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Conceptualization of product development model based on use function evolution

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Abstract:

Aim: The aim of the article is conceptualization of product model basing on use functions.

Design / Research methods: Literature analysis and model concept identification , theoretic model formulation.

Conclusions / findings: New product development processes based on innovation are still the most important challenge for companies. This process should link company decisions on strategic and operational levels. Classical approaches show their insufficiencies particularly when a company introduces a technology innovation based on a new product. The risks accompanying this type of development and the growing involvement of the customer in innovation commercialization could however provide sufficient reason for developing a new approach to product structure and lifecycle evolution. Hence the proposed new product structure based on the determination of use functions.

Originality / value of the article: technical debt as innovativeness parameter, concept of quantitative model of new technology based product.

Keywords*: NPD, Product structure, use function, customer value, innovativeness, technical debt.*
JEL: O31, O33, M11.

1. Introduction

Companies commercializing innovations could develop new offer that enable flexibility by allowing consumers to develop product concepts based on their own preferences. This concept of customer integration into new product development is gaining an important role in the management process, particularly in its communication aspect (Ziamou et al., 2012). As a first step this should imply

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a concept of a theoretic decision model which is useful for product design where the applicability would be confirmed by the degree of successful interaction efficiency. This ensures the integration of customer and organization innovativeness and finds its amplification in the research of new product concepts which are successful in innovation based market rivalry. This approach, appreciated by practitioners, presents the different issues regarding the future needs and requirements of customers as risk minimization essentially linked to new product development (Bartl et al., 2012). Hence the need for conceptualizing the model of a new product which can be applied in qualitative and quantative approaches to an innovation commercialization process.

2. The Role of use functions in product value creation process

The Role of customers in the innovation of new products is widely recognized and often exploited when the question of offered value maximization is discussed. The fact of being the leader on a conceived new market gives the possibility of creating an autonomous price policy so a value creation strategy can be applied without limitation as long as customers perceive the distinctness of proposed product use as satisfying their needs (Kumar, Phrommathed, 2005). Innovation based product commercialization gives the company a unique possibility for new market creation and also its development in the later product modification process. The first stage of potential success depends on the radicalness of the commercialized innovation in terms of its fit to client need satisfaction. This is the moment at which the decision about the future development of the introduced product together with its future composition should be taken. In this way the innovation development process becomes more incremental and its logic is more associated with completing the existing core product with new features. In this way it is possible to enlarge its use possibilities or to create a new use either through new or through different configuration. This will also positively impact market growth because of value proposition development. Hence the popularity of research concerning the possible use of Customer Relationship Management (CRM) as the bridge between the customer and the company serving to develop the market valuable application of new technologies (Huang, Wang, 2013) treated as potential sources of enlarging new use functions and also the new product structure. This approach underlines the role of customer acceptance of offered product functions and redefines the term of product utility as the sum of the utilities of individual product components (Eversheim, 2009). This perspective enlarges the

product concept definition which is now perceived as a combination of different grades of distinctness of the different characteristics arranged by the user. Associating customer value to the development process of new technologies should be a key factor of new product development (NPD) being the condition for successful commercialization. Company management is strongly concerned by rationalization of NPD in its first stage to make their decisions less risky and more adequate to the customer in terms of the market placement of new technologies (Jespersen, 2012). What is often underlined is that changing market conditions influence the detail level of new product conceptualization when there are no competition references. This is the case in new technology based innovation. The importance of the customer role in this process is supported by studies on consumer behavior which suggest that consumer value design can help a company amplify the degree of differentiation.

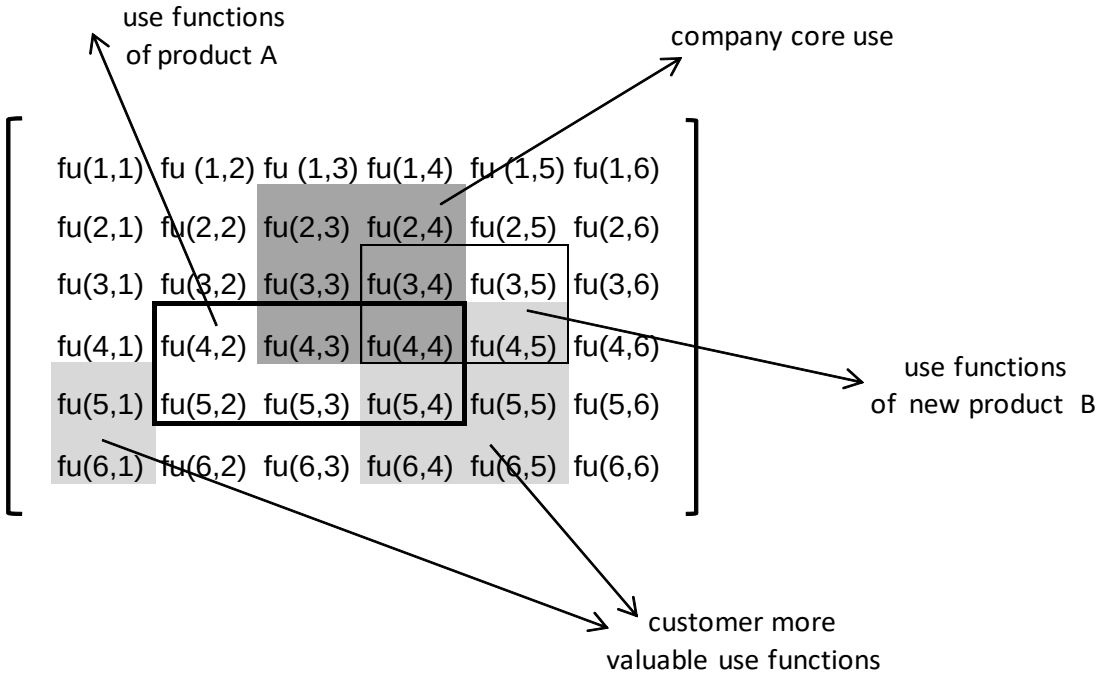
The Association between product differentiation and complexity can be perceived as the right direction not only to satisfy consumer needs but also to generate them. In this way the value creation process can be expanded to conceive new use functions, which means the decomposition of the offered value of a product into several product function values. Adopting complexity as the key factor in the product value offer makes it possible to offer a differentiation based product to a large group of clients, in effect market segmentation will be possible with the activization of different use function configurations. In some cases this configuration can change the main product purpose (ex. bike vs. exercise bike) and consequently attract new clients, according to the rule that given more complex designs and the option to look at specific modules within a single design, more individuals and individuals with different knowledge backgrounds might be able to relate to that design and find various parts of it interesting (Jensen et al., 2014). This approach to value creation by use function analysis presents to the producer new possibilities of the optimization of company product policies whilst at the product structure level and minimizes the risk of failures if used in the first stage of NPD. This issue, which underlines the role of product utilities in value creation, should be deepened because of different perception modes of product functions which reflect customer preferences for new products. The integration of customer optics in the product function design must be realized with the understanding of the hedonic and utilitarian approaches regarding the product (Verhagen et al., 2010). The innovativeness based value creation process must be developed as a compromise between the hedonic and utilitarian perception toward customer need satisfaction as value maximization is the main company objective. This process will

be realized during every phase of the live cycle and imposes an equilibrated development of product use function, meaning that with time some use function originally perceived as hedonic become, with time, utilitarian. In addition, through use function development, a company can optimize the offered value in a manner which conforms to the degree of new technology exploitation (Ha, Park, 2013).

Adopting this approach can make a company ready to perceive the business offer not only as a wide range of products but rather as a set of offered functions (ex. software). The hedonic-utilitarian dualism described earlier, can serve in this case as the base for an offered value mapping process and then as the first step in new product conceptualization particularly in product core function design. The question of core product function cannot be easily determined because it is more an issue of company strategy contextualization – some companies augment offered value based on an utilitarian use function moving to a use function potentially perceived as hedonic (ex. using I. Maslow model logics). Others "break the rules" by proposing a unique set of hedonic use functions and then completing with utilitarian functions. Of course, the behavior described is similar to the nature of the innovation development process and for this reason, new product development must be realized using customer designed functional characteristics which will, in this way, increase the potential utility market value or create new use associations augmenting product efficiency and comfort (Townsend et al., 2013).

Hence the notion of functional values related to product features, which can be defined as use function aggregation presenting benefits to the consumer. In admitting the central role of the customer in the value creation process, it is possible to engage the customer in the product design process, allowing them to compose the most attractive compilation of features. This approach seems to be very attractive in the case of innovation product development (IPD) and can be used as a base for the conceptualization of product design from the perspective of the consumer (Moon et al., 2015). The understanding of various customer value preferences and their hierarchization minimize the risk of market failure and also should be considered as the starting point of future company product portfolio composition. The other dimension of this approach is to obtain and to understand the customer's product innovativeness perception through their value composition of product features. This description of the customer role in product feature valuation is currently applied in the case of packages of offered services and their compilation can be optimized by the company with regard to the strategy realized or the availability of resources.

Fig.1. Company offered use function set and its customer preference distribution – platform general theoretic approach



Source: authors' own elaboration.

When developing a product the design team must get, on one side, a clear sense of the functions that target consumers want and expect corresponding to the assigned market value and, on the other side, a readiness on the part of the company to offer the complete use functions. Under the premise that is possible to consider the company offer as the collection of use functions, every current and future product can be represented as a use function configuration (fig.1.) with a set of use functions represented by: fu(t,v), where t is the technology applied to obtain the use function and v is the customer perceived value of the use function. When fu(t,v) = 0 it means that a specific use function does not exist or has not yet been invented.

Based on what has been presented above, a company's offer can be regarded not as a combination of products but as a combination of use functions. This idea for offer presentation, particularly in the case of traditional product oriented companies must take into consideration the historical specialization of the company understood as its technical specialization around applied resources. From this is derived the concept of core use function which will be therefore related to the company function realized within strategic process management, and strongly dependent on

organization core competencies being often conditioned by the current development stage of a company and the nature of accessible resources associated with owned technologies. In this context, modification of a company's core use function offer results in a radical innovation by the organization.

Consequently, it is possible to analyze provided use functions in the context of the actual product offer and the future proposition including customer expectations in the value of product. In extreme situations, this mode of analysis can be used for a new product design process carried out under a customer valuation regime. Design methods based on a use function platform is feasible and can be effective, and is widely requested in company theory and practice. This type of use function platform can illustrated as a company's collection of shared design and common parts within a family of products, and can be the basis of a series of derivative products (Fan et al., 2015). Analogously, it is possible to develop a definition of company product family based on a use function platform, which is a configuration of closely related or not related use functions derived from the configurations of components and subsystems optimizing the customer value and which stay subordinated to current and future company resources.

3. The impact of new technologies on use function design

The concept described above namely basing a company's future product portfolio on use function composition enables a configurative innovation process, this is particularly important in new technology based products where there exists a very significant problem with assessing the degree of innovativeness. Low innovative products have a reduced potential customer value perception and high innovative products are often undervalued because of technological complexity and insufficient customer recognition (Schultz et al., 2013). Hence the need for combining technology with the customer perception to form the base for new technology product development and enforce the impact on the prototyping stage to enable market success. Conventional prototyping is often the source of rising costs until the optimal level of customer need satisfaction is obtained and the new product is introduced. Particularly in the case of innovations, market assessment is made ex-post using a sequential operation logic which potentially causes delays and additional production reconfiguration costs. Using this market introduction approach means that new technology based customer value creation is the consequence of an investment

process yet to be undertaken where, in the case of market failure, there is no possibility to avoid losses. The same applies to new product differentiation projects (Holt, 2002). New technology market valuation could be better realized in parallel or in the first stages of development as a part of making the investment possible. At same time market introduction of a new technology must be preceded by a profound analysis of its customer value, from this arises the notion of technology customer function which is associated with the product's new features.

The proposed attempt to define technology use function is similar to its product connotation but its practical definition and valuation will become the source of product functions. If the purpose of a product function can be described as providing value for the customer because of its usability for need satisfaction, the technology use function must be understood as the future source of market success of the new technology based product. This premise enables a basic parameterization in terms of cost, technical debt, life cycle stage and customer value where the significance of those parameters will be similar to the meaning of product function but with some extensions.

The customer value of a technology use function will be defined with the formula for customer perceived value = (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.

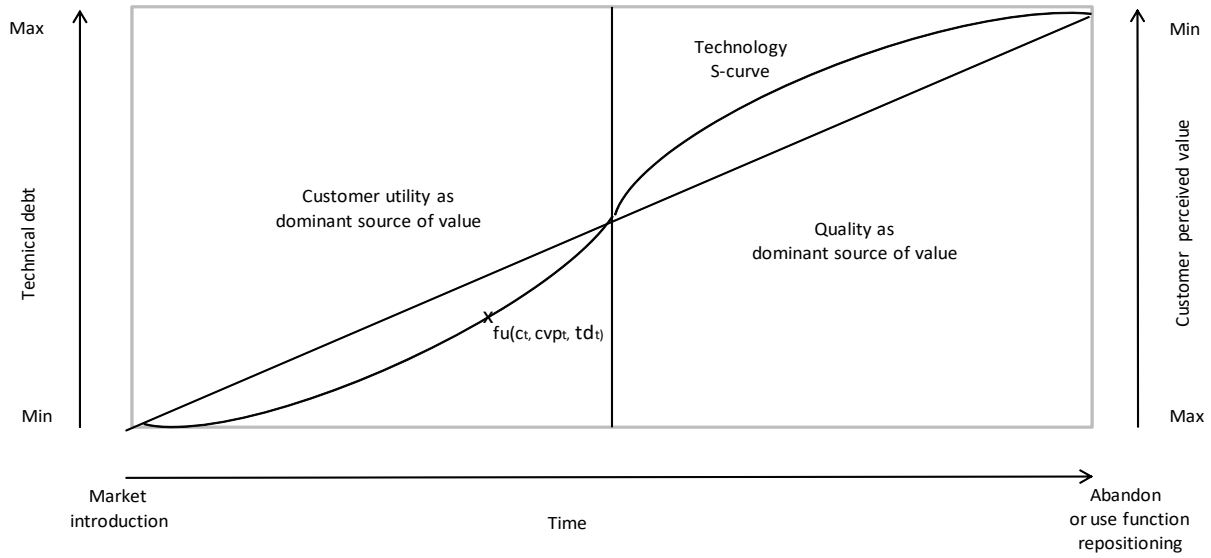
Technical debt will be expressed as the deferred costs of change requests and defects (Snipes, Robinson, 2012). Technical debt appears as the result of time pressure arising from fast new product market introduction and if not controlled, diminishes future customer value because of a growing lack of customer responsiveness. In the case of a new technology based product, the technical debt is null (Highsmith, 2009). The main reason for this is the fact that new technology based innovations have no competition in the first stage of market introduction and, in this situation buyers aren't familiar with it. That are also two main aspects characterizing the market innovation. Its consequences for technology innovations are a nonexistent initial technical debt and the desire to satisfy future customer needs as the source of growth. Thus, technical debt in the context of

technology innovation will be used as an innovativeness measure. High innovativeness means a low technical debt – there is no reference for a new technology based product introduced to the market and the customers are only adopting the producer use function proposition as the unique source of offered value. Low innovativeness is characterized by technical debt growth as the effect of competition imitation and high customer responsiveness resulting from the use experience as the source of new needs identification. In fact, the trend of adaptation of the new product to changing customer needs undermines the innovativeness effect.

Considering the costumer perceived value ratio, it is possible to assume that in first periods of commercialization, company activities are concentrated on the utility as the decisive value factor and when product innovativeness softens the impact on the quality factor is amplified. This is also implied in the technology life cycle model interpretation. The importance of this model can be also extended to use function value analysis where its assumptions are based on the technology diffusion performance stage distinction (Kaplan, 2009). The first stage is introduction, 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. The second reason for this slow progress is the need for new technology translation into practical and meaningful improvements in product performance. Then comes the growth stage with the rapid propagation of the new technology. This stage usually begins with the emergence of a dominant standard which determines the characteristics of most products as well as consumer preferences. This consensus stimulates research on the new platform, which in turn leads to improvement in its performance. Furthermore, publicity of the standardization draws a large number of researchers to study the new technological platform. Their cumulative and interactive efforts also lead to rapid increases in performance. This 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 third stage is maturity. This is the period of slow technology propagation and market saturation. This maturation is due to less innovation activities because of the large competitive offer and the loss of attractiveness for customers.

The use of this perspective on technology based product evolution and the presupposition that the product is the aggregation of its use functions which derive from new technology application makes possible the conceptualization of a use function evolution model (fig.2).

Fig.2. Conceptualization of product use function evolution model



Source: authors' own elaboration.

The main presupposition is still actual, to conserve the stipulation that the new technology based innovation is offering value for the customer and that this value cannot be easily imitated, hence the role of product design as the source of positive customer perception. The design can also be treated as an important use function in the shape of the product. New design skills can be used to promote other use functions derived from the new technology, which however, may not necessarily be so important for the customer. Therefore, the design form of an innovative product must be developed and evaluated with customer assistance (Truong et al., 2014).

The proposed product use function parameterization underlines its similarity to services offered to the customer (Sorli, Stokic, 2009). The proposed perspective on use function evolution enriches the conventional model 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 of product development can be seen as a leading idea for reaching a balanced competition advantage through the use of technical debt 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. The proposed repositioning of the use function is another aspect of analysis, which makes possible the visualization of the mix of future product use functions, or the redesign of the actual proposed product optimizing customer needs satisfaction. This is based not only on the customer interaction but also considers the actual and future costs of the introduced technologies. For this reason the investment in design of new technology innovation can be easily controlled and its financial consequences can be determined, even at the stage of market introduction. The integration of technical debt to the new product development process makes more predictable actual and future funding risks even when the proposed products have no market competition which is the case of new technology commercialization.

Also the goal of creating a learning process based on the customer interaction with the company's technological innovations, can be made concrete later as a new use function. This insures the commercialization process and will be the base for a new product concept developed with the customer and by the customer. Observation of conceptualized use functions and monitoring of their evolution, seen as customer accommodation to new product features, will become the first step in new product design, specifically in the evaluation of its technological complexity, which level is often problematic in the case of an innovative product (Ziamou et al., 2012). The described proposition of use function configuration as interactive, makes possible the immediate involvement of the customer in innovations on the level of their capability, changing their character from radical to incremental making them more acceptable by the customer (Menguc et al., 2014).

4. Conclusion

The presented model concept effectively develops the idea of the product analyzed as a set of use functions. This is more accurate if a technological innovation and a new product or service are viewed interchangeably. Hence the possibility of changing the logic of new product development process where basing on technology lifecycle, its introduced parameterization, combined with use of customer value and technical debt, makes the decision process more detailed and controllable if the just cost structure is analyzed. The introduction of use function as a factor

to characterize company outputs reduces dissonance between product and service as separated offer elements and shapes them into a combined entity. Hence providing a coherent allocation of company technologies to the product use function configuration process. Adaptation of a link concept between technology and the use function of a product makes possible a controllable technology choice and rational innovation development.

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