

## Old but sexy: Value creation of old technology-based businesses models

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### Abstract

The purpose of this study is to contribute to a better understanding of the strategic and organisational configurations that companies can use to generate value with product-market systems and their business models that have been dominant in the past but forced back into niche positions by innovation.

The former dominant music format vinyl was rapidly substituted after the introduction of digital music. However, still nowadays some customers use and buy old technology-based products – vinyl sales boom again since 2007. Due to the two-sided nature of the market, customers have to get access to complementary goods. We are thus interested in technologies which have been outdated by the emergence of new technologies. The originality lies in the combination of the two areas: business models and old technologies. Furthermore, vinyl is an example not analysed in depth by scholars so far.

We approached this by undertaking an in-depth literature review to generate hypotheses regarding the value-adding activities of old-technology based businesses as a basis for further research in this area. In addition the paper gives first insights into the constellations to be expected over time for old technology-based businesses models in platform markets.

We here focus on a neglected topic in the strategy literature which, however, bears relevance for many businesses locked into product-market systems which make it hard for them to (completely) switch to a new technology emerging in the market. It is especially valuable to describe the consequences in a systematic fashion.

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Keywords: Value Creation Architecture; Business Model; Old Technology; Competitive Advantage; Resources; Platform Market

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## **Introduction: Can old technologies create value?**

In the strategy field implications of a dynamically changing environment are widely researched: Innovative technologies in new and quickly changing markets are the drivers to investigate questions of efficient and effective organisational forms and relevant underlying resources and/or capabilities (e.g., Bosch et al., 1999; Chatterjee, 2013; Ismail et al., 2014). Such organisational forms may include market-related, cooperative and hierarchical elements. In more established marketplaces similar questions stay relevant with the industry going through the more mature phases of the lifecycle (e.g., McDermott et al., 2013, p. 3). Technological change greatly affects the structures of industries (Schumpeter, 1942) and therefore is also suggested to impact business models and related exchange partners.

As soon as an industry context is on the decline due to the emergence of a revolutionary new technology, management research seems to somewhat lose interest, at least in business models which are locked into the production and/ or distribution of the outdated product (for exceptions see Cooper and Schendel, 1976; Adner and Snow 2010). At the same time it can be observed that usually some firms in declining industries (e.g., analogous photography, typewriters, mechanical watches and vinyl records) go on to exist with the old product focus for a relatively long time span after it is clear that new technologies would make the sustainability of the success at least highly questionable. Understanding how businesses may be able to create as much value as possible in a declining industry context in which they are locked into by their product-system-specific investments thus is an interesting and relevant question.

The research deficit sketched is the point of reference for this paper and the emerging literature on business models (e.g., Amit and Zott, 2012; Teece, 2010; Zott and Amit, 2013; Yrjölä, 2014; Ahokangas and Myllykoski, 2014; Lund and Nielsen, 2014) is suggested to deliver fruitful input. Based on the work of Afuah and Tucci (2001), Osterwalder et al. (2005) and Zott et al. (2011), Massa and Tucci suggest to conceptualize business models broadly “as depicting the rationale of how

an organization (a firm or other type of organization) creates, delivers, and captures value (economic, social, or other forms of value) in relationship with a network of exchange partners” (Massa and Tucci, 2014, p. 423). This understanding of business models – as one among a vast number of existing business model definitions (Ahokangas and Myllykoski, 2014) – guides us in this paper. Value creation by old technology driven players requires a long-term perspective. Since “[b]usiness model choices define the architecture of the business, and expansion paths develop from there on out” (Teece, 2010, p. 181) a certain path dependency has to be taken into account: This on the one hand side can form an isolating mechanism against competitors, on the other hand, however, it also may lock a focal player into a particular structure hard to change after once being established (Teece, 2010). Thus, it is interesting to investigate if and how business models in a certain market change after revolutionary technological innovations. While Teece (2010) wants to investigate how business models bring firms in a position to capture value from technological innovation, this article addresses the issue of value creation and appropriation of old technology-based firms.

We use one aspect of the broad concept of business models here: Value creation architectures (VCA). In this paper we understand value creation architectures as “the structure and relationships of all the value-adding activities that are carried out by various actors and companies to bring a particular product or service to market” (Dietl et al., 2009, p. 26). VCA thus can be understood as a specification of the broad concept of a business model, which leads to a more in-depth understanding of how value creation is embedded into different intra- and inter-firm organisational structures. Over the last decades a trend towards disintegrated value chains could be observed in many industry contexts (McDermott et al., 2013, p. 1; Lund and Nielsen, 2014, p. 106) and VCAs can range on a continuum from highly disintegrated to very much integrated forms with different hybrid/cooperative forms in-between. To understand strategic advantages of firms it is not sufficient anymore to stop at firm boundaries but a functional perspective appears more appropriate to compare different value-creating structures competing in bringing a certain type of product into the market. Choosing this perspective enables the inclusion of

a loose network of small players into analysis in the same way as a large, highly integrated player. We here follow the understanding of Sah and Stiglitz (1986, p. 716) who suggest that the performance of an organisation should not solely be put in relation to the internal structures but that the underlying architecture should be taken into account.

Competitive advantage is rooted in the ability of a firm to create customer willingness to pay for a product or service. Therefore the offered service or product in the marketplace is our starting point. We identify the value creation activities necessary to offer the service or product to come to an understanding of the VCA. The field of strategy delivers the fundament here with different conceptualisations of competitive advantage from a resource-oriented (e.g., Peteraf, 1993), a dynamic capabilities-based (e.g., Teece, Pisano and Shuen, 1997) and a relational perspective (Dyer and Singh, 1998). The performance of the VCA in the relevant competitive environment can be assessed building on a market-based perspective (e.g., Porter, 2008) complemented by taking further market specificities into account: Market contexts where the quality and availability of complements is strategically relevant became known as platform markets and recently have been intensely investigated regarding useful strategy and organizational design (e.g., Parker and van Alstyne, 2014). In the current literature it is in focus how an actor may be successful in starting a superior product-market-system in such a two-sided market or remain a platform leader (e.g., Eisenmann et al., 2011; Gawer and Cusumano, 2014; Suarez and Kirtley, 2012; Lund and Nielsen, 2014, p. 115-116). The consequences for the incumbents in the then inferior product-market system (which has been dominant previously) are of less interest and thus reflect that a research deficit exists here. Incumbents competing with an old technology in a platform market are in the focus of this research.

As the areas of business models, value creation architectures and platform markets are still under development, scholars did not pay much attention to date on how firms, after technological change, arrange their value creation activities to support the survival of an old declining product. However, it is not uncommon to see old technological products (for instance, analogue cameras and turntables or also mechanical watches) that, even after the rise of a new superior technology,

survive for very long time and go on generating value for some firms. However, the inner “creative destruction” of technological change (Schumpeter, 1942) will be likely to lead firms to modify the traditional implementation of their business processes, for example in terms of integration and/or disintegration. Various scholars analysed the strategic reactions of established companies to technological change (Cooper and Smith, 1992; Adner and Snow, 2010; Schiavone, 2011; Schiavone and Borzillo, 2014). Great emphasis was given to the reasons leading firms to failure (Christensen, 1997). Conversely, scarce attention was paid to the evolution of VCA (as a specification of business models) of incumbent firms after new technology emerges and their products suddenly became old and obsolete. Therefore, the core research question of this study is:

*How do companies (re-) design their value creation architectures for old technology-based products where demand declined after technological change?*

The article is organised as follows: The next section reviews the main literature about VCAs and the strategizing of old technology-based companies after technological change in order to form the conceptual fundament for the study. Implications of the existence of complete product-market systems that became old fashioned are taken into account. The third section describes propositions for future research in this area and illustrates in some detail possible research strategies to investigate this further. The fourth section summarises the main conclusions. To come to fruitful avenues for future research, considerations are developed for a case-based analysis of remaining players in the vinyl industry as one prominent example of old technology.

## **Towards a useful conceptualisation: Competitive advantage, value creation architectures and old technology-based firms**

The following sections highlight core findings of the literature regarding competitive advantage realisation of different VCAs as well as the effects of technological changes on old-technology-based businesses. The literature review results in a conceptual fundament for further investigations.

## Value creation architectures and competitive advantage

Creating value for the customers is central for firms in order to generate returns for the firm owners (Porter, 1996; Hambrick and Fredrickson, 2001). The fundamental question in the field of strategy is how do firms achieve and sustain competitive advantage (Royer, 2005). "Strategic management, in both theory and practice, tries to understand how firms may improve their performance in competitive interactions with other firms" (Sanchez and Heene, 1997, p. 303). Strategic management thus wants to understand why some firms perform better than others with regard to this objective.

Performance in terms of competitive advantage realisation in the economic strategic management approaches is conceptualised in different types of rents: Firms may earn monopolistic rents on the basis of positioning strategies in imperfect markets (Porter, 1980). Taking into account resource heterogeneity, Ricardian rents accrue from the possession of scarce resources (Peteraf, 1993). While such Ricardian rents may lead to sustainable competitive advantage, Schumpeterian or entrepreneurial rents (Teece et al., 1997) rather imply temporary advantage. Firms realise them on the basis of certain capabilities and through risk taking and entrepreneurial insights in an uncertain or complex environment. Over time the underlying capabilities diffuse into the market and become best practice. In cooperative ventures relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities as well as effective governance may generate relational rents for the partners (Dyer and Singh, 1998). Especially the recent developments in the strategy literature regarding relational rent generation highlight that it is acknowledged that an internal firm analysis is not sufficient for understanding strategic opportunities (Dyer and Singh, 1998; Lavie, 2006). It also has to be understood where cooperative core competencies (Duschek, 2004) or network resources (Gulati, 1999) may be used to generate competitive advantage. Isolating mechanisms such as causal ambiguity (Dierickx and Cool, 1989; Barney, 1991), inter-organisational asset interconnectedness, scarcity of partners, indivisibility of resources and certain institutional environments are suggested to protect such relational rents against imitation (Dyer and Singh, 1998, p. 672). However, coop-

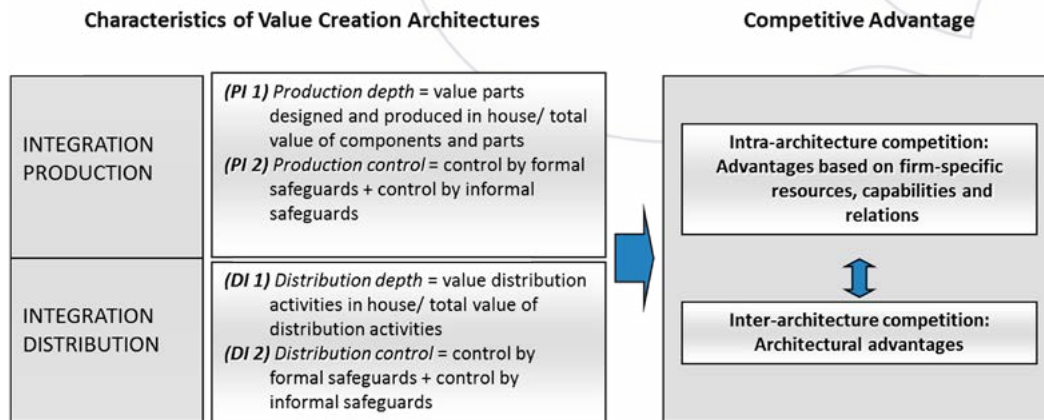
eration partners may also face a danger in what Lavie (2006, p. 647) calls spillover rents. Such rents may be generated by one partner in an opportunistic fashion on the basis of network resources.

On the basis of the strategy literature with economic roots we want to take into account competitive advantage generated on the basis of network resources as well as firm-internal resources and capabilities. We do extend our perspective beyond firm boundaries and focus on a VCA competing in a certain market to bring a particular product or service to the customer (Dietl et al., 2009). "[T]emplates that emerge in a sector and circumscribe the division of labor among a set of co-specialized firms" are called industry architectures (Jacobides, Knudsen and Augier, 2006, p. 1201). Since we assume different architectures in the same industry context, we here use the term VCA and suggest that different degrees of (dis)integration compete against each other in the same market. Findings from case studies of the European automotive industry back this view (see Dietl et al., 2009 and Stratmann, 2010). Two levels of competition become relevant for our analysis: (1) the competition between different VCAs (inter-architecture competition) and (2) the competition between the actors in the same VCA to appropriate a high share of the resulting rents within that particular system (intra-architecture competition). Figure 1 summarises the VCA approach we are using for this analysis.

Thereafter the analysis of VCAs deals with the level of integration in production (production depth and production control) and the level of integration of distribution (distribution depth and distribution control). Both, the choice of a certain level of depth of production and distribution, can lead to value creation and competitive advantage of the focal actor at the intra- and inter-architectural level (Dietl et al., 2009). Hence different VCAs can have significantly different characteristics which are, as an extension of Coase's (1937) differentiation of internal production and the use of the market and the transaction cost economics' view by Williamson (1985), grouped in three distinct generic categories: Integrated, disintegrated and quasi-integrated forms of VCAs.

Referring to Figure 1 'integrated' means a high level of





**Figure 1': Conceptual framework linking value creation architectures with competitive advantage**

production and distribution depth. On the other side of this continuum disintegrated VCAs can be found: this form is characterised by a low level of production and distribution depth and therewith the usage of markets to procure inputs (Jacobides and Billinger, 2006; Dietl et al., 2009). In between mixed forms can be found which are characterised by low production and distribution depth combined with a certain level of control and coordination for the other actors of the same VCA. Such control and coordination mechanism may include self-enforcing safeguards (e.g., trust or hostages) and third-party safeguards (e.g., legal contracts) and potentially generate relational rents (Dyer and Singh, 1998). When we use the term 'control' here, we are interested in how close the focal actors' relationships with external partners via formal and/or informal mechanisms are. Product innovations often are not sufficient for gaining competitive advantage as competitors are in many cases quickly able to copy these (Cliffe, 2011; Matzler et al., 2013). Hence VCA innovation (as part of BM innovation) is an opportunity to build sustainable competitive advantage (Teece, 2010). This can be achieved if customer value increases and a new value creation and revenue model gets established so that a new way of value appropriation is possible (Matzler et al., 2013). For multinational corporations, for example, it is in a fast changing global environment suggested to be important to repeatedly re-evaluate and reconfigure their value chains to gain competitive advantage and to stay ahead of the competitors (Maitland and Sammartino, 2012).

The American computer manufacturer IBM at a certain time had valuable resources and excellent capabilities

to build PCs and hence was able to create great value with its PC business. Looking at a distinction made by Gawer and Cusumano (2014) who suggest to differentiate between different types of platforms in terms of internal (firm or product) platforms as well as external (industry) platforms one may say that IBM was even able to establish their product as an industry platform (Gawer and Cusumano, 2014, pp. 417). However, their value creation architecture put suppliers such as Microsoft and Intel into such strong positions that the focal player of the VCA, IBM, failed to appropriate the value created and to build a long-term competitive advantage in this field and industry/architectural leadership in the 1980s shifted to Intel and Microsoft (Gawer and Cusumano, 2014, pp. 423). The example shows the importance of the design of VCAs and the link to competitive advantage. Questions of how to find a balance between competition and cooperation thus seem to be highly relevant, especially in areas where we have dynamic technological change.

However, what about old-technology-based industries such as the vinyl pressing industry? Here, the environment seems to be more stable making a vertically integrated structure more likely to lead to benefits (McDermott, 2013, p. 3). Comparing e.g. the vinyl pressing industry with other audio segments such as CDs, the sales numbers are relatively small, yet increasing. The number of players still in the market thus also can be assumed to be declining. This decline leads – next to other implications – to a lack of potential cooperation partners on a horizontal as well as vertical level.

On the basis of this reasoning we assume that firm

1: Source: Dietl et al., 2009, p. 31.

internal resources play a central role in old technology (niche) markets as for example the vinyl industry to come into a position to generate competitive advantage. The relevance of shared and network resources may be lower. The underlying reasoning is that a relatively integrated VCA would be beneficial in old technology markets while a disintegrated structure may be favourable in new technology contexts. When analysing old technology VCAs, the aspect of competition between rivaling VCAs (inter-architecture competition) thus is more in our focus than competition and competitive advantage realisation in a single VCA (intra-architecture competition).

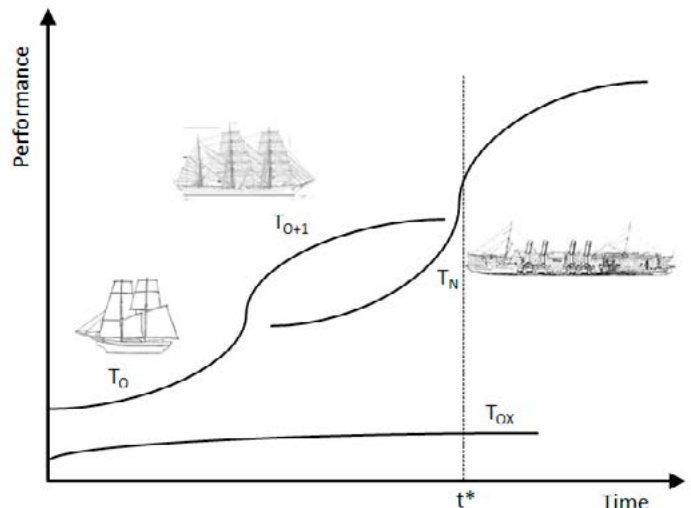
### Old technology-based firms after technological change

A review of the literature about the main strategic reactions of incumbent firms during or after technological change outlines different behaviours for preserving and/or renewing their VCAs. Adner and Snow (2010a) analyse old technology firms that do not want to exit from the market or switch to a new technology. This strategy of maintaining the focus on the old technology implies the creation of “coexistence between obsolete and superior technologies” (De Liso and Filatrella, 2008, p. 593). In this context it can be differentiated between mainly two strategies called racing and retreat strategies.

A racing strategy implies that firms behave in a way that is sometimes labelled as the sailing ship effect (Cooper and Schendel, 1976; Gilfillan, 1935; De Liso and Filatrella, 2008 and 2011; Liesenkötter and Schewe, 2013; for a critical perspective see Howells, 2002 and Mendoca, 2013). The key element of this reaction is the improvement of the performance and the characteristics of old-technology – the companies hence continue to invest in the old technology and “technologies diffuse slowly” (Chari and Hopenhayn, 1991, p. 1161). Gilfillan (1935) shaped the term sailing ship effect when he described how the sailing ship was heavily improved as soon as the steam ships emerged during the 19th century (Gilfillan, 1935, pp. 156).

The model of competing technology S curves goes back to Foster (1986, pp. 101). Figure 2 shows an established, now old, technology ( $T_0$ ) that has secured its position over other available technologies ( $T_{OX}$ ) and from a cer-

tain time on was confronted with a new technology (TN) with a technology which was superior from time  $t^*$  on. However, the old technology improved ( $T_{O+1}$ ) with the introduction of the new technology. This effect is a “process whereby the advent of a new technology engenders a response aimed at improving the incumbent technology” (De Liso and Filatrella 2008, p. 593).



**Figure 2:** Scheme of technology competition: The sailing-ship effect

The case of sailing ships first described by Gilfillan (1935) shows how at the beginning of the 1900s the rate of technological innovation of sailing ships, after the introduction of steam ships, lasted for over 30 years (since 1850 up to the 1880s) and the period of substitution between the two competing technologies lasted for over 70 years. The sailing ship producers perceived the steam ships as a threat and, thus, improved the performance and innovated their traditional products: “It is paradoxical, but on examination logical, that this noble flowering of the sailing ship, this apotheosis during her decline and just before extermination, was partly vouchsafed by her supplanter, the steamer” (Gilfillan, 1935, pp. 156).

Some scholars (Howells, 2002 and Mendoca, 2013) analysed in detail the sailing ship effect and, overall, criticised the conclusions by Gilfillan. The results of their studies show that the real existence of this phenomenon is questionable. Howells (2002) argues that in practice the sailing ship effect is the output of superficial knowledge about the cases analysed. Such misleading view is supported (Howells, 2002, p. 903) by (1) the coexistence of apparently substituting technolo-

2:Source: Own figure based on Adner and Snow (2010a) and Sandström (2013)

gies through long periods of time and (2) the confusion of continuous innovation in the old technology with innovation induced by the threat of substitution.

Similarly, the historical analysis by Mendoca (2013) shows that the technological competition between sailing ships and steam boats was a distortion of what really happened. For instance, when new technology emerged, sailing ships were already in the most innovative phase of their history and that both technologies rather complemented each other even hybrid forms existed for some time (Mendonca, 2013, p. 1732). However, Mendonca also concludes that “the ‘sailing ship effect’ may hold true for other industries” (Mendonca, 2013, p. 1735). These arguments, however, highlight various endemic problems of conceptualisations and empirical research about the so-called sailing ship effect.

Howells (2002) attempts to find proofs for the sailing-ship effect as one of three possible generic responses (exist, switch, sailing-ship effect) to substitution by analysing the two cases of sail and alkali (Howells, 2002, p. 887). For these cases Howells could not find strong evidence but emphasized the radical notion of change of these examples (Howells, 2002, p. 905). Rather other cases should be analysed (Howells, 2002, p. 905). He even describes the most cited source of the sailing-ship effect, Gilfillan (1935), as misinterpreted: “Not only does Gilfillan not make an explicit claim for the ‘sailing-ship effect’ as private sector phenomenon, he provides persuasive evidence that government was the more important funding agency [...]” (Howells, 2002, p. 892). Howells (2002) thus states that switch or exit are the dominant strategies for old tech firms. However, there is another possibility: stick to the old technology to be able to create value from a niche position.

Despite the real existence of the sailing ship effect it is hard to clearly identify in the available empirical patterns; this technological concept anyway outlines a number of interesting strategic implications when companies face technological change:

- Companies have used their R&D efforts and innovation resources to analyse/develop both old and new technology over the transition phase.

- The emergence of new superior technology reshapes the old industry. Differences in reaction by users and producers might lead to industry-specific strategic and competitive configurations - more complex than the classifications by Howells (2002).
- The destiny of old technologies may be to disappear from the market in the long term but in the short-medium term they can still provide room for value creation, niche companies may even be able to sustain their competitive position in the long run.

Another example of technology race between old and new technologies is the case of carburettors: With the introduction of electronic fuel injection (EFI) the number of cars sold with carburettors declined sharply by 1984 whereas the fuel economy (measured in miles per gallon, MPG) increased heavily at the same time. However, various other industry examples of this phenomenon are provided in the literature (Utterback, 1994; Snow, 2008), e.g. vacuum tubes vs. transistors, steam locomotives vs. diesel-electric, fountain pens vs. ball-point pen, fossil fuel power plants vs. nuclear power plants, safety razors vs. electric razors, aircraft propellers vs. jet engines, leather vs. polyvinyl chloride plastics (Cooper and Schendel, 1976, p. 64-65). All these examples were studied by Cooper and Schendel (1976) and they concluded that “[i]n every industry studied, the old technology continued to be improved and reached its highest stage of technical development after the new technology was introduced [...]” (Cooper and Schendel, 1976, p. 67).

Furthermore, Cooper and Schendel (1976) found out that most firms followed a dual strategy, divided their resources and were active in both the new and the old technology. Their commitments to the old technology stayed substantial. “Perhaps this demonstrates the difficulty of changing the patterns of resource allocation in an established organization” (Cooper and Schendel, 1976, pp. 67). Where the old technology continued growing the companies could keep their competitive and financial advantages especially as the new technology firms never entered the old technologies market (Cooper and Schendel, 1976, p. 68). In a later study Cooper and Smith (1992) studied eight young industries and 27 firms that were threatened by that new technology to analyse the respond strategies, espe-

cially the case of entering the emerging young industry (Cooper and Smith, 1992, pp. 55). The limited number of successful examples, however, made it only possible to come up with the problems associated with a strategy of participation in the new industry and suggest ways how to avoid them rather than to develop success formulas (Cooper and Smith, 1992, pp. 67).

One key point is that it is not the challenge to also introduce the new product but to being able to further improve performance, quality and costs which is necessary for the commercial success (which is easier if the company has very strong R&D and financial resources or competition does not yet exist). They also saw a tendency of trying to fold the new product into the old strategy and were slow in trying out new concepts rather than to allow new experimental strategies and to carefully analyse the strategies of the new technology firms which often have different resources, skills, and ideas and do not care about the status quo (Cooper and Smith, 1992, pp. 68).

Technological retreat (Adner and Snow, 2010) is a strategic approach by which old technology companies re-trench their products in a niche position within their traditional market and/or search for new market applications (see Figure 3). Hence the goal is not growth and expansion but rather survival and contraction which is “contrary to traditionally assumed firm objectives” (Adner and Snow, 2010, p. 1657).

If an old technology loses the mainstream this does not necessarily mean that it loses the entire market. Even though it is possible that all customers uniformly prefer the new technology, it is a matter of evaluation

criteria. There exist “several drivers for variance that may lead parts of the market to continue to prefer the old technology to the new” (Adner and Snow, 2010, p. 1662). Reasons might be budget constraints, heterogeneity of preferences over attribute bundles or emotional/ nostalgic elements of the old technology (Adner and Snow, 2010, p. 1662).

Another reason might be lock-in by an industry which Arthur shows on the examples of nuclear-reactor technology and petrol-versus-steam cars (Arthur, 1989, pp. 126.). Farrell and Saloner (1986) describe the lock-in from the customer side: customers who decided to adopt a technology that became old through the introduction of a new technology are described as installed base that are “somewhat tied to the old technology” (Farrell and Saloner, 1986, p. 954), also described as stranding effect (Farrell and Saloner, 1986, p. 941) and quite common in platform markets. Liesenkötter and Schewe (2013) follow the idea of lock-in of industries by combining the concept of path dependency with the sailing-ship effect and an analysis of patents for different car engine types to explain why it does not make sense for the car manufacturer to immediately change technology to electric or hybrid cars (Liesenkötter and Schewe, 2013, p. 276). The vehicle manufacturers as the focal actors of the current automotive industry have their core competences in the design and production of combustion engines (Dietl, Royer and Beckmann, 2013, p. 23). This means that they are somewhat locked into this bundle of resources specific to cars that need fuel and not electricity. These types of reactions imply changes on both the production-side and the demand-side for companies.

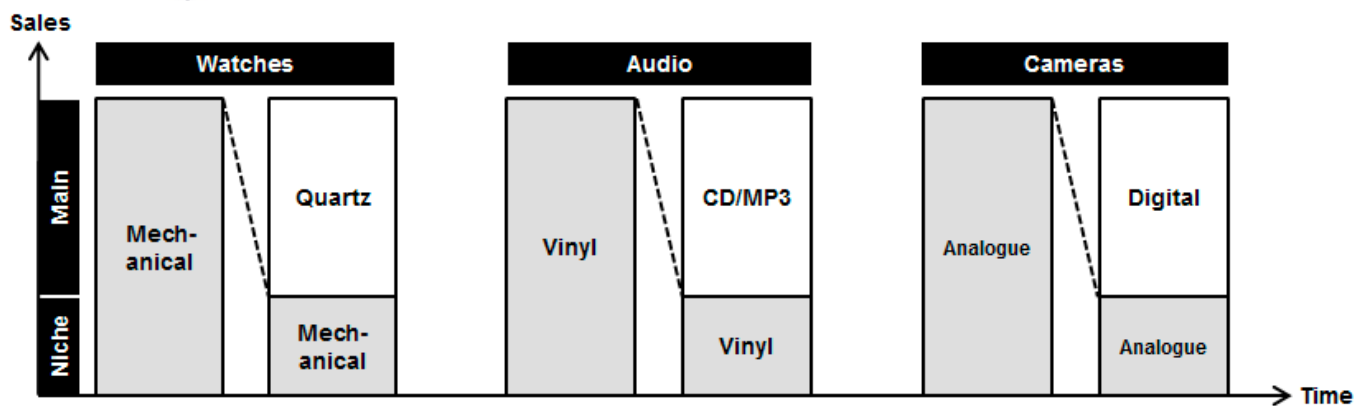


Figure 3<sup>3</sup>: Technological retreat

3: Source: Own figure.



This reviewed body of literature focuses mainly on the innovation, marketing and/or strategy of old technology-based companies reacting to technological change. An in depth analysis of how the companies underlying VCAs may change (or not) due to new technology still lacks in the literature. However, technological races and technological retreats have different and deep implications within and outside organisations. Firms have to develop new marketing, manufacturing and engineering capabilities despite they keep focusing on the old technology. The first concern is to develop these internally or by integration of new and necessary capabilities.

Referring to the internal development, acquisitions are a typical but risky way to coping with change by disruptive technology and creating capabilities (Christensen, 1997). A well-known example of such risks is the 1984 acquisition of Rolm by IBM in the PC industry. The IBM mistake to push Rolm resources into its original large computer business destroyed a large part of the value of the acquired company in few years (Christensen, 1997). Referring to the external environment, the usual reduction of the market size of old products entails the traditional economies of scale are not achievable anymore by companies. Old technology firms must search for flexibility (Adner and Snow, 2010). The inclusion of new technology-based components in the old declining products should reduce, therefore, the extent of integration of the production process of retrofitted (improved) old technological products.

A critical issue of old technology-based companies and their competitive advantage, thus, is to keep legitimacy in their business ecosystem (Adner and Snow, 2010). When a technology starts declining the firm has to face the issue of revising its set of suppliers. Many of them might decide to exit from the industry or switch to new technology. Companies performing technological retreats, thus, should try to keep the best suppliers and redesign their VCA accordingly with the new components.

The repositioning of old technology products from mass to niche market could affect also the selection of distribution partners and channels. For instance, after the rise of quartz watches some firms manufacturing mechanical watches repositioned and sold their

products by new distribution partners. General purpose technologies might introduce new technological competencies and distribution channels or partners into the industry which affect old technology and its (retrofitted or not) products. For instance, the widespread of e-commerce pushed old technology firms in many industries to extend their VCAs by integrating reliable e-commerce providers and global shipping companies. It can also be a possible move to establish own brick-and-mortar-outlets to compensate for a decreasing number of attractive sales outlets in the market. Sellers of high end cutlery or porcelain may lose their established sales infrastructure due to the decline of certain types of shops for exclusive homeware or jewellery stores and follow the sketched avenue.

### **Conceptualising relevant elements of VCAs of old technology firms**

After the discussion of relevant elements from the literature the further research process shall be fuelled with propositions which may be contrasted with reality in the course of future research. The aim of this paper is to come to a sound conceptualisation of propositions about VCAs for providers of old technology on the chain of arguments developed from the literature. The propositions are elaborated with the explicit objective to develop them further towards testable hypotheses. Therefore, next to a thorough description of the variables in the propositions, we want to sketch first concrete ideas for the operationalisation of these constructs.

From the literature on old-technology firms and value creation architectures we have derived several propositions: Building on the reasoning developed from the literature and showed above we deduced that two levels of competition are relevant for our analysis, i.e. the competition between different VCAs (inter-architecture competition) as well as the competition between the actors in the same VCA to appropriate a high share of the resulting rents within that particular system (intra-architecture competition) (see Dietl et al., 2009).

Due to the specificities of old technology firms – as outlined above and using Adner and Snow's (2010) considerations as a point of reference – we in the first step of research propose to focus on inter-architecture competition as intra-architecture competition seems to play

a minor role due to the assumed decreasing number of suppliers and other potential partners in the VCA.

When we want to understand value creation possibilities for old-technology firms we suggest that we have to come to an understanding of the situation before and after the dominance of a superior new technology. Therefore the analysis of the process of technological change can be – similar to what is shown in Figure 1 building on Adner and Snow (2010a) and Sandström (2013) - split into two relevant time periods: (1) time period 1 [tp1] as the time span when old-technology firms see their possibilities to realise rents threatened by the emergence of a superior technology, and (2) time period 2 [tp2] as the time span after new technology became dominant, some old-technology firms were forced to leave the market and only a smaller number of niche players competes on the basis of the old technology (see Figure 3 again).

We assume that old-technology firms usually have to fight hard against also threatened old-technology competitors when a superior technology emerges in a market in tp1 when they are locked into the old technology product-market system and cannot switch to the new technology. This assumption is in line with Porter's (2008, p. 85) understanding of a high intensity of rivalry in a given industry being pushed by fights of incumbents for market share in an environment characterised by declining growth and exit barriers due to specific investments. Competition between the incumbents (and therewith between their VCAs) is fierce in this point in time since they all have a lot to lose and they are all due to their specific investment into the whole platform forced to fight hard or leave the market with high investment ruins. They basically fight for their survival in a marketplace where the expected total rents to be gained are shrinking. This reasoning leads to the first proposition:

**Proposition 1:** Old-technology firms focus on out-competing other old technology-based rivals in tp1 so that a fierce (inter-architecture) rivalry between the incumbents comes into being.

However, from the perspective of an old-technology incumbent the rivalry in tp1 is not limited to the other old-technology competitors. Further, obviously the new-

technology firms are a major threat to profitability for an old-technology player as well. After reviewing the literature on old technologies and the strategic reactions of race and retreat (e.g., Adner and Snow, 2010a; de Liso and Filatrella, 2008) a link between these two may be assumed: before a technology retreats in a niche market in tp2, it races with the new emerging technology and therewith improves (see Cooper and Schendel, 1976; Gilfillan, 1935; De Liso and Filatrella, 2008 and 2011 for an elaboration of this sailing ship effect). It thus may be assumed that an old technology gets improved through the pressure of the introduction of a new technology (i.e., a race gets started):

**Proposition 2:** Old technology firms facing the introduction of a superior technology into the market show a high level of product innovation in tp1.

Building on that chain of assumptions as well as the assumption that just companies with strong (however, locked-into the old technology) resources (e.g., patents and/or R&D capabilities) stay into the old technology market, we - on the basis of Adner and Snow's (2010) considerations on retreat strategies- suggest the following: The old-technology firms with a high level of innovations in the first phase are also the later old-tech survivors in the second analysed phase. In this phase they then retrench into a market niche. Furthermore, we assume that they will gain significant market share/ importance in this specific niche as the number of players will be increasingly limited with the structural market changes. These assumptions are phrased in the following two propositions:

**Proposition 3a:** Old technology firms with a high level of product innovation in tp1, are likely to survive in tp2.

**Proposition 3b:** Old technology firms with a high level of product innovation in tp1, follow differentiation strategies in tp2 and thereby retrench into strategic niche positions of the overall market.

On the basis of the VCA concept (Dietl et al. 2009) we suggest that old-technology firms which are successful in surviving the introduction of a superior technology into their markets face a situation which is characterised by a small number of competing niche players in the old-technology segment in tp2. By having retreated to a niche there is also a certain protection against

new-technology firms as well as against new entrants. Thus, we assume that the old-tech survivors usually lay respectively have to lay major focus on competitive advantage realisation inside the borders of their VCA. We suggest that old technology firms have to concentrate on their own resources and capabilities since the number of vertical and horizontal partners and competitors is declining with the decline of the old technology. Since their products can be characterised as niche products it can be assumed that old-technology based firms are more likely to compete in a relatively stable industry context once the number of other old-tech providers is relatively small. In such a market they are able to appropriate value and build long-term competitive advantage with an integrated value creation architecture. From this reasoning a further proposition arises:

Proposition 4: Old-technology firms surviving the introduction of a new technology build highly integrated value creation architectures for the old technology in tp2.

Furthermore, old technology firms in platform markets are usually locked-in to the old product, e.g. through resource allocation and path dependency as well as compatibility issues (see Arthur, 1989 for an elaboration of the lock-in phenomenon).

Old-tech companies may in addition find it hard to totally giving up the old technology due to economic as well as emotional lock-ins. This may have the implication that they stick to the old technology, even when they make parallel efforts to switch to the new technology, i.e. follow a dual strategy.

Proposition 5: Old-technology firms with sufficient resources often follow a dual strategy with the old and the new technology after tp2.

## Conclusions and implications for further research about VCAs in the vinyl market

Within this piece of research we focused an area which often is not regarded by scholars even though it is important and highly interesting: the area of old-technology firms which survived and still operate today. We therefore reviewed the main literature about VCAs and the strategies of old technology-based companies after technological change. Based on these analyses we elaborated the following six propositions (see Table 1 for a summary of the propositions) for further research in this area.

**Table 1<sup>4</sup>: Propositions about the structure and strategy of old-tech providers in platform markets**

Proposition 1	Old-technology firms focus on out-competing other old technology-based rivals in tp1 so that a fierce (inter-architecture) rivalry between the incumbents comes into being.
Proposition 2	Old technology firms facing the introduction of a superior technology into the market show a high level of product innovation in tp1.
Proposition 3a	Old technology firms with a high level of product innovation in tp1, are likely to survive in tp2.
Proposition 3b	Old technology firms with a high level of product innovation in tp1, follow differentiation strategies in tp2 and thereby retrench into strategic niche positions of the overall market.

4: tp1 = time span when old-technology firms see their possibilities to realise rents threatened by the emergence of a superior technology; tp2 = time span after new technology became dominant and only a smaller number of niche players competes in old technology segment

Proposition 4	Old-technology firms surviving the introduction of a new technology build highly integrated value creation architectures for the old technology in tp2
Proposition 5	Old-technology firms with sufficient resources often follow a dual strategy with the old and the new technology after tp2.

Further research is needed to discuss these propositions and contrast them with the reality e.g. by applying a case study research strategy. We suggest the case of the vinyl industry in Europe to be a good example and worth to study in-depth as it shows interesting market characteristics with its boom after many years of decline of sales. There still exists a good number of vinyl pressing companies with different degree of integration of their value creation architectures.

The next step in this research regarding VCAs in old technology context in our eyes thus has to be an empirical investigation. A case study approach may be developed to contrast for instances our Proposition 4 which suggests that a relatively integrated VCA would be beneficial in old technology markets with the reality. We plan to explore this in a case study where we apply the concept to analyse value creation architectures in the industry context of vinyl, focusing on the vinyl pressing businesses as the focal actors.

Vinyl seems to be an attractive example to investigate: A vinyl revival occurred over the last ten years. Latest statistics report that the amount of vinyl purchased in the U.S. in 2012 reached 4.6 million units which is an increase of 17.7% compared to 2011 (Nielsen, 2012). Even though 2014 was a bad year for the U.S. music industry overall, vinyl stayed a noteworthy trend with its 51.8% rise in sales compared to 2013 which means 9.2 million vinyl sales and 6% of all physical music sales. Compact disc sales on the other hand declined by 14.9%. (Nielsen, 2015). Physical formats still account for more than half of all global revenues, vinyl here grows as a nice product (IFPI, 2014, p. 7).

The vinyl sales in the U.S. in 2012 accounted for 177 million USD, while it was only 166 million USD in 1997

(IFPI, 2013). One of the motivations explaining the current purchase of vinyl by end-users and the current value creation in this industry lies in the fact that vinyl became popular and trendy between young artists as well as music listeners (e.g., Pankinkis, 2012). The sound quality of vinyl is perceived to be much higher than of CDs or MP3s by these customers. Some labels or stores (e.g., Amazon) meanwhile offer to download the songs for free as MP3 when buying the vinyl album and therewith combine the best of both worlds. Another motivation relates to the on-going use of turntables by some (vintage) communities of DJs (e.g., Schiavone, 2013). When put in relation to the music market vinyl album sales have accounted for 1.4% (2.3%) of all album sales (all physical album sales) (Hughes, 2013, p. 27). The market share documents that it is a niche market (Christman, 2013). Music companies foster this niche by producing a limited number of vinyl records as a deluxe product (James and Grogan, 2011, p.51).

To analyse the theoretical approach in a real-life context a multiple case design may be useful (Yin, 2003, p. 39). Case studies are a useful approach to illustrate general facts or theoretical concepts (Boos, 1992). They are an “[...] empirical inquiry that investigates a contemporary phenomenon within its real-life context [...]” (Yin, 2003, p. 13) and “copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to coverage in a triangulating fashion [...]” (Yin, 2003, pp. 13-14).

We here suggest to use a cases study strategy further since the research subject in terms of the complex variables and the interdependencies between them can only be sufficiently analysed when data from different



sources are taken into account and in-depth interviews are conducted with industry experts which excludes analysing a large number of cases (Weber, Mayrhofer, Nienhüser, Rodehuth & Rüter, 1994, p. 55). We suggest a nomothetic case study research design here to be able to actually contrast the propositions with the reality and thereby test them. Nomothetic in this context refers to the fact that each of the cases of old tech players investigated in the vinyl market is to be classified on the basis of the theoretical considerations from the developed propositions. Data maybe collected with quantitative as well as qualitative methods which both can be useful. The aim of a hypotheses testing nomothetic case study lies in eliminating implausible hypotheses in a process of comparing them with the characteristics the variables show in the different cases investigated (Fisch and Boos, 1987, p. 356; Weber et al., 1994, p. 51).

After setting up the propositions as an outcome of the theoretical discussion of the VCA of old-technology firms one tricky part therefore lies in operationalising the complex constructs used in the variables. We thus here want to come up with first ideas regarding the operationalization of them with regard to a cases study research of different remaining players in the European vinyl market(see Table 2).

Within further research the propositions are to be tested with the help of a case study analysis in the vinyl industry (or other fitting industry contexts). We think that it is fruitful to analyse the vinyl pressing industry which in our view is a good example of an old-technology based industry which survived building a niche market for some players and even grows nowadays. As cases we would choose remaining players (respectively their VCAs) in the European vinyl market.

Limitations of our approach lie in the fact that so far we have no empirical data included. However, due to the complexity of the field we saw it as highly relevant to focus on a sound conceptualisation of propositions in the first step and test them in follow up studies.

The aim of this paper was to generate propositions regarding the companies' value-adding activities in order to sustain an old platform or establish new platforms for old products in decline. Thereby we focus on a neglected topic in the strategy literature which, however,

bears relevance for many businesses locked into product-market systems which make it hard for them to (completely) switch to a new technology emerging in the market. It is relevant to describe the consequences in a systematic fashion and this is what we did on the basis of the strategic literature used. In addition, we wanted to come to a deeper understanding of the relationships between different elements in that context which led us to the formulation of the propositions summarised in Table 1. These are a good fundament for future research in this area as well as first insights into the constellations to be expected over time for old tech businesses in platform markets.

**Table 2: Avenues towards operationalising the relevant variables**

Variables	Time	Possible measures
tp1	-	- relevant time period suggested for the vinyl market 1981 – 1989
tp2	-	- relevant time period suggested for the vinyl market 2006 – 2012
rivalry/ competition	tp1	<ul style="list-style-type: none"> <li>- price discounting (Porter, 2008, p. 32)</li> <li>- [number] of new product introductions (Porter, 2008, p. 32)</li> <li>- [number] of advertising campaigns (Porter, 2008, p. 32)</li> <li>- service improvements (Porter, 2008, p. 32)</li> <li>- industry growth in % (slow growth precipitates fights for market share; Porter, 2008: 32)</li> <li>- industry decline in %</li> <li>- [number] of relevant companies offering the product/ competitors</li> </ul>
product innovation	tp1	<ul style="list-style-type: none"> <li>- [number] of old products revitalised;</li> <li>- [number] of new products developed;</li> <li>- [number] of new patents</li> </ul>
survival	tp2	- [years] of existence (year of closure/ today minus founding year)
niche position	tp2	- market share in overall market in [%]

<p>differentiation</p>	<p>tp2</p>	<ul style="list-style-type: none"> <li>- focus on special sales [price level], e.g. high-end/ luxury, compared to new technology, quality focus</li> <li>- [number] of distribution channels/ distribution partners</li> <li>- [number] raising and creating elements the industry has never offered (Porter, 2008)</li> <li>- Differences in [quality] which are usually accompanied by differences in [price]</li> <li>- Differences in functional features or design</li> <li>- Ignorance of buyers regarding the essential characteristics and qualities of goods they are purchasing → [buyer behaviour]</li> <li>- Sales promotion activities of sellers and, in particular, advertising, e.g. [number] of campaigns</li> <li>- Differences in availability (e.g., timing and location) (Sharp and Dawes, 2001)</li> </ul>
<p>integration</p>	<p>tp2</p>	<ul style="list-style-type: none"> <li>- Production depth: ideally [%] of in-house processes compared to outsourced ones (production steps)</li> <li>- Production control: duration in [years] and sustainability of relationships in [number] of suppliers (multiple sourcing vs. exclusive supplier); [level] of location-specific investments (geographic proximity of supplier plants), integration of direct suppliers – focus on direct tier 1 supplier</li> <li>- Distribution depth: ideally [%] of direct sales/ direct involvement and intervention compared to sales via third parties</li> <li>- Distribution control: [type] of sales and contracts with dealers (e.g., franchise); [level] of specific investments at dealers – focus on relationships with direct distributors</li> </ul>

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