Competitive Strategies for Value Creation During Disruptive Innovations

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Abstract
Electric mobility will play an important role in individual traffic in the upcoming decade and create revolutionary changes in product and process technologies. Electric mobility can be described as a disruptive innovation resulting in high risks in market development and many technological alternatives. These are specific for disruptive innovations which represent a major challenge in designing the value creation process.

To address these challenges, it is essential to develop strong competitive strategies for the value creation process of the electric powertrain. Literature has suggested different value creation approaches that can basically be classified into the market or resourced based view. Recently, new approaches like the basic value creation architecture approach were introduced. Yet, in the case of disruptive innovations, basic decision parameters that are required for the value creation approaches cannot be analysed due to the risky and unpredictable market and technology development. Hence, a new approach for designing the value creation process for risky, disruptive innovations is needed.

We argue in this paper that the competitive value creation strategy for disruptive innovations should consist of four steps: Firstly, a strategy for the value creation is needed. From an internal company perspective, this includes the definition of the depth of the added value. Secondly, from an external view, the value network has to be designed. Moreover, a risk strategy for taking the uncertainty of disruptive innovations into account is needed. Thirdly, from an internal view, companies have to define their strategy for managing technological alternatives. Fourthly, the external view of risk management considers the market development. In each of the four steps, companies can follow a focused or a general strategy. This paper will conclude with different examples from companies to show how they develop their strategy for value creation.

Keywords
Enterprise Engineering, Value Creation

1 INTRODUCTION
The automotive industry is facing fundamental changes in the upcoming decade. Electric mobility will play an important role in individual traffic. The perspective for the market share of pure electric vehicles varies in different studies between 4% and 10% for the year 2020. The key drivers for the electrification of the car are environmental policy, environmental awareness of the customer, and availability of fossil fuels as well as improving cost structures of the electric powertrain [1]. As a result, the global market for components of the automobile powertrain will grow from 190 bn Euro today to 460 bn Euro in the year 2030. Even though the conventional combustion engine will dominate this market for a long term, there will be a mix of different powertrain technologies competing for market shares [2]. Thus, there is a high uncertainty in the technological and market development of the powertrain.

At the same time, production processes of conventional and electrical powertrains differ significantly. For example, machine times of chipping are reduced by 74% [3]. Moreover, specific competences like coating of chemicals in battery production are needed and cost structures of components as well as of the whole car change dramatically [1]. This reveals that electric mobility resembles a disruptive innovation and new processes for value creation must be designed from scratch.

Value creation describes the activities within a firm or industry that produce added value such that the output of the transformation process presents an increased level of customer utility compared to the input [2]. From a company perspective, a value creation model needs to cover relevant processes and competences of a business that generate enhanced customer value [5]. The goal of value creation management is to generate sustainable competitive advantage for which innovation activities and value networks are significant levers [6]. The approach presented in this paper helps to develop a competitive strategy for value creation taking technological and market uncertainty into account.

In the second chapter of this paper, electric mobility is described in the framework of disruptive innovation and technological and market
uncertainties are explained. Thereafter, the limitations of existing models are clarified in the third chapter. The fourth chapter shows an approach to design value creation with respect to technological and market uncertainties taking the challenges of disruptive innovations into account. The approach is presented in more detail in the fifth chapter including examples from battery production. Finally, a conclusion summarizes the findings and gives an outlook on future research.

2 CHALLENGES IN DESIGNING VALUE CREATION DURING DISRUPTIVE INNOVATIONS

2.1 Electric mobility as a disruptive innovation

Revolutionary changes in product and process technology are described in the literature as disruptive innovations. In contrast to evolutionary innovations, disruptive innovations do not incrementally improve the performance of a technology but dramatically change the value measure within a competitive market. That includes that the performance of the technology might be inferior at the beginning, as it is with electric vehicles that have a reduced range and speed. In the long term, disruptive innovations outperform existing technologies as electric and hybrid vehicles will minimize emissions and increase the driving performance [7]. Disruptive innovations are characterized by a high market and growth potential but the development is not predictable at the beginning. High risks in market development and many technological alternatives are specific for disruptive innovations and represent the major challenge in designing a competitive strategy for value creation [8].

According to GOVINDARAJAN, the challenges of disruptive innovations are characterized by five aspects [9]. Table 1 gives an overview on these characteristics and shows that electric mobility can be described as a stereotype of a disruptive innovation. CHRISTENSEN already presented it as such an example at the beginning of his theory on disruptive innovation [8].

![Figure 1 - Electric Mobility as a disruptive innovation](image)

2.2 Technological and market uncertainties

Along with disruptive innovations, companies are confronted with high uncertainties. It is unclear which knowledge, resources or processes will be relevant in the future. The degree of uncertainty is substantial since future markets and applications of the new technology are unknown. Further on, the technological feasibility is usually also unclear and further development necessary. Hence, technological and market uncertainties reflect one major challenge of disruptive innovations [10].

Regarding the technological alternatives, there are first of all different powertrain configurations from micro hybrids to pure battery electric vehicles (BEV). But even considering only BEVs, different system designs exist. For example, the electric powertrain can be a central system on the axle or a closed system in each wheel. For each of the components, there are again various technological alternatives. For the electric motor, it is for example unclear if synchronous, asynchronous or reluctance machines will dominate in the future. These uncertainties in the product development result in an unclear perspective of the competences needed in the production of future powertrain components. Moreover, there is also a range of options in the production technologies. One example is the contacting of the tabs of the battery cells which can be done with different joining technologies like laser or ultrasonic welding [11].

The uncertainties in the market development can be motivated according to PORTER’S Five Forces [12]. First, new competitors enter the market of the electrical powertrain with many years of know-how and experience in components that are now relevant for the automobile industry [2]. Second, competition between current automobile manufacturers and suppliers sharpens as new customer loyalties are created, new co-operations are founded, and political support differs between countries [13]. The variety of technological alternatives in the powertrain described above reflects thirdly the threat of substitute products. Finally, regarding the bargaining

<table>
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<tr>
<th>Disruptive Innovation</th>
<th>Electric Mobility</th>
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<td>The mainstream market does not value the innovation’s particular package of performance attributes at the time of product introduction.</td>
<td>E.g. electric vehicles offer a reduction of life cycle costs (energy, taxes, maintenance) but have a significantly higher selling price.[10]</td>
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<td>The innovation performs poorly on the attributes mainstream customers value.</td>
<td>E.g. electric vehicles offer only a short range with current battery technology.[2]</td>
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<td>The innovation is first introduced in an emerging or insignificant niche market.</td>
<td>E.g. current electric vehicles are niche products from manufactory or prototypes for upcoming series. First products for a broader market still have high selling prices.[1]</td>
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<td>There is not necessarily a word-of-mouth effect, or</td>
<td>E.g. automobile manufacturers have detected a competitive</td>
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power of customers and suppliers, the uncertain question is how value creation will be divided between the automobile manufacturers and suppliers. To obtain current value share, the automobile manufacturers must cover about 50% of the production of the electric motor and most of the production of the battery pack [2]. Hence, technological and market uncertainties must be taken into consideration to design competitive strategies for future value creation.

3 DEFICIENCIES IN EXISTING APPROACHES TO DESIGN VALUE CREATION

Value creation has been subject to research and analysis for a long time in several different settings. Within the theory of strategic management, different approaches exist which can be fundamentally separated into a market and a resourced based view [5]. The market based view which incorporates the theory of industrial economics is based on BAIN’s Structure-Conduct-Performance paradigm from 1956 [14]. Therein, corporate strategy is seen from an outside-in perspective where the characteristics of a given industry, specifically growth, economies of scale and market barriers are essential. Following this basic approach, PORTER derived the competitive model of the five forces based on competitors, customers, suppliers, new market entrants and substitute products, as well as the generic strategies for corporate success: Cost Leadership with highly competitive prices as value proposition and differentiation including superior product performance. The segmentation strategy is an additional option focused on market niches. PORTER also introduced the value chain as a fundamental tool for the analysis of value adding processes [12]. The market perspective has been criticized for overemphasizing the influence of industry characteristics which would lead all rational actors to form equal strategies. On the contrary, the resource based view employs an inside-out perspective and the strategy for value creation is based on tangible and intangible strategic resources [15]. The resource based view is based on works from PENROSE and SELZNICK [16,17]. In order to qualify for competitive advantage, strategic resources need to be durable, value creating and difficult to imitate, replace or transfer between organizations [18]. Further approaches have extended the resource based view to centre on core competences, capabilities or knowledge [19,20].

The transaction cost theory within the new institutional economics focuses on the organization of value creation [21,22]. The optimal form in between hierarchy inside an enterprise and free market value exchange is traced back to minimal transaction costs. This model is therefore employed in determining the optimal depth of value added, while the dichotomy of the outsourcing problem was extended by a network perspective to the question of “make, buy or cooperate” [5,6]. Building up from these underlying models of understanding, more specific considerations have been devoted to the characteristic ways of creating added value. HEUSKEL describes four typical value archetypes within the production of goods and services [23]. While the specialist or layer player is focused on one specific process step within the value chain which is carried out for several different industries, pioneers or market makers innovatively create their own market by substituting old or integrating new value adding processes. The orchestrator focuses only on a small part of the actual value adding activities, yet coordinates the number of outsourced processes whereas the integrator represents a fully vertically integrated enterprise.

As a result of the deconstruction of organizational borders and traditional value chains, the focus has shifted from the logic of internal vertical integration towards an inter-organizational network of customer value creation [24]. KRAUS presents a stepwise approach for strategic value added design consisting of the generation of future scenarios, the definition of the core business and intended role, and the identification of strategically critical value creation activities [25]. The presented perspectives on value creation have in common that they concentrate particularly on the composition of value adding processes which the company carries out itself (i.e. core competences), those that can be conducted in cooperation with partner firms (i.e. value creation network) and the ones that are to be executed by external parties (i.e. outsourcing). Therefore, the value creation strategy can be aggregated to an innovation focus including the core activities and role of the company on one hand and a cooperation focus which covers the interfaces to external organizations. Though the given models are built around similar core topics, they develop a variety of solutions and methods. However, they cannot support a decision making process in a highly uncertain environment where crucial future determinants are unclear.

In the case of disruptive innovations, markets undergo fundamental changes through newly developing technology. The conventional approaches face the challenge that basic decision parameters cannot be analysed due to the risky and unpredictable market and technology development. As new markets are emerging, the competitive landscape as well as detailed customer preferences cannot be assessed ex ante which leads companies to stick with well-known products with seemingly less market risk [8]. Similarly, the firm’s resources and core competences of today may in fact represent rigidities for innovations of tomorrow [26]. Furthermore, transaction cost minimization does not represent a practicable managerial tool that sufficiently includes all social factors and risk considerations of in- and outsourcing [27]. The practically oriented approaches of value added design provide important insights for specifying
strategic value creation decisions, yet they lack a specific risk perspective necessary for the discontinuous environments of disruptive innovations.

As a certain risk is part of every innovation process, the integration of project and risk management methods presents a possibility to cope with pressure and changing environments [28]. However, the revolutionary competitive consequences of disruptive innovations are specifically severe in turning over traditional market value propositions and often misinterpreted even by profoundly established firms [29]. Hence, an approach for the design of the value creation strategy is needed at the beginning of planning process that takes the risk of disruptive innovations into concern.

4 DEVELOPMENT OF COMPETITIVE STRATEGIES FOR VALUE CREATION DURING DISRUPTIVE INNOVATIONS

The configuration of a company’s strategic orientation in value adding processes is a key factor for success in the innovation process. In order to meet the challenges of disruptive innovation, an integrated approach for future value creation is suggested that combines relevant aspects of existing models extended by a perspective that covers discontinuity and uncertainty in market and technology. The proposed model covers the core areas of value creation strategy and disruptive risk strategy, each from an internal and external perspective. The value creation strategy deals with the design of corporate activities through which customer value is generated, defining both the steps of the value chain that a firm carries out internally and the inter-organizational interfaces to external partners along the value chain [5]. The risk strategy accounts for the uncertainty in the development of disruptive technology changes. From the risk management perspective, market and technology risk are the pivotal concerns of the innovation process that represent the two perspectives [30]. The model represents a holistic approach which incorporates main aspects of the resource based view in the internal perspective, while core elements of the market based view are to be found in the external point of view. The approach can be separated into four steps which are represented by the illustrated focus points.

![Figure 2 - Overview Value Creation Approach](image)

Each focus area consists of two dimensions and contains a range of possible future options which require a company’s strategic positioning. Paradox extremes on both ends of the option spectrum are employed to visualize the existing alternatives of action and to encourage discussion among the management. The presented model intends to identify the relevant parameters of value creation and to illustrate possible configurations in the environment of disruptive innovation without generally judging the superiority of certain configurations. In fact, the actual definition of a firm’s position has to be individually defined in strategic initiatives [31].

4.1 Innovation focus

The internal perspective within the value creation strategy is composed of the innovation focus which outlines the core processes and the role of the company in the value network. The amount and character of conducted activities as well as the variance and spectrum of the product outputs are defined. The first positioning dimension is the depth of value creation which describes the amount of value added within the firm in relation to the overall end customer product value [5]. The secondary axis displays the width of value creation which includes the bandwidth of the product portfolio represented by the amount of product variants respectively industries supplied [31].

![Figure 3 - Innovation focus](image)

The architecture of the production of goods and services within a company is defined through its vertical integration and its horizontal diversification [25]. The decision which tasks a firm carries out independently and which responsibilities it gives to partners and suppliers is crucial for the success of an innovation [29]. The processes that are executed by the company itself should represent the core competences of the organization and such steps where a realistic differentiation potential exists [32]. However, one has to be very careful as these valuable activities may change over time and especially in the environment of disruptive changes, conventional competences may not be demanded in future scenarios [29]. Furthermore, trust and control in regard to critical know-how may justify the in- or outsourcing of a process step.

On the extremes, a company can choose between the focus on a single process step within the value chain or covering and coordinating the complete chain of production processes. Similarly, processes
can be designed to generate a single product or a range of different variants of the same product for a variety of applications and industries. The main advantage of the orientation towards the single process and product focus is the reduction of the time-to-market due to the minimized ramp up effort. On the other hand, covering the complete production process enables the improved overall optimization, coordination and adaption of the individual process steps. This option allows for installing a smooth process flow and building up know-how along the whole process chain [33].

4.2 Cooperation focus

The cooperation focus describes the external perspective of the value creation strategy. It includes the design of interfaces towards external partners in the production of goods and services. The dimensions outline the design of the collaboration in the vertical, thus up- and downstream, and the horizontal, thus on the same level within the value chain, direction of the value network [34].

![Figure 4 - Cooperation Focus](image)

The interactions between firms throughout the production of goods are governed by interplay of self-interest, competition, cooperation and mutual support. An example of vertical cooperation can be found in the automotive supply chain management including activities such as information exchange along the value chain to encounter the bullwhip effect, supplier development and competence management in virtual networks [35, 36]. Horizontal cooperation is depicted for example in joint vehicle platform development among different automobile manufacturers representing shared responsibilities on an equal level of value creation [35]. Several difficulties and opportunities are induced by the coexistence of cooperation and competition [37]. In between pure market sale and purchase, loose contract agreements, strategic alliances, virtual factories and joint ventures, the design of cooperation can vary within a wide range of degrees of intensity. The positioning within the cooperation focus has to consider on one hand potential risks, such as know-how drain, unclear responsibilities and increased dependency and on the other hand opportunities, such as economies of scale and scope, knowledge and skill acquisition, time advantages and investment splitting [24].

Autarky as one extreme illustrates the objective of maximum independency of a single firm with a low degree of cooperative interactions where no coordination effort for external interfaces is necessary. A closely connected and interdependent value network describes the other extreme wherein a number of firms concentrate on their individual competences only and produce goods and services that are marketed jointly. The main goal of a network structure is increased flexibility and reactiveness.

4.3 Technology focus

The uncertainty around the technological development of disruptive innovations constructs the basis for the technology focus. Technology timing and selection are important elements of a corporate technology strategy. Thus, technological maturity and market entrance timing on one hand and the number of simultaneously pursued technologies on the other hand represent dimensions for positioning [38].

![Figure 5 - Technology focus](image)

Disruptive technology changes are very difficult to forecast due to their initially low market performance and the existence of only few means to identify such innovations [8, 39]. Furthermore, in the early phase of an innovation before the emergence of a dominant design, several technological alternatives often coexist [38, 40]. At this stage of uncertainty, there are two basic options in particular to cope with the unclear technological future: Either a company can decide to specialize in one alternative and try to shape the future market actively, or it can try to keep all options open simultaneously by monitoring several alternatives in order to react quickly to changes in the environment [41]. Thereby, the specialist is exposed to a significant technology risk whereas the generalist on the contrary aims to cope with uncertainty by hedging and monitoring several options which increases cost and effort in exchange for decreased risk [42].

Similarly, the innovation timing has to be considered. While an early acting pioneer in a new technology can make use of first mover advantages, such as technological leadership, pre-emption of
scare assets and switching costs, a follower strategy can profit for example from free rider effects, decreased uncertainty or shifts in customer needs [43]. While for example high tech start-ups often possess the innovative flexibility for new development and early market entrance, large incumbents may use their market power to imitate and scale up. However, research has shown that in the case of disruptive technologies and profound value market migration, an early market entry and innovation leadership has proven particularly successful [8].

4.4 Market focus

Disruptive technologies can create completely new, unexpected market structures. The market focus demonstrates the target customer segments and the ramp up characteristics. The level of product standardization or individualization and the breadthness of the product ramp up present important measures that are described in the dimensions of the market focus [44].

![Figure 6 - Market focus](image)

Depending on the targeted customer segments, the product requires a different degree of standardization. For competing on the one hand in a narrow niche market, individual solutions and close customer relationships are a key factor for success with higher margins than in the broad market. In the broad mass market on the other hand, products need to be standardized to a certain degree in order to reach a sufficient sales quantity in several customer segments within a price competitive market [31]. Along with this, the ramp up can either be carried out gradually starting from one focal point (waterfall) or rapidly on a global scale (sprinkler strategy) [44]. Due to resource restrictions and the importance of personal relationships, small niche players tend to employ the first, continuous option [45]. At the same time, large enterprises often aim for maximum growth and ignore small market niches due to low turnover. Therefore, a focused niche strategy that aims at market leadership within a small segment can prove to be successful, especially since disruptive innovations often emerge within initially small niches. However, concentrating on the niche market also includes a substantial market risk regarding the high dependence on a small segment, the threat of premium status loss or substitution and the minor economies of scale [8].

![Figure 7 - Strategic value creation model for disruptive innovations](image)

The four focus points of the value creation model for disruptive innovation combined to a framework visualize the strategic alignment of a company’s configuration. It can be employed to discuss positioning options in the handling of innovations and serve as the basis for a target/actual analysis. Employing the scenario planning method future configurations and targets can be created, analysed and evaluated.

5 EXAMPLES OF BASIC STRATEGIES FOR VALUE CREATION

The presented framework can be used to show the consistency of a company’s strategy for value creation. Since up to now no empirical data has been collected, all positions in the framework can potentially be combined. Nevertheless, basic strategies can be derived as two examples are given in Figure 8.

![Figure 8 - Basic value creation strategies](image)

The case of company 1 shows a very general approach. In all dichotomies, the company is oriented to the outside position. In this way, the company focuses on the whole process and works in a wide network together with partners. Moreover, the company tries to minimize risks by following a wide range of technologies and a broad market penetration. A generalist behaviour is employed in order to deal with uncertainty and to produce open-mindedness towards all possible options [31].
However, to follow this paradigm, high investments and assets may be necessary which especially larger, established firms bring along. By monitoring several technologies and pursuing a follower strategy, a firm tries to avoid high development cost and risk while using marketing and scaling skills with promising options [46]. The cooperation within the network generates new potential for impressing customers through new product characteristics exceeding the basic functionality. The lower cost structure based on outsourcing allows for a price competition in the broad market that still gains profits.

Taking the equipment suppliers for battery production as an example, this would be a general contractor delivering the majority of resources needed for the whole process. Automation companies take this role together with partners for special processes like coating. An effective technology management is required as these general contractors need to find a range of solutions for different customers and often only purchase the technologies. The market penetration is wide since they can usually build up the equipment worldwide. The overall process can be individually designed for customers but often consists of standardized modules.

A focused approach is shown in case of company 2. The company is oriented to the inside position in all dichotomies. The focus is on a single step in the value creation and on a specific technology. These types of companies strive for technological leadership in their respective field; they act independently and sell technology to specialized customers. With their technological focus these companies often operate in a niche market. In early stages of product development, small focused firms are particularly capable of dealing with interdependent product architectures and degrees of freedom in engineering [29]. Autarky in value creation presents a way to reach optimal product functionality while supply structures for a new product are not established. These firms mainly produce customer specified, individual goods and services within a niche market which may nevertheless be the basis for a fast growing disruptive innovation. While focusing on specific steps of the value chain, these frequently rather small firms develop innovative solutions in cooperation with their customers early on.

One example in the battery production could be the suppliers of special resources like testing equipment. They focus on single production steps and follow one technology which differentiates them from other companies. Moreover, testing equipment is usually purchased by general contractors. Since these companies are often locally oriented they have a rather limited market focus.

6 CONCLUSIONS

Electric vehicles will gain a significant share of the automobile market in the future. To build up a competitive value chain, new strategies for the value creation are essential. These strategies have to be designed from scratch. Required core competences, supplier networks and skills of employees differ significantly from the existing value creation of the internal combustion engine. Hence, electric mobility can be described as a disruptive innovation with the challenge of high technological and market uncertainties.

Existing approaches to design value creation fail to cover challenges of disruption in the industry. Whereas market based view, resource based view, transaction cost theory and risk management as well as several more specialized models provide valuable insights, the fundamental consequences of disruptive innovation cannot be addressed in a holistic way. Thus, a new, integrated approach to design value creation under disruptive innovations has been presented.

The given approach can be separated into four steps. First, a strategy for the value creation is needed. From an internal view this includes the definition of the depth of added value for the company. Is the focus on a small part of the value chain or rather the whole process? Second, from an external view the strategy for value creation involves the design of the value network. Is a close collaboration or joint venture useful or rather an independent position in the market? Third, a risk strategy to take the uncertainty of disruptive innovations into account is needed. The internal view covers the strategy to manage technological alternatives. Will all technological alternatives be considered or only single ones? Fourth, in the external view of the risk management, the market development is regarded. Is the focus on a specific market application or rather on worldwide standard customers? In each of the four steps, companies can follow a focused or a general strategy.

Future research is needed to detect the successful strategies within this methodology. Based on current research, all positions in the framework are possible. Empirical data could help to identify successful strategies and to manage disruptive innovations. Currently, this data is collected in a survey to investigate successful value creation strategies.

Further on, recommendations are required for the extreme points in the framework, e.g. how to manage various technological alternatives at the beginning of the innovation process. As the challenges described in the risk strategy are inherent in disruptive innovations, management strategies to cope with them are needed.
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BIOGRAPHY

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