New Product Conceptualization Trough the Technology Based Use Function Reconfiguration

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Abstract

New technology based innovations often become the key factor for the company portfolio configuration. Its purpose is to minimize the investment risk and insure the future market success. Hence the importance of adequate strategy model formation, particularly in case of actual market saturation and growing pressure for profound differentiation as the source of commercialization process for technological innovation. The conception of such strategy model based on Moore's law is presented and its viable parametrization using the technical debt and customer perceived value is discussed. Also the interesting approach the structure of product consisting of the use function configuration is shown and explained with an example of new product conceptualization. The potential model of use function value and technical debt as the company portfolio source is finally presented and future areas of research are indicated.

Keywords: New technology based innovation, product port-folio, customer perceived value, technical debt, product use function configuration

1. Introduction

Actual market requests underline the importance of customer product perception and make the important challenge for companies' differentiation strategies. The differentiation concept enlargement is influenced by the new technologies development perceived as the main source of innovation based value process creation. The practical aspect of this changes in company strategy definition is reflected by new product development process reconfiguration. Particularly at the point of product conventional definition contestation in the context of new product dimensions researches often associated with the technological epiphany. The logics of innovation commercialization implies the rational identification of possible new use function, assigned to application of the new technologies. This attended rationalization of new product idea necessitates the reformulation of product notion. The Application of technological innovation in this context invokes in this case the parametrization of this new notion. The new possible conceptualization of the product is proposed and the measure tool in the context of innovativeness and customer perceived value is conceived. Also this idea of new product idea formulation complements to possible company new technology portfolio strategy model. Hence resulting the perspectives for new technology based product concept evolvement as the useful management tool.

2. Technical Debt and Customer Value as Product Innovativeness Parameters

2.1. Technology S-Curve and Technical Debt as Innovation Strategy Drivers

To anticipate technological progress, the company strategy models are often based on the technology s-curve, presented by Foster (1986). This curve reflects the progress of a base technology as a function of the R&D effort. The s-curve is also adopted to the area of product and technology substitution. Analyzing the possible management application of technology, P. Asthana (1995) remarks that the primary barrier to adopting a new technology is uncertainty about its acceptability to the market. Any unfamiliar technology takes time to gain acceptance in the marketplace, and the early market penetration is slow because size of buyer market is small. Being first makes for the company the unique situation of acting without competitor's pressure, so the capture of large market part is possible and the position of market innovator is granted and the introduced product represent a particular value for the customers just because of its innovativeness. This situation makes possible to realize the extraordinary margins, but at same time this unique market position is very suitable for other companies hence the danger of imitation. The concept fails to take into account the impact of how long it will take for the market to accept new high-technology products. For a product that has no time lag between the technology s-curve and the marketing s-curve, first-to-market certainly can be a winning strategy which exposes the importance of

commercialization time shortening. Sood and Tellis (2005) signalize the multitude of technological s-curve interpretations, present its holistic description based on three stages approach. The first is introduction stage, during which a new technological platform makes slow progress in performance during the early phase of its product life cycle, because the technology is not well known and may not attract the attention of researchers. Second reason for this slow progress is the need new technology translation into practical and meaningful improvements in product performance. Then comes the growth stage with the rapid propagation of new technology, this stage usually begins with the emergence of a dominant standard which determinates the characteristics of most products and consumer preferences. The rapid progress leads to increases in sales of products based on the new technology, which increases revenues and profits and offers further support for research and for performance improvement. The next, third stage is maturity. This is the period of technology slow propagation and its market saturation. The maturation is due to the less innovation activities because of large competitive offer and the loose of attractiveness for customers. Pearce and Robinson (1994) remark that in a rapidly growing market, even a small or relatively weak business often is able to find a profitable niche. The business strategy of differentiation requires that the business have sustainable advantages that allow it to provide buyers with something uniquely valuable to them.

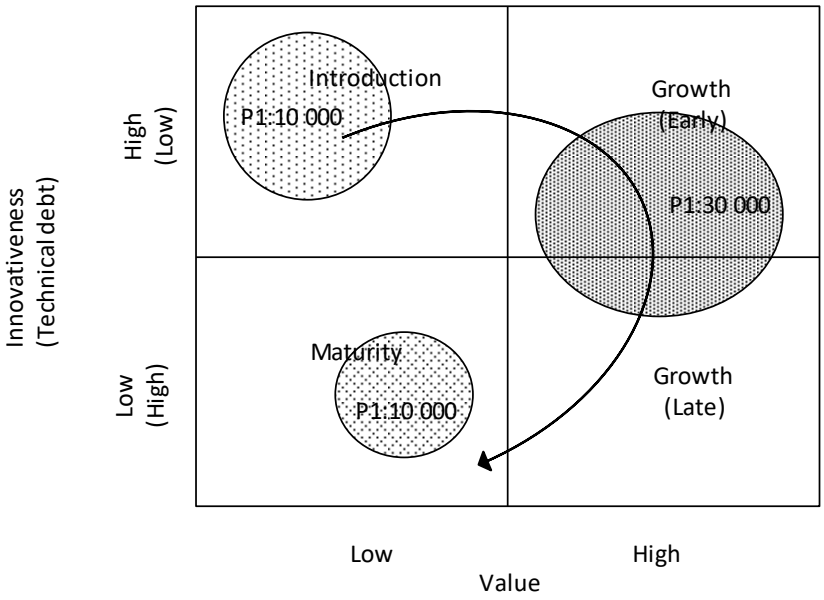

Figure.1: New Technology Based Product Portfolio Analysis Model Concept Proposition Based on S-curve Holistic Interpretation. An Example of Products (P) and Their Repartition, (Use propagation: items of product).
Source: based on Filipowicz (2014)

A successful differentiation strategy allows also the business to provide a product or service of perceived higher value to buyers at differentiation cost below the value premium to the buyers, which makes the described market conditions similar to those characteristic for new technology based product. Differentiation usually arises from one or more activities in the value chain that creates a unique value important to buyers. The innovative company can show the importance of the innovation through its goals and these are different from one firm to another. In some firms, the innovation is in the essence of products and services, therefore, the business philosophy must demonstrate the firm´s commitment with technological innovation. The simplest way to visualize this commitment will be the use of proposed tool (figure 1).

To use this tool, each of the company product or offer proposition position depends on innovativeness rate and offered value. The proposed model becomes helpful for estimation of potential participation of customers in the case of new technology based products. Innovative companies in aiming to anticipate the optimal value of new technology product incorporation, have to be strongly engaged in co-production activities, hence the necessity management operationalization of the presented model. It is also important to underline the communication function of this tool by providing simple visualization of changes appearing in value allocation towards different innovation based products. Thus providing management with a holistic perspective on the company's value creation process, which allows the comparison of the development of different projects or technologies.

But company product innovation strategy must be conceptualized not only by focusing on R&D activities, but also by linking the innovativeness of prepared conception to the company potential. In fact, when analyzing the actual state of

organization, innovation strategy design should be associated to technical excellence which has to be measured by both; capacity to deliver customer value today and by creating an adaptable product for tomorrow, hence the conception of lowering technical debt as an integral part of the development process of new technology based innovation (Highsmith, 2009). Technology based competitive advantage is not the key company success factor. Because due to rapid propagation competitors can easily react by imitating products. In this situation, producers have to enlarge the customer value proposition by changing the product perspective. Then appears an interesting approach to the product structure by introducing the notion of use function, which gives the possibility of more detailed analysis, adequate to the eventual operationalization of new innovative product and which also précises the use functions value proposition.

2.2. Customer Value Estimation of Product Use Function

Value based management process underlines the importance of competitive customer value added as the most important source of shareholder value (Porter, 1985). From this perspective, customer value add (CVA) can be defined as the relationship between the degree of customer satisfaction with the products and services received and the satisfaction with the price paid. In case of incremental innovation, company creates customer value added when its products and services are of greater value than it could be expected from those of competitive companies in similar markets. CVA can be measured through market surveys of customer satisfaction and is calculated as a ratio of a company's performance relative to its competitors (Laitamaki & Kurdupleski, 1997). This definition of customer value is however based on a comparison of competitive offerings on the premise that they are available, which occurs rarely for innovation based products or services. In effect, CVA is an external measure of customer value based on analysis of competitive products or services. From an internal perspective, the capability of an organization to capture the strategic value of a new technology implementation is a critical competence for successful innovation and thus, for competitiveness. Due to the complex nature of rapidly emerging technological changes, this organizational capability is imperative yet difficult to create and sustain. As a result, the strategic process of technology evaluation for successful innovations varies from company to company. Successful technology innovative companies take into consideration customer needs before the introduction of technological changes by applying technology evaluation strategies. Hence the interest for the use of customer perceived value notion (CPV) which seems to be more appropriate for valuing the radical innovation based product, because of underling also the utilitarian and quality aspect of new product (Asgarour et al., 2015). Technology evaluation with the participation of potential customers is critical, and should therefore form an integral part of innovation routines. This is in spite of the fact that market dimensions for technology evaluation are often critical for diffusion of innovation and the future technological radicalness of new products or services. This suggestion leads to more detailed notion of technology use function customer perceived value defined with the formula of CPV = (quality + utility) / price (Dobbs, 1999). This notion links the value perceived by customer with the utility of the product and, what is important in the case of innovative products, it doesn't relate to the competition. In this formula, value is the subjective appreciation of offered utility compared to the price, this means that product value can be determined by the customer's sense of offered utility, often defined as the satisfaction experienced from use of the product. In this way the notion of utility consistently expands use function relevance and the customer perceived value increases in connection with the use functions development or with diminishing price. This individualized customer approach can be regarded as a crucial factor in a situation where a company tries to commercialize new technology. The role of the customer is decisive and their opinion should be benefited from even in the user function determination process, thus much earlier than market testing of new products or services. This strong emphasis on the customer role in the innovation development process makes possible a parallel development of the commercialization concept which minimizes operations time and the risk of market failure (Ritter & Walter, 2012). Analysis of the proposed value level should therefore enable a definition of the set of user functions F_0 which are to be available in a specific version of product in period RD_0. In the value creation model proposed by Ho et al., (2014), value can be described as val(n) of user function f(n) and is defined as the weighted average of the ascribed user function priorities from among all the (weighted) criteria from all the (weighted) interest parties. One can conclude from this that total value offered $Tval(F_0)$ is defined as the sum of all the values of the individual user functions: $Tval(F_0)=\sum_{f(n)} val(n)$. Obviously, value offered to a customer will also be associated with the quality of the product at a specific moment of time and the simplest approach is to associate this with the number of defects identified which are eliminated in subsequent versions. For each user function it is possible to define its technology corresponding and also the level of offered utility and also, to develop the formula with notion of CVA or CPV. Hence the possible formulation of CVA as ratio of customer value add of offered functions relative to the $Tval(F_0)$. Or by analogy of CVP as the

perceived value of F0 is expressed by proposed formula:
Tval(F0)=[$\sum_{f(n)}(quality(n) + \text{utility(n)})$]/price(F0), where the price of F0 correspond to market price of product incorporating the F0. The presented parameterizations of value added allows to adapt them as the quantitate dimensions of presented tool for new technology based product company strategy estimation (figure 1).

3. New Technology Based Use Functions as the Base of New Product Conceptualization

3.1. New Product Conception Based on Use Function Port-folio

The idea of an innovation strategy detailing tool based on the premise that the company market offer is directly associated with the value of offered use functions can be used as a base for an organization's decision process. This issue of the innovation commercialization dilemma and its impact on a company's condition is often emphasized concretely at the moment a new technology investment decision is taken together with the realistic possibilities of monitoring and measuring this activity. Obviously, the incorporation of customer opinion into the strategic decision level is justified and reasonable in preparing market actions which insure a positive response to innovative offer commercialization (Mugge & Dahl, 2013). Alas, discontinuities can still be observed between innovation based new product development and its integration with the actual company portfolio also concerning the company strategy and the needed resources. They are resulting in a less than holistic decision perspective so required at strategic level management especially in new technologies based firms. Existing and often used product portfolio strategy models shall also include technology insights in the rationalization of innovation management process (Buganza et al., 2015). An outline of a future company product portfolio whilst dynamic technological changes take place shall also, even as an indication, reinforce a company's decision confidence by including multivariate company technological innovation development scenarios (Samli, 2011). Hence the question about the significance of product notion, particularly in the actual innovation oriented company management process. The conventional meaning of product seems to constrain the innovation based commercialization potential. Enlargement of product concept is evoked in marketing, often associated with technological epiphany phenomena, implying the new product meaning which is corresponding at operational level to the notion of product use function (Verganti, 2011).

The use function based concept requires the assumption that it is possible to define a set of use functions characterized by customer value and derived from the application of a specific technology. As a consequence, there is also the possibility of extracting from the antecedent use function; a subset Q_F which can be conceptualized with existing knowledge and technology development forecasting. All these use functions will also be described by the customer perceived value estimated through market research. Moreover, by constricting this subset, it is possible to delimit its subset Q_c of use functions which are associated with the actual available new technologies depending on a company's own core activities and representing the company interested customer perceived value level depending in turn on the expected financial results. Extracting the last subset can thus serve as the base for a company's innovation strategy design tool. The presented matrix groups use functions which are possible to prefigure with existing knowledge about the potential new and existing technologies and are possible to be perceived as valuable for the customer - $Q_F = \sum_{\substack{1\le i\le 10\\ 1\le j\le 10}} F_u\ (td_i, cpv_j)$, in this way, Q_F represents the viable area of company possible choice regarding pro-innovative development. It will be also appropriate to define the Q_C subset as denominating the company achievable use functions with their known value of technical debt and the actual customer perceived value - $Q_C = \sum_{\substack{3\le i\le 8\\ 4\le j\le 7}} Fu(td_i, cpv_j)$. Also, the value of the maximum acceptable technical debt level is determined by the company's responsiveness to a customer need shown in accordance with the product use function evolution model (figure 2). For every use function product or whole company offer, the value of its technical debt can be set out in time or money units. The application of the tenets concerning the technical debt presented above can be useful in a concrete company innovation gap evaluation at the level of singular product or of the whole organization offer. This will be the case for a new technology based use function introduction with potential technical debt bigger than the calculated maximum value. Customer perceived value as the second dimension of the proposed concept is also calculable and can be defined in the simplest way as the margin realized on a newly introduced use function as deducted from the product sales margin, but only on condition that the company uses a value based management approach. On these assumptions the example of product level analysis, where the new product concept P_C is considered as the sum of use functions. Hence P_C= {fu (1, 2), fu (4, 5), fu (4, 8), fu (7, 6)}. The use function fu (1, 2) is at the stage of introduction based on new, yet undefined new technology, having low technical debt and a high degree of innovativeness, but with a low value staying unknown for the customer and stays out the actual range of the company. Its potential materialization can be relished through the epiphany.

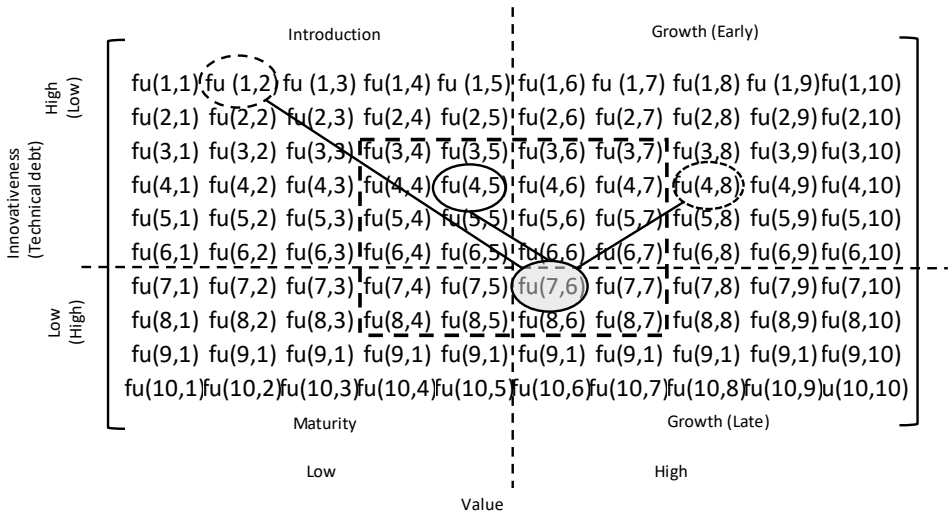

Figure 2: Conceptual Model of New Product ($\boldsymbol{P_C}$) Consiedered as Technology Based Use Function ($\boldsymbol{fu_i}$) Portfolio. Source: Own

The use function fu (4, 5) is the use function based on new technology being actual commercialized by company. The next use function fu (4, 8) represents the high value for customer but needs to be implement into the company by means of new exogenous technology transfer or external acquisition. The last considered use function fu (7, 5) is the most important in company offer due to generated customer value, probable linked to the core business, based on perfectly controlled company technology. The presented use functions mix product concept discussion shows the possibility of more detailed approach to the company offer approach. These contentions confirm that the link between the product and its technology can be enlarging and that there is an interesting analytical perspective based on development and diversification of possessed technologies through the use function as the base of configuration system. The remaining use functions stay operational for the company in technical debt and market delimitated dimensions. Although, it must be borne in mind that the presented description does not take into account the technical debt structure, which is too early to include at the moment of model creation. In addition it is possible that this structure will reflect use function interaction synergies or dyssynergies.

3.2. Use Function Based Future Product Configuration

The anticipation of user needs will be crucial for the composition of a new technology portfolio even when the company outsources some of them. Often in the case of adopting a presumption perspective on the innovation process, the challenge in the management process is to preconfigure a new use function, which may satisfy an emerging market need concept (Keinonen & Takala, 2006). In addition, it is important to make possible for a company to configure and evaluate a multiple innovations based product portfolio and make possible to modify product structure with new use functions as new technologies are introduced. In the customer assessment of the company offer, innovativeness remains a very important constituent of the value creation process. Similarly, company potential for development is strongly associated with large numbers of new product market introductions (Schultz et al., 2013). Consequently, innovativeness, mainly in the terms of strategic elasticity, becomes important as a measure of company technology versatility and agility. Its analysis and assessment can be crucial in determining the impact of new technology uses not only on the attractiveness of offered product but also on the future company portfolio configuration as it evolves due to customer references. Particularly in the case of a high level of environment dynamics, the company has to be adept at considering multiple forms of portfolio configuration for possible new technology uses (Mul & Di Benedetto, 2011). This approach can be very important if the profitability of new technology is concerned and can serve to conceptualize often required quantitative managerial decision models of product innovation and NPD project efficacy (Artmann, 2009). Hence the possibility of product analysis as a set of use functions where every use function is supported by company used technology meaning that the innovativeness of a proposed use function is linked to the company technology development stage (figure 3).

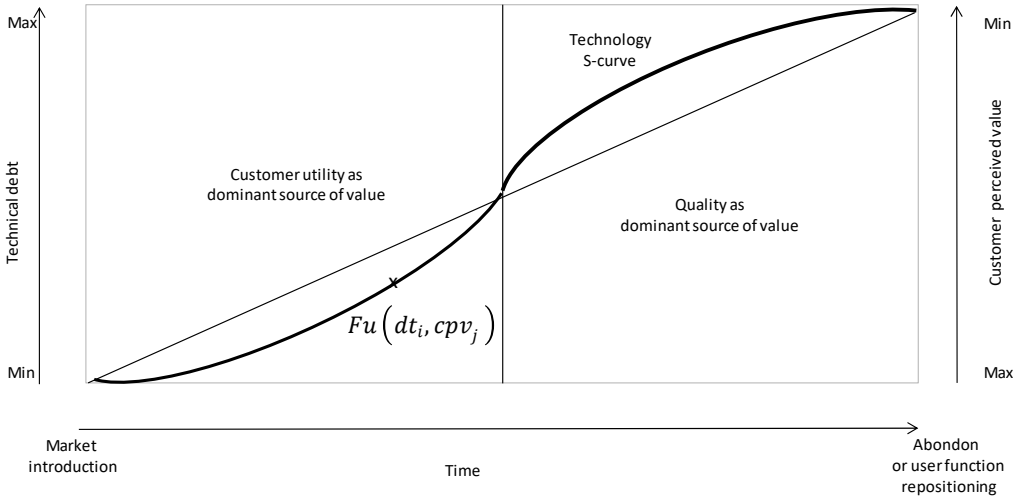

Figure3: Conceptualization of Product Use Function Evolution Model.
Source: Own

The concept of product modularity – often popular in production management – can be applied here as the base for modular conceptualization of innovative products. The idea of modularity can be formalized at the level of product (P) which can be defined as the sum of offered use functions - P=$\sum_{i,j}^{n,m} Fu\left(dt_i, cpv_j\right)$. Every use function is attributed with its technical debt value and its customer perceived value. As mentioned earlier, it is also possible to assume new use functions, which are possible to offer with new technology integration and which are new and valuable for the customer. The customer can also assess the attractiveness of a proposed use function by its value assignment. Basing on use function technology lifecycle stage analysis, it is possible to propose the modification of a proposed use function configuration through continuous contact with the customer (Filipowicz, 2015). The proposed product use function parameterization underlines its similarity to services offered to the customer (Sorli & Stokic, 2009). This perspective on use function evolution enriches the conventional product models and can serve as the base for user centric design of the new product. Also the suggested measurement can be used for the mapping of customer value perception evolution of the offered innovation. The mentioned new technology base for product development can be seen as a leading idea for reaching a balanced competition advantage through the technical debt optimization of every use function proposed by the company.

In effect, the assignment of technical debt to the use function can be an interesting manner either of new product or of whole company product portfolio configuration where the monitoring of use function technical debt dynamics results in financial potential for the new technology based innovation funding strategy seen especially in product portfolio development possibilities.

4. Conclusions and Further Research

Introduced use function product visualization can be also applied as the base for the communication process with customer. In accordance with the customer judgment, a set of use functions can be changed or totally new and innovative products can be designed and their value perception can be tested virtually. Moreover, potential customer segmentation for a new proposition can also be created. A similar proposition can be formulated at the level of the company use function portfolio to become the base for new product offers. The proposed perspective of product use function conception can be treated as the base for the future value proposition as a function of technological change. The proposed parameterization – value and technical debt – can become the base for a framework for mapping the relationship between company innovation effort and its consumer perception. The company first application trails are undertaken.

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