

A business model framework for product life extension

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Abstract

Product life extension is an increase in the utilization period of products. Design research on product life extension strategies has so far mainly focused on technical aspects of products, like 'prevention engineering' or 'design for repair, maintenance and upgradability', and on individual consumer-product relationships, like 'design for emotional durability'. The viability of product life extension in a business context and the associated consequences for product design, have however remained largely unexplored. In this paper a starting point is provided for this exploration, by outlining the development of a business model framework for product life extension, using strategies for product life extension and mapping these against common elements of contemporary business model theory. Drawing on case studies, examples are used to show how the framework can be used in practice by designers and business developers.

Keywords: Business model, product life extension, strategy, product design, resource use

1. Introduction

Background

Product life extension is an increase in the utilization period of products, which results in a slowdown of the flow of materials through the economy.

The last few years, there has been a renewed interest in strategies for product life extension. A recent study by Huisman et al. (2012) showed that material flows through society are accelerating. The average lifespan of products like ICT, white goods, etc., has decreased by 10% between 2000 and 2010, implying an increase in the associated waste streams.

Design research on product life extension strategies has so far mainly focused on technical aspects of products, like 'prevention engineering' (Stahel, 1994) or 'design for repair, maintenance and upgradability' (Nes, 2003), and on individual consumer-product relationships, like 'design for emotional durability' (Chapman, 2009). The viability of product life extension in a business context and the associated consequences for product design, have however remained largely unexplored.

Research aim and context

Prompted by these recent developments and the current lack of research, we started the research project 'Products That Last' to explore the relationship between business and product life extension.

The central research question is:

'What are the critical success factors that make longer lasting products feasible in business to business (B2B) and business to consumer (B2C) contexts?'

As a first step in finding answers to this question, we developed a framework to map out business structures (regardless of venture type) in relation to product life extension strategies, facilitating comparison and pattern recognition.

Here we will present the initial development of this framework and provide examples of how the framework can be used in practice by designers and business developers, drawing on some of the ongoing case studies of the 'Products that Last' project.

2. Methodology

A literature review led to the development of a first iteration of a theoretical framework for product life-extension. A workshop with industry was held in order to test its validity and robustness. After refining the framework, we mapped the business models of four companies that successfully promote longer lasting products to further validate the framework and to identify patterns in the way these businesses are organized.

3. Results

Describing business

In order to be able to analyze and compare alternative forms of doing business we needed a set of descriptive parameters with which the essence of any business could be captured. We found this set in the 'business model' concept. First coined as early as 1960 (Jones, 1960 cited in Osterwalder, 2004), the term is by now widely used in current management vocabulary when referring to a description of the underlying structure of a business and has proven valuable as classifying device for describing, classifying and understanding business phenomena and in developing ideal types (Baden-Fuller and Morgan, 2010). Basically, '*a business model describes the rationale of how an organization creates, delivers and captures value*' (Osterwalder and Pigneur, 2010).

Capturing business structure regardless of venture type

After extensive research of existing business model descriptions, Osterwalder arrived at nine '*building blocks*' that could be used to describe any business venture (Osterwalder, 2004).

In his more recent book 'Business Model Generation', coauthored by Yves Pigneur, these nine building blocks are described in their latest reincarnation (table. 1), the result of careful reviewing, testing and refining together with a community of over 470 practitioners in 45 countries (Osterwalder and Pigneur, 2010). It is this version we have adopted for our framework.

Building block	Description
Customer Segments	The different groups of people or organizations an enterprise aims to reach and serve.
Value Proposition	The aggregation of features and benefits that create value for a specific Customer Segment.
Channels	How a company communicates with and reaches its Customer Segments to deliver a Value Proposition.
Customer Relationships	The types of relationships a company establishes with specific Customer Segments.
Revenue Streams	The income a company generates from each Customer Segment.
Key Resources	The most important asset required to make a business model work.
Key Activities	The most important things a company must do to make its business model work.
Key Partnerships	The network of suppliers and partners that make the business model work.
Cost Structure	All cost incurred to operate a business model.

Table 1. The nine business model building blocks from 'Business Model Generation' (Osterwalder and Pigneur, 2010)

Integrating strategy and operations more closely with the business model ontology

In their study 'The entrepreneur's business model: toward a unified perspective', Morris et al. (2005) analyzed over 30 definitions of the term 'business model' and their respective components. This analysis led them to propose a triple layer framework for business models.

Their proposed 'foundation level' is shaped by strategic decisions, primarily aimed at determining what a business is and is not and ensuring these decisions are internally consistent. The outcomes of these essential decisions provide us with a generic basis for comparison across different kinds of businesses and allows for recognizing basic business model patterns.

At the next level, the 'proprietary level', we find the tactical decisions that determine the unique marketplace advantage and identity, the fingerprint so to speak, of a business.

Finally there is the 'rules level', containing detailed operational decisions that determine how the defining outcomes of the two previous levels are preserved and expressed in day-to-day operations.

Where Osterwalder (2004) distinguished a strategic layer, a business model layer and an operational layer and chose to keep them separated, the multi-layered framework by Morris et al. (2005) offers a way to more closely and seamlessly integrate the three (fig. 1).

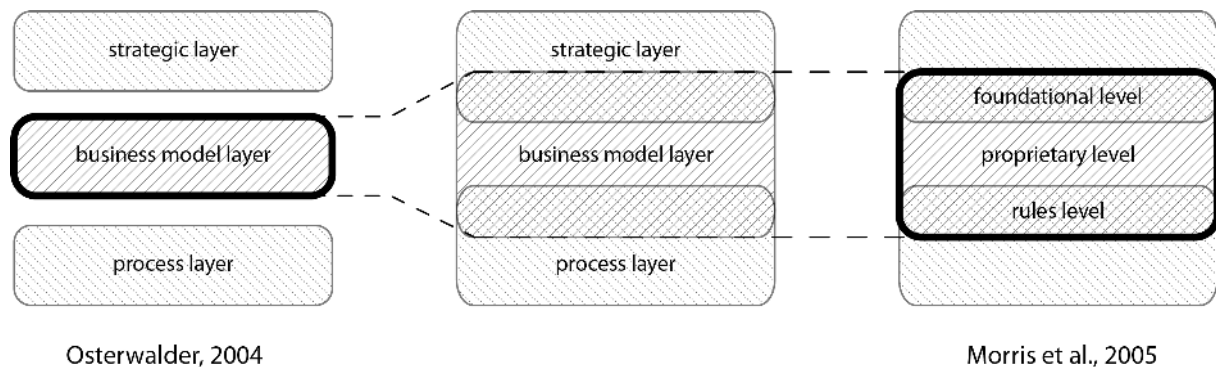


Fig. 1 Expanding Osterwalder's (2004) narrower business model layer into the triple layer framework by Morris et al (2005).

The reason for incorporating (at least part of) this strategic layer, is that Cooper et al. (1999) have found, in their research on new product portfolio management, that businesses who manage their portfolio based on their business strategy are the most successful. As this might also be the case for successful businesses around product life extension, we wanted our framework to be able to reflect this.

Describing Product Life Extension

In order to come up with a set of non-overlapping strategies for product life extension, we built on research by Linton and Jayaraman (2005), in which they systematically catalogued different modes of product life extension.

Although we have chosen to adopt large parts of their classification of product life extension strategies, including many of the definitions, as basis for our set of product life extension strategies, we introduced some modifications.

We added:

- 'Product integrity' as a concept and ordering principle. Building on the concept of 'Product identity' as introduced by Linton and Jayaraman (2005), we defined the level of integrity of a product as being at its peak right after its production and being at its lowest (but not zero) when reduced to its component parts. According to our definition, the point of zero integrity is reached when a product loses all of its original geometry (i.e. shredded or melted down).
- 'Product attachment', as van Nes (2003) has shown the positive influence of an emotional bond between user and product on preventing, or at least postponing, product replacement.
- 'Product durability' as a product life extension strategy: making products that are inherently designed and built to last;

- 'Standardization', as making use of standardized components should facilitate reparability because of wider availability of interchangeable parts, both over time and from different manufacturers;
- 'Product pooling/sharing' (Tukker, 2004), since shared use of a product could contribute to a more effective use over time.

We merged:

- 'Preventative maintenance' and 'Predictive maintenance' into 'Maintenance' because the two are closely related ('predictive maintenance' is essentially condition driven 'preventative maintenance'). If need be, they can easily be re-differentiated in later stages (proprietary level and rules level).

We removed:

- 'Recall' as a product life extension strategy, because we consider it a contingency measure;
- 'Recycling', because it operates on a material level and completely destroys original product geometry, thereby reducing product integrity to zero.

Product Life Extension Strategies defined

Product life extension strategy	Definition
Product attachment	The strong emotional connection users feel to a product, due to the service it provides, the information it contains, and the meaning it conveys (Chapman, 2009).
Product durability	The ability of a product to perform the function(s) it was designed and built for over a long period of time without breaking down and without showing inordinate amounts of wear and tear.
Standardization	The provision of products and their parts with more interchangeability than is logically necessary (Farrel and Saloner, 1985).
Product pooling/sharing	The use of a product by two or more users, either at the same time (pooling) or sequentially (sharing) (Tukker, 2004).
Product reuse (direct)	The use of a product in its same form for the same use without remanufacturing (Kopicki et al., 1993, p. 3 cited in Linton and Jayaraman, 2005, p. 1815).
Maintenance	The performance of inspection and/or servicing tasks to retain the functional capabilities of a product (Smith, 1993 cited in Linton and Jayaraman, 2005, p. 1814).
Repair	The restoring of a product to a sound or good condition after decay or damage (Flexner, 1987 cited in Linton and Jayaraman, 2005, p. 1813).
Upgrading	Improving the quality, value, effectiveness or performance of something (Flexner, 1987 cited in Linton and Jayaraman, 2005, p. 1814).
Remanufacture	The restoration of used products to a like-new condition, providing them with the performance characteristics and durability as least as good as the original product (Lund, 1984 p. 1 cited in Linton and Jayaraman, 2005, p. 1815).
Part reuse	The use of a part in its same form for the same use without remanufacturing (Kopicki et al. 1993: 3 cited in Linton and Jayaraman, 2005, p. 1815).

Table 2. Product life extension strategies in order of descending product integrity.

Mapping and visualizing

We next devised a way to visually map both the foundational business model level of a business and the application of product life extension strategies by that business in a single diagram.

Business Model mapping

For the business model representation we modified the basic nine axis diagram as proposed by Osterwalder (2004) to represent his more recent version of the nine building blocks and ordered them in line with the 'Business Model Canvas' (BMC) diagram (Osterwalder and Pigneur, 2010). We arrived at the scoring values for each of the nine axes by condensing the detailed options within each of the building blocks as summed up by Osterwalder and Pigneur (2010), into a dimension we assumed potentially relevant to product life extension and that would not exclude any of the wider option content.

The scoring values were placed in such a way at the respective ends of each axis as to minimize the number of 'star shaped' graphs resulting from our test plots in favor of more 'rounded blob' graphs (fig. 3), thus providing the clearest visual shift between graphs of business models that promote product life extension and those that don't.

Axis label	BMC	Axis value 1	Axis value 2
Value proposition	VP	Single dimension: for example 'lowest price' or 'smallest' or 'fastest' whilst otherwise mostly similar to competition.	Multi dimensional : a composite value proposition, for example 'efficient' and 'lifelong warranty' and 'small'.
Customer relationship	CR	Shallow: no contact beyond time of purchase, customers are anonymous and interchangeable	Deep: mutual exchange of information, contact beyond time of purchase, recognition of individual customer
Channels	CH	Single phase emphasis: Channels for one product lifetime phase, for example 'purchase phase' are highly developed whilst channels in the 'after-use' phase are not	Multi phase balance: Channels for each of the product lifetime phases are equally well developed
Customer segments	CS	Low level of segmentation: Little or no criteria for differentiation between groups of potential customers	High level of segmentation: Complex of criteria for differentiation between groups of potential customers
Revenue streams	R\$	Over time: For example through leasing, pay-per-use or subscriptions	One time: Most often through transfer of ownership
Cost structure	C\$	Value driven: Aimed at creating premium value propositions	Cost driven: Aimed at minimizing cost wherever possible
Key partners	KP	Strategic: Long term relationships based on mutual strategic fit	Buyer-supplier: Transactional relationship, centered around product price, availability and terms of sale
Key resources	KR	Soft: People (attitude and skills) and intellectual property	Hard: Physical assets and financial resources
Key activities	KA	Services	Manufacturing

Table 3. Axes labels and scoring values for business model diagram

Product Life Extension Strategy mapping

For product life extension strategies we chose a linear mapping device, representing the linear ordering by 'product integrity' we introduced earlier. The mapping represents the relative level of application by a business for each of the ten strategies, where higher means more (fig. 3). The resulting graph now has whole product related strategies to the left (I), intervention related strategies in the middle (II) and (dis)assembly related strategies to the right (III) (fig. 3).

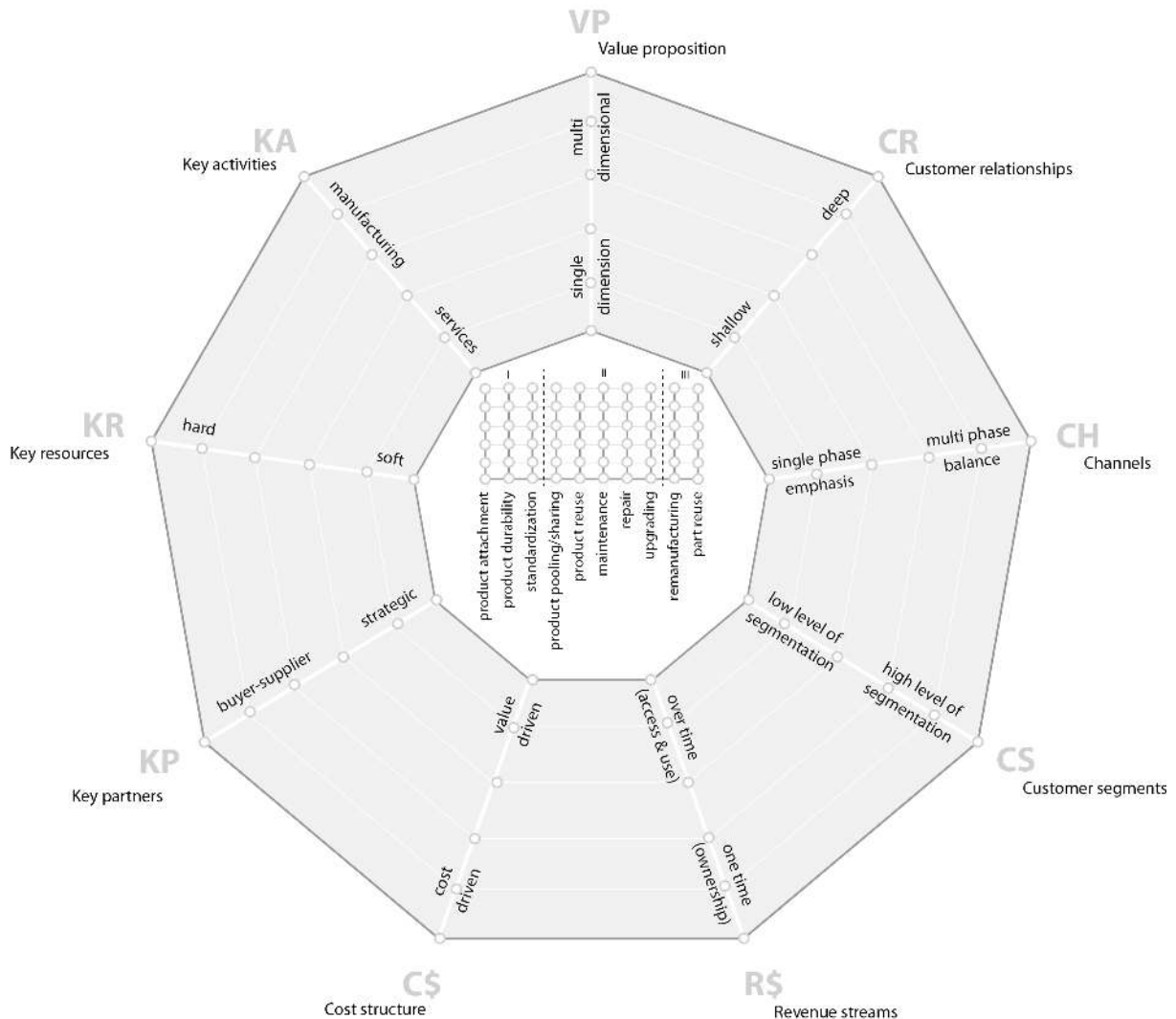


Fig. 3. Integrated business model and product life extension diagram for visual mapping

Case study examples

We have mapped out four businesses that promote longer lasting products in different sectors onto our diagram. The businesses and the means by which we acquired the information needed for mapping are listed below (table 4.):

(Detailed case study descriptions will be subject of a future research paper.)

Company name	B2B/B2C	Product	Method of acquiring information
BMA Ergonomics	B2B	Office chairs and furniture	Interview
Miele Nederland	B2B/B2C	Household appliances	Interview (diagram filled out by employee)
Océ Technologies	B2B	Copiers, printers and plotters	Interview and workshop
Vitsoe	B2B/B2C	Wall shelving	Website analysis (www.vitsoe.com)

Table 4. Case study: four businesses that promote longer lasting products

The resulting diagram, when filled out is shown below (fig. 4):

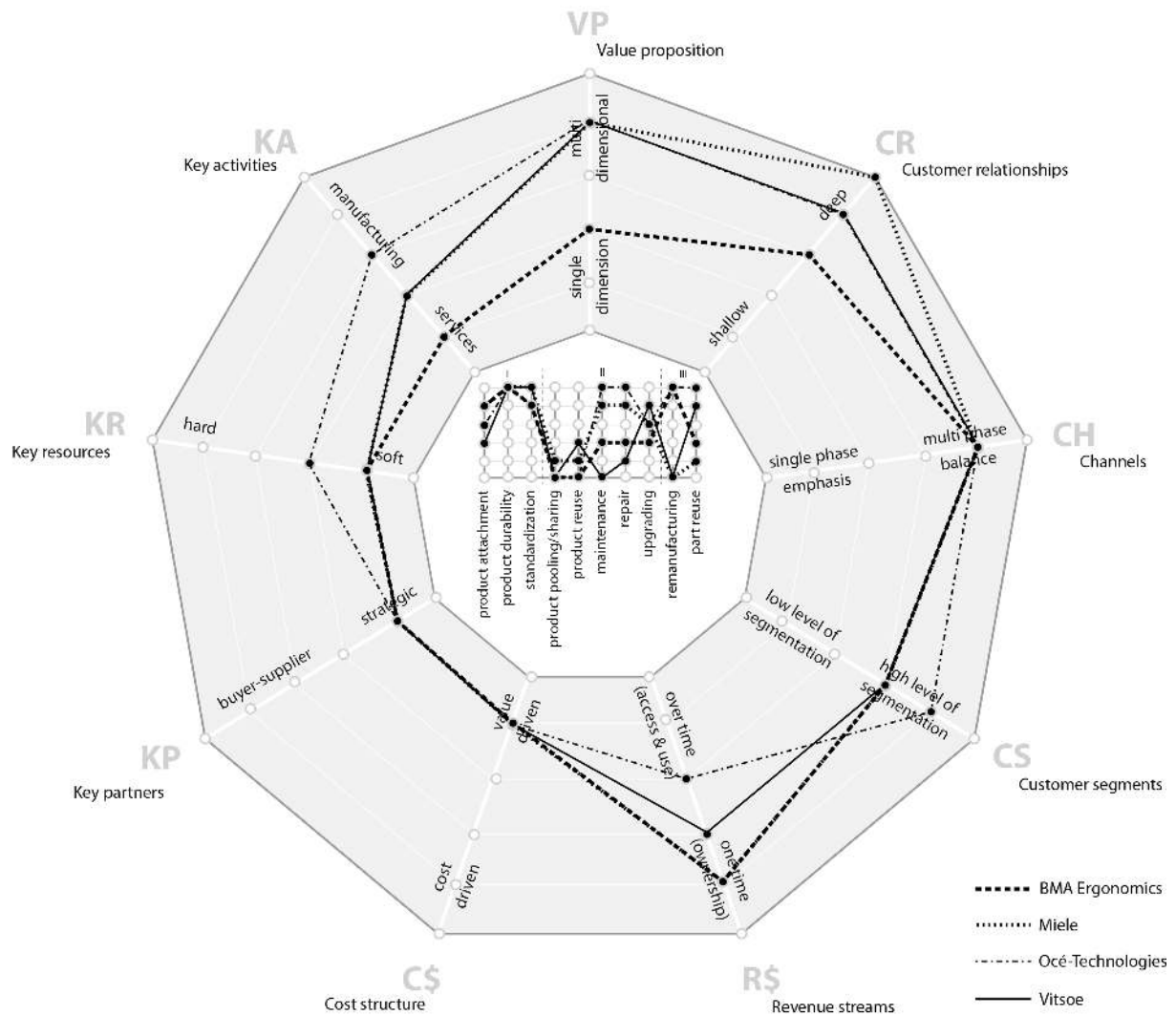


Fig.4 Case study: four businesses that promote longer lasting products mapped out in diagram

4. Discussion

From the diagram it is clear that, even taking into account errors in interpretation of the interviews or the website material, both the business models and the spectra of product life extension strategies of the companies seem to have a lot in common, at least at this level of analysis.

The companies tend to (with regard to their business model):

- not compete solely on price (multi dimensional value propositions in conjunction with the remarkable absence of 'cost driven' cost structures);
- stay connected with their individual customers (deep customer relationships);
- be visible to and available for communication with customers over the whole product life cycle (multi phase balanced channels);
- tailor their offering to well defined segments of the market (high level of segmentation);
- have 'value driven' cost structures
- maintain lasting strategic relationships with their partners (strategic key partnerships);
- view their human resources and intellectual property as essential (soft key resources);

and (concerning product life extension strategies),

- strive for intrinsic product durability to start with (strategies from category I);
- apply not just one, but a combination of product life extension strategies;
- focus more on repair, maintenance and remanufacturing as the product gets more complex;

- shun direct product reuse, especially those companies with more complex products. The reason Miele gave for this was that their brand name could suffer damage because the quality of reused, sometimes modified, products is quite unpredictable, depending on factors outside Miele's control;

We believe the combination of the most recent version of Osterwalder's business model ontology (2010) with the triple layer framework by Morris et al. (2005) provides us with a well defined, but at the same time almost organic, organizational principle for progressively mapping out the structure of a business, from an initial overview down to any level of detail needed for our future research. The non-overlapping set of product life extension strategies we have assembled, covers the full spectrum of possible interventions over the lifetime of a product, from design intention to part and (reverse) logistics related strategies.

Of course, the results we presented cover only the foundation needed to systematically explore and analyze the complex relationship between product life extension strategies and business models. Further research and more detailed case studies will be necessary to provide the content to this framework at all levels, hopefully enabling us to discover emerging patterns and to identify the critical success factors that make longer lasting products feasible in B2B and B2C contexts.

5. Conclusion

In this paper we have outlined the development of a framework for exploring the relationship between product life extension strategies and business models and illustrated the use of a visual mapping device, quite literally offering us initial insights into patterns emerging out of the complex relationship between product life extension strategies and business models.

Acknowledgements

The authors gratefully acknowledge the support of the Innovation-Oriented Research Programme 'Integrated Product Creation and Realisation (IOP IPCR)' of the Netherlands Ministry of Economic Affairs, Agriculture and Innovation and would like to thank all companies partnering in the 'Product That Last' project and those outside of the project consortium for their willing cooperation and contribution to our research.

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