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METHODS TO MEASURE CUSTOMER VALUE FOR THE NEW PRODUCT DEVELOPMENT PROCESS

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INTRODUCTION

"Everything is worth what its purchaser will pay for it" (quoted by Anderson and Narus, 1998) was one of the first conceptualizations of customer value importance and was stated by Publilius Syrus... in the first century B.C.. Thus, customer value is not a new concept to the marketing discipline or to the industrial world in general, and although it did not attract much explicit attention for many decades, as early as 1991, a popular business magazine -BusinessWeek -described customer value as the "new marketing mania". It then started to become a watchword for all marketing activity and, in recent years, there has been an increasing interest in the value construct among both practitioners and marketing researchers. As an example, the mission statement of Exxon Chemical is a proof of how customer value is today placed at the core of marketing strategies: *"Our mission is to provide quality petrochemical products and services in the most efficient and responsible manner to generate outstanding shareholder and customer value"*. On a more theoretical point of view, marketing academics have also placed customer value on top of their research agendas. As a matter of fact, over the past twelve years, the Marketing Science Institute has consistently included customer value in the list of its research priorities. In the area of business marketing, both the Institute for the Study of Business Markets (ISBM) at the Pennsylvania State University, and the Center for Business and Industrial Marketing (CBIM) at Georgia State University— two major US institutions giving special attention to business-to-business marketing—have integrated customer value research in their research programs. Finally, several international conferences and seminars have given broader attention to this area of research.

But how and why did customer value gain so much importance throughout the years?

To understand why creating customer value is becoming the centre of business strategy, a quick glance at the evolution of global competitive advantages since the birth of the industrial area can be useful.

More than two decades ago, in the 1980s, U.S. businesses were confronted to the threat posed by the superior quality of many foreign-made goods and numerous studies supported the existence of a relationship between product quality and performance. As a consequence, quality management became popular and managers learnt how to improve the quality of both their organization's products and internal operations processes. These efforts brought important performance improvements but ironically, too often they reinforced an internal orientation. Managers were consequently asked to take their customers into account when determining which improvements were needed, and customer satisfaction measurement emerged to bring the "voice of the customer" into quality efforts, which was a first step towards customer value orientation.

The 1990s was then the "product development decade": fast-followers became more and more efficient, reverse engineering and making an equivalent and less expensive version of many products in less than a year became possible. Product life cycles were no longer measured in years, but in months, and innovation became a key factor of success.

Thereby, during both the 1980s and the 1990s, the changes in competitive advantages were due to contextual and environmental changes. Today, organizations are confronted to new context mutations: more demanding customers, global competition, and slow-growth economies and industries; in this more and more complex context, managers lament that product quality and innovation no longer provide the basis for a competitive edge, at least if they do not bring their products and processes into line with customers'

requirements. Consequently, the search for advantage goes on, and instead of the same focus on internal processes and structure, it is widely agreed that a major management transformation should be a better attention to markets and customers.

Many organizations already reoriented their strategy towards superior customer value delivery and there are many cases of success stories of companies that manage this way. Some might say that the correlation between customer value orientation and performance is nothing obvious, but empirical studies and theoretical frameworks that confirm this positive link are convincing the last refractories.

For example, assuming that a high customer value is inextricably linked to loyalty -which sounds quite reasonable: if the clients come back for more, that means the product or service they bought met their needs or, so to say, that the customer value of this product or service was satisfying enough -, it was empirically proved that seemingly insignificant changes in customer retention rates often result in impressive improvements in profits. More precisely, Reichheld, Markey and Hopton (2000), studying a wide array of industries, found that an increase of 5% in customer retention could result in 25% to 100% profit swings, depending on the industries. Today, the companies with the highest retention rates (evidence of superior customer value) also earn the best profits.

The same authors created a theoretical framework attesting the positive effects of focusing on customer value. According to this framework, described in **Figure 1**, the value creation process is at the core of any successful enterprise; value creation generates the energy which holds the business together, and the correlation between customer value and profits is clearly underlined. In short:

1. Revenues and market share grow as the best customers are swept into the company's book of business, building repeat sales and referrals.

2. Costs shrink as the expense of acquiring and serving new customers and replacing new ones declines.
3. Employee retention increases because job pride and job satisfaction increase, in turn creating a loop that reinforces customer retention through familiarity and better service to the customers.

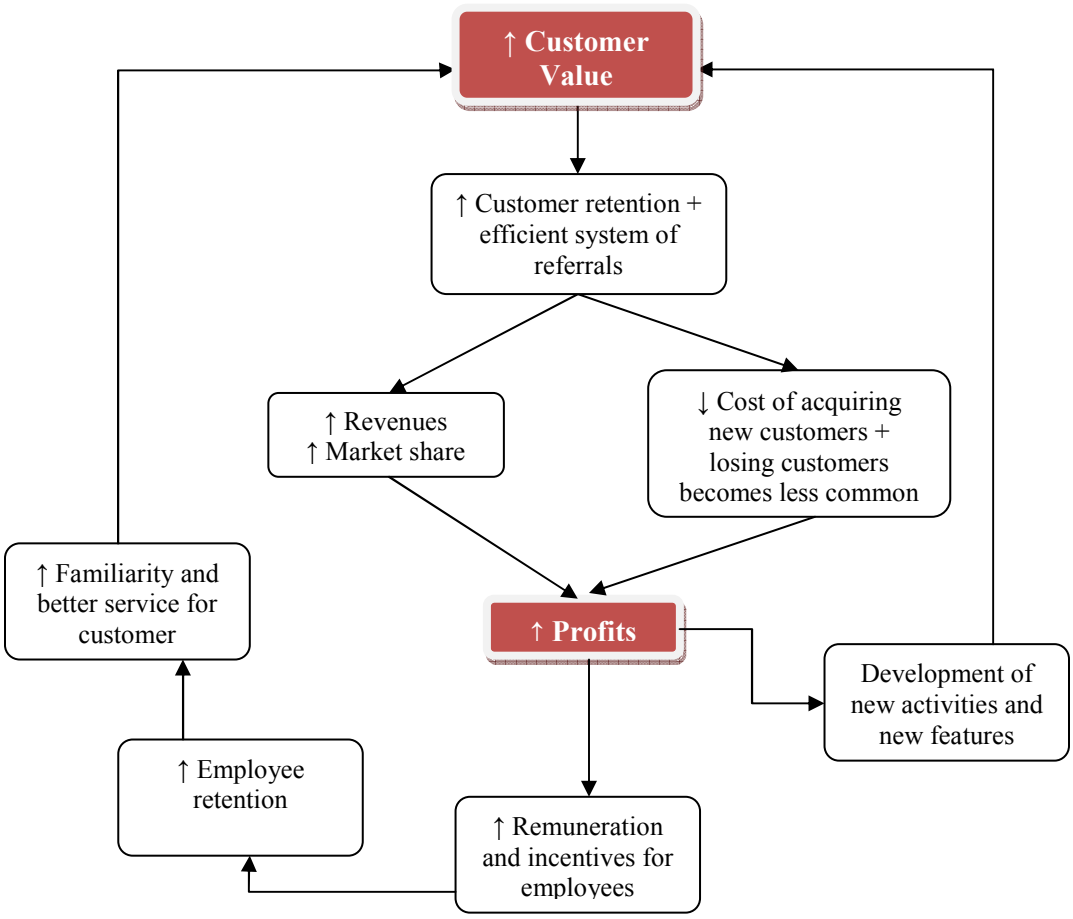


Figure 1: A theoretical framework about the link between customer value and profits

As costs go down and revenues go up, profits increase. This provides the resources to invest in superior employee compensation (further reinforcing retention) and in new activities or features that enhance customer value, thus further increasing both customer and employee retention.

However, the problem is that even if there are plenty of theoretical frameworks confirming the necessity to focus on customer value as a competitive advantage, there is a big gap between philosophy and practice, and the issue does not seem to be whether an organization should compete on customer value delivery but rather *how* it should do it.

If organizations want to become better at competing on superior customer value delivery, they need a corresponding set of "tools of customer value", they need to learn extensively about their markets and target customers. Deciding how to compete on superior customer value delivery raises difficult questions such as what exactly do customers value, how well do customers think a company delivers that value, or how will customers value change in the future. And this is not the easiest thing on earth. In most organizations, the producers assume that they know what the consumer will value and therefore buy. Unfortunately, the past provides too many examples in which those assumptions were far from valid. The Ford Edsel and McDonald's McLean Burger are notorious cases in point (Butz and Goodstein, 1996). More powerful tools are needed to really understand what the customer is looking and waiting for.

Moreover, even if customer value is correctly captured by a firm, managers must then translate customer learning into superior performance with customers or, so to say, an organization's internal process for delivering value must be brought in line with what customer value, increasing once again the difficulty of the task. Many are the business areas where customer value information should be integrated: new product development, product modification, design of marketing communication and sales tools, pricing, competitive analysis, demand forecasting, new investments etc. and the challenge is to integrate properly the customer value information that was collected into each of these business areas.

This work is an overview of how companies manage today to capture customer value and represent it in product design and development, through appropriate techniques, tools or technologies.

A first part, from chapter 1 to chapter 3, is a summary of what can be found in literature about the different theories around the notion of customer value (chapter 1), about the different means to measure customer value (chapter 2), and finally, chapter 3 is a presentation of the most important techniques, especially the ones related to lean manufacturing, used to incorporate the information on customer value into efficient product development processes. These first three chapters are mainly based on a literature review and a description of the state-of-the-art. The Excel table of **Appendix 1** summarises the principal ideas of each document that was consulted and served as the basis for organising the different contributions and writing a synthesis of all the ideas they held.

In the second part, we present the empirical study that we led to get a general idea of the customer value orientation of different Italian companies. In particular, two case studies were conducted: a first one to understand how different people perceive the customer value orientation inside a given company, and a second one to compare the customer value orientation of different companies. Chapter 4 is a description of the questionnaire that was created (the survey can be consulted in **Appendix 2**) and of the different companies that responded to the survey, whereas the results of our two case studies are gathered in Chapter 5.

The figure on the following page is a synthetic way of presenting the structure of our work.

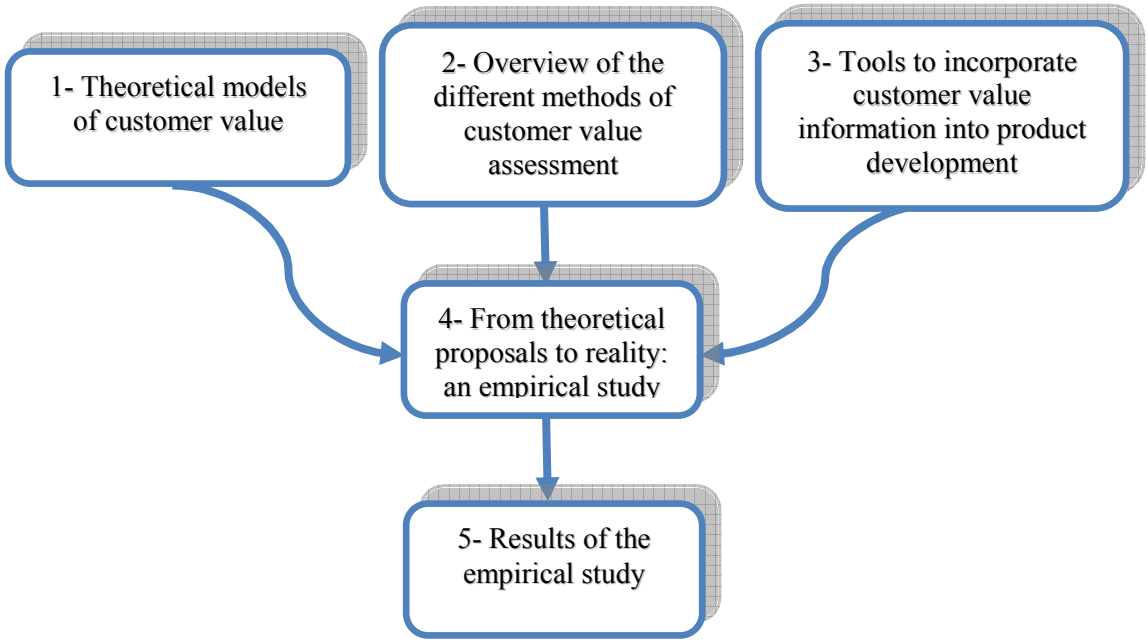


Figure 2: Structure of the paper

1. THEORETICAL MODELS OF CUSTOMER VALUE

ABSTRACT

The introduction underlined how taking customer value into account became a necessity and why developing customer value strategies is not a choice any more if companies want to survive. However, making customer value strategies work begins with a good understanding of the concept itself, and despite the many articles, there is still relatively little knowledge about what value is and what its characteristics are or, so to say, about the way to define it. This first chapter gives an overview of the most significant models about customer value and tries to clarify this concept. After a presentation of the most significant definitions of customer value and their common threads, a categorization of the different models will be proposed. Two interesting models -one taking into account "relationship value", and the other one easily applicable to lean product development processes -will then be introduced. Finally, the relationships between customer value and other similar concepts will be clarified.

1.1.A high diversity of definitions

A review of the literature on value reveals a wide diversity of opinions and no accepted definition of value exists. This variety of opinions comes from the fact that everyone who has written about value seems compelled to create a unique definition of the concept. Nonetheless, most of the definitions have things in common, that we will try to summarize in this part of the work. But first of all, the most quoted definitions of customer value are presented hereunder.

Chronologically, customer value has been defined as:

- *"The consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given"* (Zeithaml, 1988)
- *"The trade-off between the quality or benefits they perceive in the product relative to the sacrifice they perceive by paying the price'* (Monroe, 1990)
- *"The perceived worth in monetary units of the set of economic, technical, service and social benefits received by a customer in exchange for the price paid for a product, taking into consideration the available suppliers' offerings and prices"* (Anderson, Jain and Chintagunta, 1993)
- *"The market-perceived quality adjusted to the relative price"* (Gale, 1994)
- *"The emotional bond established between a customer and a producer after the customer has used a salient product or service produced by that supplier and found the product to provide an added value"* (Butz and Goodstein, 1996)
- *"A perceived trade-off between the positive and negative consequences of product use"* (Woodruff and Gardial, 1996)

- *"A customer's perceived preference for and evaluation of those product attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situations"* (Woodruff, 1997)

The existence of so many definitions makes a scientific discourse on customer value difficult because one may be discussing a completely different construct than his interlocutor's. Furthermore, many of these definitions rely on other subjective terms such as consequences, market-perceived quality, utility, emotional bond, perceived worth and perceived benefits, and two people using the same definition might still be considering value differently, depending on how they define these other terms.

However, these many definitions have common components, that we will call "common threads," and that we present here in order to get a first global idea of the value concept.

First of all, value is perceptual and this is probably the most universally accepted aspect of the concept. Indeed, some authors even use the terms "perceived value" or "value judgments" to refer to customer value. That means the consumer's evaluation of the value of a product or a service is not an objective process but is influenced by a perceptual distortion of reality, and that might be the main reason why, after all, it is so hard to find a universal definition to this concept.

Then, another widely shared opinion is that value is situationally and temporally determined. Thus, the perceived value of a product can be expected to vary across different types of purchase situations. Moreover, even for the same type of purchase situation, the value of a product can change over time based upon the customer's past experiences or satisfaction. It was agreed that a reduction in perceived value over time is

the most common outcome of multiple experiences, leading to brand or supplier switching.

Other areas of consensus are the following ones: customer value is linked to the use of a product, making it different from personal or organizational values, which are more enduring values (*see* ***§1.4.1.***); also, customer value is something perceived by customers rather than objectively determined by a seller; as Doyle (1989) said, value is *"not what the producer puts in, but what the customer gets out."*. Finally, it is generally a trade-off between what the customer receives (e.g. quality, benefits, worth, utilities) and what he or she gives up to acquire and use a product (e.g. price, sacrifices) - however, we will see in the following section that some theoretical models of customer value are not based upon this trade-off.

On the other hand, we can also identify some areas where the concept diverges. For example, the definitions differ as to the circumstances within which customers think about value; they may consider value at different times, such as when making a purchase decision or when experiencing product performance during or after use, which correspond to different judgement tasks.

Thus, many authors have acknowledged the difficulties involved in defining customer value, but they all made a contribution to the development of the customer value concept. These difficulties, as we underlined it before, stem from the subjectivity and ambiguity of value which come from the fact that customer value is a dynamic concept that evolves over time. Next section goes beyond the definitions, into more details, and present a categorization of the different theoretical models of customer value.

1.2. A categorization of customer value models

Khalifa (2004) built a categorization of the customer value concepts, making it clear that although these models were (to some extent) different, they were not mutually exclusive but overlapped with each other. Taken separately, each model is incomplete in itself and its usefulness is limited, because each category emphasizes certain dimensions of the concept and pays little attention to others.

According to him, the definitions of customer value can be grouped into three categories, with some variations within each category:

- value components models,
- utilitarian or benefits/costs ratio models,
- and means-ends models.

In the following sections, a brief explanation of each category of value models is presented.

1.2.1. Value components models

In the value components models, categories are created that gather the performances or physical characteristics of a product according to the different relevancies and influences they have in the customer's mind. The different classifications -or categories - of these features and functions depend on the models.

For example, according to Kaufman (1998), the principal value elements can be classified as: esteem value or "want," exchange value or "worth," and utility value or "need." Kaufman defines these elements as follows: esteem value or "want" invokes the buyer's

desire to own for the sake of ownership; exchange value or "worth" explains why the product interests the buyer and how and when the buyer will use the product. Finally, utility value or "need" is the primary value element which describes the performance and physical characteristics of the product.

Another model belonging to this category of value components model -and certainly the most famous one -is the Kano's model of customer perception of value. It includes three components of value: dissatisfiers (must be), satisfiers (more is better), and delighters (exciters). **Figure 3** is a representation of the effects of each of these components on customer satisfaction. A quick description of the notions of dissatisfiers, satisfiers and delighters then follows the figure.

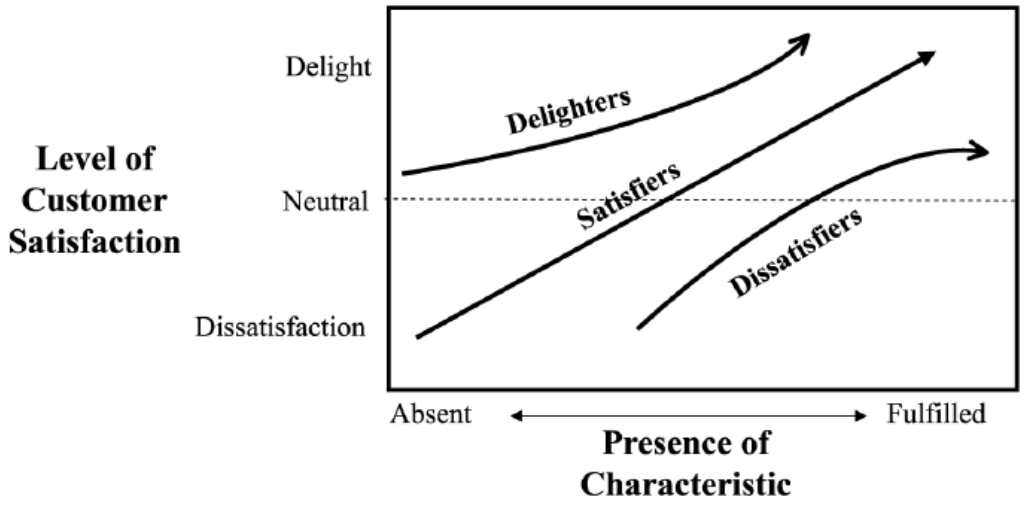


Figure 3: Kano's model of customer perception (Khalifa, 2004)

(1) *Dissatisfiers* are characteristics or features that are normal to a certain business industry, that are generally taken for granted, and that the customers have come to expect. Since they are expected to be there, their "presence" only brings customers up to neutral but their absence annoys them. They are sometimes called basic or must-have needs. These needs drive customer defection and attrition if they are not met.

(2) *Satisfiers* are expected features and they are explicitly requested by customers. They typically meet performance related needs and they add value for the customer. Customers are disappointed if these needs are poorly met but have increasing satisfaction (and perhaps even delight) the better these needs are met. These features are often considered the minimum standards to stay in business. However, it is important to note that very often, what is originally a satisfier then becomes a dissatisfier. Customer expectations generally rise and once an organization establishes a desired level of customer value, failure to maintain that level can be dangerous.

(3) *Delighters* are new or innovative features or characteristics that customers do not expect and they surprise them in a good way. They innovatively solve a latent need of the customer and add value that is beyond the customer's expectations or desires, at least on a conscious level. For example, offering a babysitting service by a cinema operator will delight movie-loving parents with small children. Since they are unexpected, there is no negative effect if they are absent; but when present they have a positive effect.

These value components models are especially useful when thinking about product features in the process of developing new products and/or services. However, since they mostly focus on product features, they pay modest attention to the interaction and relationship between customers and suppliers in product/service delivery, which can be another aspect of customer value. Moreover, they pay much less attention to the full customer activity cycle that goes from need identification through purchase to use and disposal of the product. Finally, they are also incomplete in that they focus on customer's benefits and demote the customer's sacrifice side of the value equation… what utilitarian models do take into account.

1.2.2. Utilitarian models

With utilitarian models, the problem of not considering the customer's sacrifice side of the equation is resolved, and value is defined in relation to pricing as the difference (or ratio) between customers perceptions of benefits received and sacrifices incurred. For this particular reason, utilitarian models are also called benefits/sacrifices ratio models.

These models are probably the most popular ones and the literature is full of utilitarian definitions of customer value.

For example, Woodruff and Gardial (1996) assert that the judgment of value results from a *"trade-off in positive consequences (benefits) or desired outcomes and negative consequences (sacrifice) or costs"*.

Treacy and Wiersima (1995) see customer value as *"the sum of benefits received minus the costs incurred by the customer in acquiring a product or service"*. For them, costs include both the money spent on the purchase and maintenance, and the time spent on delays, errors, and effort. Both tangible and intangible costs reduce value.

Huber, Herrmann and Hennerberg (2007) suggest that the costs of obtaining the perceived benefits are usually the major concern of buyers. In his model they propose that the relevant costs of a purchase considered by consumers include the following: monetary costs, time costs, search costs, learning costs, emotional costs, and cognitive and physical effort coupled with financial, social, and psychological risks.

Monroe (1990) defines customer-perceived value as *"the ratio between perceived benefits and perceived sacrifice"*:

$$Customer\ perceived\ value = \frac{Perceived\ benefits}{Perceived\ sacrifice}$$

In this formula, the perceived sacrifice includes all the costs the buyer faces when making a purchase: purchase price, acquisition costs, transportation, installation, order handling, repairs and maintenance, risk of failure or poor performance. The perceived benefits are some combination of physical attributes, service attributes and technical support available in relation to the particular use of the product, as well as the purchase price and other indicators of perceived quality.

Finally, Zeithaml (1988) defines customer-perceived value accordingly: *"Perceived value is the consumer's overall assessment of the utility of a product based on a perception of what is received and what is given"*. This definition is almost identical to the one of Monroe, but Zeithaml also points out that perceived value is subjective and individual, and therefore varies among consumers.

The common point of all these models is that consumers assess value by weighing the benefits received against the costs incurred. **Figure 4** is a representation of this concept. However, in any case, multiple benefits and multiple costs have to be considered, and these multiple benefits and costs might vary according to the models.

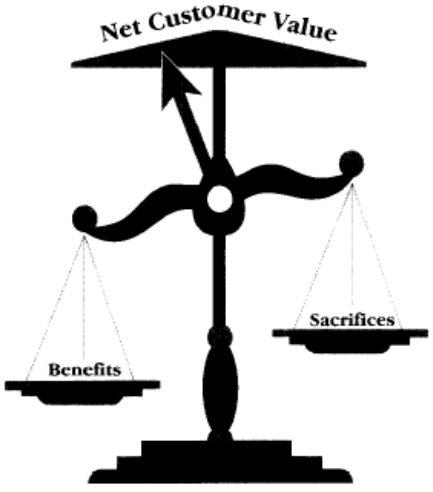


Figure 4: Representation of net customer value in utilitarian models (Butz and Goodstein, 1996)

Generally, when developing a utilitarian definition of customer value, authors specify which costs (monetary and non monetary factors) have to be taken into account (*see the examples of definitions on the previous pages*). However, even if it is commonly agreed that benefits include tangible and intangible attributes of the product/service offering, there is very rarely a clear explanation of what is intended by those "benefits". To fill in this gap, other authors tried to develop categorizations of benefits.

Palmroth (1991) suggests that consumers seek the following in the objects they acquire:

- *Safety*: protection from physical danger, financial loss, mental discomfort, or emotional anguish;
- *Performance*: how well the object does what is intended to do;
- *Appearance*: how the product looks to the buyer and how it will make the buyer look to others:
- *Comfort*: physical and mental comfort, ease and convenience;
- *Economy*: value for money; and
- *Durability*: how long the object will continue to provide the desired benefits

Examination of these benefits and their definitions reveals that they are consistent with the tangible/intangible dichotomy. Some benefits, such as performance and durability, derive directly from the attributes of the object while other benefits, such as comfort and safety, are aspects attributed to the object.

Sheth, Newman and Gross (1991) identified five benefits that they call consumption values. These are:

- *Functional value*: the perceived utility acquired by an alternative due to its ability to perform its functional, utilitarian or physical purposes;
- *Social value*: linked to the association with one or more specific social groups;

- *Emotional value*: linked to the ability to arouse feelings or affective states;
- *Epistemic value*: linked to the ability to arouse curiosity, provide novelty, and/or satisfy a desire for knowledge;
- *Conditional value*: linked to the specific situation or context faced by the choice maker.

This typology not only fits the tangible/tangible dichotomy but also adds some aspects that are consistent with the common threads we suggested in ***§1.1***. For instance, the conditional value specifically addresses the situational nature of value.

Finally, Holbrook (1994) described eight types of customer benefits or value:

- *Efficiency*: value resulting from manipulating something as a means to a self-oriented end;
- *Excellence*: personal satisfaction associated with the admiration of the characteristics of an object because they provide a means to an end;
- *Politics*: value resulting from manipulating something as a means to the other-oriented end of achieving a favourable response from someone else
- *Esteem*: value arising from the contemplation of one's own status or prestige as reflected in the opinion of others;
- *Play*: value derived from the pleasure of engaging in some activity;
- *Aesthetic*: value achieved by admiring something not as a means to an end but because it provides value in itself;
- *Morality*: value achieved by doing things because they are the "right" things to do, not because they gain us favour with others;
- *Spirituality*: doing things because of the value of faith or religious ecstasy.

Holbrook's typology is interesting because it allows an easier adaptation to a broader range of consumption experiences, such as religion, arts, and leisure activities. However,

by expanding to this more abstract level, it is more difficult to compare it directly to other benefit typologies.

As a conclusion to the utilitarian models, it can easily be argued that they are broader than the value components models and more complete. They consider customer value in a longer time horizon perspective and include almost all elements of customer activity cycle. However, they do not pay much attention to the dynamics of value building and destruction; they seem to be static rather than dynamic. They do not link benefits and sacrifices with customer ends, values and purposes. They also do not offer much on the importance of different benefits to customers or the significance of sacrifices, nor do they consider explicitly the consequence of all these on customer behaviour. The models from the last category, the means-ends models, do take some of these aspects into consideration.

1.2.3. Means-ends models

Means-ends models are based on the assumption that customers acquire and use products or services to accomplish favourable ends: means are products or services, and ends are personal values considered important to consumers. The means-ends theory, in other words, postulates that linkages between product attributes, consequences produced through consumption, and personal values of consumers underlie their decision-making processes.

Lanning (1998) is one of the authors who made an important contribution to the means-ends theory. He insists on the fact that the value that matters is the value in the

customer's experience not the value in the product, and thus gives the customer value concept a totally different perspective. He argues that the customer's resulting experience includes one or a series of related physical or mental events leading to an end-result or a consequence that is measurably specific. Learning to discover resulting experience to customers is often hard work but once discovered and articulated clearly, they are easy enough to understand. The question to ask, in order to understand the customer's resulting experience, is: "what would the customer perceive as the value of the end-result consequence of this event, compared to alternatives, if they could experience it?"

In an attempt to consolidate the diverse means-ends oriented definitions, Woodruff (1997) proposed: "*Customer value is a customer's perceived preference for and evaluation of those product attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situations*". Woodruff emphasizes that value stems from customers' learned perceptions, preferences, and evaluations.

His model in **Figure 5** demonstrates that moving up and down the customer value hierarchy explains both desired and received value and suggests that customers conceive desired value in a means-end way. Starting at the bottom of the hierarchy, customers learn to think about products as bundles of specific attributes and attribute performances. When purchasing and using a product, they form desires or preferences for certain attributes based on their ability to facilitate achieving desired consequence experiences, reflected in value in use and possession value, in the next level up in the hierarchy. Customers also learn to desire certain consequences according to their ability to help them achieve their goals and purposes (i.e., the highest level). Looking down the hierarchy from the top, customers use goals and purposes to attach importance to consequences. Similarly, important consequences guide customers when attaching importance to attributes and attribute performances. The customer value hierarchy

describes received value equally well. Customers evaluate products using the same desired attribute, consequence, and goal structure that they have in mind at that time. Further the customer's use situation plays a critical role in evaluation as well as in desires. If the use situation changes, the linkages between product attributes, consequences and goals and purposes change as well. For example, a customer's value hierarchy for Internet services used at work may look quite different than the hierarchy for those services used at home for entertainment.

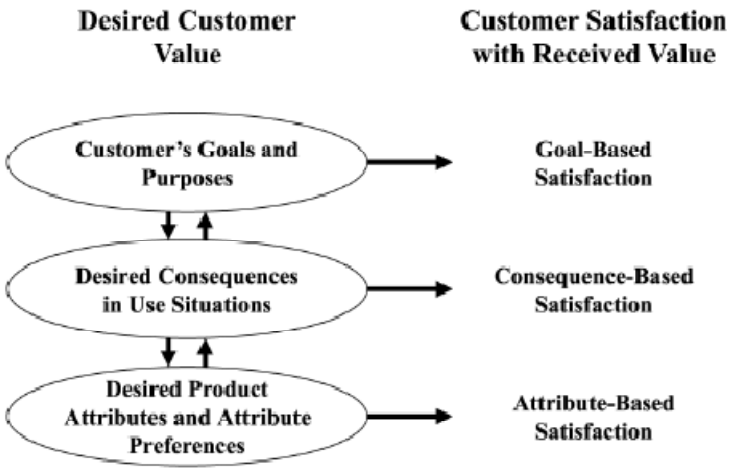


Figure 5: Woodruff's means-ends model of customer value (Woodruff 1997)

Parasuraman (1997) observes that Woodruff's discussion captures the dynamic and context-dependent nature of how customers judge value, the criteria they use to do so, and the relative importance they place on such criteria.

The means-ends models of customer value fill a gap in the literature by being able to explain why customers attach different weights to various benefits in evaluating alternative products/services. They also take into account the negative consequences of

certain product/service attributes but fail to pay sufficient attention to the sacrifices a customer is likely to bear in acquiring, using, or disposing of the product/service (whereas utilitarian models pay more attention to these elements). They also do not elaborate on the trade-offs customers are expected to make between benefits and sacrifices.

1.3.Two "out-of-category" models

The third section of this first chapter presents two interesting models of customer value that cannot really be associated to any of the categories that were previously exposed. The first one is actually an evolution of the utilitarian models, and takes into account the value of the relationship customer-producer during the whole life of their interaction. The second one is a more practical model, developed to help designers in the product development process.

1.3.1. Relationship value and a model of "total episode value"

Ulaga (2003) underlines that most research on customer value adopts a transactional approach focusing on product-related issues and neglecting relational dimensions of customer-perceived value. However, the value of having a relationship, for example the value of commitment from both parties, also needs to be taken into account when analysing the offering provided and the manner in which it influences the customer's perception of the value; the relationship itself might have a major effect on the total value perceived. The reason for purchasing may be simply because the customer has a relationship with this supplier and even though the offering is not exactly the one sought, the parties involved try to come to an agreement where the objectives of both parties can be met. In this situation the point of the discussion is changed. The issue is not what kind of an offering the company provides – rather it is what kind of relationship the company is capable of maintaining.

Since going into the details of all the relationship oriented customer value works would be too complicated, we decided to provide only a summary of these works in **Figure 6**. A careful review of these conceptualizations raises three important issues. First, although some common dimensions emerge, the proposed constituents of relationship value vary considerably among these definitions ("social benefits", "behavioural benefits", "relationship benefits", "network function"...). Second, most dimensions are only described in very broad terms and do not provide a clear understanding of their underlying facets ("strategic benefits" or "relationship costs"). Finally, no guidelines are provided as to how these dimensions could be combined to form an overall measure of relationship value.

Authors	Benefit dimensions	Sacrifice dimensions
Anderson et al. (1993); Anderson and Narus (1995, 1999)	economic benefits, technical benefits, service benefits, social benefits	price
Wilson and Jantrania (1995)	economic benefits, strategic benefits, behavioral benefits	none
Ravald and Grönroos (1996)	episode benefits, relationship benefits	episode sacrifices, relationship sacrifices
Grönroos (1997)	core solution, additional services	price, relationship costs
Lapierre (2000)	product-related benefits, service-related benefits, relationship-related benefits	price, relationship-related sacrifices
Möller and Törrönen (2003)	efficiency function, effectiveness function, network function	
Walter et al. (2003)	direct functions: quality volume safeguard indirect functions: market function scout function innovation function social support function	direct function cost reduction

Figure 6: Conceptualizations of relationship value (Ulaga, 2003)

We chose to develop herein only the applicable framework of Grönroos (1997), which might be the most concrete and understandable work on relationship value. This model is a particular evolution of the utilitarian models. Grönroos points out that the trade-off between benefits and sacrifices in long-term-oriented exchange processes is not restricted to the single episode level. Rather, value assessments should take into account both episode and relationship benefits and sacrifices. More concretely, in a customer-supplier relationship, Grönroos uses the term "total episode value", which then could be described as a function of both episode value and relationship value:

$$Total\ episode\ value\ = \frac{Episode\ benefits + relationship\ benefits}{Episode\ sacrifice + relationship\ sacrifice}$$

Grönroos defines supplier relationship costs (relationship sacrifice) as direct costs (e.g. insurance premiums, subscription fees etc.), indirect costs (e.g. delayed delivery, incorrect invoices etc.) and psychological relationship costs (e.g. cognitive effort needed to worry about whether the supplier will fulfil his commitment or not etc.).

As we can see with the formula above, a poor episode value can be balanced by a positive perception of the relationship as a whole. If the value of having a relationship with a certain supplier is perceived high by the customer, then a not so positive perceived value on an episode basis can be balanced and the total episode value kept on a satisfactory level. Moreover, according to Grönroos, the episode value and the relationship value exist in a mutually dependent relationship; positive episode value enhances the relationship value and a positive relationship value increases the total episode value.

Finally, according to Grönroos, the first equation is equivalent to the following ones:

$$Customer\ Perceived\ Value = \frac{Core\ solution + Additional\ services}{Price + Relationship\ costs}$$

$$Customer\ Perceived\ Cost = Core\ Value + or - Added\ Value$$

They describe the same value concept from varying angles. The core value means the benefits of a core solution compared with the price paid for that solution. The added value is created by additional services in the relationship compared with the relationship costs that occur over time. This added value can be both positive and negative: if it is positive, for example because of quick delivery, attentive and supportive service employees or smoothly handled service recovery, it contributes favourably to total perceived value; however, if additional services cause unnecessary or unexpected relationship costs, the effect of the added value component is negative. Negative added value is created by complicated systems, non-user friendly technology, unfriendly or unskilful employees, late deliveries, incorrect invoices, badly handled complaints, delayed maintenance of equipment, complicated equipment documentation, long queues to get served, etc. Even an excellent core value is quickly destroyed by late deliveries, lack of proper support and delayed maintenance, or unfriendly and untrustworthy personnel and a lack of interest in service recovery.

1.3.2. A model oriented towards lean product development processes

The second model that we chose to present in this paragraph is a model from Robert A. Slack (1999) from the Massachusetts Institute of Technology. The main interest of this framework is that it is far less theoretical than the other ones, and it is focused on the way to consider customer value in a product development process, which is particularly relevant for our work.

Robert Slack gives the following definition of value:

"Value is a measurement of the worth of a specific product or service by a customer, and is a function of (1) the product's usefulness in satisfying a customer need, (2) the relative importance of the need being satisfied, (3) the availability of the product relative to when it is needed and (4) the cost of ownership to the customer."

This model is thus part of the utilitarian models, and, according to Slack's work, value is defined as being directly proportional to the product of the need for an object (or service) and the ability of this object to satisfy this need, and it is inversely proportional to the cost of the product or service. He gives the following equation:

$$Customer\ Value = \frac{N * A * f(t)}{C}$$

Where:

- *N* = the importance of the need of the product or service. The value of *N* is fully determined by the customer.
- *A* = the ability of the product or service to satisfy the customer need. The value of *A* is determined by how well the product development process is executed.
- *f(t)* = the availability of the product or service to the customer, relative to the customer need date.
- *C* = the cost of ownership, is a function of product and service attributes as well as the efficiency of the product development process.

The above formulation is very similar to the one used in traditional Value Engineering where value is defined as the ratio of essential function over cost, which helps identify lower cost approaches to provide a given function (*see* ***§3.1.2.***).

The quantity *N* represents the importance for a given product. In the context of complex systems development, a given product may have a multitude of needs or requirements with specific individual importance. The above equation therefore could be used to evaluate value for a given requirement or function, or it could be used to evaluate the aggregate value of the product. The generalized aggregate value equation takes the form:

$$Customer\ Value = \frac{\sum(N * A) * f(t)}{C}$$

A, the ability of the product to satisfy the customer need, can be viewed in terms of probability: it increases as the product progresses through the product development process until the verification that the requirement has been accomplished, at which point it would be a maximum (1). A product which has demonstrated by test the ability to meet a requirement has eliminated the risk associated with this requirement and is of greater value to the customer than a product which has an element of risk associated with meeting this same requirement. The ability of the product to satisfy a customer need can be related to risk by the following simple relationship:

$$A = 1 - R$$

Where:

- *A* = the probability for a specific product to meet a specific customer requirement
- *R* = risk, the probability that a specific product does not meet a specific customer requirement.

With the above, a relationship between this definition of value and risk in the product development process is given by:

$$Customer\ Value = \frac{\sum[N * (1 - R)] * f(t)}{C}$$

The denominator of this equation, *C,* cost of ownership, is equivalent to the total life cycle cost of the product and includes acquisition costs and support, operations and retirement costs. This implies that to maximize customer value in the product development domain all of these costs have to be considered during development decision-making processes.

1.4.What customer value is NOT

Customer value is often mistaken with other concepts, and without knowing what value is, we cannot know what it is not. However, now that we had an overview of the main theories about customer value, it is important to understand what this concept is *not*. This conclusive part of the first chapter presents the conceptual differences between customer value and related terms.

1.4.1. About value in general

The term "value" shows up in several different contexts. For example, an increasingly common perspective on managing organizations argues that creating and delivering superior customer value to high-value customers will increase the value of an organization. High-value customers and the value of organization consider value from the perspective of an organization: high-value quantifies the monetary worth of individual customers to the organization, whereas the value of an organization quantifies an organization's worth to owners. Customer value, on the other hand, takes the perspective of an organization's customers, considering what they want.

Moreover, customer value is also different from personal or organizational values: it is inherent to the use of the product, whereas personal or organizational values are long-term, anchored values. Value refers to a preference judgements; values refer to the "criteria" by which such judgements are made. The value a consumer perceives in an item is driven by the values held by that consumer.

1.4.2. Quality, satisfaction and value

We herein delineate the interrelationships between quality and value, and between satisfaction and value.

First of all, perceived value and quality are a "higher level" and a "lower level" constructs. As a general rule, value is conceptualized on the basis of quality (i.e. the benefits of an offering) and price of the service (comprising all related sacrifices in order to gain access to the offering). More specifically, in the utilitarian models, value is understood as a cognitive trade-off of some kind between the benefits of an offering and the total cost the consumer has to invest in order to receive this offering (*see* ***§1.2.2.***). These conceptualizations of customer value clearly demonstrate the relationships between quality and value. Since quality is, by definition, an input to the offering benefits and therefore value judgments of the consumer, it is reasonable to assume that value is a higher-order concept than that of quality; it is a richer and more comprehensive measure of customers' overall evaluation of a product/service than its quality. Quality, in conclusion is only one of the determinants of value, it can lead to value, but is not equivalent to it.

The difference between satisfaction and customer value might be a bit more subtle. They are related, but distinct concepts. Many different models attempt to describe the link between customer value and customer satisfaction, but the most famous one may be the disconfirmation paradigm. The disconfirmation paradigm states that the customer's feeling of satisfaction is a result of a comparison process between perceived performance and one or more comparison standards, such as expectations (Woodruff, 1997). Prior to purchase and use of a product, customers form expectations of product performance in a

particular use situation. These expectations are predictions of the nature and level of performance the user will receive. After using the product, the consumer compares perceived actual performance with expected performance. The customer is satisfied when he feels that the product's performance is equal to what was expected. If the product's performance exceeds expectations, the customer is very satisfied, if it remains below expectations, the customer will be dissatisfied. **Figure 7** represents this relationship between customer value and customer satisfaction.

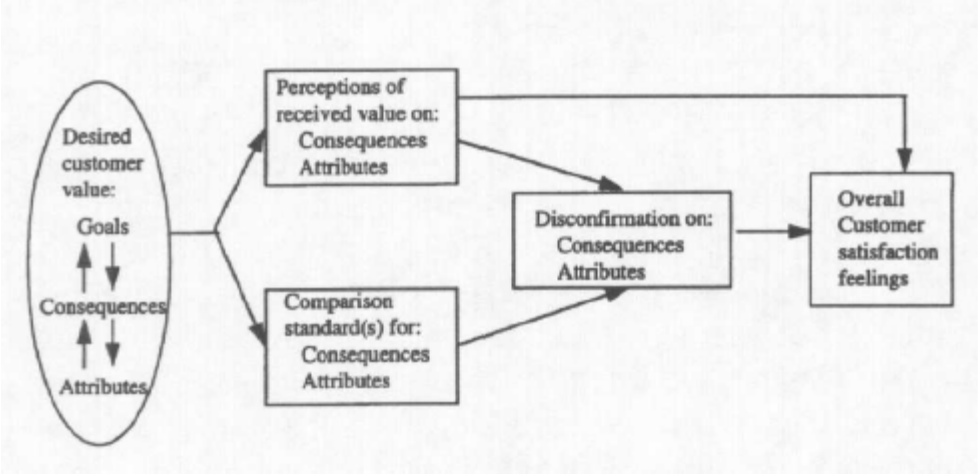


Figure 7: Relationship between customer value and customer satisfaction (Woodruff, 1997)

Consequently, the feeling of satisfaction essentially represents an affective state of mind whereas value is the result of a cognitive comparison process. Moreover, satisfaction must be considered a post-purchase construct and customer value, in turn, is independent of the timing of the use of an offering and can be considered as a pre- or post-purchase construct.

Thus, given that satisfaction is an inherently emotional and temporary mental state, and that it is only a post-purchase reaction, it is likely that instruments measuring customer satisfaction provide poor approximations of customer value. Actually, a research showed

that in business after business, 60-80% of customers who defect to a competitor said they were satisfied or very satisfied on the survey just prior to their defection.

To conclude this section, we can summarize the biggest differences between the two concepts in **Figure 8**.

Satisfaction	Customer perceived value
Affective construct	Cognitive construct
Post-purchase perspective	Pre-/post-purchase perspective
Tactial orientation	Strategic orientation
Present customers	Present and potential customers
Supplier's offerings	Suppliers' and competitors' offerings

Figure 8: Conceptual differences between satisfaction and value (Eggert and Ulaga, 2002)

2. OVERVIEW OF THE DIFFERENT METHODS OF CUSTOMER VALUE ASSESSMENT

ABSTRACT

Now that the value concept has been clarified, and with the definition of customer value clearly in mind, we can turn our attention to its measurement. Since a number of methods for customer value assessment exist but little is known about the usage of these methods in practice, the objective is to identify the set of methods used in assessing customer value and to determine the extent of their usage by industrial firms, through understanding of present practice. More precisely, this second chapter will first introduce a conceptual framework of customer value assessment, to make it clear how to proceed when one wants to capture customer value. A state-of-practice of the different methods to get data on customer value first, and to transform this data into information then, will be presented in the second and third sections of the chapter. The tendency towards the usage of integrated information systems to work on customer value will finally be referred to in the last part, with an example of a marketing software.

2.1.A conceptual framework of customer value assessment

The conceptual framework that is presented here is largely inspired from the "Customer Understanding Process" proposed by Butz and Goodstein (1996). Some of Woodruff's ideas (1997) were then added to make this framework more complete.

We therefore present here the first three steps of the customer understanding process proposed by Butz and Goodstein, which correspond to the process of customer value assessment:

- customer identification,
- planning the data collection,
- collecting the data.

2.1.1. Customer identification

The starting point is to clearly identify the customer, including everyone who affects the "buy decision": to fully understand how to increase customer value, it is essential to include each as a source of data. This is not always so easy, because today, decisions made by only one individual are quite rare and anyone who can exert positive or negative influence on the decision to buy must be included as a customer. This is particularly true if the customers are other businesses, because in such cases, the decision-making process is typically complex (different categories of people can be involved: procurement agents, contracting officers, multiple layers of management, boards of directors, etc.). The list of customers can then be put in priority order based on the degree of influence each has on the "buy decision." Developing that priority list requires input

from all those in the business who regularly deal with the customers. At the very least, one needs to identify the key decision makers, those who can derail any decision, and makes certain that their needs are met.

Since it is hardly possible to test customer value with all the current customers, targeting high-value customers -if they are recognizable - should be more efficient. A study showed that the top 10% of the customers of a firm were worth five to ten times as much in potential lifetime profits as the bottom 10% (Reichheld, 1996).

Finally, Woodruff underlines that this targeting process may include current customers, lost customers, and potential customers. Clearly, current "bonded" customers will provide important information. But so will former customers-those that have been lost over the years for one reason or another. These former customers can provide additional data that gives several different perspectives. Also important are competitors' customers-those who are implicitly stating that they do not think that one can meet their needs. Listening to them makes it possible to understand the substantive reasons of their choice and learn a good bit about the reasons why one have failed to meet the needs of certain elements of the marketplace.

2.1.2. Planning Data Collection

Conducting a complete customer understanding process is both time-consuming and expensive and consequently needs to be planned correctly. It can also disrupt the often fragile relationship between the customer and the supplier: indeed, by inquiring about how well we are serving our customer, we are implicitly raising his expectations about our service; having him express some of his needs makes him expect a positive response to this expression. Consequently, there must be explicit support for this process

in the highest levels of the organization, and this support requires an understanding of the process: its costs, including the risks, on the one hand, and its benefits, on the other. Moreover, there must be a commitment to using the results of this analysis. The customer understanding process should not be put in place unless a clear program of result analysis is defined.

Butz and Goodstein, focusing on the business-to-business aspect, argue that it is not possible to develop an adequate understanding of the customers and their needs without visiting them in their usual place of business, and that careful planning must precede any visit. One question that frequently arises in planning customer visits is at what level the visit should be conducted. Though there clearly needs to be dialogue at the most senior levels of management, there are significant advantages to broader interactions as well. Another planning question is whether the customer will even want to participate in such a process (and this is true even if no visit is planned, if the interaction is only "virtual", or if the client is not another business). Consequently, one has to make it clear how and why participation will benefit the customer, for example explaining that the customer will be helping the supplier position itself to meet both present and emerging customer needs, or that there will be fewer problems during the course of ordinary business between customers and suppliers. In any case, it is important to have ready answers for customers when they ask why they should participate in a process that initially appears to have advantages only for the supplier.

More concretely, the planning process is made up of mostly two phases. The first one is about collecting and analyzing whatever data is available about the customer. In a business-to-business perspective, this may mean studying the customer's annual reports and other relevant documents, to understand the customer's corporate goals, culture, and "driving forces". Next, a list of what questions to ask has to be drawn; a data collection checklist should be prepared. A sample checklist is provided in **Figure 9** hereafter. About

the questions to ask, Woodruff underlines that typical practice involves identifying the preferred or desired attributes. Organizations tend to learn most about the attributes that its customers value. Consequently, they may be missing an in-depth understanding of the specific use consequences, which would limit their ability to create and implement superior customer value strategies. Woodruff thus recommends using techniques that provide a more complete picture of customers' entire desired value hierarchy (*see* ***§1.2.3.***) or, so to say, that makes it possible to explore a broader, more complete range of desired value dimensions, particularly with regards to consequences.

Understanding the customer/product interaction

- Why does this customer use our product?
- How does this customer use our product?
- What customer problem does our product solve?
- What additional or new problems does our product create?
- How could our product be easier for this customer to use?
- How could we expand our service(s) to reduce this customer's problems?

Understanding the customer's values

- How does this customer define success?
- What does this customer see as *its* distinctive competence?
- What are this customer's problems?
- How can we make this customer more successful?
- What does this customer value?
- What changes does this customer see coming in his or her environment?

Understanding the customer bond

- How does this customer make his or her selection decision?
- How much of the total product budget does this customer spend with us?
- What would we have to do to increase our percentage of this customer's budget?
- How do we compare to our competition?
- What does this customer see as *our* distinctive competence?
- Under what circumstance might we lose this customer?

Figure 9: A sample checklist for the Customer Understanding Process (Butz and Goodstein, 1996)

2.1.3. Collecting the Data

The data-collection checklist serves to steer the data collection. If the checklist has been carefully and thoughtfully prepared beforehand, the actual collection process should be straightforward. However, a checklist is only a guide to keep the discussion focused on the customer's fundamental needs. The customers' responses require follow-up questions and interpretation to develop a full understanding of customer value.

To do so, data collection requires skills and sophistication in interviewing, skills that many persons do not have. Selecting the right people to conduct this task is critical to its success. For this particular reason, Butz and Goodstein recommend to use senior level people, perhaps accompanied by a consultant who is familiar with the company and who possesses outstanding listening and interpretative skills.

Moreover, in asking the questions, one must be aware that customers tend to give socially acceptable answers to many questions. For example, McDonald's developed the McLean Burger because its market research reported that customers wanted a "healthy" food -the socially acceptable response. When confronted by the choice between the new healthy product and the traditional Big Mac, however, the customers' true preference quickly emerged. One way to avoid such false leads is by asking customers comparative questions. For example, under what circumstances would they would choose Product A over Product B or Product C.

The next paragraph provides an overview of the most common techniques to collect data.

2.2.How to get data on customer value: a state-of-practice overview

2.2.1. Description of different methods

In this section, the most usual methods that are used to assess customer value (according to a study by Anderson, Jain and Chintagunta, 1993) are presented. The first three ones are part of a larger category called "industrial engineering estimates of customer value".

Internal engineering assessment

The first method requires little or no direct customer input, and is called internal engineering assessment. With this technique, an estimate of the value of a product is obtained by laboratory tests conducted by scientists/engineers within the supplier's own firm. Application of this method depends upon detailed knowledge of the usage of the product by the customer (as well as the usage in the customer's production process in the business-to-business case). Assumptions are typically made about the way in which results from lab tests will generalize to the customer's actual usage of the product.

Field value-in-use assessments

They are interviews conducted with the customers to determine a comprehensive listing of cost elements associated with the usage of a product. All relevant costs associated with the product offering and its usage need to be considered. Making then explicit assumptions, values are assigned to these cost elements to estimate the overall value-in-use of the product offering in that application. By contrast with the first method, value-in-

use assessments require considerable customer cooperation and active input to arrive at an estimate of customer value.

Gemba research can be considered an evolution of value-in-use assessment. Gemba is a Japanese word which means ‘‘the true source of information’’. It is the place where the product or service acquires value for the customer; where it is actually used. During a Gemba research, customers are not only asked about the different costs elements associated with the usage of a product, but they are observed while using this product. These observations then make it possible for the “observer” to determine the different costs incurred by the usage of the product, the problems or the opportunities it creates.

Indirect survey questions

This method is intermediate to the previous two methods in the extent of customer cooperation or active input that is required to provide an estimate of value. Respondents are asked what the effects of one or more changes in the present product offering would be for them. From these answers, typically combined in some way with other known information, estimates of the value or worth of each product offering change can be obtained. Hence, this method can be used to fill in critical gaps in the supplier firm’s knowledge of the customer’s usage of its product offering, or to test whether assumptions made about this usage are reasonable.

The next method provides overall estimates of customer value.

Focus group value assessment or direct survey questions

In some cases, field value assessment is not possible and the only way to obtain information for a value model is to rely on customer perceptions. Within a focus group setting or through direct survey questions, participants are exposed to potential product

offerings or product concepts, and are then asked what their value or worth would be for them. The goal is to gain a better understanding of the perceptions and reactions of participants to actual or potential product offerings. In doing so, the researcher attempts to generate estimates of value. A series of follow-up questions would be needed to gain an understanding of how the component parts of an offering contribute to its overall estimated value.

Two methods of customer value assessment can be grouped together as being "decompositional"; that is, they enable a researcher to break down a respondent's overall perception of the value of a product offering into the elemental values contributed by its component parts. They are the conjoint analysis and the benchmarks.

Conjoint analysis

Respondents are asked to evaluate a set of potential product offerings in terms of their purchase preference for each of the offerings (through a specific rating or ranking). Each offering consists of an array of attributes or features, and the levels of these attributes are systematically varied within the set of offerings. Statistical analysis is then used to "decompose" these ratings into the value that the respondent places on each level of each attribute. The range of these values for the levels of each attribute determines the relative value of attributes themselves. Green, Krieger and Wind (2001) precise that for such studies, researchers may prepare prop cards like the ones in **Figure 10**. After the respondents sort the prop cards in terms of preference, they might be asked to rate them on a 0 to 100 likelihood-of-acquisition scale. This method has received the most research by marketing academics of any value assessment method. Thousands of applications of conjoint analysis have been carried out over the past three decades.

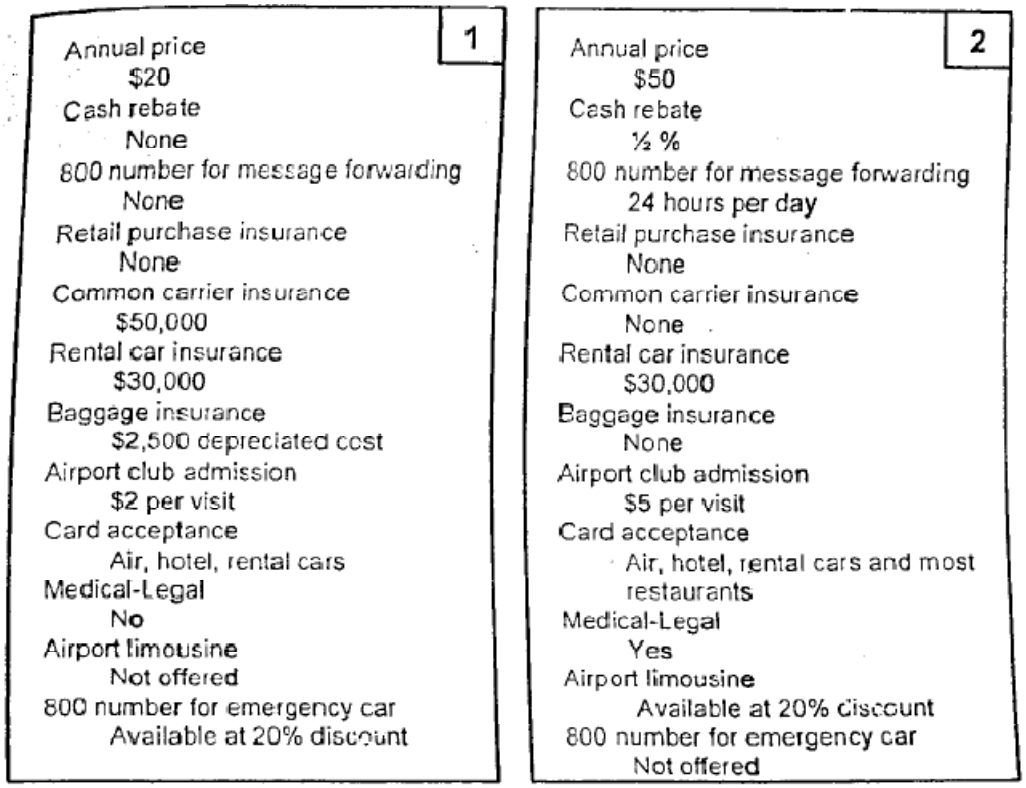


Figure 10: Prop cards of services that a credit card could offer (Green, Krieger and Wind, 2001)

Benchmarks

With this second decompositional method, respondents are given a description of a product offering, typically representing the present industry standard, which serves as a "benchmark" offering. They are then asked how much more they would be willing to pay for selected additions in product attributes or features to this "benchmark" offering. Likewise, they might be asked how much less they would expect to pay for selected reductions in attributes or features from the "benchmark" offering.

An opposite methodology is taken with the compositional approach, also referred to as the self-explicated approach.

Compositional approach

With this approach, an overall value estimate for an offering is built up from separate value estimates given by respondents for each of its elements: respondents are asked to directly give the value of selected levels of a set of attributes or features; the values given for the attribute levels can then be added to give estimates of the overall value of various product offerings to the respondent. Although the compositional approach has the strength of being relatively easy to use, particularly when the number of attributes studied is large, it does have some potential shortcomings, such as respondent unwillingness to reveal the true values for attribute levels.

Importance ratings

Respondents are given a set of attributes or features of a product offering and are then asked to rate (or rank) theses attributes on importance to them. For the attributes or features that were rated, respondents are also asked to rate (or rank) the supplier firms with respect to their performance on them, thereby providing a competitor analysis of the value provided by each supplier's product offering. A shortcoming of importance ratings as a method of customer value assessment is that they do not provide an estimate of the perceived worth in monetary units of the product offering or its elements.

Apart from these eight methods described by Anderson, Jain and Chintagunta in their study, we find it important to underline that most companies willing to measure the customer value of their products organize satisfaction studies. In those studies, clients are asked what they think about particular features of a product or service they bought. However, the section about the efficiency of the different methods (*see **§2.2.3.***) provides some arguments against such techniques, and we already mentioned in **§1.4.2.** that satisfaction generally provides poor approximation of customer value.

Other techniques also include field-depth interviews and field tests. Field-depth interviews, conducted at the customer firm, trade shows or industry meetings, make it possible for the supplier firm, who has less information, to learn more about very technical products. Field tests of sample or prototype product offerings can help assessing whether a higher performance product also meets customers requirements.
Finally, some researchers argue that studying customer defections can also be a good way to do it (*see* ***§2.2.3.***).

To conclude about the different methods to measure the customer value of a product, it might be interesting to briefly describe how Toyota, following its Lean philosophy (*see* ***§3.2.1.*** *for a quick description of Lean*) manages to assess customer value. As a matter of fact, Toyota goes beyond the techniques that were previously described, selecting program leaders with the background and the experience to establish an emotional connection with the target customer (Morgan and Liker, 2006). Morgan and Liker precise that the program leader at Toyota is the Chief Engineer (CE). In addition to being a super engineer, he or she must understand what customers value and how these value characteristics fit to the new vehicle performance characteristics. Toyota's chief engineers and their staffs go to great lengths to achieve this understanding. One anecdotal example illustrates this fact: a chief engineer did not hesitate to move in with a young target family in Southern California to enhance his understanding of the generation lifestyle associated with the customers of a new vehicle. Moreover, to assure that the driving experience achieves maximum benefit, CE team members receive advanced driving training as well as vehicle evaluation-skill training to identify problems and recognize improvement opportunities.

2.2.2. Usage of the different methods

Figure 11 on the next page presents the results of the study by Anderson, Jain and Chintagunta (1993) about the usage of the different methods. After a definition was given for each method, informants were asked "Are you familiar with this method?". The percentage of informants answering "yes" is presented. Then, they were asked "Have you used this method in the past two years", and the results are presented in the last column ("usage").

A general finding is that industrial firms rely upon methods that have less complexity or cost associated with them. For example, focus group value assessments and importance ratings are the only methods that have 90% or greater familiarity and 60% or greater usage. Direct survey questions and internal engineering assessments are also quite common methods. Compositional approach, on the opposite, is much less familiar, maybe because of its greater complexity. The same remark can be done for conjoint analysis.

No general figure is available about satisfaction surveys, but they are likely to be the most common method. Defection analysis, on the opposite, is used by very few companies. Reichheld (1996) uncovers seven principal reasons for this underutilisation:

- Many companies don't understand the intimate, causal relationship between customer loyalty on the one hand and cash flow and profits on the other.
- It is unpleasant to study failure too closely, and in some companies trying to analyze failure can even be hazardous to careers.
- Customer defection is often hard to define.
- Sometimes customer itself is a hard thing to define.
- It is extremely hard to uncover the real root causes of a customer defection and extract the appropriate lessons.

- Getting the right people in an organization to learn those lessons and then commit to acting on them is a challenge.
- It is difficult to turn the analysis of customer defections into an ongoing strategic system, closely supervised by top managers and quickly responsive to changing circumstances.

Method	Familiar With[a]	Usage[b]
Internal engineering assessment	61.3	42.5
Field value-in-use assessment	63.8	36.3
Focus group value assessment	92.5	60.0
Direct survey questions	91.3	48.8
Importance ratings	91.3	62.5
Benchmarks	83.8	27.5
Conjoint analysis	75.0	28.8
Compositional approach	45.0	10.0
Indirect survey questions	71.3	26.2

Figure 11: Usage of the different methods (Anderson, Jain and Chintagunta, 1993)

2.2.3. Success of the different methods

Again, the results about the judged success of the methods from the study by. Anderson, Jain and Chintagunta (1993) are presented in **Figure 12**. It appears from this table that even allowing for the subjective nature of judging success, applications of these methods are almost never "not successful." Further, all the applications of these methods are judged to be successful, rather than partly successful.

Considering specific results, conjoint analysis has the highest percentage of judged successful applications (85.3%). So, when firms use conjoint analysis, it successfully provides the answers to the value-related questions that they wanted to address. However, in some specific cases, conjoint analysis might not be the best method to capture customer value, for example for complicated or abstract product concepts.

On the contrary, internal engineering assessment has the lowest percentage (55.9%) of judged success, perhaps because of the difficulties of internally having sufficient knowledge of the customer firm's actual usage of the product offering.

The most-widely-used methods, importance ratings, focus group value assessments and direct survey questions, are judged to be successful in 75.8%, 70.0% and 66.7% of their applications, respectively. However, these methods should not be used alone. Generally, focus group value assessments are perceived to be most useful as a preliminary value assessment method, particularly at the concept stage of product development, rather than as a method that can be used to conclusively determine value. Importance ratings can be used to identify key attributes of a product offering, but additional ratings of the relative performance of suppliers on the attributes of the product offering would be needed to obtain a ranking of the value provided by the alternate suppliers' offerings. Finally, direct survey questions should be used when quick, quantitative information is needed and for

familiar, simple, non-technical products; otherwise, it should be used in conjunction with other methods.

Method	Partly Successful[a]	Successful
Internal engineering assessment (u = 34)[b]	44.1	55.9
Field value-in-use assessment (u = 32)	28.1	71.9
Focus group value assessment (u = 60)	30.0	70.0
Direct survey questions (u = 48)	33.3	66.7
Importance ratings (u = 62)	24.2	75.8
Benchmarks (u = 28)	32.1	67.9
Conjoint analysis (u = 34)	14.7	85.3
Compositional approach (u = 8)	25.0	75.0
Indirect survey questions (u = 25)	32.0	68.0

[a]Includes sparse informant reports of "not successful" (3 reports, .9%)

[b]The number of reported usages, u, is given in parens for each method.

Figure 12: Judged success of the different methods (Anderson, Jain and Chintagunta, 1993)

Specific comments then have to be made about the efficiency of satisfaction surveys, which are widely used by the biggest industrial companies. Some academics refer to this phenomenon as the “satisfaction trap”. In the first chapter, the conceptual

distinction between satisfaction and customer value was underlined (*see* ***§1.4.2.***), and according to these academics, as tools for measuring the value a company delivers to its customers, satisfaction surveys are imperfect. They argue that satisfaction surveys have two principal problems (Reichheld, Markey and Hopton, 2000).

The first one is that satisfaction scores have become an end in themselves for many companies -in many organizations, they are considered a higher goal than profits, whereas satisfaction is not directly related to market share and profits. Today, as a result, more than 90% of industry customers report that they are satisfied or very satisfied, but repurchase rates remain in the 30% to 40% range. Even more striking, in business after business, 60% to 80% of lost customers reported on a survey just prior to defecting that they were satisfied or very satisfied.

The second problem is that satisfaction surveys are often poorly conceived and conducted: they measure the wrong activity or the wrong customers; they are easy to manipulate; they encourage companies and employees to invest time and money unproductively. For example, whenever rewards are based on satisfaction scores, the result is unproductive behaviour. Employees naturally seek the easiest ways to improve scores, not necessarily the most profitable ways. To illustrate this fact, calling customers immediately after they have bought a car and asking about the experience is one way to keep scores high but probably won't lead to increased loyalty. Another drawback is that surveys ignore critical distinctions among customer segments (in the first phase of the framework presented in ***§2.1.1.***, one advice was to focus on high-value customers). Satisfaction research conducted broadly across the entire customer base will necessarily show the influence of unprofitable customers: companies should channel their consumer-satisfaction investments toward customers with the highest potential value. Finally, another weakness of satisfaction surveys is that an increasing number of customers are

tired of being surveyed. Some companies contact their customers up to six times in a year, for six different surveys.

On the opposite side, despite being scarcely used, defection analysis is gaining increasing support amongst academics, for two main reasons. First of all, and contrarily to satisfaction, defections are strongly linked to customer value and are even the clearest possible sign that customers see a deteriorating stream of value from the company. Second, a climbing defection rate is a sure predictor of a diminishing flow of cash from customers to the company, and is consequently closely related to profits (*see* ***Introduction***).

Finally, Gemba research is also seen as a very powerful tool to measure customer value and its efficiency is highly recognized. An explanation for this high success is that only by meeting customers and by seeing how they use products and services can manufacturers understand what customers consider to be important, what difficulties they have to deal with, or what their wishes and opportunities are. Many of these problems are invisible to outside observers, and given that customers may not express these needs verbally, observing customers ‘‘at work’’ is an excellent way of learning more. However, customers’ words or phrases are usually too general and detailed to be directly used as customer needs and therefore they need to be ‘‘translated’’ into more suitable terms.

2.3.How to transform customer value data into information

Very often, the methods that were previously presented provide data such as the importance of different product attributes or the performance of a given firm on these attributes. However, this data is sometimes not enough to implement an efficient value-oriented strategy. This section is a presentation of the most famous tools used to transform customer data into real information.

2.3.1. Gap analysis

Most of the time, techniques to transform data into information are based on a gap analysis. However, many different kinds of gap analyses can be conducted.

For example, the method of gap analysis proposed by Parasuraman (1997) can be used to test for gaps between producers' perceptions and customers' expectations about attributes. A negative (positive) gap occurs for contribution to product value when the customer's mean response is greater (less) than the producer's mean response for attributes. In this case, identifying and correcting the gaps can help the producer prioritize resources and avoid loss of revenue. Removing gaps can also help ensure the delivery of value to the customer. **Figure 13** shows the results of a gap analysis about the contribution to product value. Negative gaps are considered more important because such gaps may result in a loss of customers. Positive gaps are not necessarily good because they can indicate an over-commitment of resources in one or more areas.

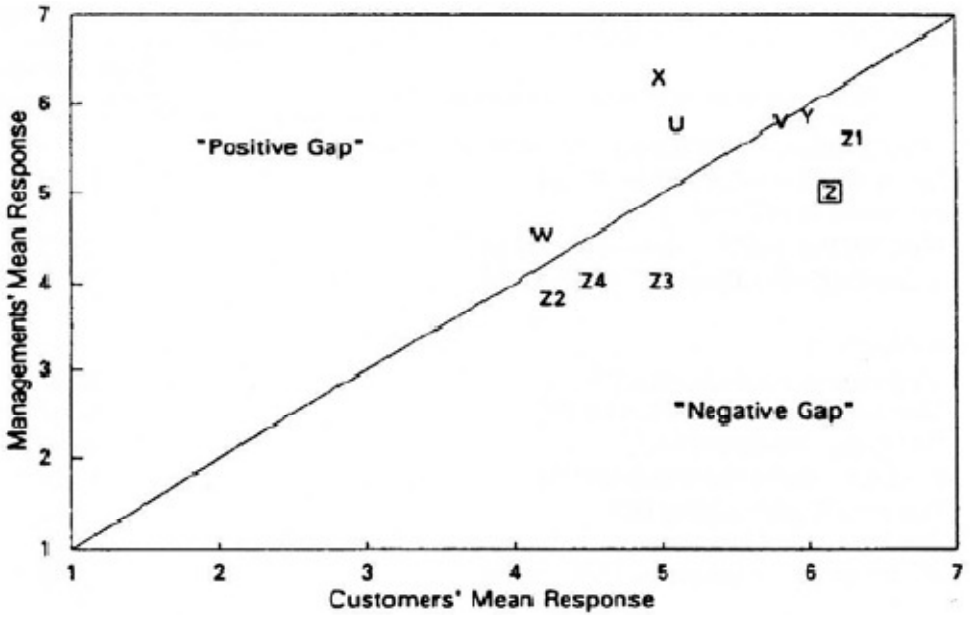


Figure 13: Gaps between the producer and the customer interviewed about the contribution of attributes to overall product value (Idassi, Young, Winistorfer, Ostermeier and Woodruff, 1994)

In this figure, the product attribute X contributed less to the overall product value of the customers than perceived by the producer, whereas the management underestimated the contribution of attribute Z.

Another kind of gap analysis can be down considering the satisfaction between the producer and the customers' other best supplier, as shown in **Figure 14**. In this particular case, customers are globally pleased with attribute Y whereas attribute Z2 has one of the lowest levels of satisfaction. However, there is a positive gap for this attribute Z2: the producer performs better than its competitors on this attribute. A negative gap occurrs for the service attribute U: the customers are less satisfied with this attribute for the producer than for their other best supplier. This type of gaps may be critical to a

company for maintaining its present level of cutomers and designing proactive strategies for improving customer relations.

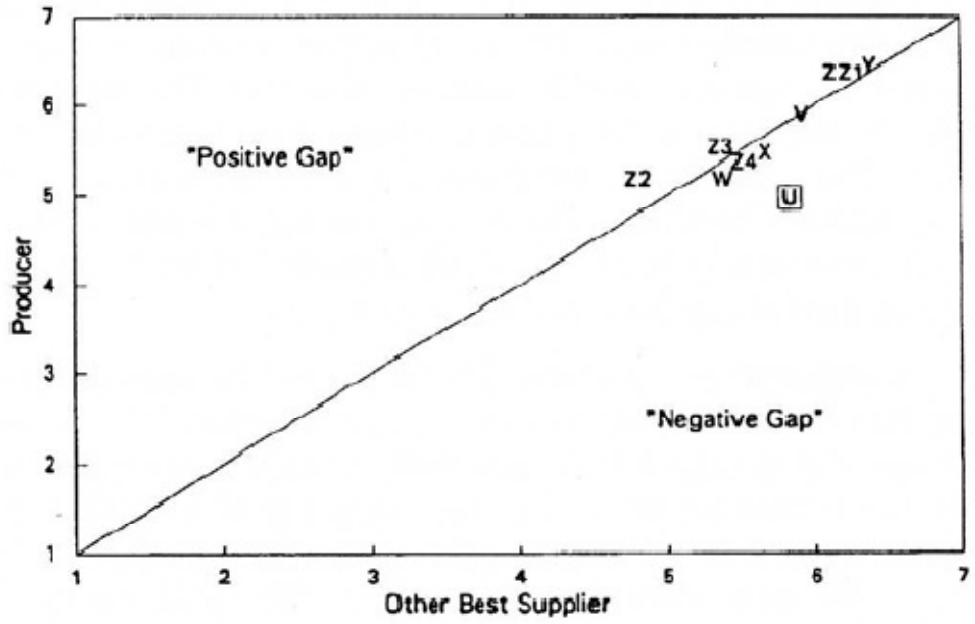


Figure 14: Gaps in satisfaction between the producer and customers'other best supplier, as related to product attributes (Idassi, Young, Winistorfer, Ostermeier and Woodruff, 1994)

The Importance-Performance analysis can be considered another kind of gap analysis. The last paragraph of this section goes into more details and explains how this particular gap analysis can be used to identify value.

2.3.2. The value map

The customer value map, introduced by Gale (1994), is a tool to analyse whether a product has provided superior customer value by plotting market perceived quality

(MPQ) against market perceived price (MPP) on a two-dimensional chart (*see* ***Figure 15***). MPQ is the sum of multiplications between performance scores ratio (R) and importance weight (W) on each quality attribute (for example aesthetics, environmental impact, ease of maintenance…). MPP is calculated as MPQ; the only difference is that MPP is applicable on price attributes such as purchase price, resale price, or interest rates.

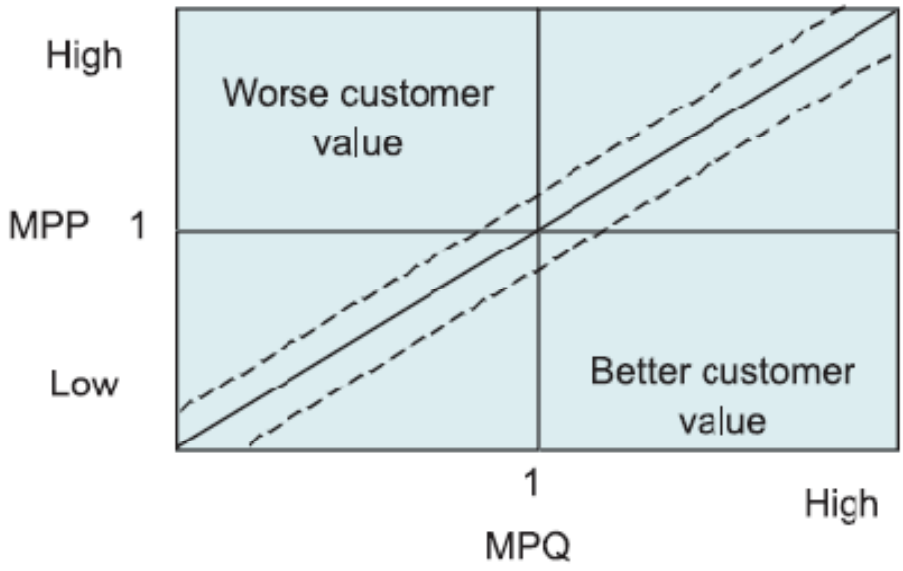


Figure 15: Customer Value Map (Setijono and Dahlgaard, 2007)

Performance and importance scores data are usually collected using one or more of the methods previously presented (*see* ***§2.2.***). Performance scores represent customers' cognitive judgment on product attributes, for example measured on a 1-7 scale, while the importance weight usually is measured using a 0-100 scale, which represents how the various product attributes are weighted in the customer's decision.

Hence, we have:

$$MPQ = \sum_{i=1}^{n} Ri * Wi$$

$$MPP = \sum_{j=1}^{m} Rj * Wj$$

where:

- i = 1, 2, 3, . . . n, represent the quality attributes,
- Ri: ratio between the performance score of a product and the performance score of the competing product(s), on the quality attribute i,
- Wi: the weight (importance) of quality attribute i,
- j = 1, 2, 3, . . . m, represent the price attributes,
- Rj: ratio between the performance score of a product and the performance score of the competing product(s), on the price attribute j,
- Wj: the weight (importance) of price attribute j.

The "fair value zone" is the area where the ratio between MPQ and MPP is approximately 1. Within this zone, products or firms provide ''fair'' customer value, meaning that customers perceive a product with a certain quality level worth to be bought at its current price level. Outside this zone, a product or a firm provides more or less customer value (depending on the location of the point). A product or firm that provides better customer value is more competitive in the market compared to its competitors. However, Gale does not further discuss the way to determine the zone of fairness. Therefore, the fair value zone must first be determined, and no objective method has been created so far to do so.

Additionally, the value map mainly highlights customer value as a factor that influences purchasing decisions and not customer value in a use-context. However, by extending the

term “price” to “life cycle cost”, and thus considering the cost of ownership during the lifetime of a product, it can be argued that the customer value map is also applicable in a use-context.

As a conclusion about this tool, the value map is useful to indicate whether the value of a product is perceived as ‘‘superior’’ or ‘‘inferior’’ compared to other competing products, and if the value of an individual product is perceived as fair, low value, or high value.

However, the value map is inadequate to indicate what product attributes must be improved to enhance the value provided to the customers. Therefore, the value map should be combined with a Performance-Importance matrix to identify improvement opportunities, so that the product attributes that cause the ‘‘inferiority’’ on customer value can be identified.

2.3.3. Importance-Performance analysis

The last tool that we want to introduce and that can be used to understand customer data is the Importance-Performance matrix (I-P matrix), considered as a particular gap analysis. The I-P matrix can be used as a tool to evaluate a firm’s competitive position in the market, to identify improvement opportunities, and to guide strategic planning. It utilizes customer satisfaction data, where for each product (or service) attribute, the average score of performance is plotted against the average importance score using a 2x2 matrix; these attributes are then positioned in a grid with four quadrants, as represented on the next page (*see* ***Figure 16***).

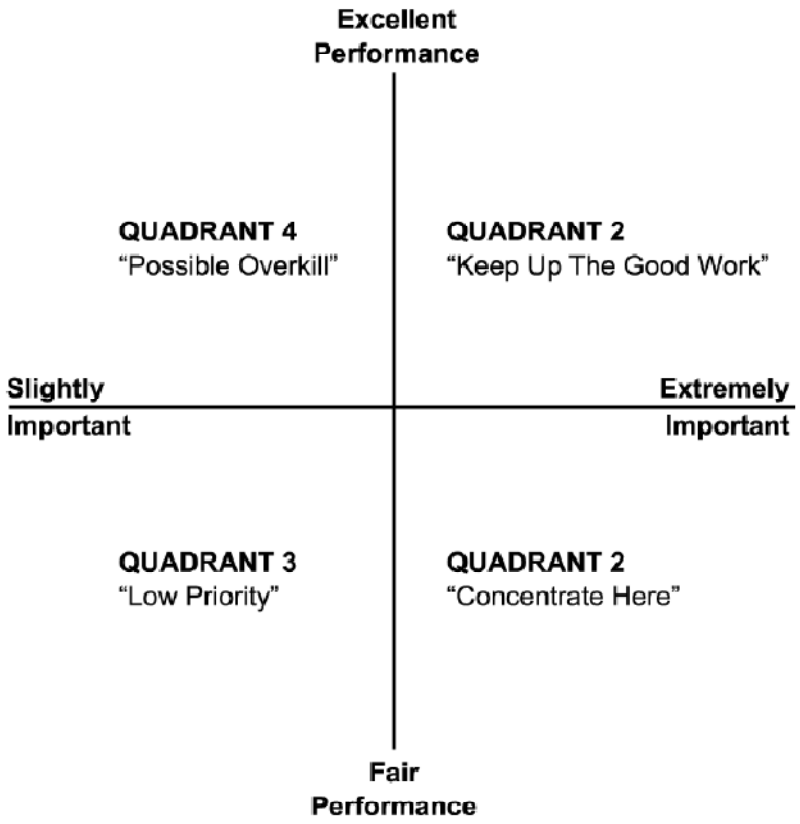


Figure 16: The four quadrants of the Importance-Performance analysis (Garver and Cook, 2001)

The area where the difference between the importance score and performance one is close to 0 is called the "satisfaction interval", as represented in **Figure 17**. This area is analogue to the zone of fairness in the value map, if we define ''fairness'' as the absence of gap between performance and importance. Hence, satisfaction is here defined as a condition where the difference between P and I is equal or near to 0, which is coherent with the arguments of **§1.4.2.**. Outside this zone of satisfaction, product attributes are categorized as delighters if their performance is larger than their importance, while these

attributes are dissatisfiers for the customers if the performance is lower than the importance.

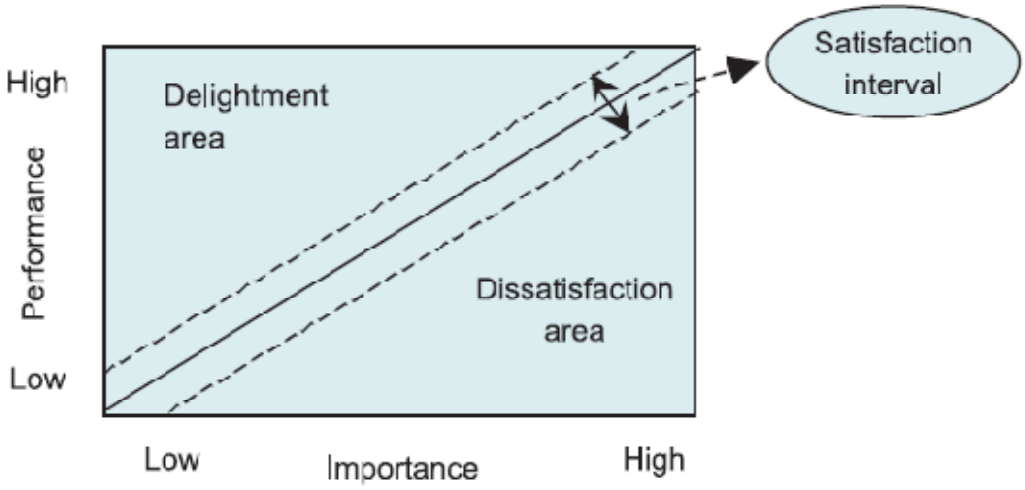


Figure 17: The satisfaction interval in the I-P matrix (Setijono and Dahlgaard, 2007)

However, numerous studies reveal a big limitation of the Importance-Performance Analysis (IPA), as there is growing evidence that the relationship between attribute-level performance and overall satisfaction with a service can be asymmetric and nonlinear (*see the Kano's model* ***§1.2.1.***). In other words, the "importance" of attributes in the creation of the customer's overall satisfaction may vary, depending on the current level of attribute-performance. Neglecting these asymmetric effects has implications for IPA and can be misleading, because the technique assumes linear and symmetric relationships that do not allow for the possible existence of satisfiers and dissatisfiers.

2.4.Towards an integrated information system

Finally, the last part of this second chapter introduces some aspects about information systems aimed at capturing and analysing customer value. After some general considerations about such systems, the example of a specific software, "Marketing War Room™", is given, and its functionalities are presented, as well as some snapshots of its interface.

2.4.1. General considerations about customer value oriented marketing information systems

Organizations are moving forward in developing information systems to create and implement superior customer value delivery strategy. Such systems help managers learn about both performance outcomes of customer value delivery (they can have access to sales, purchase intentions, customer retention, satisfaction…) and the causes of that performance (these systems contain data about product offer components, customer evaluations of received value on important value dimensions…). Analysing current performance, managers can monitor the need for improvement; analyzing the determinants of performance, they can focus on how to achieve that improvement.

A good customer value oriented marketing information system should provide information both about customers' current preferences, evaluations and behaviour, so that managers know where immediate action is needed, but also about patterns of change, to help them understand, predict and respond to future change.

One main advantage of such information systems is that they enable companies to integrate their customer value information, that can be extracted from different sources (*see* ***§2.2***.). **Figure 18** illustrates this opportunity to gather various kinds of data.

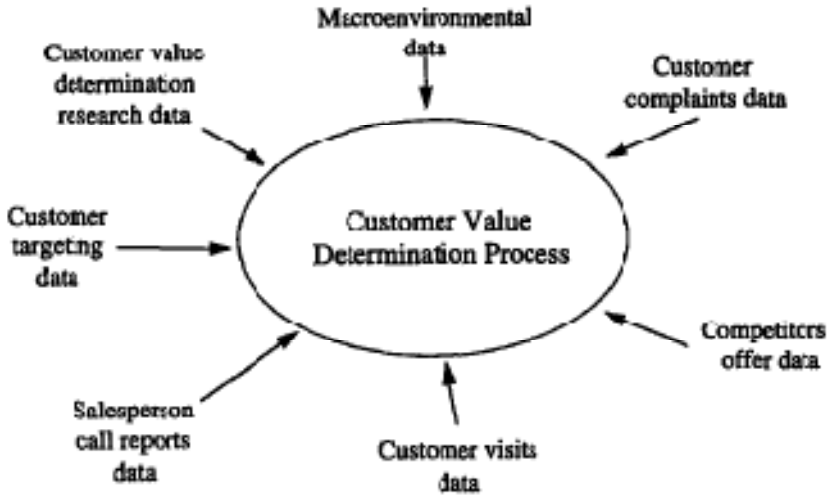


Figure 18: Integrating customer value data (Woodruff, 1997)

Thus, it allows an organization to match different types of data, organize this data, or look for complementary relationships between data from specific steps in the customer value determination process, from satisfaction surveys, or macroenvironmental data (especially to uncover determinants of changes in customer value in the future).

However, information integration raises several problems for an organization to resolve. One is about the form of customer data. A significant portion of that data is qualitative: customer interview transcripts, salesperson call reports or complaints data, for example, are generally textual data. Few managers will take the time to read such data in their original form, so ways must be developed to draw out key findings and present them in condensed form. Moreover, information integration should consider how to combine

quantitative and qualitative data. For example, complaints data could be coded and categorized based on the same customer value dimensions measured by customer satisfaction measurement.

The other main functionality of customer value oriented marketing information systems is that analytical models can assist in the integration of customer value data. For example, they can identify the strategically most important customer value dimensions that influence customers' behaviour thanks to regression and conjoint analysis techniques. They can also analyse the impact of customer value decisions on customer behaviour before implementing such decisions, which can be useful for example to assess the effects on market performance of new product designs.

Since these systems contain the critical information for learning about customer value, Woodruff (1997) argues that all the managers across an organization should have access to it. Integrating customer value information should facilitate the sharing of customer value learning and eliminate the gaps between the different views, across various departments, about what value customers desire.

2.4.2. Example of an integrated information system : the "Marketing War Room™"

Although customer value oriented information systems are becoming more and more numerous, we chose to present the functionalities of one of them, called "Marketing War Room™" (*see http://cval.com/index.htm*), since it is quite representative of what is currently done in terms of information systems. According to the software brochure,

"Inc.'s Marketing War Room™ is a personal-computer software for helping a productmarket team develop strategies to increase the value of their offering to their customers." It was developed by Dr. Bradley Gale and inspired from his book, "*Managing Customer Value"*. The software uses data from many sources (market research, competitive intelligence, customer satisfaction surveys, expert evaluators, business plans and management judgment) and guides the management in finding and organizing data on transaction prices and product performance.

More precisely, the Marketing War Room™ has eight main features:

- *Customer-value accounting*: it compares competitors on price and performance scores; analyzes importance to customers of price and performance differences among potential suppliers; positions products on a Value Map (*see* ***§2.3.2.*** *and* ***Figure 19***); calculates a fair price for each offering and compares to actual prices; performs Head-to-Head Value comparison versus any competitor, and calculates the economic worth to customers of your performance advantages and disadvantages.

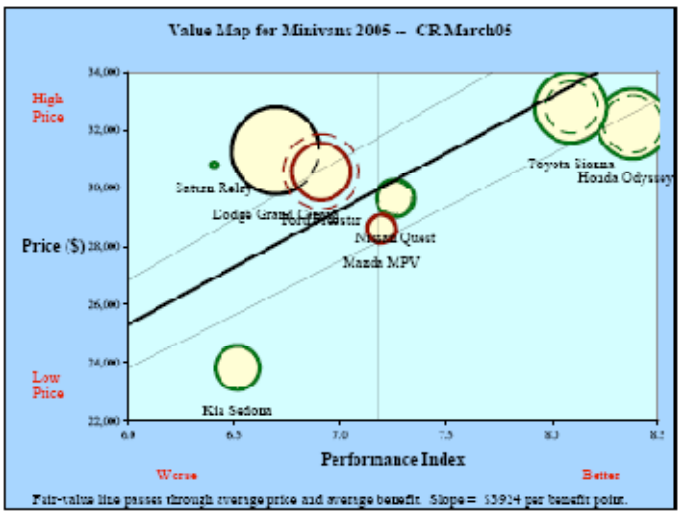


Figure 19: A Value Map generated by the Marketing War Room™ (http://cval.com/index.htm)

Concerning the value map, the software can show average price and average performance in the market category, relative size of different suppliers in the market thanks to bubbles; it can draw the fair-value zone, or identify the best prices available to the customer at different performance levels.

- *Support for Value-Based Pricing*: Product Appraisal Table; Value Pricing Chart; "slider controls" for simulating pricing strategy and flexible logic for isolating costs of use and ownership.

- *Simulating value propositions*: it simulates how changes to benefit scores, prices, or importance weights would affect customer-perceived relative value; analyzes "what-if" scenarios using value map (see **Figure 20**), head-to-head, and other tools; helps set realistic targets and scenarios can be stored and retrieved for further refinement.

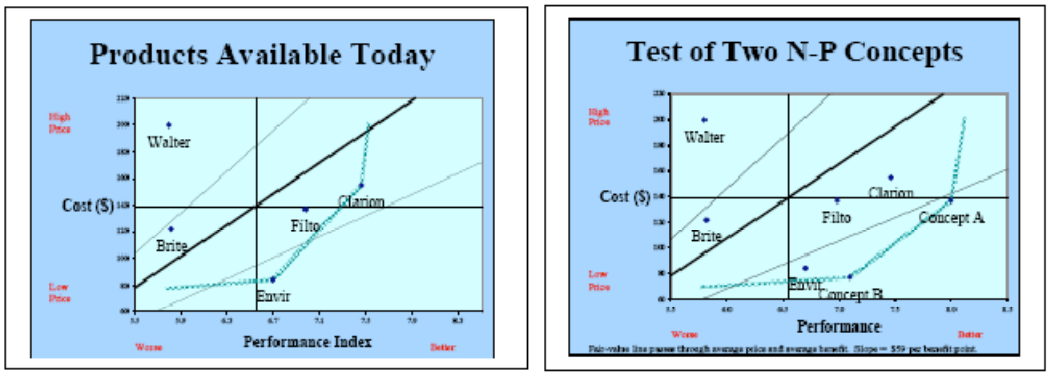


Figure 20: Simulation of two alternative concepts and positioning in the Marketing War Room™ value map (http://cval.com/index.htm)

- *Defining the business and market*: it places current and potential competitors on a chart to help define a business and its competitive space and Product/Market matrix clarifies how to segment a market for competitive analysis.

- *Tools for crafting a value proposition*: attribute score comparison (see **Figure 21**); attribute positioning chart showing importance vs. performance gap; opportunities-for-improvement chart and comparative advantages table.

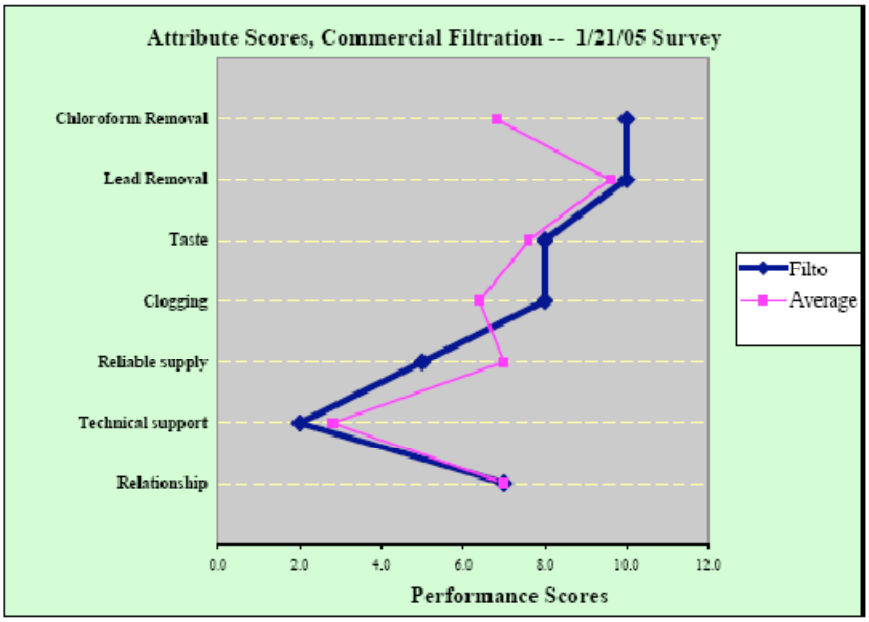


Figure 21: The attribute plots of the Marketing War Room™ (http://cval.com/index.htm)

- *Tools for analyzing market position*: Key-Events time line tracks how key events have affected business trends; custom competitive-market data base design and analysis.

- *Tools for aligning people, programs and strategy*: □What/Who Matrix shows which functions are responsible for maintaining customer-valued performance; Program/Objectives matrix documents the performance-enhancement objectives of major strategic programs; □Program/Responsibilities Matrix documents who is responsible for managing strategic programs.

The program is built on Microsoft Excel, which allows easy interface with other files and adds flexibility for users familiar with spreadsheets. Moreover, it is quite easy to transfer displays to Word or Powerpoint.

3. TOOLS TO INCORPORATE CUSTOMER VALUE INFORMATION INTO PRODUCT DEVELOPMENT

ABSTRACT

Chapter 2 presented some methods to assess a product's competitiveness and to identify which product attributes need to be improved. However, that is far from being enough to increase the customer value of a product and gain a competitive advantage. As a matter of fact, once the customer value of a product has been assessed, one has to trace to the processes that are "responsible" for the quality attributes, and incorporate the information about customer value into product development. This chapter is a presentation of some tools that might help product developers integrate the information from the customer value assessment into the product development process. A first section will present the most "usual" tools such as Quality Function Deployment or Value Engineering, while a second part will explain how lean product development can lead to a better utilization of customer value information. More particularly, this second part will explain how one can know how much value is added by product development activities.

3.1.Different methodologies to use customer value in product development

In this first section, the most famous methodologies used to take customer value into consideration in the product development process are briefly presented: we will first describe Quality Function Development, and then provide an overview of Value Engineering characteristics. Many companies are trying to implement these two techniques, but not always with great success since both methodologies need people with very different functional roles to be highly involved in the process. However, when successfully implemented, they prove to be of very high interest.

3.1.1. Quality Function Deployment (QFD)

Quality Function Deployment (QFD) was conceived in Japan in the late 1960s and early 1970s, at Mitsubishi's Kobe shipyard site. Hauser and Clausing (1988) define it as a planning and communication framework that helps design, produce and market the goods/services that customers wish to purchase, using information about customer value. Over the years, QFD has been enhanced with new tools and mechanisms (many of them developed by Toyota), but the cornerstone of the entire theory is the "House of Quality", which is illustrated in **Figure 22** (the figure is commented hereunder). The foundation of the House of Quality is the belief that products should be designed to reflect customers' desires and tastes; marketing people, design engineers and manufacturing staff must work on it together from the time a product is first conceived. Top executives know that the use of interfunctional teams benefits design, and that coordinating design and production

decisions to focus on customers' wants became absolutely necessary, and the House of Quality appears to be *the* tool that makes it possible.

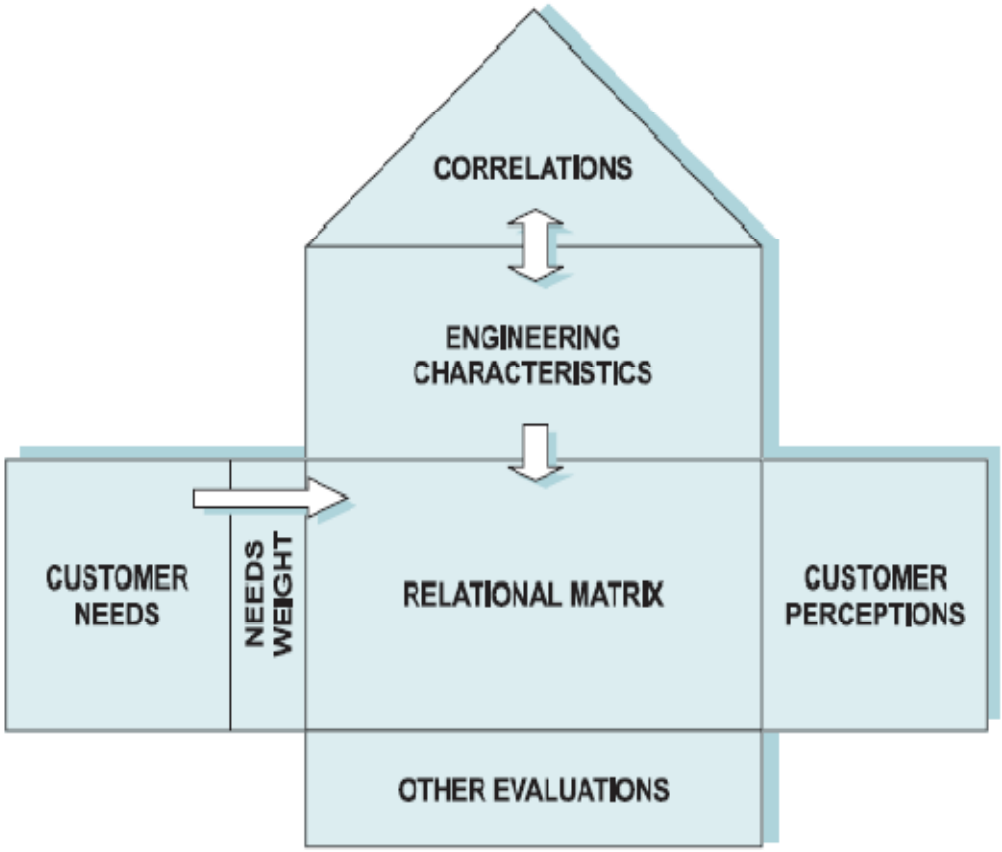


Figure 22: The House of Quality (Ulaga, 2003)

The first step in building a House of Quality is to identify customer needs or ''customer attributes'' (CAs): phrases customers use to describe products and products characteristics. CAs can be gathered using one of the techniques described in **Chapter II**. A typical application would have 30 to 100 CAs, which are generally reproduced in the customers' own words.

Not all the needs, however, carry the same importance. Consequently each one is given a weighting, which is usually established by market research and interviews (this is the part

called “needs weight” in **Figure 22**). Weightings are displaced in the house next to each CA, usually in terms of percentage (a complete list totaling 100%).

On the right side of the map, opposite the CAs, stands the perception (or perceptual) map, which is a customer’s overall assessment of the firm’s current product/service in comparison to its competitors’ product/service. That is a way for companies that want to match or exceed their competition to first know where they stand relative to it, and to identify opportunities for improvement. Ideally, these evaluations are based on scientific surveys of customers.

Once defined, the CAs must be converted into product/service features or the so-called engineering characteristics (ECs): we need to describe the product in the language of the engineer. These ECs become the design objectives, and are usually located in the top part of the House of Quality. Each EC is likely to affect one or more CA(s). If a standard engineering characteristic affects no CA, it may be redundant to the EC list on the house, or the team may have missed a CA. On the other hand, a CA unaffected by any EC presents opportunities to expand the product’s properties. As a rule, an engineering characteristic should describe the product in measurable terms and should directly affect customer perceptions.

The next step is to complete the main part of the house, the relational matrix, which illustrates the effect that each technical characteristic has on each customer attribute. This relational matrix is actually the intersection between the CAs (they are the rows of the matrix) and the ECs (they are its columns). The team seeks consensus on these evaluations, and uses numbers or symbols to establish the strength of these relationships. Building this matrix enables each of the ECs to be assigned a weight.

Once the team has identified the voice of the customer and linked it to engineering characteristics through the relational matrix, it adds objective measures at the bottom of

the house beneath the ECs. When objective measures are known, the team can eventually establish target values, which are ideal new measures for each EC.

Another part of the house is its "roof": on the "roof" of the House of Quality, the correlation matrix is drawn. In this matrix, the relationships between the different ECs are illustrated through an appropriate scale (for example, from -9 to 9), or through symbols. That helps the engineers specify the various engineering features that have to be improved collaterally and facilitates necessary engineering trade-offs. In many ways, this roof contains the most critical information for engineers because they use it to balance the trade-offs when addressing customer benefits.

These are the basics of the House of Quality, but design teams often custom-build their houses. Some add another row that indicates the degree of technical difficulty for each EC, showing how hard or easy it is to make a change. Others input relative weights to the EC. There are no hard-and-fast rules: the aim is to help the teams to set targets which are, in fact, entered on the bottom line of the house. For engineers, it is a way to summarize basic data in usable form; for marketing executives, it represents the customer's voice; and general managers use it to discover strategic opportunities. A good example of a House of Quality is presented in **Figure 23**. This example is taken from the car manufacturing industry and was created by Hauser and Clausing (1988).

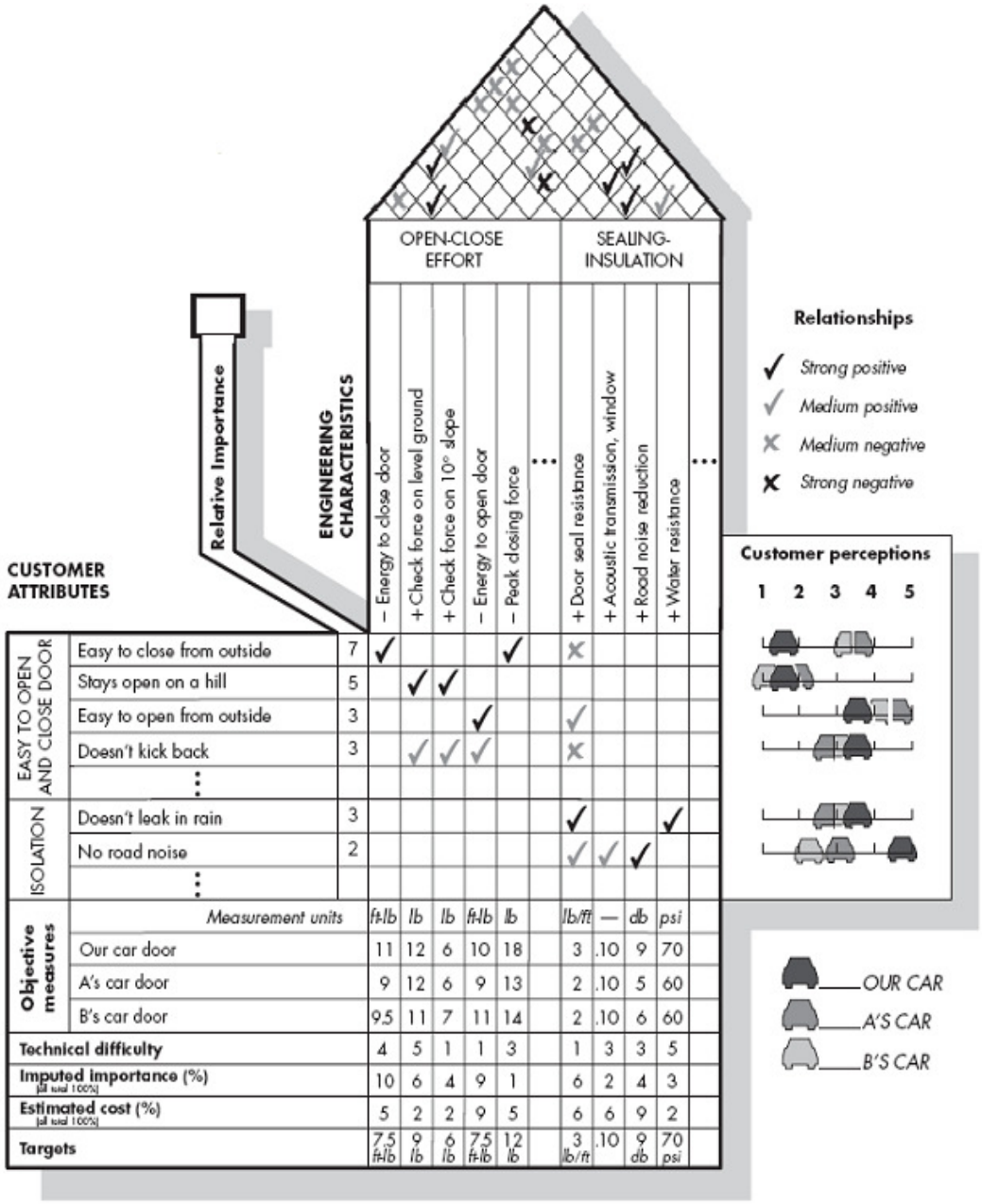


Figure 23: A good example of a House of Quality (Hauser and Clausing, 1988)

3.1.2. Value Engineering (VE)

Value Engineering is a systematic method to improve the value of goods by using an examination of functions, i.e. what something "does" (not what it is), and was created

at General Electric Co. during World War II. Cell and Arratia (2003) argue that VE analytic approaches and methods have quietly been saving millions of dollars a year, in companies and countries around the world, and use of the VE approach has been steadily growing for over 50 years. VE has no great corporate proponent, or hot best-selling book, to promote its use. Nevertheless, it continues to grow and evolve as a discipline for the simple reason that it works - it will reduce cost and increase value of items, systems, and processes, and it offers great flexibility.

VE is based on the assumption that value can be defined as the ratio of function to cost, and can therefore be increased by either improving the function or reducing the cost. Function analysis is consequently the heart of VE. More concretely, when a team successfully undertakes the process of identifying a system's component functions, it is then prepared to conduct a range of analytic and creative actions, the most important of which is creating alternatives for each function. In addition, a good function analysis will help a team identify value mismatches, which are instances where a disproportionate amount of cost is allocated to an area of low customer interest. On the other hand, one of the goals of VE, as a consequence of pursuing value improvements, is to ensure that basic functions are preserved and not reduced.

In VE, functions are always described in a two-word statement consisting of an active verb and measurable noun (what is being done - the verb - and what it is being done to - the noun), and that has to be done in the most non-prescriptive way possible. Value engineering uses rational logic (a unique "how" - "why" questioning technique) to identify relationships that increase value.

VE is often done by systematically following a multi-stage Job Plan. There are many versions of the Job Plan, but one widely-used version has six steps (Cell and Arratia, 2003):

1. Information gathering
2. Analysis
3. Creation/speculation
4. Evaluation
5. Development
6. Presentation

Four basic steps in the job plan are:

- Information gathering: in this step, we try to identify what the requirements for the object are. Function analysis is usually done in this initial stage, to determine which functions or performance characteristics are important. Questions such as: *What does the object do? What must it do? What should it do? What could it do? What must it not do?* are asked.
- Alternative generation (creation): in this stage value engineers try to find answers to the following questions: *What are the various alternative ways of meeting requirements? What else will perform the desired function?*
- Evaluation: all the alternatives are assessed by evaluating how well they meet the required functions and how great the cost savings will be.
- Presentation: in this final step, the best alternative will be chosen and presented to the client for final decision.

In a nutshell, VE offers analysts an effective analytic method for developing design changes to reduce cost and increase value: developing value increasing design changes is VE's bread and butter. Few approaches or methodologies can match VE's ability to increase value in product design or attributes, but some researchers argue that Lean and VE complement each other because they share many important attributes (both approaches, for example, first focus on what the customer wants). According to them, VE can leverage, accelerate, and amplify efforts to implement Lean principles and practices

in an organization and in turn, Lean can enhance the effectiveness of VE efforts. The second section of this chapter rapidly presents the attributes and some frameworks of Lean methods in the new product development process.

3.2. A lean approach to product development

Development of Lean was led by Toyota and later adapted by American companies, most notably car and truck manufacturers. Lean then spread to the aerospace industry, which now uses Lean extensively but use of Lean principles and practices continues to grow in other industries. For those organizations that take the Lean approach seriously, Lean produces excellent results: Cell and Arratia (2003) argue that steady improvements in productivity of 40%-60% are common. Lean reduces cost, improves the efficiency of production, and focuses on customer wants and needs which is, as we underlined it in the global introduction of this work, a key factor to gain competitive advantage.

However, most of the companies that adopt the Lean approach use Lean Manufacturing, and companies are finding that this is not enough to stay competitive. To approach Toyota-like levels of performance and survive the current global challenges companies must take Lean and other strategic concepts upstream into new product development. Products that do not reach out to customers in terms of price, performance, and benefits do not sell well. In short, designs that arrive at the factory late, with poor production yields, major manufacturing problems, and unresolved engineering problems, undermine the benefits of Lean Manufacturing. Moreover, applying standard Lean tools to the new product development process will certainly reduce development lead-time. The key is then to understand how to adapt the Lean principles to product development.

After a quick overview of what Lean management is and how Toyota implements its Lean philosophy into its new product development process, two different frameworks of Lean product development will be presented.

3.2.1. Overview of lean management

Lean thinking provides a way to specify value (from the customer's perspective), lineup value creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively. However, to do so, Lean requires a long-term, enterprise-wide cultural change.

Lean's roots, as precised in the introduction, are in the Toyota Production System. Taiichi Ohno (1912-1990), the Toyota executive credited with developing the Toyota Production System, evolved the Lean concept through his frustration with waste – (*muda* in Japanese). He defined *muda* as any human activity which absorbs resources but creates no value for the customer.

Lean's power lies in its ability to view a "Value Stream" from the customer's perspective. Lean then improves processes to optimize the value stream by removing non-value added work. At the heart of this continuous improvement approach is the Kaizen event. This is typically a week-long event, and targets a specific area within the Value Stream. Kaizen events are repeated on a regular basis, and involve teams composed of employees from all parts of the organization, including top management. Waste-eliminating actions which may have been missed in one event, future events will eventually address, in addition to addressing changing work conditions, customer requirements, or adjusting to impacts from other Kaizen events.

Lean employs a systematic approach based on these 5 principles:

1. VALUE: specify what the value is and what one is trying to do; this element can be described only by the customer.

2. IDENTIFY THE VALUE STREAM: determine the core set of actions required to produce a product or, so to say, the individual steps that one has to do to deliver the identified value.
3. FLOW: make these actions or steps flow.
4. PULL: let the customer pull; he should begin to pull the product on an "as-needed basis". One should never simply turn the process on and begin to "pile up" products.
5. PURSUE PERFECTION: develop and amend the process continuously to pursue perfection; one can always make things better.

3.2.2. Lean product development at Toyota

Even if Lean was first applied to manufacturing systems, Toyota also adapted his Lean approach to the new product development process. Morgan and Liker (2006) describe the different steps that Toyota follows in its product development process to deliver value to the customer.

As we mentioned it before (*see* ***§2.2.1.***), at Toyota, it is the chief engineer's (CE) responsibility to deliver value to the customer. First, he communicates customer-defined value, vehicle-level performance objectives, and aligns the vehicle-level performance goals of the entire program team. This step begins with the "Chief Engineer's Concept Paper", which outlines the CE's vision for the new vehicle. The concept paper, a document that rarely exceeds 25 pages, usually takes several months to complete. It includes both quantitative and qualitative objectives for vehicle characteristics, performance, cost and quality. Many people provide input for the concept paper but it is

written and issued by the CE and finally presented in a large auditorium as the marching order for all participants.

Once the concept is approved, the next step in the customer-defined value process is to develop specific objectives that support the chief engineer's vision for all functional program teams. The vehicle-level performance goals set by the CE must be translated into specific, measurable objectives for the stylists, packaging engineers, body engineers, stamping engineers, etc. that make up the program team. Putting into operation customer-defined value at a vehicle level creates a value hierarchy. As the CE team moves down this value hierarchy, it decomposes the high-level vehicle-level performance targets and aligns them at each level into a set of specific actions. This process gives Toyota an internal customer perspective for each functional team

Next, "module development teams" (MDT), responsible for each vehicle subsystem, meet to develop specific, measurable goals for each subsystem and communicate it to the CE team. Using a customer-first attitude and the CE as the primary voice of the customer, the various MDTs go through fairly intense negotiations and ultimately commit to specific objectives designed to support the vehicle-level performance characteristics. This process drives everyone to focus all efforts and energy toward delivering value to the customer. The final version of these objectives is posted and tracked throughout the program. Team members' performance is judged, in part, by their ability to hit these targets. This results in each member of the program contributing directly to delivering customer-defined value.

The next step in the process requires intensive cross-functional participation among the MDTs to develop specific strategies and value targets to deliver the value-driven commitments each team made. Equipped with predetermined value targets, the various MDTs work together by studying field quality data, tearing down competitor products,

and visiting dealerships to document direct customer feedback. They also visit their own and competitor's manufacturing quality and efficiency.

Finally, Morgan and Liker precise that it is important to understand that as the cross-functional MDTs go to the source, they are going with a common set of objectives and goals based on vehicle-level performance objectives set by the chief engineer. Because the MDTs begin their quest for delivering value early in the process, while the vehicle concept is most fluid, they are able to communicate and integrate their value-driven commitments with the design, engineering, processing, and manufacturing departments, which presents many opportunities to discover potential improvements to their development ideas.

This Toyota-inspired Lean product development process, however, is only one of the many possibilities to adapt Lean principles to product development. Many other researchers proposed their own vision of Lean product development. Our intention here is not to present all of them, but we chose to mention two interesting proposals: one from PureInsight, which is an independent source of business management information for experienced managers of design, innovation, product development and technology, and another one from the Lean Aerospace Initiative.

3.2.3. Some principles of Lean product development according to Pure Insight

In its report of May 2009, Pure Insight proposes actions for each of the five Lean principles when trying to apply them to the product development process. It presents an assessment of the five key concepts underpinning Lean product development describing each concept and how it plays its part in maximizing the efficiency of the new product

development process. We will not go into the details of this assessment, but we find it interesting to briefly present the actions proposed to focus on customer value during product development. These actions are mainly related to the first two Lean principles: understanding customer value and mapping the value stream. Some comments about the fourth principle (pull the customer) will also be made.

As far as the "understanding customer value" principle is concerned, the authors of the report argue that customers should be engaged in prototyping: this way, companies bring customers' views on value into product development. A number of recognized voice-of-the-customer techniques and disciplines with prototyping and usability testing already exist. Pure Insight argues that there is no reason to implement 100% of the product functionality in the first prototype that gets built, that "rapid prototyping" increases capability and reduces costs, and that the key is testing with prototypes on customers in the product development process as early as possible. Involving then the customer into the regular testing of design prototypes makes it possible to uncover difficulties and provide feedback that will enable a development team to make informed decisions on how designs can be changed to eliminate user frustrations.

More precisely, models of rapid prototyping can be used:

- during the initial design stages to quickly check the end effect of what the team is trying to do for the customer,
- for customer assessment to get quick feedback from potential customers on new designs,
- for customer panel appraisals for trade shows and exhibitions and to generate promotional material prior to production.

Globally, building something that people can react to -through usability testing for example -leads to much richer voice-of-the-customer information. For example, Nokia

uses prototypes throughout the product development process in the development of its mobile phones to allow better collection of customer requirements, and sees prototyping as a key to getting user driven products right.

Pure Insight also provides its readers with a practical tool to map the value stream. This tool is a table that traces the efficiency of the new product development process and the value of the product under consideration. **Figure 24** is a sample of this tool. The scorecard should be used during Kaisen workshops (*see* ***§3.2.1.***), and these workshops should include not only the manager responsible for the process being improved or people who actually do the work within the process, but also customers, because the most important phase of the workshop is the identification of their needs.

METRIC	UNIT OF MEASURE	BASELINE	TARGET	% IMPROVED	OWNER
Lead time	*Days*				
Delivery	*% on time*				
Quality	*No. deficiencies per project*				
Productivity	*Hours per project*				

Figure 24: A process improvement scorecard (Pure Insight, 2009)

Last but not least, the report clarifies what "pull" in product development means. According to the researchers, "pull" means responding to the articulated and unarticulated needs of the customer (both external paying customers and internal process customers) rather than guessing what is needed and pushing it out. Consequently, the "pull" concept is especially important during the design phase because it ensures that all activities in the development program are in sync with end-customer requirements. "Pull" techniques help translate customer requirements accurately into product design, functional engineering,

and process design. These techniques also ensure that critical requirements are transferred consistently between the different main-line stations.

The last section of this chapter is a presentation of a framework proposed by the Lean Aerospace Initiative (LAI) to take customer value into consideration during the product development process, in a Lean optic. This framework is made up of both theoretical and practical tools.

3.2.4. The value creation model and value activity map of the LAI.

The Lean Aerospace Initiative (LAI), considering and going by past work by other researchers, proposes a framework for defining and measuring value within product development or, to be more precise, to determine the amount of value that product development activities add and their sensitivity with respect to performance, cost, time, and risk. In particular, the researchers from LAI propose two conceptual tools to allow a better understanding of the development of value in product development. The first one is a conceptual framework for value creation in product development, referred to as the "Value Creation Model". The second tool is the "Value-Activity Map", which shows the relationships between specific activities and value attributes. We find it interesting to present both these tools here.

Actually, the Value-Activity Map is a practical application of the Value Creation Model. This Value Creation Model was created after the LAI product development team, in the summer 1999 workshop, concluded that data based metrics must be used to drive activities, and that the value associated with a task must be addressed at each step of the

process. One of the models that can be used to identify value in the product development process is the one by Robert A. Slack that was presented in ***§ I.3.2.*** However, researchers from LAI propose another conceptual framework about how value is created in product development, and how it can be measured. **Figure 25** is the representation of this Value Creation Model.

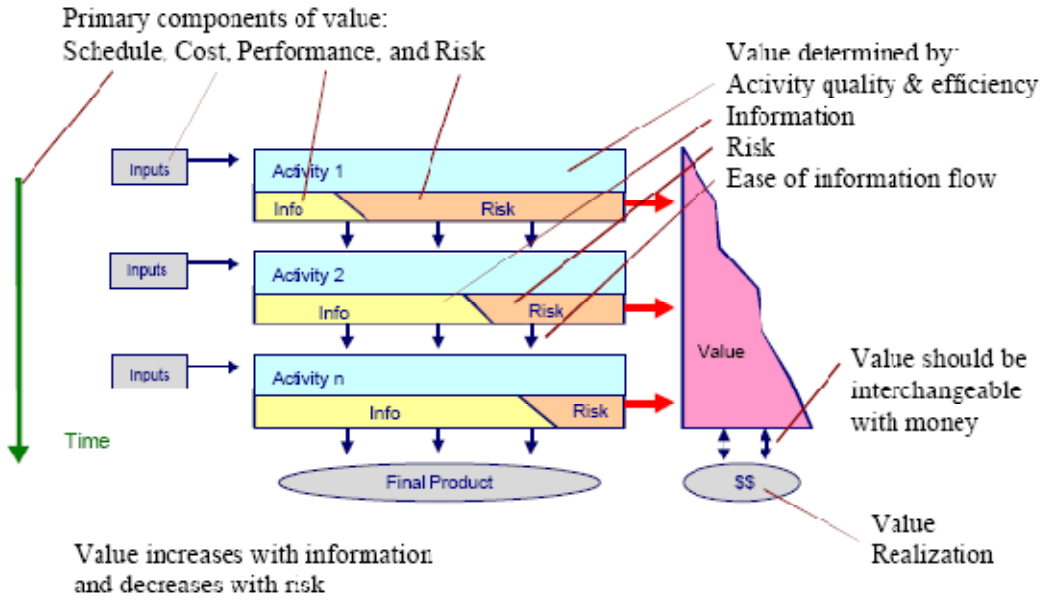


Figure 25: The value creation process (Chase, 2000)

Product development activities are shown creating information and reducing the risk and uncertainty of the project. To proceed, these activities need both internal inputs (from previous activities) and external inputs (knowledge and resources). The activity passes information to the following activities, hopefully in a form useful to them. Just as information is collected to produce the final product, one can imagine value accumulating. There is also a final metric of the end value of the final product, expressed in terms of final value to the customer.

The challenge lies in determining the relationship between the product development entities and the accumulating value (represented by the horizontal arrows feeding value in **Figure 25**). A method is proposed by the LAI for capturing this relationship by decomposing it into specific associations between activities, information and value added. At each step, the activity and the information created by it (including information about risk) is mapped into locally available attributes and/or metrics of value. A list of value attributes is shown in **Figure 26.**

Type	Attribute	Units
Performance	Performance specification n	% increase of n due to task
	Overall performance	% increase weighted to customer desirability
Risk	Risk specification n	% decrease of n due to task
	Overall risk	% decrease weighted to customer desirability
	Predicted future iterations	#
Schedule	Set-up time	hours
	Cycle time	hours
	Integration time	hours
	Dissemination time	hours
	Total time	hours
Cost	Fixed overhead cost	$
	Variable cost	$
	Total cost	$
	Future cost – development	$
	Future cost – manufacture	$
	Future cost – operation	$
	Future cost – support	$
	Future cost – retirement	$
	Total future cost	$
Form	Information retained	% of information captured
	Time spent reformatting data	hours
Fit	Necessity of information	% of information actually used
	Depth of information	% of information present that is needed
Function	Complexity of information	(1 – 10)
	Time spent handling info	hours
Timeliness	Time before first access	hours
	Time before last access	hours
	Times accessed	#

Figure 26: Value attributes for product development (Chase, 2000)

Completing the value attributes of **Figure 26** for a given activity makes it possible to capture a measure of value for that activity. If all activities in a product development process are mapped against all available value attributes and metrics, the result would be a value mapping tool.

This proposed tool is the Value-Activity Map we introduced at the beginning of this section. A Value-Activity Map, as intended by the LAI, is a matrix that relates product development activities and information to specific value metrics (see **Figure 27**). The rows of the matrix list alternating activities and information ordered as sequentially as possible. The columns contain the value attributes with their associated metrics. The size of the map will depend on the level of detail to which the product development process is decomposed. Researchers of the LAI argue that a balance has to be struck between the desire to model in detail and the obvious possibility of the map becoming intractably large.

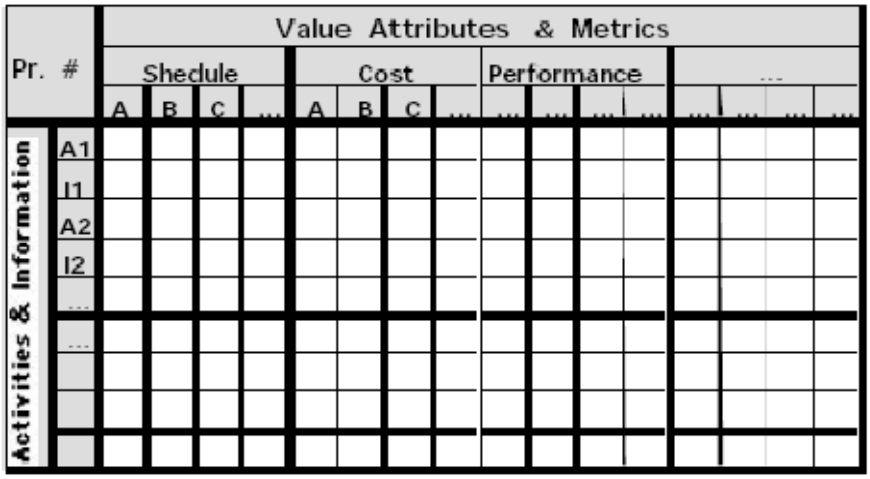


Figure 27: The Value-Activity Map (Chase, 2000)

This approach presents many benefits. Simply comparing the boxes where a relationship exists to the "white space" in the matrix will graphically illustrate how value evolves throughout a product development process. If several projects are analyzed, then a global look will capture best practices. Another benefit is the possibility to integrate the matrix into a systems dynamics model. The matrix would directly correlate with the relationships used in the model, and the system dynamics model could then contain an accurate

portrayal of the product development process. The model could then be analyzed for optimization and sensitivity. Finally, a simple modification would combine the value attributes into a single value metric. This would produce a chart that shows the increase of value with time, as proposed in the Value Creation Model.

4. FROM THEORETICAL PROPOSALS TO REALITY: AN EMPIRICAL STUDY

4.1. Scope of the study and methodology

In order to give a concrete dimension to our work and to understand more deeply what is effectively done in big companies in terms of measuring customer value, we decided to lead an empirical study with some Italian companies. Actually, the difference is often huge between what academics recommend and how people in the field work, and the scope was to get a general idea of the importance given to customer value orientation inside some companies, and of the usage of different customer value oriented tools in practice.

To do so, a questionnaire focused on customer value and its influences on the product development process was redacted. This questionnaire was partly based on a work done by some team members of the LeanPPD project (*see* ***§4.1.1*** for further explanation about this project.) but was then modified to better match our goals (*see* ***§4.1.2.***). It was sent to different people, with different functional roles in different companies. Actually, two different case studies were conducted in parallel: a first one to understand how customer value was perceived inside a given company (*see* ***§4.2.***), and a second one to compare the perceptions and the customer oriented tools of different companies (*see* ***§4.3.***).

This first subsection of the chapter will describe how the questionnaire was built, whereas the last two ones are a presentation of our two case studies.

4.1.1. The LeanPPD project

As specified on its website, the LeanPPD project is composed of 12 leading industrial and research European partners, and is addressing the need of European

manufacturing companies for a new model that goes beyond lean manufacturing to ensure the transformation of the enterprise into lean environment. This is to respond to customers and market demands for value creation incorporating sustainability, culture and customisation. More concretely, the aim of LeanPPD is to develop a new model based on lean thinking that will consider entire product life cycle, providing a knowledge based environment to support value creation to the customers through innovation and customisation, and delivering high quality, more sustainable and affordable products.

To do so, the project is developing a comprehensive set of lean methods, design techniques, and tools. Specifically the model has four tools to provide as an outcome of the research project, and one of them is called "The LeanPPD Product Development Value Mapping Tool (PD-VMT)". This tool will be used to take a snapshot of a development process to identify value adding and non value adding activities and a subsequent help to stream line the process.

In particular, the Task 230 "Measuring Product Value from the Customer perspective" within WP 200 "Product Development Value Mapping Tool" led one of the teams of the project to the elaboration of a "Customer Value Questionnaire". The scopes of this questionnaire were to help to build a set of values that customers require in products and to review methods for assessing customer value. The survey was organized in three sections, respectively called "Value", "Waste" and "Product Development Process", which represented a total of 33 pages and 48 questions.

That was far too long for the questionnaire we wanted to send to the companies, but still it contained some interesting elements: the LeanPPD survey was modified to better fit our specific goals. The questions of the last two parts, in particular, were not always of high relevance for our work, and were not re-used -except for two of them

which seemed more coherent with our own objectives -. However, the first part on value, since it was more related to what we wanted to do on the one side, and because we thought that its questions were more "understandable" and pertinent on the other side, gave us some elements for our own survey. Some of the questions from this first part -as well as their answers -were reformulated, others were added, and we got a first version of our questionnaire.

4.1.2. Our questionnaire

That first version was reviewed by two specialists of the new product development process: Vincenzo Pagliarulo, mechanical engineer with experience in the new product development process in the automotive industry, and Michele Riccioni, consultant at JMAC Europe Milano S.P.A., a management consulting company focused on the logistic and production processes and on the technology and product innovation fields. Their advice helped us improve the survey, which was finally made up of three main parts:

- a first general part -but maybe the most important one- to understand what definition the respondents gave to "customer value", what their customers would consider as value in their product(s), and how the company captured customer value (who is in charge of it, which tools are used to do so, which are the clients involved in the process, and how do they translate customer information for their product development process);
- in the second part, we focused on their customer value orientation going into more details about benchmarking with competitors, specific training on customer

value analysis, reporting about customer value, or IT tools to track customer information for example;

- finally, the questions of the last part of the survey were about improvements and performances and referred to the position of the company about waste, the initiatives to reduce costs and lead times in new product development, and the KPIs used to assess the performance of this process; the purpose of this final part was to get a better understanding of how people in the product development process of the company worked.

The final survey, made up of 19 questions and 7 pages, was created on *surveymonkey.com* (a website to create professional surveys, get responses and analyse the results with ease) and sent to potential respondents through a web link. See **Appendix 2** for the questionnaire.

4.2.First case study: an internal comparison at the Indesit company

As mentioned at the beginning of this chapter, the purpose of our first case study was to analyse the points of view of different people with different functional roles inside a given company, to understand whether there was a shared knowledge on customer value or not. The company that was chosen participates in the LeanPPD project and is Indesit.

Indesit Company is one of the European leading manufacturers and distributors of major domestic appliances (washing machines, dryers, dishwashers, fridges, freezers, cookers, hoods, ovens and hobs). It is the undisputed leader in major markets such as Italy, the UK and Russia. Founded in 1975 and listed on the Milan stock exchange since 1987, the Group posted sales of € 2.6 billion in 2009 (see **Figure 28**). Indesit Company has 16 production facilities (in Italy, Poland, the UK, Russia and Turkey) and 16,000 employees. The Group's main brands are Indesit, Hotpoint-Ariston and Scholtès.

Results - €/m	2007	2008	2009
Revenues	3,408	3,155	2,613
EBITDA	333	271	260
EBIT	192	141	119
PBT	166	95	67
Group profit	105	55	35

Figure 28: Results of Indesit for the last three years (www.indesitcompany.com)

On the next pages, more information about the different markets of the company and its product lines is given. All this information was taken from the website of the company. The results of the case study are gathered in **§5.1**.

4.2.1.Indesit's markets

Indesit Company has its roots in Fabriano, a town in Le Marche where it has its headquarters, innovation centre and a number of production facilities. Internationalization and unification of European markets hasn't blurred the Italian identity of Indesit Company, and its values enabled it to successfully replicate its model of an industrial district in other countries. The company has eight production plants in Italy (in Le Marche, Campania, Piemonte, Veneto and Lombardia) serving local and European markets, but is now looking towards increasingly competitive emerging markets, as shown in **Figure 29**.

Figure 29: Indesit's markets (www.indesitcompany.com)

A brief description of each of these markets is given in the following.

UK and Ireland

With the Hotpoint brand and over three million new customers every year, Indesit Company is the market leader in the UK and Ireland. The Group has also consolidated its leadership in the Service business, with After-Sales Service Centres throughout the region. The service is run from a single unit, in Peterborough, which has a Contact Centre, a spare parts warehouse and a team of specialists guaranteeing after-sales service for a platform of over 24 million products. In recent years, Indesit Company has won various major awards which have helped consolidate its position even further. In 2008, for example, it was given two important awards at the Motor Transport Awards, in the "Customer Care" and "Network of the Year" categories, in recognition of its logistics organization.

Western Europe

Western Europe is a vast commercial area with mature and highly competitive markets. Over the years, Indesit Company has succeeded in its policy of maintaining its financial solidity and, thanks to a strong, consolidated commercial network (24 commercial offices worldwide), has continued to strengthen and consolidate its position by exploiting the proximity of major markets like France and Spain. The Group's approach in these markets is based on strong technological innovation, products that are increasingly advanced and tailored to consumers' needs, re-positioning of the three main brands and a strong focus on quality.

Eastern Europe

Indesit Company has long believed in the capacity for development of central and Eastern European countries and over the years there has been considerable overall growth in the

region, thanks also to foreign investment. The Company can now boast leadership positions in Romania, Bulgaria and Ukraine and a significant industrial presence in Poland and Turkey. In particular, the Group has concentrated its fridge and cooker production in the Łódz Special Economic Zone. In 2008, it opened two new plants in Radomsko to make washing products, thus completing the range and creating the biggest white goods centre in the country. High growth rates, competitive production costs and an optimum geographical position have made Turkey too an attractive industrial base.

Russia

Indesit Company has been in Russia and the CIS since 1974 and was one of the first European companies to invest in the country's economic development. The Group now has ten commercial offices and over 300 after-sales centres in 150 cities in the region. Its production capacity in Russia, based on know-how and technology supplied by headquarters in Fabriano, is concentrated in a fast developing industrial area, Lipetzk, some 400 km south of Moscow. The Lipetzk industrial district has two plants (one making fridges, the other washing machines) and, since 2005, the biggest white goods logistics centre in the Russian Federation and the biggest in Europe in the industry.

Overseas

Outside Europe, Indesit Company operates in the Middle East, Far East, Argentina, South & North America, Africa & Israel through three commercial branches in Dubai, Singapore and Buenos Aires.

Figure 30 on the next page summarizes the company's results by operating segment for year 2009.

Results by operating segment - 2009								
€ ML	Italy	UK & Ireland	Western Europe	Russia	Eastern Europe	Internat.	Costs not allocated	Total
Revenues	459.6	718.4	558.7	372.1	375.8	128.4	0	2,613.0
Segment results	57.1	76.5	29.2	65.2	18.3	13.6	-141.6	118.6
% on revenues	*12.4%*	*10.6%*	*5.2%*	*17.5%*	*4.8%*	*10.2%*		*4.5%*

Figure 30: Indesit's results by operating segment, 2009 (www.indesitcompany.com)

4.2.2.Product Lines

As far as the product lines are concerned, Indesit mainly operates in three different fields, that we describe here below:

Cooling

The cooling products sector is strategically located over a vast area, from West to East, and accounts for around a third of the Group's total production. In particular, the Łódz plant puts in excellent results thanks to a new platform that makes it possible to develop and efficiently produce different types of fridge for different markets.

Washing & Drying

Indesit Company makes around five million washing machines a year. Production is geared to consumers' needs, environmental protection and compliance with user safety regulations. The development of appliances that can guarantee top performance with

minimum consumption of energy, water and time and with scrupulous attention to the needs of the laundry too, is priority for around 4,000 people in the various production units. Indesit Company's production of dishwashers is concentrated in None (Turin) and Radomsko (Poland). The None and Radomsko plants produce free-standing and built-in dishwashers for all the Group's brands. All Indesit Company's dryer production is at Yate (UK), the biggest dryer production facility in Europe with 700 employees.

Cooking

Indesit Company produces over 3.5 million ovens, hobs and cookers, all with Class A certification. Recent innovations have further improved the ergonomic aspects and ease of use thanks to special studies of consumers' needs.

4.3.Second case study: a confrontation between three big Italian companies

The purpose of this second case study was different from the Indesit one. Here, we contacted a unique person from the new product development process of different companies, and the goal was to compare the differences in the companies' approaches to customer value. In particular, we were interested in knowing the kind of tools the companies used to measure customer value and to integrate it into the new product development process, and in the customer value orientation of these companies.

This section is a presentation of the three companies that accepted to collaborate on this work (ABB -SACE division, Carel Industries SRL and Dell'Orto S.P.A.), and the results are gathered in **§5.2**.

4.3.1.ABB SACE division

ABB is a Swiss-Swedish multinational corporation headquartered in Zürich, Switzerland, operating mainly in the power and automation technology areas. ABB has operations in around 100 countries, with approximately 117,000 employees, and reported global revenue of $31.8 billion for 2009. ABB is traded on the SIX Swiss Exchange in Zürich and the Stockholm Stock Exchange in Sweden since 1999, and the New York Stock Exchange in the United States since 2001

ABB is the world's largest builder of electricity grids and is active in many sectors, its core businesses being in power and automation technologies. The company has one corporate division and five production divisions since reorganisation in January 2010:

- Power Products
- Power Systems
- Discrete Automation and Motion
- Low Voltage Products
- Process Automation

4.3.2. Carel Industries SRL

Carel SpA is an Italian society working in the HVAC/R market, established in 1973 and located in Brugine (Padua - Italy), specialized in the manufacturing of humidification systems and electronic controls for refrigeration and air-conditioning. The company is consolidated internationally (70% of sales are made outside of Italy), and operates both directly through subsidiaries and an organisation that is present in around eighty countries. Indeed, since the early nineties, CAREL has been operating abroad through a number of subsidiaries. 850 employees work for the company, and the annual sales amount 110M€.

4.3.3.Dell'Orto SpA

Dell'Orto is an Italian company, headquartered in Cabiate, specialized in the construction of carburetors and electronic injection systems. The company was founded in 1933 as "Società anonima Gaetano Dell'Orto e figli" (Gaetano Dell'Orto and Sons). Their first products were carburetors that came fitted as standard to new vehicles. Shortly

before World War II they began producing carburetors with aluminum bodies for use in motorcycle racing.

At the beginning of the 1960s Dell'Orto was producing OEM carburetors for the Fiat group, as well as other Italian and foreign constructors. At the end of 1980s, under the supervision of Luigi Dell'Orto (son of Gaetano), the company's first injection systems were released.

The company is today one of the worldwide leaders in the field of carburetion, with annual sales of 40M€, and is present in the sport field as partner of Gilera that participates in the Road Racing World Championship.

5 - RESULTS OF THE EMPIRICAL STUDY

5.1.Results of the Indesit case study

12 participants from Indesit filled in the survey, most of them between 30 and 40 years old (only three participants were a bit younger) and with 1 or 2 years of experience in the current position (only two people claimed a longer experience : 4 and 5 years).
Different profiles were targeted. For example: project managers (3), Interaction Design & Ergonomics specialists (2), a quality manager, a marketing analyst, an innovation manager, a R&D manager.
On top of the survey, a visit to the Fabriano production site was organized at the beginning of June, to expose the results to Renato Aiello, who gave us further information about the company's orientation towards customer value and organized a visit of the company.
The next paragraphs are a summary of the results extracted from the questionnaire.

5.1.1.About customer value perceptions

Although most of the respondents (more than 90%) agreed on the fact that the company follows a market pull strategy to develop new products, they seem to have very different outlooks on what customer value means and on what their customers really value.
First of all, there is not a shared definition of customer value inside the company. Even if all the participants agree or strongly agree on the definition from the value components models ("the features that a customer would like or need to be considered in the development of a new product") -which is the poorest one, they have different opinions on the definitions that also consider the costs or sacrifices incurred in acquiring and using

a product. As a matter of fact, the last two definitions that were proposed, and that are supposed to be more complete than the value components definition, split the participants into 2 groups: 50% globally or strongly agreed on these definitions, 50% hold a different view. Two people proposed their own definitions of customer value; the first one only considers benefits, the other one also mentions costs: “the benefits that the end user would like to have and the values in which the customer believes”, “a sum of benefits which manufacturers promise customers receive in return for the customer's payment”.

Regarding the different components that their customers value, once again the participants from Indesit provided different responses. Some elements such as brand, reliability, efficiency, quality or product cost were predominantly categorized as “demanded elements” (or *must-have*). Others, however, were positioned in different categories depending on the respondents; materials used, ease of disposal, accessibility or shape, for example, were classified in three or four different categories (*unwanted/nice to have/must have/exciter*), with sometimes a total score of 25% in each category, showing that the participants did not share the same point of view on the value of these elements.

5.1.2.About the customer value definition process

According to the different answers that we got, the sales department is in charge of capturing the customer value, the product and requirements engineers analyze it, and the marketers do both. Apparently, no mixed team of both sales managers and engineers has been created so far to work on customer value, and some respondents did not include engineers in the process of analyzing customer value.

About the tools they use to capture customer value, the results are on **Figure 31**. Focus groups and satisfaction surveys, which are the easiest tools to put in place, seem to be

used since a high percentage of respondents chose them. No certain conclusion can be drawn regarding the other tools (except maybe for value-in-use assessments which got 63,6% of positive response), since respondents gave different answers.

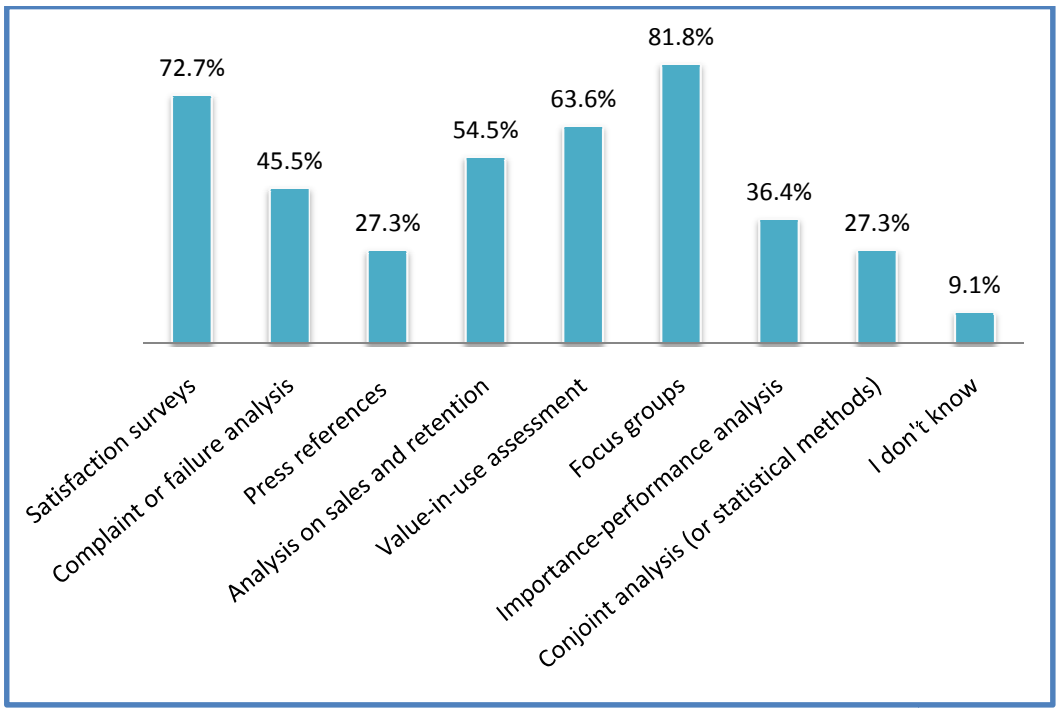


Figure 31: Tools to capture customer value at Indesit.

About the tools to represent the captured customer value in product design and development, results are shown in **Figure 32**. No structured tool seems to be used since only brainstorming got more than 50% of positive response. But once again, the weak coherence in the answers that were given might mean a scarce awareness of the way the responsible entities inside the company deal with customer value, more than a lack of tools to do so.

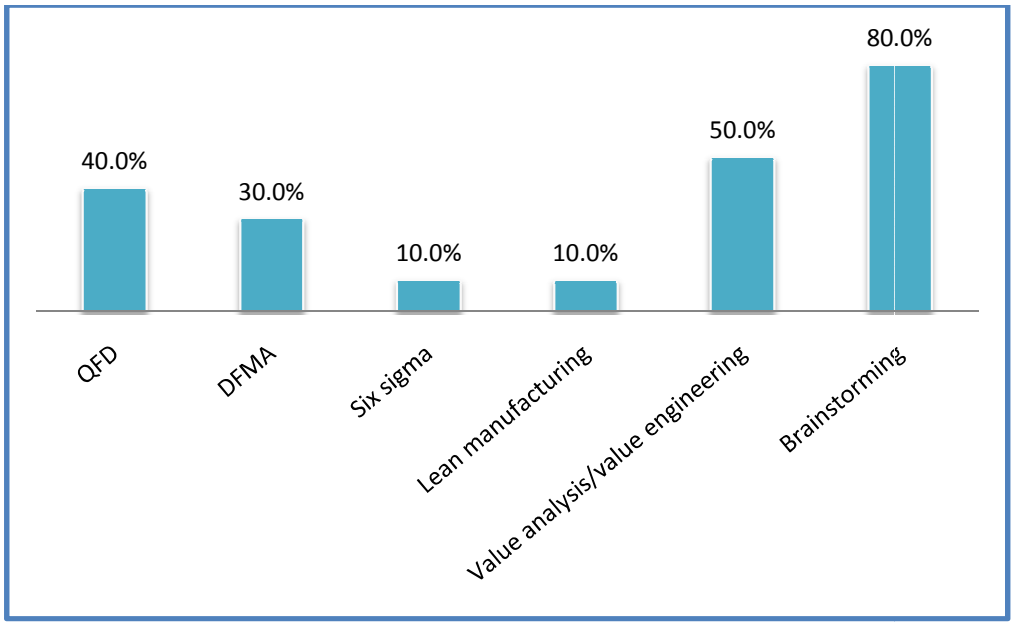


Figure 32: Tools to represent the captured customer value in product design and development at Indesit.

Finally, when asked about which kind of clients were involved in the value determination process:

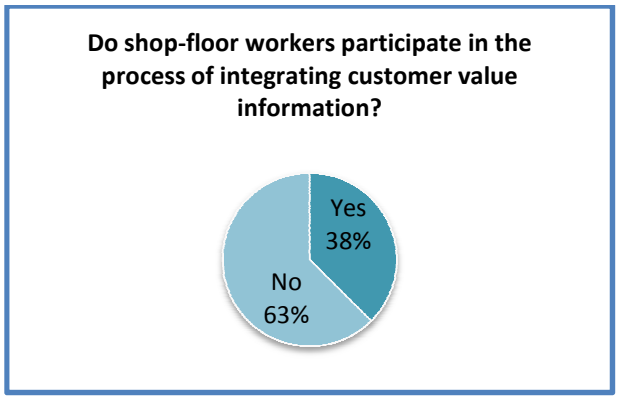
- 90% of respondents underlined the participation of potential customers,
- 80% the involvement of current customers,
- and only 20% said that lost customers were also involved.

40% of the respondents stated that competitors' customers also participated in the process, but more than 90% responded *yes* to the question "does the company benchmark the customer value against its competitors". 80% of the people declared that the customers were also involved during the different phases of the product development process to feedback the company about the value seen in the product.

5.1.3.About the customer value orientation

The results about the customer value orientation part of the survey kind of confirm the sensation that Indesit employees can gain a better awareness of what is done in the company to capture and analyze customer value.

The three graphs of **Figure 33** show the results about the implication of different categories of employees in the customer value determination process. Shop-floor workers and engineers seem not to be involved in the customer value determination and integration process, whereas some managers might get a specific training on value analysis methods, even if only 50% of respondents (and all of them were managers…) affirmed so.



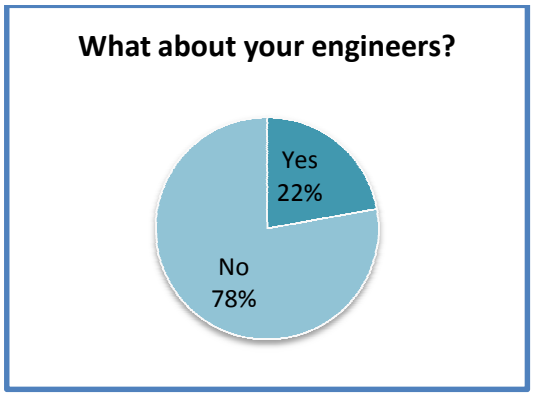


Figure 33: Implication of different categories of employees at Indesit

Five respondents declared that the product development team received information about customer value through product specification and requirement documents. Two of them underlined that the marketing department was in charge of communicating internally and follow-up the customer value information, but, according to more than 60% of the participants, this process is not known by all the employees participating in the development process.

Moreover, a majority of respondents declared that:

- the achievement of the captured customer values after the product has been designed is not measured,
- the company does not reward employees that contribute to achieve the customer value expectations,
- the company does not have any IT tool to document and track the information about the customer values during the product lifecycle.

5.1.4.About improvements and performances

About waste, a wide majority of participants (more than 70%) declared that "There is interest to improve the product development process by eliminating waste, but there is no clear plan"

Finally, about defining and carrying out improvement initiatives to reduce cost and lead times in the new product development, opinions were more divided but nearly 40% of respondents said that "Improvement efforts are periodically undertaken using an unstructured improvement process".

5.2.Results of the second case study

For this second case study, we got four respondents: two from ABB SACE division (a project manager and a design engineer), the product development director of Carel Industries SRL, and a product development and planning manager from Dell'Orto SpA. Here again, the results are presented in the next paragraphs.

5.2.1.About customer value perceptions

The three companies said that they followed a market pull strategy to develop new products, showing their involvement in focusing on their customers' wants. That was a necessary condition to carry out our survey, since it would have made no sense to ask the companies about customer value if they were only technology oriented.

Regarding the meaning they give to customer value, respondents agreed or strongly agreed on two out of the three definitions of customer value that were proposed. More precisely, they all agreed on the definition from the value components models (*see* ***§1.2.1.***) and on the one from the means-ends models, whereas the opinions about the definition from the utilitarian models were more contrasted. That was the first surprising result of this second case study: whereas in the Indesit company, the utilitarian definition of customer value got the highest number of positive responses, the respondents of the second case study gave more importance to the other definitions and only partly agreed on the utilitarian one. This is all the more surprising since the means-end definition is supposed to be an evolution of the utilitarian one.

However, we might have got different results if we had asked other people in the three companies –and that is what happened with the Indesit case. Then, the "safest" conclusion that we should draw since, moreover, all respondents agreed on at least two

definitions, is that there might not be a unique and well-defined position on customer value.

Finally, even if the companies operate in different sectors and it might make little sense to compare the opinions of the respondents about the features that bring value to their products, some common results emerged. For example, reliability, efficiency, ease of maintenance and quality were categorised as *must-have* by all respondents, whereas they agreed on the fact that creativity, brand, aesthetics, shape and colour could be considered as *nice to have*.

5.2.2.About the customer value definition process

Regarding the way the companies capture and analyse customer value, and according to the results that we got, the same functional groups in the different companies are involved. Actually, for all of them, the marketing department is in charge of capturing and analysing information from customers, and product engineers, even if they are not responsible for capturing customer value information, support the marketing department in analysing it. Project managers also play their part in the process in the three companies: they analyse customer value information at Carel Industries SRL, whereas they also capture it in the other companies. Finally, an interesting outcome of the survey is that, except for marketers, all the people implied in the customer value definition process have significant experience in the company (at least 6 years), which is coherent with the conceptual framework we presented in **§2.1**.

About the tools they use in this process, however, the results are more heterogeneous. Both ABB and Dell'Orto Spa use complaint or failure analysis, satisfaction surveys, press referrals and analysis of sales, whereas people at Carel Industries SRL use value in use assessments and talk with customers and competitors to get more information about

value. In the three companies, present and potential customers are part of the process, but Dell'Orto Spa also interacts with lost customers.

Finally, the techniques used to represent the captured customer values in product design and development vary amongst the companies. All of them use brainstorming as a mean to translate and integrate customer value information into their product development process, but this process comes with other specific methodologies. For example, Carel Industries SRL uses Quality Function Development, whereas ABB and Dell'Orto Spa use Design For Manufacturing and Assembly and lean tools. In any case, shopfloor workers are not involved in the process.

5.2.3.About the customer value orientation

The results of this part of the survey, once again, were globally quite similar for the different participants. In particular, in the three companies, neither the managers nor the engineers get a specific training on value analysis methods, and there is not any kind of motivational techniques linked to market orientation. Only Dell'Orto Spa measures the achievement of the captured customer values after the product has been designed and has an IT tool to document and track the information about the customer value during the product lifecycle. Both ABB and Dell'Orto Spa have a formal process to gather, communicate internally and follow up the customer value information; this process is known by all the employees. Finally, in these two companies, the customer is involved in the different phases of the product development process to feedback the company about the value seen in the product.

BIBLIOGRAPHY

[1] Anderson J.C., Jain D.C., Chintagunta P.K., "Customer Value Assessment in Business Markets : A state-of-Practice Study", ISBM Report, 1993

[2] Angelis J., "Customer value and lean operations in self care", POMS 19th Annual Conference, La Jollan California (USA), 2008

[3] APQC (American Productivity & Quality Center, Houston, Texas), "Customer Value Measurement: gaining the strategic advantage. Executive Summary", 1999

[4] Arnheiter E. D., Maleyeff J., "The intergration of lean management and six sigmas", The TQM Magazine, Vol. 17, N° 1, pp 5-18, 2006

[5] Butz H.E., Goodstein L.D., "Measuring customer value: gaining the strategic advantage", Organizational Dynamics, Issue 3, 1996

[6] Cell C. L., Arratia B., "Creating value with lean thinking and value engineering", SAVE, Internation Conference, June 2003

[7] Chase J., "Measuring value in product development", The Lean Aerospace Initiative, working paper WP00-05, Massachusetts Institute of Technology, 2000

[8] Chen C.H., "Development of a model to measure customer satisfaction with international tourist hotels in Taiwan", Texas Tech University, 2009

[9] Daniels S., "Customer Value Management", Emerald, Vol. 49, N° 2, pp 67-70, 2000

[10] Day E., Crask M.R., "Value assessment : the antecedent of customer satisfaction", Journal of Consumer Satisfaction, Vol. 13, pp 52-60, 2000

[11] Doyle P., "Building successful brands: the strategic objectives", Journal of Marketing Management, Vol. 5, N°1, pp.77-95, 1989

[12] Dube L., Renaghan L.M., Miller J.M., "Measuring customer satisfaction for strategic management", Cornell Hotel and Restaurant Administration Quarterly, Vol. 35, 1994

[13] Eggert A., Ulaga W., "Customer perceived value : a substitute for satisfaction in business markets ?", Journal of Business and Industrial Marketing, Vol. 17, N° 2/3, pp 107-118, 2002

[14] Evans G., "Measuring and managing customer value", Emerald, Vol. 51, N° 3, pp 134-139, 2002

[15] Fandos Roig J.C., Sanchez Garcia J., Moliner Tena M.A., Llorens Manzonis J., "Customer perceived value in banking services", International Journal of Bank Marketing, Vol.24, N°5, pp 266-283, 2006

[16] Flint D. J., Woodruff R. B., "The initiators of changes in customers' desired value", Industrial marketing management, N°30, pp 321-337, 2001

[17] Fontenot G., Gresham A., Behara R., "Using six sigmas to measure and improve customer satisfaction", 2004

[18] Gale B.T., "Managing Customer Value", The Free Press, New York, NY, 1994

[19] Garver M.S., Cook R.L., "Best practice customer value and satisfaction cultures", American Journal of Business, Vol. 16, N°1, pp 11-21, 2001

[20] Green P.E., Krieger A.M., Wind Y., Thirty years of conjoint analysis: reflections and prospects", Interfaces 31:3, Part 2 of 2, pp S56-S73 , 2001

[21] Grönross C., "Value-driven relationship marketing: From products to resources and competencies.", Journal of Marketing Management, Vol. 13, N°5, pp 407-419, 1997

[22] Harmon R. R., Laird G., "Linking marketing strategy to customer value: implication for technology marketers", Innovation in technology management: the key to global leadership, PICMET, 1997

[23] Hauser J.R., Clausing D., "The House of Quality", Harvard Business Review, 1988

[24] Holbrook M.B., "The nature of customer value: an axiology of services in the consumption experience", Service quality: new directions in theory and practice, Thousand Oaks, CA: Sage publication, pp 21-71, 1994

[25] Huber F., Herrmann A., Hennerberg S.C., "Measuring customer value and satisfaction in services transactions, scale development, validation and cross-cultural comparison", International Journal of Consumer Studies, N°31, pp 554-564, 2007

[26] Huber F., Herrmann A., Morgan R.E., "Gaining competitive advantage through customer value oriented management", Journal of Consumer Marketing, Vol. 18, N°1, pp 41-53, 2001

[27] Idassi J.O., Young T.M., Winistorfer P.M., Ostermeier D.M., Woodruff R.B., "A customer-oriented method for hardwood lumber companies", Forest Product Journal, Vol. 44, N° 7/8, pp 67-73, 1994

[28] Kaufman J.J., "Value Management: Creating Competitive Advantage, Best Management Practices Series", Crisp Publications, Menlo Park, CA, 1998

[29] Khalifa A. S., "Customer Value: a review of recent literature and an integrative configuration" Management Decision, Vol .42, N°5, pp 645-666, 2004

[30] Kothandaraman P., Wilson D. T. , "The future of competition: value-creating networks", The Pennsylvania State University, ISBM Report 6-2000, 2000

[31] Lanning M.J., "Delivering Profitable Value: A Revolutionary Framework to Accelerate Growth, Generate Wealth, and Rediscover the Heart of Business", Perseus Books, Reading, MA, 1998

[32] Lassar W., Mittal B., Sharma A., "Measuring customer-based brand equity", Journal of consumer marketing, Vol. 12, N°4, pp 11-19, 1995

[33] Mikulic J., Prebezac D., "Prioritizing improvement of service attributes using impact range-performance analysis and impact-asymmetry analysis", Managing Service Quality, Vol. 18, N°6, pp 559-576, 2008

[34] Monroe K.B. , "Pricing: Making profitable Decision", McGraw-Hill, New York, NY, 1990

[35] Morgan J.M., Liker J.K., "The Toyota Product Development System: Integrating People, Process And Technology", NY: Productive Press, 2006

[36] Palmroth W., "Always remember the six buyer benefits", American Salesman, Vol. 36, N° 9, pp 12-18, 1991

[37] Panizzolo R., "A methodology to measure the value of service provided to customers in manufacturing firms", Measuring Business Excellence, Vol. 12, N°3, pp 3-15, 2008

[38] Parasuraman A., "Reflection on gaining competitive advantage through customer value.", Journal of the Academy of Marketing Science, Vol. 25, N°2, pp 154-161, 1997

[39] Pureinsight, "The Principles of lean product development: a European perspective", Inside Track Report, 2009

[40] Pureinsight, "Successful product development", 2007

[41] Ravald A., Grönroos C., "The value concept and relationship marketing", European Journal of Marketing, Vol. 30, N° 2, pp 19-30, 1996

[42] Reichheld F. F., Markey R.G., Hopton C., “The loyalty effect - the relationship between loyalty and profits”, European Business Journal, 2000

[43] Reichheld F.F., “Learning from customer defections”, Harvard Business School, 1996

[44] Rintamaki T., Kuusela H., Mitronen L. , “Identifying competitive customer value proposition in retailing”, Managing Service Quality, Vol. 17, N°6, pp 621-634, 2007

[45] Rygielski C., Wang J.C., Yen D.C., “Data mining techniques for customer relationship management”, Technology in society, Vol.24, pp 483-502 , 2002

[46] SAVE International Value Standard, “Value Standard and Body of Knowledge”, 2007

[47] Schaupp L. C., Bélanger F., “A conjoint analysis of online consumer satisfaction”, Journal of Electronic Commerce Research, Vol. 6, N°2, pp 95-111, 2005

[48] Setijono D., Dahlgaard J.J., “Customer Value as a Key Performance Indicator and as a Key Improvement Indicator”, Measuring Business Excellence, Vol. 11, N°2, pp 44-61, 2007

[49] Sharma A., Krishnan R., Grewal D., “Value creation in markets, a critical area of focus for B2B markets”, Industrial marketing management, Vol. 30, N° 4, pp 391-402, 2001

[50] Sheth J.N., Newman B.I., Gross B.L., “Consumption values and market choices: theory and applications”, Cincinnati, OH: Southwestern , 1991

[51] Slack R. A., “The lean value principle in military aerospace product development”, extracted from "The application of lean principles to the military aerospace product development process", Massachusetts University of Technology, 1999

[52] Slater S.F., Narver J.C., “Intelligence Generation and Superior Customer Value”, Journal of the Academy of Marketing Science, Vol. 28, N°1, pp 120-127, 2000

[53] Treacy M, Wiersima F.,“The Discipline of Market Leaders”, HarperCollins, London, 1995

[54] Tzokas N., Saren M., “Value transformation in relationship marketing”, Australasian Journal of Marketing, Vol. 7, N°.1, pp.52-62, 1999

[55] Ulaga W., “Capturing value creation in business relationships: a customer perspective”, Industrial Marketing Management, Vol. 32, pp 677-693, 2003

[56] Ulaga W., “Customer value in business markets”, Industrial Marketing Management, Vol. 30, pp 315-319, 2005

[57] W.E. RAMAGE, “Commerce Center Suite 1000. System and method for customer value creation“, United States Patent Application Publication, 2010

[58] Wang Y.S., Tang T.I., Tang J.E., “An instrument for measuring customer satisfaction toward web sites that market digital products and services”, Journal of Electronic Commerce Research, Vol. 2, N°. 3, pp 89-102, 2001

[59] Womack J. P., Jones D. T., “Lean consumption”, Harvard Business Review, Reprint R0503C, 2005

[60] Woodruff R.B., “Customer value: The next source for competitive advantage”, Journal of the Academy of Marketing Science, 1997

[61] Woodruff R.B., Gardial S.F., “Know your customer: New approaches to understanding customer value and satisfaction “, Cambridge, MA: Blackwell Publishers, 1996

[62] Zeithaml V.A., “Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence”, Journal of Marketing, Vol. 52, pp 2–22, 1988

APPENDIX

Appendix 1: Excel table, synthesis of the papers

Appendix 2: Questionnaire on customer value and its influences on the product development process

Appendix 1: Excel table, synthesis of the papers

Reference		Categories			
Authors	**Date**	**Theoretical conceptions of Customer Value (CV)**	**Practical studies, study cases**	**Operational tools to measure CV**	**Operational tools to integrate CV**
Anderson J.C., Narus J.A.	1998	Def of CV. Focus on "total cost models" and lifecycle cost.		Different paths of a field value assessment: putting together the right people, generate list of value elements, gather data, validate the model, create value based sales tool.	Different situations to use CVA : managing offerings, product development, gaining customers, sustaining relationships
Anderson J.C., Jain D.C., Chintagunta P.K.	1993	Definition of the concept of customer value; business decisions areas where knowledge of value is critical.		Existing methods of customer value assessment (9). Results about usage of the methods (most used = focus group value assessment + importance ratings), their success (most successful = conjoint analysis), the methods used for each business decision. Implications for research: comparisons among methods	
Angelis J.	2008		Study in the health care sector in UK. Particular status of the client/patient: not really able to dictate his wants ... Doctors are in the best position to know what patients need! Market freedom limited		About how lean management can be applied in health care centers.
APQC	1999			Summary of a benchmarking study of 30 organizations. Identification of 4 areas for research, and then 15 key findings in these 4 areas --> conclusions of the study about the best practices.	
Arnheiter E. D., Maleyeff J.	2006				Overview of 6 sigma and of lean management. Misconceptions regarding both methodologies. Reasons why firms should intergrate lean management and 6 sigma --> "lean six sigma".
Butz H.E. , Goodstein L.D.	1996	Def of CV as "emotional bond". Customer bonding is more about how customers behave than about what they say. 3 levels of CV (expected, desired, unanticipated).		5 steps in customer understanding: customer identification, planning data collection, collecting the data, measurement of CV and implementation.	

Cell C. L., Arratia B.	2003				Presentation of lean requirements, characteristics and of the reasons why VE and lean should be leveraged: address different areas, one is a strategic decision while the other provide practical tools. Shared attributes of the 2 philosophies. What VE can bring to lean and vice versa.
Chase J.	2000	Theories about value creation in product development.			Methods and tools to measure value in product development: economic value added functions, PDCV model, design structure matrix (DSM), risk value method. Framework to measure value locally in the product development process and link PD entities and accumulating value --> VALUE-ACTIVITY MAP (matrix)
Chen C.H.	2009		Dissertation about satisfaction in taiwan hotels. Presentation of the most famous national customer satisfaction index (swedish/american/european ones). Presentation of a new model with 4 dimensions: image, service quality, perceived value and customer satisfaction. Survey to establish relationships between these dimensions : techniques used = SEM, AMOS, factor analysis, content analysis for open ended questions ...		
Customer Value, Inc	N.A.			Brochure of a software that helps develop value-based strategies. Features: assesses a product's competitive strengths and weaknesses and hones a value proposition. Based on different tools : value map, attributes plot, improvement opportunities ... Useful to account CV, to simulate a value proposition, to analyze a market position, to align people/program/strategy ...	

Day E., Crask M.R.	2000	Common threads about the def of value (7). Presentation of the different categorization of perceived benefits (at least the 3 most famous). New concept of value : the customer decision making process is a risk assessment process; value increases when risk decreases.			
Dube L., Renaghan L.M., Miller J.M.	1994		Study in the food service arena. Conjoint analysis to determine the relative powers of different attributes simultaneously, thanks to the presentation of 16 scenarios to the customers of a restaurant (scale 0-100). 2 situations taken into account (business and pleasure)		
Eggert A., Ulaga W.	2002	Study of the interaction between satisfaction and CPV. Satisfaction is driven by affective variables, CPV by cognitive variables. Study : CPV impacts on satisfaction that impacts on repurchase/word-of-mouth/loyalty --> satisfaction is a better predictor for behavioral outcomes but the 2 concepts are complementary (and not substitutes!)			
ETI Group	2005				Lean production method of ETI Group. 7 steps : define product, establish product line optimization team (PLOT), determine target costs, translate requirements into specifications, design at system level, design at detailed level, production preparation process (3P)

Appendix 1: Excel table, synthesis of the papers

Evans G.	2002	Explanation of the evolution of CVM.		Advices to do it well: 3 key questions (key buying factors? Our performance? Relative importance of factors?) + necessity to set an organizational strategy. Importance to persuade all the employees of its usefulness, education of managers. Regularity of reports. Which customers should we work with? Data mining: can help analyze the survey + choose the correct customers we should send the survey to.	
Fandos Roig J.C., Sanchez Garcia J., Moliner Tena M.A., Llorens Manzonis J.	2006	Aim of the research: to establish a scale of measurement of the overall perceived value (like GLOVAL in the tourism sector) in the bank sector. Use of a specific sample, questionnaire, factor analysis ... Results : 6 dimensions of perceived value (hypothesis of multidimensionality confirmed), and then attribution of weights to obtain the overall perceived value			
Flint D. J., Woodruff R. B.	2001	New theory about how CV changes. Differentiation between perceived and desired value. A number of forces (5 categories of environmental factors + 3 categories of perceived current capabilities) create customer tension, characterized by its affective strength, perceived extensiveness and temporal dynamism. Then, perception that the suppliers are needed to reduce the tension --> changes in desired value.			
Fontenot G., Gresham A., Behara R.	2004				How to adapt 6 sigmas (statistical device to measure the number of defects) to customer satisfaction. Applicable on high expectation attributes or on defection rate. Need for simplified processes
Garver M.S., Cook R.L.	2001		Study of the best practices regarding customer oriented firms. 4 dimensions of a CVS culture (employees must realize the importance of CVS data, desire to listen to the customers, be capable to understand the data and use it for decision making). Evidence of the successful strategies: customer champions and executive support, intensity and persistence.		

Green P.E., Krieger A.M., Wind Y.	2001			Conjoint Analysis = favorite methodology to find out how buyers make trade-offs. Explanation of the basic ideas (measure of trade offs analyzing surveys, use of "prop cards", of ranked response data...). Types of conjoint data collection. Conjoint models. Evolution of this methodology. Illustrative application and future prospect.	
Harmon R. R., Laird G.	1997	Describes the ways to use CV-oriented marketing. Description of the 5 values that drive customer's choice, of the 5 major CV driver classes and of the key areas linked to CV. CV should be used to select the target market, to integrate CV knowledge with value creating and delivery activities and to measure customer satisfaction.			
Hauser J.R., Clausing D.	1998				Need for a tool to design new products: explains how to build the House of Quality, and how to go beyond the tools. + example that illustrates the methodology
Huber F., Herrmann A., Hennerberg S.C.	2007		Study of CV and satisfaction in the after-sales automobile service transaction. Link about quality CV and satisfaction. Results : value has a positive influence on satisfaction, each of the service transaction episodes influence transaction satisfaction to a different degree, and each of them is represented by the value dimensions (emotional, practical, logical and risk) to a different degree.		
Huber F., Herrmann A., Morgan R.E.	2001	Model of CV integrrating psychological notions (means-end theory). Cf graph of the model pp 6.			Implications on marketing (segmentation), on advertising, distribution; importance of interfunctional teams.

Idassi J.O., Young T.M., Winistorfer P.M., Ostermeier D.M., Woodruff R.B.	1994	Product attributes are not sufficient to explain CV --> benefits from use are to be taken into account too. And then CV measurement is not sufficient --> include measurement of satisfaction too	Interviews, then mal questionnaire for both a group of suppliers and a group of customers. Then gap analysis to identify discrepancies between producers' perceptions and customers' expectations. Ex of results : graphs customers response/management response.		
Khalifa A. S.	2004	Summary of the 3 different models of CV : value components models, benefits/costs ratio models and means-ends models. Presentation of an integrative configuration, with 3 complementary viewpoints: the value exchange model, the value buildup model and the value dynamics model.			
Kothandaraman P., Wilson D. T.	2000	Proposition of a model of value-creating networks: core capabilities necessary to deliver superior CV but very rare --> deintegration, + relationships to assemble the core capabilities = value-creating networks. Tool to analyze value-creating networks. Impact of electronic commerce.			
Lassar W., Mittal B., Sharma A.	1995	Positive relationship between CV and brand equity --> necessity to measure brand equity. 5 dimensions of brand equity : performance, social image, identification trustworthiness and perceived value.		Scale for each item (each item belongs to a particular dimension of brand equity), then the sum of scale ratings for a brand gives its 'average brand equity rating'	
Mikulic J., Prebezac D.	2008			Presentation of "IPA" = importance-performance analysis, that scores the importance and performance of attributes depicting them on a 2D grid --> used to set priorities based on the voice of the customer. Contentious about the method. Proposition of a new framework (measures of attributes performance, importance and asymmetric effects on customers' satisfaction, implication for IPA). Empirical study.	

Panizzolo R.	2008			Best way to capture the voice of the customer = meet him and see how he uses the product --> GEMBA. General methodology followed: QFD, house of quality. Customers attributes were attributed a degree of importance and a benchmarking index (both thanks to surveys) + a strategic index (voice of the firm). Then weight = DI*BI*SI. Then weights assigned to services (central matrix of the House of Quality). Then matrix with weight of services and their diffusion in the market. Total Customer Satisfaction Index.	
Parasuraman A.	1997	Woodruff's def of CV and CV hierarchy. Additional questions: difference between measuring satisfaction and measuring CV? Which framework can contribute to organizational learning about CV? Presentation of such a framework, based on the division of clients in 4 categories. Each category focuses on a particular level of the CV hierarchy.			
Pureinsight	2009				About lean product development process
Pureinsight	2007				
Ravald A., Grönroos C.	1996	Previous def of customer perceive value + new one, taking into account the relationship dimension: (episode benefice + relationship benefice) / (episode sacrifice + relationship sacrifice). Importantt to understand the needs and to consider the relational aspect. Alternatives for creating value : increase benefits or decrease sacrifice understanding the customer's value chain (2 dimensions : cost efficiency and market efficiency)			
Reichheld F. F., Markey R.G., Hopton C.	2000	Evidence of the link between loyalty and profits. Positive effects of loyalty (increase in revenues, in employment retention, decrease in costs) --> increase in profits. And retention is directly linked to CV --> so direct positive link between CV and profits.		Satisfaction trap and necessity to monitor defections: cf source 7. Necessity to focus on the high potential value clients, not all of them.	

Reichheld F.F.	1996			Reasons why defections measures are not really used: difficult to link loyalty/profits, to look at failure, to define defection, to identify core customers BUT essential to do it. Explanation of how to conduct a root cause analysis, of which people should do it, and how to do it permanently. Satisfaction trap: problems of satisfaction surveys	
Rintamaki T., Kuusela H., Mitronen L.	2007	Def of customer value proposition, 3 kinds (all benefits, favorable points of difference and resonating focus). Framework for identifying CVP based on a matrix with a hierarchy of the value dimensions (eco, functional, emotional and symbolic).			
Rygielski C., Wang J.C., Yen D.C.	2002			Explanation of what data mining techniques are, of their categories (discovery, predictive modeling and forensic analysis), and of their models (classification, regression, time series, clustering, association analysis and sequence discovery). Link with CRM; marketing has to focus on the depth of each customer's needs.	
SAVE International Value Standard	2007				About Value Engineering. Defines the steps of a value study, Proposes a generic methodology, common terminology and standard practice. Provides guides to know at what point to apply value methodology to a project.
Schaupp L. C., Bélanger F.	2005		Report about a conjoint analysis study. Explanation of the method and its different steps (selection of a model, data collection method, stimulus set construction, stimulus presentation, measurement scale for the dependent variable, estimation methods). Presentation of results and limitations.		

Appendix 1: Excel table, synthesis of the papers

Setijono D., Dahlgaard J.J.	2007	Synthesis of the different def of value. Presentation of the 'ValMEA' = value modes effects and analysis : added value, perceived value, received value and satisfaction correspond to different moments		Presentation of the value map and the performance-importance matrix, with propositions to improve those tools : determination of the zone of CV fairness, LCC and CCJ, value-driven P-I matrix.	Mentions the QFD and the lean six sigma.
Sharma A., Krishnan R., Grewal D.	2001	Proposition of a framework to create value: management decision process (selectivity of customers cause high diversity and better info), then description of the technology delivery process, the product delivery process and the customer delivery process. Fig 1 p 4 = summary of the model			
Slack R. A.	1999	Presentation of a model of CV taking into account quality, total cost of ownership and time. Value = need * ability to satisfy the need * f(t) / total cost. Other value perspectives to take into account while mapping the process: employee value (job quality + compensation) and shareholder value (EVA); linkages between them.			About how to consider customer value (and other values) while mapping a process in a lean organization
Slater S.F., Narver J.C.	2000	Study about the link between intelligence generation and superior CV. 4 types of intelligence generation, each one of them is correlated to specific components of CV. Conclusion = a well developed intelligence generation capability is positively associated with superior CV			

Tzokas N., Saren M.	1999	New approach to the concept of value: CV is a dynamic concept ("continuous interaction between firm and customers") and cannot be measured once + it is CO-created by the firm and the customers (not only by the firm!). Anthropological and social approach; consumption decisions are value creative (construction of one's identity, beginning of a competition against one another). Criticism of usual tools to collect data --> only relationship marketing can be efficient, everything is about dialogue (it "shapes needs and behaviors to develop mutual advantage")			
Ulaga W.	2003	Importance of relationship value, study about the costs and benefits of the relationship supplier-customer. Grounded theory: theory is derived from the analysis of data; data collected through interviews. Then assessments of trustworthiness, and results.			
Ulaga W.	2005	Presents the different articles of the special edition of 'industrial marketing management' about CV in business markets. 3 different perspectives of CV: buyer's perspective, seller's perspective, and buyer-seller perspective.			
W.E. RAMAGE, Commerce Center Suite 1000	2010			Software to collect, manage, analyze and act on data from customers (=manage customer value creation). 3 data types: differential value proposition, demand influence and opportunities. Tool to understand the impact of different products on customers' profitability and to better know where to invest to create a competitive advantage.	

Wang Y.S., Tang T.I., Tang J.E.	2001		Presentation of a real study and its results in a particular field. Use of different items and a Likert-type scale for each of them. Then, data collection, and treatment with factor analysis. Conclusions about possible extended works and limitations of the model.		
Website of "Customer Value, Inc", competitive marketing strategy.				Value map, benefit attributes, head-to-head value comparison, importance-performance analysis...	
Womack J. P., Jones D. T.	2005				Introduction of lean consumption to provide the full value the customer desires, because expanding array of choices but decreasing time and energy. 6 principles : solve the customer's problem completely, don't waste his time, provide exactly WHAT he wants, WHERE and WHEN it wants it, continually aggregate solutions to reduce his time and hassle
Woodruff R.B.	1997	New definition of customer value (mixing received and desired value). Implications: richer theory of CV, more CV method tools, evidence impact of the tools on performance.		Customer Value Determination to replace CSM and to take into account not only the attributes but also the consequences and the goals. CVOMIS (information system to consider many info sources - cf fig 6).	Explanation of how to translate learning into customer value delivery.

QUESTIONNAIRE ON CUSTOMER VALUE AND ITS INFLUENCES ON THE PRODUCT DEVELOPMENT PROCESS

DATE:
COMPANY:
Annual sales:
Number of employees:
Sector:
Product line under consideration:
Direct customers of the product (end user, internal organisation, external organisation, government ...):
NAME *(optional)*:
Age:
Position:
Years in this position:

This questionnaire is part of a study about customer value and the different ways you deal with customer value information inside your company. After a first introduction part, you will be asked general questions about the meaning you give to customer value, the people involved in the customer value assessment process, and the various tools you use to capture and then integrate customer value information into product design. In a second part, you will be able to answer around ten more specific questions about your customer value orientation (e.g. about how customer value information is communicated internally). Finally, a few questions related to your product development process, its performances and its improvements, will conclude this survey.

Appendix 2: Questionnaire on customer value and its influences on the product development process

1. Which business strategy does your company follow to develop new products?

☐ Technology push ☐ Market pull

2. What do you think about the following definitions of customer value?

	I strongly agree	I agree with the general meaning	I hold a very different view	I completely disagree
(1) The features that a customer would like or need to be considered in the development of a new product.	☐	☐	☐	☐
(2) The difference between the utility of a product for consumers and the costs incurred in acquiring it.	☐	☐	☐	☐
(3) A summation of benefits minus the sacrifices that result as consequence of a customer using a product to achieve his goals and purposes.	☐	☐	☐	☐

If you have your own definition of customer value, please write it below:

_____

_____

_____

3. Which of the following would your customer consider as value in a product?

	Irrelevant *(unwanted)*	Desired *(nice to have)*	Demanded *(must have)*	Exciter *(not expected but highly appreciated)*
Creativity/originality/innovation	☐	☐	☐	☐
Brand	☐	☐	☐	☐
Aesthetics/general look	☐	☐	☐	☐
Shape	☐	☐	☐	☐
Weight	☐	☐	☐	☐
Colour	☐	☐	☐	☐
Materials used	☐	☐	☐	☐
Environmental impact	☐	☐	☐	☐
Extended product lifetime/durability	☐	☐	☐	☐
Reliability	☐	☐	☐	☐
Efficiency	☐	☐	☐	☐
Ease of maintenance	☐	☐	☐	☐
Quality	☐	☐	☐	☐
Accessibility	☐	☐	☐	☐
Ease of disposal	☐	☐	☐	☐
User friendliness/operability	☐	☐	☐	☐
Flexibility/modularity	☐	☐	☐	☐
Product cost	☐	☐	☐	☐
Service cost	☐	☐	☐	☐
Emotional aspects	☐	☐	☐	☐
Others:				

4. Who is responsible for CAPTURING and ANALYSING customer value in your company (you may wish to select multiple options)? If possible, precise the average number of years of experience inside the company of those people.

	Capture	Analyse	Experience
Marketing	☐	☐	
Sales	☐	☐	
Product engineers	☐	☐	
Requirement engineers	☐	☐	
A team of sales personnel and engineers	☐	☐	
Project Manager	☐	☐	
Other (please specify)			
I don't know	☐	☐	

5. How does your company capture customer value?

- ☐ Satisfaction surveys
- ☐ Complaint or failure analysis
- ☐ Press references (positive and negative)
- ☐ Analysis on sales and retention
- ☐ Value-in-use assessment (interviews and observation of the customers to determine a comprehensive listing of cost elements associated with the usage of a product)
- ☐ Focus groups (participants are exposed to potential product offerings, express their feelings and are asked what the value of these offerings would be for them)
- ☐ Importance-performance analysis (technique to measure attribute importance and performance)
- ☐ Conjoint analysis or other statistical methods (content analysis, factor analysis...)
- ☐ Others (please specify):
- ☐ I don't know

6. When trying to capture customer value, which of these categories of people do you usually contact?

- ☐ Present customers
  In this case, please precise :
  - ☐ *New buyers* *or* ☐ *Any buyer*
  - ☐ *Most valuable buyers* *or* ☐ *Any buyer*
- ☐ Potential customers
- ☐ Lost customers
- ☐ No one

Do you use data mining techniques to target these contacts?

☐ Yes ☐ No

7. How do you represent the captured customer values in product design and development (techniques, tools, technologies)? You may wish to select multiple options.

- ☐ QFD (Quality Function Development)
- ☐ DFMA (Design For Manufacturing and Assembly)
- ☐ Six sigma
- ☐ Lean manufacturing
- ☐ Value analysis/value engineering
- ☐ Brainstorming
- ☐ Other (please specify):

Do shop-floor workers participate in this process?

☐ Yes ☐ No

The following questions are more specific questions about Customer Value and the New Product Development Process

About Customer Value orientation

8. Does the company benchmark the customer value against its competitors? Is the company aware of which of its product attributes/values are better compared to its competitors and which of them are not?

☐ Yes ☐ No

9. Do your managers get a specific training on value analysis methods?

☐ Yes ☐ No

If yes, which managers?

_____

_____

What about your engineers?

☐ Yes ☐ No

If yes, which engineers?

_____

_____

10. Do you assess/measure the achievement of the captured customer values after the product has been designed?

☐ Yes ☐ No

11. Does the company reward employees that contribute to achieve the customer value expectations or do you have any kind of motivational technique linked to market orientation?

☐ Yes ☐ No

12. Has the company defined a "formal" process established to gather, communicate internally, and follow-up the customer value information?

☐ Yes ☐ No

If yes, how do you report about customer value: how often, who is responsible for it and who gets the information?

_____

_____

_____

13. Is this process known by all the employees participating in the product development process?

☐ Yes ☐ No

If yes, in what form does your product development team receive information about customer value?

- ☐ Product specification and requirement document
- ☐ Business understanding document
- ☐ Experience from previous programs (i.e. things the customer expects but does not specifically ask for.)
- ☐ Other (please specify):

14. Does the company have an IT tool to document and track the information about the customer values during the product lifecycle?

☐ Yes ☐ No

If yes, what kind of tool is it and what are its functionalities?

_____

_____

15. Is the customer involved during the different phases of the product development process to feedback the company about the value seen in the product?

☐ Yes ☐ No

Comments/details related to questions 8 to 15:

_____

_____

_____

_____

_____

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_____

About improvements and performances

16. What are the short-term and medium-term goals in terms of product development? Please select the first three goals for 2010 and the first three goals for the 2010-2013 period.

	2010	2010-2013
Product cost reduction	☐	☐
New product development efficiency	☐	☐
New technologies introduction	☐	☐
New market penetration	☐	☐
A shorter time-to-market	☐	☐
Other:	☐	☐
Other:	☐	☐
Other:	☐	☐
Other:	☐	☐
Other:	☐	☐

17. Which of the following statements best matches your company's position about waste (=anything that does not add value to your product, that your customer would be unwilling to pay you to do):

- ☐ There is no roadmap to eliminate waste in the New Product Development Process considering customers' inputs
- ☐ There is interest to improve the product development process by eliminating waste, but there is no clear plan
- ☐ Some product development teams use value stream mapping to identify value-added activities and waste
- ☐ All product developments teams use value stream mapping tools and focus on eliminating waste in all their projects
- ☐ Initiatives focus on eliminating waste not only within the company, but also at the suppliers' product development process
- ☐ None of the previous answers

18. Do you continuously define and carry out improvement initiatives to reduce cost and lead times in the new product development

- ☐ Continuous improvement projects in the product development are encouraged to reduce cost and time, but there is resistance to change and there is neither clear plan nor long term roadmap
- ☐ Improvement efforts are periodically undertaken using an unstructured improvement process.
- ☐ Some improvement initiatives use a structured methodology that is well known by all product development teams (e.g. Plan - Do - Check - Act Cycle or Six Sigma)
- ☐ Most of the employees actively carry out product improvement projects using a structured methodology to optimise new product development projects, focusing to reduce cost and lead times
- ☐ All new product development teams participate in improvement projects integrating suppliers and customers to optimize the complete value chain
- ☐ None of the previous answers

19. What are the different KPIs you use to assess your Product Development Process?

Thank you for completing this questionnaire.