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EXPLORING THE DIMENSIONS OF VALUE: THE FOUR DIMENSIONS FRAMEWORK

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1. Introduction

In today's highly competitive marketplace, companies have to innovate their commercial offer in order to survive. It is widely acknowledged in literature that innovating means designing something that will not only work from a technical point of view, but will also make business sense (e.g. [Schilling 2008], [Cantamessa et al. 2013]). According to this belief, firms should carefully analyse and continuously improve their design activities, in order to develop products and services that generate new value for customers.

Several scholars agree with the observation that initial design stages and markedly Product Planning result particularly crucial to determine the successful achievement of innovation initiatives [Pahl and Beitz 2007], [Ulrich and Eppinger 2008]. In the recalled phase, one of the main activities is the idea generation task that allows identifying distinguishing features or original ideas regarding a new product [Alam 2006], [Riel et al. 2013]. Although a well-managed idea generation can be considered as a primary source of commercial success and several methods to support this activity exist, many companies do not allocate sufficient resources to perform this stage accurately [Alam 2006]. Such a discrepancy can be put into relationship with the perception of idea generation as a random process, where ideas may be detected only by intuition, observations, discussions or accidents, without using structured approaches capable of stimulating the creativity of the involved people [Stasch et al. 1992].

The authors share the vision that more systematic approaches can result beneficial also in this early product development stage [Pahl and Beitz 2007], which is, conversely, pronouncedly entrusted to individual skills [Bacciotti et al. 2013].

According to this objective, the authors propose, in the present paper, an approach to browse the aspects viable to impact customer value, thus supporting the product ideation task. The task is actually challenging, since manifold product aspects contribute to determine value [Chen and Yan 2008], [Lee et al. 2010], [Cantamessa et al. 2012]. The advanced tool, namely *Four Dimensions framework* (FDf), assumes that all the product characteristics can be schematized into four dimensions: *General Demands* (GDs) of customers, product *Stakeholders* (SHs), different stages of product *Life Cycle* (LCs) and different levels of detail (*Systems*, SYSs). The generation of original combinations of dimensions' attributions urges designers exploring a wide range of situations, circumstances and working conditions, where new sources of value for customers can be individuated. FDf stands therefore in the backbone of a proposal for proactively generating new product attributes, avoiding employing customer opinions, which generally hinder the identification of new needs to be satisfied [Bacciotti et al. 2013].

In order to show how FDf works and obtain some feedback about its applicability, the authors have employed a case of study concerning one of the most successful PC developed by Apple Inc., i.e. the iMac. The known evolution of its characteristics allowed understanding to which extent FDf, if

applied to the first PC model, would support the identification of the new features appearing as time progressed.
The second section of the article introduces the concept of value, highlighting and discussing the dimensions that represent possible sources of value generation for customers. Then, the third section presents an overview of methods that support the idea generation phase, shedding light on their capability of exploring the introduced dimensions of value. Subsequently, the fourth section describes the proposed tool and the step by step application to the considered case study, revealing the main outcomes arisen by the example. Eventually, the most remarkable results and the future research directions are summarised and discussed in the fifth section, which concludes the paper.

2. The dimensions of value

The central goal in New Product Development is to create a product with superior value for the customer so that his/her needs will be satisfied (e.g. [Van Kleef et al. 2005]). However, the concept of customer (or user) value can assume different meanings, according to the research field [Boztepe 2007]. The authors refer to the capability of designed product properties to engender customer satisfaction, satisfy needs and generate benefits for users. In this sense, a value proposition strategy pursues the objective of differentiating the company's offer from the industrial standard, with the attempt of developing new products and services that enhance customer satisfaction through additional benefits and unprecedented experiences [Kim and Mauborgne 2005]. Such a kind of value innovation strategy fundamentally redefines the market boundaries by identifying new product characteristics.
Several sources are acknowledged in literature as opportunities for the generation of customer value, according to them, the idea generation phase should be carried out by exploring the following value dimensions:

- *General Demands* (GDs): they refer to the existing, emerging or unspoken needs perceived by the customers and satisfied through the benefits generated by the product features. The recalled benefits are generally defined as Product Attributes (PAs) [Borgianni et al. 2013]. Hence, in the remainder of the paper, the authors will indicate with this term the distinctive tangible (e.g. quickness and speed in performing the functions, ergonomics, storability) or intangible (e.g. aesthetics, fun and adventure, ethics) characteristics of a product that generate value for the customer. This first value dimension can be specified and explored by the other three following dimensions that identify actors, life cycle phases and systems involved in the value generation process.
- *Stakeholders* (SHs): they are all the actors that interact with the product during its life cycle. The concept of "customer" is extended from buyer to user, beneficiaries, service recipients and outsiders, with the aim of identifying new opportunities to increase the delivered value. As stated by [Cantamessa et al. 2013], buyers and users might be different individuals (e.g. parents and children) and the actor(s) that will ultimately benefit from the product might be different from either the buyer or the user.
- *Life Cycle phases* (LCs): they concern the circumstances that may occur along the different stages of product existence, from the moment in which any stakeholder begins to interact with the product, to the end of product functioning. By analysing all these situations, several scenarios where any stakeholder may perceive value can be identified [Rotini et al. 2012]. Hence, it can be deduced from this that SHs and LCs dimensions are strictly related [Cantamessa et al. 2013]. This investigation is crucial to avoid focusing only on the phase of product's use, losing several opportunities to identify sources of value for the customer.
- *Systems* (SYS): this dimension suggests analysing the product at different levels of detail, including the "super-system" [Altshuller 1984] in which the product will be situated along its life cycle (operative environment, working conditions, surroundings, matching systems). The design of the product taking into account different hierarchical levels of the systems (from the external environment to their parts and components) is viable to enhance customers' value.

The authors believe that the research direction in this field should be oriented towards an integrated analysis of all these value aspects that are strictly linked.

3. Overview of idea generation tools

The idea generation task is one of the main activities of the Product Planning phase, as seen in the first Section, and allows identifying attributes, features or general ideas of the product to be developed [Alam 2006], [Riel et al. 2013]. The authors have recently presented an overview of methods to support this activity [Bacciotti et al. 2013], limiting their focus on approaches to be employed during Product Planning, so excluding techniques tailored for other design phases (e.g. requirement checklists or Quality Function Deployment). The authors will now try to remark to which extent and in which ways the investigated methods support the exploration of the dimensions of value, briefly introduced in the previous Section.

[Liberatore and Stylianou 1995], as well as [Matsatsinis and Siskos 1999] suggest a set of statistical tools to combine the inputs coming from customer surveys, expertise of internal personnel and market analysis, in order to generate a list of the most beneficial GDs. These methods focus on the end user, overlooking other potential SHs; in addition, they analyse only some of the LCs and the SYSs. For instance, [Matsatsinis and Siskos 1999] considers only the phases of purchasing and use of the product and focuses on two SYSs, i.e. the product and its packaging. Therefore, only the analysis of the GDs value dimension can be considered effectively supported by these tools.

[Chan and Ip 2011] proposes a method that follows a different procedure, if compared to the previous contributions. The design team has to assess, on the basis of experience, the most beneficial GDs for the end user. Subsequently, these GDs are matched with those coming from customer surveys, in order to obtain the best set of GDs. Although the analysis of the GDs is better managed than the previously cited methods, this approach shares the same weaknesses. Indeed, it considers only the end user and the same LCs (i.e. purchasing and use) and SYSs (i.e. product and packaging) of [Matsatsinis and Siskos 1999], without using a systematic approach to explore these value dimensions.

[Lee et al. 2010] proposes a method that involves design teams striving to identify the GDs of potential stakeholders through scenario-based analysis. This technique allows analysing several circumstances occurring during LCs, however it does not consider the SYSs dimension, because the focus is exclusively on the product. Although three out of four value dimensions (i.e. GDs, SHs and LCs) can be analysed using this approach, it is characterised by a low systematic level; moreover the method is considerably based on subjective inputs and random processes.

The Lead User Method [Von Hippel 1986, 2005], does not consider neither design teams nor group of generic customers, but only pioneer users (lead users) of a product. Pioneers have spent more time in using the product with respect to the rest of the customers, so that they can suggest new GDs still latent for many potential clients. This approach focuses only on the end user, supports the analysis of the phase of use and it can consider more SYS, without using a systematic approach.

Within *Blue Ocean Strategy* [Kim and Mauborgne 2005], the most useful tool to support the designer during the idea generation process is the so-called *Six Paths framework* [Borgianni et al. 2012]. The instrument is articulated in six suggestions (i.e. look across alternative industries, look across strategic groups within industry, redefine the industry buyer group, look across to complementary product and service offerings, rethink the functional-emotional orientation of the product, participate in shaping external trends over time) that support the analysis of the SHs (according to the first three paths) and implicitly of GDs (considering all the paths). Conversely, LCs and SYSs dimensions cannot be analysed using this approach, because the method does not provide any hints to explore these value dimensions. In addition, this tool offers only mere qualitative indications that are not sufficiently systematic to support the professionals during Product Planning [Aspara et al. 2008].

[Chen and Yan 2008] illustrates a method that supports the designer in the process of product ideas generation, based on the hybridization of existing products features. The SYSs dimension is well investigated, analysing the product and all its parts, components and accessories. However, the approach does not support the exploration of SHs and LCs dimensions. Therefore the designer could probably consider only the end user and the phase of use of the product.

According to the performed review, the considered techniques do not comprehensively support the exploration of the whole set of value dimensions, since each contribution is tailored on specific aspects. Furthermore, almost all the analysed approaches are poorly systematic. Therefore, the authors developed a tool that tries to guide the designer, in a structured way, in the exploration of all the dimensions of value, supporting the idea generation with a systematic process.

4. Exploring the dimensions of value: description and application of the Four Dimensions framework

The objective of FDf is to support the analysis of the value dimensions defined in Section 2, with the aim of eliciting product attributes and individuating new sources of value for stakeholders.
In the following Subsections, the tool is shown providing details about the objectives of the constituent activities and the expected outcomes. Furthermore, the description of the proposed approach is combined with its application to a case study concerning Apple iMac. The authors choose this case because of the well-documented evolution of the product and its attributes from 1998 up to 2013. The option to apply the developed tool to a new product has been discarded, because it would require too much time in order to obtain preliminary results.
iMac has undergone notable changes in the last 15 years (Figure 1), even if it has maintained its main peculiarities. The most evident improvements are related to the technological evolution of the monitor and the electronic components that allowed a reduction of PC dimensions. However, also the software evolution has played an important role in determining the widely acknowledged success of the product.

Figure 1. Evolution of Apple iMac (1998-2013) [www.apple.com]

4.1 Step 1: Information gathering

The reference market in which the company wants to perform the new value proposition has to be deeply analysed, in order to get a complete picture of the as-is situation about the currently displayed product features (PFs). Thus, the result of this phase is constituted by a comprehensive list of characteristics capable to represent all the aspects related to existing products in a certain market field.
With respect to iMac, the authors considered all the features of the first model issued in 1998. The required information about the product has been extracted from the 1998 web site, available at the following URL: www.web.archive.org/web/19980509035420/http://www.apple.com (last access 9th December 2013). Table 1 shows an excerpt of the collected data.

Table 1. iMac 1998 collected PFs

	iMac 1998 product features (PFs)
Processor:	233-MHz PowerPC G3
Backside level 2 cache:	512K L2 cache
Memory:	32MB of SDRAM *(expandable to 128MB)*
Hard disk drive:	4GB IDE
CD-ROM drive:	Built-in 24x speed (maximum)
Display:	Built-in 15 inch (13.8-inch diagonal viewable image size)
…	…

4.2 Step 2: Exploring the value dimension of the general demands

4.2.1 Step 2.1: Translate the collected product features into product attributes

The product features collected in the previous step have to be now expressed in terms of product attributes (PAs). According to the Pas' definition introduced in Section 2, the user has to identify the benefits perceived by the customers for each PFs. The translation of PFs into PAs can be carried out through the following questions:

- which reason or scope motivates the presence of the <product feature> in the existing products?
- which benefit(s) for the customers can be achieved through this <product feature>?

Table 2 shows the results of the conversion of an illustrative iMac product feature into the related product attributes.

Table 2. Conversion of PFs into PAs

Product features (PFs)	Product attributes (PAs)
Memory (RAM): • which reason or scope motivates the presence of the ***memory (RAM)*** in the existing products? • which benefit(s) for the customers can be achieved through the ***memory (RAM)***?	Fast application launches
	Expandability/improvements of PC efficiency

4.2.2 Step 2.2: Group the product attributes according to general demands

In this step, the identified PAs have to be grouped, according to the GDs they fulfil; in such a way, it is possible to identify which are the needs already satisfied in the reference market, through the characteristics offered by the existing products. The translation of PAs into GDs can be carried out through the following questions:

- which needs for the customers can be achieved through the <product attribute>?
- which reason or scope do the product attributes have in common?

In addition, a suitable approach to guide the reasoning involved in this task is the Customer Requirements Checklist (CR Checklist) [Becattini et al. 2011], [Rotini et al. 2012], showed in Table 3. The recalled checklist consists in a record of hints, comprising a wide range of GDs. The list, although not claiming to be exhaustive, has resulted sufficiently large within the experiences carried out by the authors in the field of Product Planning. The GDs are listed according to:

- direct benefits perceived by the end user, namely *useful functions* (i.e. first row of Table 3);
- strategies aiming at eliminating or attenuating undesired effects commonly associated with the product functioning, namely *harmful functions* (i.e. second row of Table 3):
- properties leading to the reduction of the resources to be channelled by the buyer or the end user of the system, namely *resources* (i.e. third row of Table 3).

Hence, the user can analyse this list looking for the answers to the previous questions.
For instance, considering the iMac's PAs of Table 4, the application of CR Checklist leads to the identification of the general demand "quickness and speed in performing the functions".

Table 3. CR Checklist

Useful functions • the advantages arising from the exploitation of the product, which can be referred to the quality and the quantity of the desired output; • the amount of users for whom such benefits are met, thus the flexibility of the product according to different customer demands; • the capability of the product to meet the customer needs within the requested time; • the adaptability of the product when working in diverging conditions with respect to the designed preferred ones; • the stability of the product performances when subjected to external perturbations;

- the chance to effectively control the system in order to obtain the expected outcomes;
- the possibility to expand or upgrade the range of product functioning;
- the opportunity provided to advantageously employ the product for not standard users or disabled people;
- the possibility to customize the product or certain properties according to the user tastes and tendencies;
- the possibility to use the system for different employments after the termination of main product functioning, the collection of matching items;
- the aesthetical requirements and the emotional dimension of the product, the style, the fashion content, what it evokes in the user, the lifestyle that the object implies, the prestige it generates for the owner as a feeling of distinction and recognition;
- the fun and adventure resulting from the use of the system.

Harmful functions

- the integrity of the product itself, its resistance to planned or accidental stress or collisions, the strength against wear or corrosion;
- the limitation of damages towards treated objects or neighbouring systems;
- the environmental sustainability, the recyclability, the possibility to reuse the system or its parts reducing the amount of waste;
- the ethics of the product as a distinguishing factor;
- the safety and innocuousness for human health and people's psychological and social conditions;
- the absence of bother for the user employing the product or for surrounding people, the comfort of use, the ergonomics, the manageability;
- the reliability, the limited frequency of system failures;
- the duration, the expected life of the product.

Resources

- the limitation of occupied space, the lessening of the encumbrance, the accessibility, meant as a shrunk quantity of space required to allow the users to employ, store, transport, maintain and dismantle the product;
- the working speed, the reduction of time to be waited before the functioning of the product delivers the expected outcomes, including the duration of the period to be waited before physically benefiting of the bought item or service after the purchase;
- the limitation of the time required to maintain or fix the product, to change accessories, to dismantle the system, to learn how to use it, to administer or to accomplish the involved bureaucracies;
- the reduction of the information and skills to be gathered in order to correctly use and control the product, the ease of employment, the user friendliness, the limitation of required training;
- the ease of acquiring the product, due to market penetration and distribution policies;
- the ease of managing, maintaining, assembling, disassembling, upgrading, substituting components or accessories;
- the ease of choosing and individuating the product in the marketplace, according to recognizable features, due to technical, aesthetical or communication issues;
- the lightness and the portability;
- the independence from the use of different materials, instruments, technical systems;
- the absence or limitation of the consumption of consumable items or materials;
- the reduction of auxiliary functions to be delivered in order to use, install, dismount or dispose the system;
- the limitation of the required energy needed for the product working, maintaining, installing, disposing, recycling; its efficiency;
- the decrease of the human power needed to use or transport the product;
- the additional services provided in order to attenuate the consumption of individual resources, as those listed in the previous bullets, the customer care.

Table 4. Conversion of PAs into GDs

General demand	Product attributes
Questions: • which needs for the customers can be achieved through the <product attribute>? • which reason or scope do the product attributes have in common? Answer: **Quickness and speed in performing the functions**	Short boot time
	Quick file access
	Fast application launches
	Fast networking
	Speed of browsing the Internet
	Fast data transfer

4.3 Step 3: Exploring the value dimensions regarding stakeholders, life cycle phases and system hierarchies

In this step the LCs, SHs and SYSs value dimensions have to be analysed in order to identify:

- current LCs in which GDs are perceived;
- existing SHs that interact with the product;
- existing SYSs that are exploited as value sources for the customer.

4.3.1 Step 3.1: Exploring the LCs dimension

The authors proposed to adopt an appropriate subdivision of the temporal dimension of the product lifecycle, designed to pinpoint the most common situations in which stakeholders can perceive value [Rotini et al. 2012], i.e. purchasing, choice and access activities, before use operations, utilization time, elapsed time before further exploitations, end of the functioning.
The user can analyse the list of collected PAs, in order to identify the LCs in which stakeholders can benefit of each product attribute. For instance, in the iMac 1998, the PA “ease to learn”, which refers to the GD “ease of use”, is perceived in “before use operation”, as shown in Table 5.

Table 5. Correlation between SHs, PAs and GDs

General demands (GDs)	Product attributes (PAs)	Life cycle phases (LCs)
Ease of use	Ease to learn	Before use operation
Audio quality	Quality of the voice (microphone)	Utilization time
Video quality	Graphics quality	Utilization time

4.3.2 Step 3.2: Exploring the SHs dimension

Existing SHs can be identified through the information collected in Step 1, also thinking to the LCs dimension. Designers employing FDf can thus analyse the list of collected PAs, as seen for the LCs dimension, in order to establish the SHs benefitting of each product attribute in the given circumstances. A tool for supporting this task is the use, as a checklist, of the four clusters (i.e. buyers, users, beneficiaries and outsiders), suggested by Cantamessa et al. [2012], [2013]. Within these groups of customers the user can identify several subgroups of stakeholders (e.g. old people, left handed individuals, children, etc.).
The application of this step to the iMac 1998 has led to the identification of a wide list of already satisfied stakeholders, for instance the PA “compatibility with several Braille displays”, which refers to the GD “ease of use”, has a relationship with “disabled people (users)”, as shown in Table 6.

Table 6. Correlation between SHs, PAs and GDs

General demands (GDs)	Product attributes (PAs)	Stakeholders (SHs)
Ease of use	Compatibility with several Braille displays	Disabled people
Audio quality	Quality of the voice (microphone)	Educators and Students
		General consumers
		Disabled people

4.3.3 Step 3.3: Exploring the SYSs dimension

This activity concerns the identification of environments, products, parts and accessories that stimulate the generation of value for the stakeholders by fulfilling the GDs. In order to support this task, it can be useful to focus separately on three main hierarchical levels, i.e. the environment in which the product is situated, the product itself and, eventually, the parts, components and accessories of the product [Altshuller 1984]. The identification of various operating environments can be performed considering all the places where the product can be situated during its life cycle. A tool for supporting this task is the use, as a checklist, of the above mentioned five LCs phases. On the other hand, a suitable approach that could be used to enhance the analysis of the low level (i.e. product's parts and accessories), is the Design Knowledge Hierarchy [Chen and Yan 2008], which uses a tree diagram to such an aim. Eventually, the user can exploit the same approach showed for the analysis of the LCs and SHs dimensions, in order to determine which SYS fulfils each product attribute. For instance, in the iMac 1998, the PA "ease to use peripherals", that underpins the GD "ease of use", emerges from the consideration of the product sub-systems "keyboard" and "mouse", as shown in Table 7.

Table 7. Correlation between SYSs, PAs and GDs

General demands (GDs)	Product attributes (PAs)	Systems (SYSs)
Ease of use	Ease to use peripherals	Keyboard
		Mouse
Audio quality	Quality of the voice (microphone)	Audio output system
Good View (monitor)	Monitor focus	System to show video output

4.4 Step 4: Combination of the four value dimensions

This final step represents the core of the proposed idea generation tool. The collected lists of GDs, SHs, LCs and SYSs have to be combined in order to create a wide range of new situations the practitioner can investigate for generating new sources of value. The investigation schema suggested by the FDf compels the user to ask himself the following question: *Are there any circumstances related to the <general demand>, occurring during the <life cycle phase> and concerning the <system> that generate value for the <stakeholder>, resulting as inputs for the design of a new product?* Thus, the tool can be employed as a collection of questions, supporting the scope of systematically browsing the possible sources of value offered by the product. Subsequently, the individuated sources of value have to be appropriately elaborated and interpreted in order to elicit new product attributes. New attributions of any dimensions of value with respect to the gathered terms can undoubtedly result effective for the scopes of generating new PAs. However, FDf has been initially tested with the terms monitored in the as-is situation, in order to show the applicability of the approach in a systematic way. Conversely any unguided widening of the dimensions would jeopardize the systematic level of the technique, since e.g. the kinds of SHs may be countless.

Figure 2. Four value dimensions combinations

The possible combinations of the individuated elements for the four value dimensions include new and existing combinations (Figure 2). All of them can potentially support the identification of new PAs, however the new combinations have more chances to generate scenarios potentially disclosing breakthrough product ideas. Therefore, the authors suggest to primarily focus on this group of combinations, in order to identify innovative sources of value for the stakeholders.

Considering the iMac case study a possible question is: *Are there any circumstances related to the* ***ease of use****, occurring during the* ***purchasing, choice and access activities*** *and concerning the* ***PC*** *that generate value for the* ***general customer*** *(end user), resulting as inputs for the design of a new product?*. An answer to this question can be found considering the new iMac, indeed Apple has introduced free workshops and on-line tutorials with the aim of training the end users.

4.5 Main outcomes

In order to understand the capability of FDf to lead to new meaningful product attributes, the authors performed a comparison between the iMac version sold in 1998 and the current PC. For the sake of clarity, it has been simulated the employment of the FDf in 1998 and observed how this application could lead to the definition of product attributes actually implemented in the iMac 2013.
The current iMac has 47 new product attributes if compared to the first model. 26 out of these 47 new PAs can be identified applying the FDf with the mapped elements for the four value dimensions in the "as-is" situation (1998). Therefore, the obtained results show that the 55% of the new product attributes offered by iMac 2013 can be generated by exploring and conveniently combining the dimensions of value of iMac 1998. In addition, extending the four value dimensions by adding new GDs, SHs, LCs and SYSs to the existent set, FDf could even support the identification of the whole set of new PAs.
The wide range of new circumstances identified by the authors analysing the first iMac, not only allowed to find out several attributes implemented in the 15-years-later PC model, but also provided insights for generating new sources of value. For instance, an emerged question is: *Are there any circumstances related to the* ***minimal amount of space****, occurring during the* ***elapsed time before further exploitations*** *and concerning the* ***system to connect peripherals*** *that generate value for the* ***general customer*** *(end user), resulting as inputs for the design of a new product?*. An answer to this question can be found considering a way to minimize the amount of space of the power supply cord, e.g. using a wireless energy transmission.

5. Discussion and conclusion

The idea generation phase plays a key role in the product development process and some methods have been developed in order to support the designer in this critical activity. However, they suffer from an insufficient monitoring of the aspects of value that can be delivered to the end users. In order to develop a comprehensive idea generation technique considering all sources of value for the customer, the present paper presented a new tool, namely *Four Dimensions framework* (FDf). The proposal maps a wide range of situations, circumstances and working conditions, with the aim of individuating new sources of value for the customer. It considers four dimensions that contribute to the success of the product: *General Demands* (GDs) of the customers, product *Stakeholders* (SHs), different stages of product *Life Cycle* (LCs) and different levels of detail (*Systems*, SYSs) related to the product. The combination of these aspects allows systematically browsing a wide set of sources of value, thus supporting the identification of new product ideas.
In order to show how FDf works and draw some preliminary feedback about its functionality, the authors applied the tool to a successful product whose attributes evolution (from 1998 up to 2013) is known, i.e. Apple iMac. The obtained results are satisfactory, since 55 % of the new attributes introduced by iMac 2013 could be potentially identified by applying FDf to the 1998 model. The outcome is even more interesting, considering that electronic products are subjected to rapid obsolescence and hard competition [Haigh 2011]. However, the usability and reliability of the method in the industry has to be still demonstrated with real industrial applications. In addition, further research is needed for identifying possible ways to systematically extend the dimensions of value to be explored through FDf. This could make more exhaustive the search of new value opportunities. Moreover, further investigation is required to understand how the large number of combinations can be managed, in order to provide an effective idea generation method. Furthermore, the authors invite other researchers to propose additional value dimensions to be integrated in the developed approach. Eventually, the authors consider the possibility to extend the developed idea generation tool with criteria or methods that support the idea selection phase of the Product Planning.

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