

Value Chain vs Life Cycle Approach for Product Extensions

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October 28, 2016

Abstract—The methodology presented in this paper aims at supporting the whole needs and the Stakeholder Requirements definition in product development or product extension projects. To achieve that goal, the methodology forces to take into account the relevant Stakeholders and the Product Life-Cycle phases they impact on for that product. The paper shows a practical example taken from a real product extension project where the methodology was used. Since the main inputs for product extensions usually come from the marketing department, it resulted to be very effective in broadening the perspective. Thus it ended up in a holistic list of requirements, covering the needs of all the Stakeholders. Requirements frame the development problem, hence, as more they are complete as less failure risks there are. The methodology requires further experiments in other industries to prove its generality. Nonetheless it is expected to provide great support in product extension activities by lowering failure risk and by helping in satisfying all the Stakeholder needs.

I. INTRODUCTION

An artifact that is produced by a company and fulfills needs of some stakeholders is called Product. It consists of a series of interconnected features or functionalities and it is identified within a context and applicable in specific value chain. A product, like any other evolving thing, is characterized by a life cycle that starts with the conceptualization and development and finishes with the decline phase passing through growth and maturity (Figure 1). As shown in the figure the maturity phase is usually characterized by a maximum in sold units followed by a declining trend. Thus companies are very interested in keeping the growing trend as long as possible. For this reason in the maturity phase it is possible to see a product renewal that can consist of extensions of the product functionalities/features.

The product extension is usually needed because, even if the general product concept could remain valid from a marketing perspective, the change comes from the market in terms of new requirements or needs from customers (e.g. improved performances, side functionalities, user or technology maturity, etc.). The market requirements are the starting base to make considerations on the product evolution. However a structured engineering methodology is useful to secure that all the requirements from all the identified sources are captured and addressed.

Product Life Cycle: Sales vs Profit



Fig. 1. Example of Product Life Cycle from profit and sold units perspectives [1]

II. RELATED WORK

The associative network model, explained by Ref. [3], can help firms in deciding whether to expand the brand or the products. According to the model, every product is represented into the mind of the potential customers by some nodes. Every node corresponds to a specific aspect or value of the product. By interacting with the product, consumers associate the product to the nodes. Stronger is the associations, more of that aspect is embodied into a product. Thus the study of the associations

supports marketing experts in managing and planning products and products and brands extensions. However, besides the pointing of a general direction for products extensions, Ref. [3] did not provide suggestions on how to accomplish it. The product extension theme was studied by Ref. [4] as well. They focused on how firms should expand on the market through the customization of established and affirmed core products. Nonetheless, the term customization referred to product line extensions from core product [4]. Accordingly, core products are products with a strong presence in the market, in the mature phase of their life cycle. It is given that mature products are exploited to generate incomes until the decline phase either by extending its functionalities or by siding it with a product sharing the same brand and/or architecture. However, their work did not provide suggestions or guidance on how to extend a product.

Many authors agreed on the risks related to such practice, though the product extensions resulted to be less risky than the brand one. Nonetheless, it is expected that those risks are similar, though with a different magnitude, in both cases. Diluting the brand/product image, undesirable associations and cannibalization of the existing portfolio resulted to be the top of the list ([5], [6], [7]). Ref. [6] deeply studied the cannibalization phenomenon. They presented a method to calculate the amount of cannibalization.

Ref. [8] provided a list of suggestions to deal with the main risks a firm extending the portfolio has to face. However, the cited authors focused on the brand and marketing side of the matter. Thus a gap was found in terms of how to extend a product in its maturity life-cycle phase. On the other hand, strategic importance of the new product and its consumer fit (i.e. the contribution to the consumer needs satisfaction) were considered by both Ref. [8] and this paper.

Finally Ref. [5] argued that there are market segments where product extensions are competitive reality. Thus companies have to adapt their portfolio to these conditions. Nonetheless, this also helps firms in managing and introducing innovation [5]. That means that in such markets companies are highly invited in extending their products by new product use addition [3]. It is also expected that such manoeuvre helps in surviving into that dynamic environments and in posing blocks and obstacles for competitors [5]. Moreover it is expected that product extensions contribute to the enhancement of the brand visibility because the extended and parent products share the same brand name [5], [3], [7]. All those are known reasons justifying and pushing companies towards the product extension practice.

III. VALUE CHAIN VS PRODUCT LIFE CYCLE METHODOLOGY

The introduction of a new product or the extension of an existing one is usually driven, from a generic point of view, by the marketing department. They provide the list of needs that usually in later stages of the product development activity are translated into requirements. The main source of those inputs comes from customer, market and competitor

intelligence activities. In order to have the full list of needs, other points of view should be taken into consideration (e.g. Customers service, legal department, supply chain, etc.).

The proposed methodology helps in providing structure to the needs mapping into the Product lifecycle phases while considering different points of view in the company value chain. It is composed by the following macro steps:

- High Level Needs identification
- Extendable Platform Product choice and its relevant life cycle stages identification
- Stakeholders matching with LC phases
- Needs further detailing in requirements

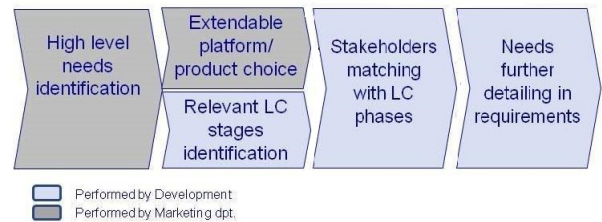


Fig. 2. Workflow description

A. Workflow Description

1) *High Level Needs Identification*: The first stage of the methodology consists on the identification of the needs (internal or external) that are the reason to start the product extension. In general the needs considered in this stage are results of marketing department activities aiming at scouting and analyzing new business opportunities or strengthening the existing ones (e.g provide more appealing cars by introducing infotainment technologies or improving smart-phones performances by introducing new generation hardware) as per Figure 3. The result is created by using marketing tools like interviews, scouting of competitors or similar businesses (e.g food and pharmaceutical for packaging business), business intelligence simulations for trends, etc.

High Level Need identification chart - ex1 new material	
Project name	Bottle1000 in bio-PET
Description	Develop a bottle from Bottle1000 but made with bio-PET instead of PET
Status	Need further information
Reference Product	Bottle1000
Reference Product Description	Bottle1000 is a bottle for liquid food of 1000ml of volume. It is shaped as a classic bottle, it is made of PET plastic and it requires a cap and a label.
Strategic Priority Area	Innovation and Environment
Key value Chain Challenge	Environment, Food Safety, Differentiation
Development Process	Product Development scaled to Product Extension
Application	New product
Business impact	

Fig. 3. Example of identified High Level Need (green brackets) and Product to be extended (yellow brackets)

2) *Extendable Platform Product Choice and its relevant life cycle stages identification* : In this stage the methodology is divided in two sub-activities:

- Extendable Platform Product Choice
- Relevant life cycle stages identification

The first activity is simple in theory but critical from the company point of view. In fact in this activity the project selects the platform of the product to extend. The choice is really dependent on how the company organized its products and related portfolio as well as its development operations. The output of this activity are the platform of the product (Figure 3) to be extended and the related list of stakeholders (Figure 4). It is important to highlight that by selecting the platform and generating the list of stakeholder we are implicitly considering the company value chain.

Stakeholders	
1	Customer
2	Legal & IP
3	Hygienic Design
4	Food Safety
5	Environmental
6	Package Safety
7	Equipment Development
8	Resources
9	Global Environment
10	Consumer
11	Channel
12	Pack.Mat. Supply Chain
13	Package Development
14	Lamination
15	

Fig. 4. Example of product platform stakeholders

The second activity is the identification of the relevant life cycle stages of the product. We are speaking about “relevant” because maybe not all the product life cycle stages could be involved in the product extension. In Figure 5 the common product life cycle stages are indicated.

Life Cycle Stages	
1	Develop
2	Procure
3	Sell
4	Supply
5	Dispose
6	Production
7	Distribution
8	Elimination
9	

Fig. 5. Example of common product life cycle stages

3) *Stakeholders matching with LC phases*: In this step we put in relation the product life cycle stages with the stakeholders in order to understand and match where in the life cycle of the product there is a stakeholder’s need to be documented. The result is the SHLC matrix in Figure 6. As shown in the example not all the stakeholders could be involved into the extension. Moreover it is not given that all stakeholders are interested in every life cycle phase. The formalization of the needs starts at this point of the process.

		Customer	Legal & IP	Hygienic Design	Food Safety	Environmental	Package Safety
1	Develop						
2	Procure						
3	Sell						
4	Supply						
5	Dispose						
6	Production						
7	Distribution	x					
8	Elimination	x					
9	Use						

Fig. 6. Example of SHLC matrix

4) *Needs further detailing in requirements*: Last part of the methodology supports the need collection by extracting them from the stakeholders vs lifecycle matrix. The outcome results in a list of needs per stakeholder and lifecycle phases. A sample need list can be seen in Figure 7.

Once the list is complete the project can start analyzing each need and develop the proper requirements linked to it,

according to the analysis phase in the Systems Engineering process.

IV. CONCLUSION

The presented methodology puts in correlation the product life cycle phases and the company value chain. The output is a list of needs mapped on the company value chain and product life cycle. From the analysis of the map it is possible to address correctly next project activities like the requirements analysis. This simple best practice can be helpful for both new products and product extension. It guides the project team to avoid losing information during the needs collection and before developing the project requirements. The figures shown in this paper as example are taken from a real industrial context where the methodology was applied in order to develop requirements for an extended product.

Another application not yet fully explored consists of product extensions in the shape of new services to be integrated in existing products. That is because it gives a structured way to collect and manage information that can be applicable to any type of requirements definition problem. In general the methodology can contribute to reduce the risk of inconsistent or non relevant information in the initial phases of any product development project.

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Customer			
Distribution	Need	1	Do not change secondary or tertiary packaging technologies
Production	Need	1	Do not change bottling equipment
	Need	2	Do not lose line performances
	Need	3	Be compatible with current sparkling liquid food
Hygienic Design			
Develop	Need	1	Be compliant with FDA standard on liquid food
	Need	2	Be chemically stable at a certain pH ranges
	Need	3	Be stable at certain environmental conditions
Food Safety			
Develop	Need	1	Be chemically stable at a certain pH range
Sell	Need	1	Be compliant with FDA standard on liquid food
Supply	Need	1	Do not affect food during supply chain operations
Production	Need	1	Do not affect food during bottling operations
Environmental			
Develop	Need	1	Be made in bio-PET
	Need	2	be composed at least of 98% recycling material
Elimination	Need	1	Be compliant with standards on plastic waste disposal and elimination regulations
	Need	2	Can be easily decomposed by environment
Package Safety			
Develop	Need	1	Be chemically stable at a certain pH range
Sell	Need	1	Be compliant with FDA standard on liquid food

Fig. 7. Example of needs captured from the customer correlated with the LC stage of the product