in these fields – entry barriers in Porter's Five Forces (2004, Wilson et al. 2008). Given the present economic climate in the Home Entertainment business, the process itself does not necessarily demand a radical cut. Just as Docdata demonstrates, two parallel operations may be useful. An evolutionary adaptation to the market development in the present field of activities may take place. Reducing manufacturing capacities according to market demand.

A second solution may be possible, when extending innovation in areas like the optical disc plus future-oriented RFId chips. Despite the argument that this type of product innovation still addresses the physical market, it nevertheless addresses new customer segments. The difference then is that mass production will be replaced by more specific manufacturing, i.e., capacities will need reduction. Again, this process may go hand in hand with a continuation of present activities as long as market demand will allow. Such progress may lead to identify further services around such new combined technologies. These will need to be built up and will bring new R&C to the firm, but may extend a firm's value chain and streams of revenues.

Generally, probably the most difficult problem to deal with and involving Kelly's statement of the unknown, is the need for entrepreneurship to be re-developed. This nexus seems important and also relates to Schumpeter's function of the entrepreneur in economic change (1997, Morlacchi. 2007). This addresses Schumpeter's theories of the entrepreneur's important part in economic developments and his creative character. To this adds Kim et al.'s theory of value innovation logic: What do we need to do, if we start anew (1998). In organisations, which are stuck in product-oriented thinking and serving a mono-structured customer base, this will probably require a rather radical change of organisational culture. On the other hand, as, e.g., iPod and iPhone have proved twice, radical combination of technologies into new products can create new markets. This argument is in line with Christensen et al.'s disruptiv innovation theory and Hargadon's concept that successful innovations are rather single-minded (2004, 2003). There are many technologies available, like the aforesaid RFId, which may be successfully combined into new radical concepts for new growth. An accompanying effect – meeting Kim et al.'s theoretical model – will then be that specific (Home Entertainment) customers will have to go (1998). Therefore, a major constraint in present organisational thinking is assumed in a second crucial double bind effect:

- A mono-culture product for
- A mono-structured customer base, the Home Entertainment Industry

This effect may need reconsideration and probably value creation logic needs to be adopted for new growth and positive developments. When technology is disruptive and market linkages shift, it is suggested that escaping an environment of decline demands not just the renewal of the technological path, but will involve the search for new markets as well.

6 Further Research

The replication industry is technologically focused in two ways: It manufactures one core product, an optical disc. It may have various forms of sub-products, but all depend finally on the same or at least a similar technology. Secondly it addresses the physical marketplace and does not sufficiently make use of the virtual

space. This is certainly a cause and effect relationship of the product's nature, but as argued, the market is shifting towards the virtual space. I.e., presently multichannel options seem to be of little or no option, nor a viable alternative. But, as argued, there is the third mono-structure in place addressing market linkages. As Doyle argues, the product life cycle needs a determinant strategy and a business can only grow by radical and often difficult changes in the positioning strategy (2008). The replication industry has since its very first days in the mid 80s of the 20th century exclusively served one type of customers, which can be united in the group of the content owners of the Home Entertainment Industry. The replication industry is in its third decade in the same habitat and here, it has not made any radical change yet, or did not need to do so before, as Doyle suggests (Cassia et al. 2006, 2008). All other areas served before, industrial customers, car navigation systems and so on, represented never more than a "nice to have" addition to the Home Entertainment Industry portfolio and more important seems the argument, that these optical discs for those different customers served the same purpose.

Therefore further research could shed light on the influence, whether this multitude of rather closed mono-structures as such and in addition to their individual constituents influences and/or has, and if, to which extent influenced the life cycle curve of the industry and the product. With reference to finding a pattern, which may be useful and sufficiently stable and reliable for an application in other industries, where different conditions may be in place, such recognitions are expected to support theory building.

Additional research may shed light on the industry-specific preparedness for change and its management. New technologically induced changes by format, e.g. DVD, have happened. But these changes did not alter the business models or in its basic structure, the customer portfolio. The assumption is that the long period of one and the same way of doing business, winning and losing customers in a way, which may be explained by a customer lifecycle model, could have impacted in a way making participants of this industry rather change-resistant. Hence, further explanation of the specific behaviour of this industry may be detected, when studying the flexibility of and preparedness for change within management and staff.

Generally, with reference to the entire research presented in this paper by parts, it is stated that the studies within this industry will continue further to condense data of findings and to add further and new insights and perspectives in an attempt of shedding more light on this industry and its behaviour in decline. If there is an opportunity for theory building and with regard to options of generalisation, potentially applicable for other industries, too, it will need a more robust and solid grid of tested and retested results detected and identified within the overall research.

7 Conclusion

The replication industry of optical discs faces a severe dilemma. It is caught in a mono-structure of product and customer base. A good number of its participants have served the Home Entertainment Industry, in which it is embedded, for up to nearly three decades. This has provided an elusive environment of security. But the earlier stiff front of rejecting the new trajectory of economic developments, the virtual dissemination of dematerialised products, has started to crumble. The evidence of decline cannot be overseen anymore and the breakthrough of the new disruptive innovation has started to build a discontinuous environment for the present dominant design of the optical disc. The latest major development of Blu-ray disc is not meeting forecasted developments and whether the next format in preparation, the holographic disc on which hopes are pinned, will resolve the scenario of decline remains unclear yet.

Replicators have started new developments, but a majority remains still too strong rooted within the industry's boundaries. Christensen et al.'s research has provided a number of theoretical concepts, which may support this industry in its endgame fight (2004). Additional support for overcoming constraints and limitations may be found in Kotler et al's concept of lateral marketing, in a simplified understanding, putting existing R&C as variables on the table and supplementing them with external ones creating innovative solutions of more radical impact on markets (2005). This pattern would correspond once more to the value innovation logic (Kim et al. 1998).

Three options have been theorised, which may develop sustainable progress. However, the assumption is that none will allow continuing as before; i.e., a rather radical change will be an essential part of further

developments. One core centre will be preparedness for thinking beyond product-orientation, another one a shift of and in the present habitat. Presently, opportunities may exist to smooth the process down, facilitating it, when using the present business model as a base to build a new model besides it. However, so the assumption based on the scholarly findings in other industries, this will need separated operations by location and by structure.

Overall the proposition is that fighting with modest, marginal or regular novelty against disruptive innovation, especially as innovation's two streams, technology and market linkages, have turned against this industry, will not be sufficient for the survival of the industry in its present structure and habitat. In the understanding of path-dependency, this industry should reflect on two aspects:

- The course of the VHS-cassette industry into obsolescence – despite that the regular innovation of a digital VHS-cassette was ready to be exploited
- Which advantages may be discovered by the use of open innovation – asking what is possible and what is needed (Chesbrough. 2006, Stefik et al. 2006).

Overall, the proposition is that the real, overarching battle is the physical place versus the virtual space, in which the replication industry plays more a minor, than a central role.

8 Literature

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