

Value Analysis

Going into a further dimension

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Abstract—Value Analysis (VA), as it was originally conceived, was defined and applied as a cost cutting tool, in order to make products more competitive. That short scope was early identified as limiting further developments and applications of the concept, by its initial pathfinder, if no extra effort was made to take the concept into other levels of management and, consequently, of business. The many different and alternative applications of the concept and of its original methodology have taken many professional practitioners and scholars to theorize and apply new concepts and methods. We can find a tremendous number of different learning exercises and theoretical evolution from that work, but that has not yet answered many aspirations regarding the initial concept of value and value analysis. This paper aims at bringing a new and more comprehensive understanding to professional practitioners, scholars, trainers and students, about some major concepts and applied methodologies in the disciplines of Value Management (VM), Value Analysis (VA) and Value Engineering (VE).

Keywords – Value; Value Analysis; Function; Function Analysis; Value Management

I. INTRODUCTION

There is a wide view among professional practitioners and scholars of the application of some managerial tools in the field of Value Management (VM). This is part of the concept of Value Analysis (VA) in itself, which leaves the application of the methodologies up to individual criteria with enough freedom for its adaptation to contexts and objectives. Despite the benefits of such freedom in the application of the methods and tools in the disciplines of Value Management, Value Analysis, and Functional Analysis (FA), such “liberty” has led to settled variations in the practice of some of those methods. This reality can be found in many papers presented in different professional conferences across continents and in some existing literature, especially in given examples of real applications.

Although most professional practitioners can differentiate and understand such subtle or evident divergences in practices, new comers to the discipline of Value Management may find it difficult to comprehend how such divergences can exist. This opens the discussion about the desired standard application of some methods, which this paper aims to touch. My individual practice and the observation of other professionals’ practices in many documented applications have helped me develop my own methodologies in my value management entrepreneurial and consulting activities. That will be explored in this article.

II. CONCEPTS AND LITERATURE REVIEW

The following literature review of concepts is restricted to the disciplines of Value Management, Value Analysis and Value Engineering (VE). As most literature repeats the same ideas and definitions in a very short range of variations, this review will focus on the best known and disseminated texts. In the same way, this literature review will only focus on aspects that are relevant to the purpose of this article, leaving out many issues related to the methodologies around value analysis, and therefore subjected to the readers own research in order to complete the full vision of the entire subject.

A. The concept of value

Miles [1], the main pathfinder of Value Analysis, had in his day questioned the future application of the concept in business: “The basic question is: what do we really have in Value Analysis? What we have is a tremendous problem-solving system.” (p.69). In Miles’s opinion, value had to go on a new and different path in supporting business development, rather than keeping its action, as at the time, exclusively in the field of “cost reduction”. He continued on his new vision for value analysis: “It becomes essential that we in Value Analysis work to help modify the management of areas into which the work will go. At the same time, we must further change our approaches in Value Analysis so that we are modifying the seed and the soil together without taking the strength out of the problem-solving approach” (p.70). This would mean, at that time, going one dimension further ahead in value analyses.

Many other professional practitioners and scholars have brought this issue up to the public and professional level, including into the standardization arena. Before going any further in pursuit of how value analysis has evolved or is yet evolving, we need to understand what value is or may be. Generally, value is understood as expressing the worth of something. But a closer look into the existing literature can reveal different types of value, as Jensen [2] has identified: (i) economic value – or value as exchange; (ii) use value – or value as utility; (iii) cultural value – or value as meaning and sign; and, (iv) perception value – or value as experience.

Cross-disciplinary research proves those findings. To Smith [3] any “good” had two different meanings, one expressing the utility of the same particular object, “value in use”, and the other, the power that the possession of the object conveys to

purchase other goods, “value in exchange”. [Aristotle (384-322 B.C.) was the first to differentiate between a use value and an exchange value of goods. (Politics, Book I.)]. According to Kopytoff [4], this is what defines a “commodity”: “an item with use value that also has exchange value” (p. 64).

The consumer or user is at the center of this inter-relation of different types of value in the same good, leading value to be understood as a perception function, represented by the equation “customer perceived value=perceived benefits/perceived sacrifice”, as referred by Raval and Gronroos [5]. Another way to view the issue, supported by Anderson, Naras and Kumar [6], is that “customer perceived value=customer benefits–customer sacrifices”, arguing that this is easier to be understood by individuals and businesses. We should note that perceived value differs from “desired value”, where the last represents what the customer wants to happen and the first represents what the customer has obtained or that it has happened. According to Flint, Woodruff and Gardial [7], desire value can take two aspects: value in use and possession value.

Clawson and Vinson [8] argue that, in order to investigate consumer's product valuation, it is necessary to integrate cultural values, personal values, consumption values, and product benefits. To Engel, Blackwell and Miniard [9], cultural values are related to how cultural, social and familial environments affect the formation and development of individual beliefs, also called “society core values”, which are implanted naturally through socialization and education. Personal values are the individuals' beliefs about what is desirable for themselves, therefore self-centered, deriving from and modified through personal, social, and cultural learning (Clawson and Vinson, op. cit.). Rokeach [10] divides “human values” into two types: terminal (or end-state), beliefs about goals that people strive for, like self-fulfillment and enjoyment in life, and instrumental (or means), beliefs about desirable ways to attain those terminal values, like owning a luxury car or going to an entertainment event. Personal values correspond to terminal values, while instrumental values are comparable to values of desirable “activities”. According to Sheth, Newman and Gross [11], people achieve personal values, or goals, through actions or activities, such as social interaction, economic exchange, possession, and consumption. Consumption values refer to subjective beliefs about desirable manners to attain personal values, therefore being instrumental in nature. To Hooley and Saunders, product benefits refer to what customers benefit from buying, using or consuming a product [12]. In the customers' perspective, product benefits are not the same as product attributes, as argued by Day [13] and by Peter and Olson [14]). In a competitive market, products have many attributes such as features, durability, quality, style, symbolism and related services, in addition to the basic provided benefits. I will return to the issue of benefits later on.

According to Boztepe [15], value can be something assigned by the user, being independent of the product's physical qualities, or embedded in the object and recognized by the user. This leads to the view of a philosophical branch concerned with the theory of value, known as axiology, which posits a bipolar distinction between objectivism (utilitarian or

instrumental use of a particular solution as a means to a specific end) and subjectivism (emotional appreciation of the consumption), as argued by Hartman [16]. Positioning value as inherent to an object, prior to any subject interaction or evaluation, is an objectivist view. On the other hand, if it is the user understanding that prevails, including many other factors under consideration, it can be seen as a subjectivist view. This dichotomy between objectivism and subjectivism views leads to a discussion between tangible or intangible, use or emotion, and utility or esteem, which I will address later, together with the issue of measuring value.

This continued “consumer perspective” creates a need to understand consumers in a much wider extension. One of the many ways to understand users' needs, as consumers, is studying their specific functional and emotional needs and, consequently, transforming those into product attributes or functionalities [17]. Value Analysis contributes to that understanding through a process of functional analysis and function costing [18], determining the relation between the satisfaction of needs and wants and the resources utilized, being this relationship called “value”. According to the European Norm EN 1325:2014 [19] value is the “measure which expresses how well an organization, project, or product satisfies stakeholders' needs in relation to the resources consumed”. On the other hand, according to the SAVE International Value Standard [20] value is “defined as a fair return or equivalent in goods, services or money for something exchanged. Value is commonly represented by the relationship: $Value \approx Function/Resources$ ”. Both versions of the same concept of value were initially mostly based on the satisfaction of the user's needs, but it has been developing into the concept that value also speaks to all other stakeholders in the same manner, as expressed in the Value Management Handbook [21] and the European Norm EN 12973:2000 [22].

Integrating all previous views and trying to encompass all possible situations of value applicability, I came to the definition of value as “the relationship between the output(s) and/or outcome(s) [expected benefits] provided by a thing or event, to an individual person or group of people, and the effort [potential sacrifice] consumed to acquire, use or make it happen” [23]. I will come to this later, to explain the rational behind this conclusion.

If we consider that all stakeholders have some kind of interest in a product and in its life cycle, that opens an opportunity to determine who out of the same stakeholders will be affected positively (positive value) and who may be impacted negatively (negative value) by the value subject. In the same fashion, different stakeholders may take advantages and benefits from some attributes or functions of the product and its life cycle in utility (tangible/use value) or emotional terms (intangible/esteem value).

These wider visions of what value is or may be take us to a new journey into the discipline of value analysis, as we need to contemplate all of those variations of value in our analytical process.

As mentioned before, value is generally understood as the result of a transaction between two parties, where the equation

“value=benefit/sacrifice” is mostly taken into account. Benefits may respond to requirements (needs or wants). Benefits can be positive, subjected to being expressed as gain, or negative, therefore expressed as a loss or damage, and, consequently, linked to risk.

Lay [24] proposes a typology of benefits related to products that consumers may derive from possession or consumption, including eight generic product benefits: functional, social, affective, epistemic, aesthetic, hedonistic, situational, and holistic. (i) Functional benefits are related to a product’s capacity for functional, utilitarian, or physical performance, deriving from tangible and concrete attributes that consumers may experience when using or consuming a product. (ii) Social benefits are perceptual benefits related to a product’s association with social class, social status, or specific social group. (iii) Affective benefits refer to the perceptual benefits deriving from a product’s capacity to enhance feelings or affective states, associated with cultural-ethnic meanings or personal idiosyncratic meanings, tastes and memories. (iv) Epistemic benefits are the benefits acquired from a product’s capacity to satisfy curiosity, provide novelty, and meet a desire for knowledge. (v) Aesthetic benefits are the benefits acquired from a product’s capacity to present a sense of beauty or to enhance personal expression. (vi) Hedonic benefits are the benefits acquired from a product’s capacity to meet a need of enjoyment, fun, pleasure, or distraction from work or anxiety. (vii) Situational benefits are the benefits acquired from a product’s capacity to meet situational needs and specific situations, measured on the profile of a particular consumption circumstance. (viii) Holistic benefits are the perceptual benefits acquired from the complementarities, coherence, compatibility, and consistency in a product constellation as a whole. Still according to Lay [24], customers’ evaluation of a product purchase begins from their perceived product benefits based on their terminal personal values and instrumental consumption values. Against the cost-and-benefit principle, which states that customers evaluate benefits against cost, Lay [24] proposes that customers’ evaluation is based on three major inputs: “perceived product benefits”, “perceived logistic benefits” and “perceived costs”. Value is, therefore, extended to a multidimensional level.

Benefits are what consumers and users take out of product attributes, and attributes are representations of functions. Functions deliver value of any of the types identified before. All those are expressed by the voice of the consumer (customer). The subject of the voice of the consumer is very important in the study of value, if one wants to evaluate the same value in an accurate manner. Many other value management tools such as Quality Function Deployment (QFD), use the voice of the customer to determine the desired value to be delivered [25]. The voice of the consumer reaches special relevance when determining the demanding importance of the attributes of a product, as argued by Zaltman and Coulter [26] and Hauser [27]. In the opposite way, the voice of the consumer can be used to identify problems and dissatisfaction [28].

All these issues will be brought into play in this article, as new elements to be taken into consideration when I present my

method to perform functional analysis. That is part of my work in developing an approach in accordance with Miles’s [1] desire in taking value analysis into a further dimension.

B. The concept of function

The European Norm EN 1325:2014 [19] defines function as the “effect of a product or of one of its constituents”. The standard notes that: (i) “Functions should be expressed in an abstract form, free of technical solutions”; and, (ii) “Functions may describe what a product or its component parts must do (meet customer requirements) or what product or component parts actually do or achieve”. According to SAVE [29] “A function is that which makes an item or service work or sell—in other words, an item’s function is why the customer buys the product or service. An item, including structures and services, is a means to the end of providing a function, not the end itself”. Rich and Holweg [30] argue that a “function can be defined as the use demanded of a part of a product and the esteem value that it provides. These functions therefore make the product work effectively or contribute to the ‘saleability’ of the product”.

Not being too far apart from one another, these views demonstrate the importance of understanding functions in products (goods or services). Product functions are, in fact, what deliver outputs and outcomes to users and other interested parties. If a product does not perform any function, it is of no use and, therefore, of no value whatsoever. We may find different actors, or interested parties, involved and with interests in a given subject of value, represented by a product (good or service) or not (event), and that will lead us to identify a variety of functions related to those.

The European Norm EN 1325:2014 [19] identifies some different types of functions of interest to this paper: (i) “user related function – effect expected from a product, or performed by it, in order to meet a part of the need of a definite user”. This type of function represents what the product does or delivers and can be of use or esteem, being this the unique interest that users and the market may have in the product; (ii) “product related function – impact of the product, what the product does, and the effect of a constituent or the effect between constituents of the product for the purpose of performing user related functions that might be either necessary or unnecessary, desirable or undesirable”. This type of function represents how the product delivers the user related function (use or esteem), and it can be related to the technology applied to produce the desired result or effect; (iii) “unnecessary function - function that does not contribute to the *satisfaction* of the need of a user, and so has no positive contribution to the value of the product”; (iv) “undesirable function - function which has an adverse effect for the user, sustainability or the environment. It has a negative contribution to the value of the product”. This type of function generally represents the unanticipated result of the technical choices or the result of waste; (v) “basic function - need which must be (or is) fulfilled in full”; (vi) “primary function - high level function which communicates the functional purpose of the product”; (vii) “secondary function - function which contributes to the fulfillment of a primary function”; (viii) “supporting function - function which

maintains the conditions for the fulfillment of several primary functions". This type of function may be associated with organizational support and brand perception that may be outside the scope of a specific value management study or value management program.

SAVE [29] classifies functions as: (i) "basic function - the primary purpose(s) for which the item or service was designed when it is operating in its normally prescribed manner. This function must be accomplished to meet the purpose of the product, structure, or service." A product (good or service) may have more than one basic function. Some professional practitioners may call it "primary" function; (ii) "Secondary functions are ones that support the basic function (and, hence, are sometimes referred to as "support functions"). They result from a specific design approach to achieve the basic function. If the design changes, the need for existing secondary functions may be modified or even eliminated". Some professional practitioners may break secondary functions into a sub-classification of "required", "aesthetic", and "unwanted".

The differences in nomenclature used by the two parties are not relevant to the exercise of value analysis per se. Despite the fact that Americans and Europeans currently use different terminologies, the semantics remain the same and there are no major obstacles for a clear understanding between the parties.

Since the very beginning of the value analysis discipline, and as defined by SAVE [29] and accepted by all other professional and scholar players, a function "is always expressed by a verb and noun", and it "must be expressed in a measurable parameter in order to obtain a value for it later in the analysis. Nouns may be either measurable or non measurable. Non measurable nouns must be explained so that they may be translated into a measurable element and later evaluated".

Active verbs, denoting action, instead of passive verbs, are preferable in the description of the functions. Despite the advisable use of two words, a verb and a noun, to describe a function, extra description should be provided in order to give full meaning to the narrative. The description used has to be as clear as possible in order to avoid misunderstandings and confusion in future utilization of such narrative.

C. The concept of function analysis

The function analysis is the "process that describes the functions and their relationships, which are systematically characterized, classified and evaluated" [19]. There are two approaches to function analysis: (i) the functional need analysis (or external function analysis), related to use or esteem functions; and, (ii) the technical function analysis (or internal function analysis) related to product functions.

There are several methods of performing a function analysis exercise, supported by different tools, in order to identify, classify and evaluate functions. The simpler methods are the "natural or intuitive search" of functions and the "random function identification", supported by exercises of brainstorming. The "function tree diagram" method (also known as "value tree diagram"), the method of "interaction with external environment" (also known as the Roseta method)

and the "functional analysis system technique" (FAST), are used for more complex value subjects analysis.

As this article is not aiming at doing any comparison of function analysis methods, like the ones just mentioned above which are well documented in existing literature, it is appropriate to leave this issue for later discussion when I revise some concepts in the discipline of value analysis.

Nevertheless, all methods identified aim at evaluating the importance of each individual function in order to compare its relative importance against its relative cost, as we will see next.

D. The concept of function cost

The European Norm EN 1325:2014 [19] defines function cost as the "whole of the expenditure forecast or incurred for including a function in a VA subject". The standard also notes that: "Before design or re-design, the function cost is a target or a limit: the expenditure which is granted for including that function. After development or implementation, the function cost is the cost which has been effectively incurred". SAVE [29] refers that "it is the cost function relationship that often vividly illustrates where unnecessary costs exist within the study project".

According to almost every existing scholar and professional literature and training program, the process of function costing can be divided in four phases: (i) identification of all components that are or will be part of the value subject. Components of a value subject can be parts (composed of materials, labor and other costs) and services (composed of activities and other costs related to the utilization of equipments and others); (ii) calculation of the cost of every component (parts and services) of the value subject. This costing exercise must be as extensive as possible, including all possible elements of cost; (iii) assignment of existing or future relationships between each function and each component. One component may be assigned to one or more functions and vice versa; and, (iv) assignments of corresponding cost to each function based upon the assigned relationship with components (parts or services).

According to one initial definition of value, the cost of each function is essential to determine the value of the same function: $\text{value} = \text{function} / \text{cost}$. However, as this cost may not include all possible sacrifices that a given user or any other interested party may have to deliver in order to make full use of the value subject (product), the concept has been adapted, transforming cost into resources used. Despite such a theoretical change being accepted by almost every professional practitioner and scholar, the observance of common practices shows that in most instances, the quantification of resources used is limited to the monetary costs of components (parts and services), determined by the economical value (monetary value) of raw materials or equivalent, plus labor, and plus direct and indirect costs, mostly determined at the production stage. That observance leads to questioning the accuracy of the method applied in such fashion. This will be brought up again during the next discussion on revising some concepts.

III. REVISING SOME CONCEPTS

In my recent entrepreneurial and professional experience, I have come to use a well-defined set of self-created concepts and definitions related to value analysis and extended to value management. They took form along many years of activity and research and are mainly the result of revising existing concepts and definitions according to my learning and practical experience. Some of that work is reflected next.

A. Value

If one needs to understand what value is, one has to go back to nature to under the phenomenon. If we consider that in the universe the total quantity of existing energy is a constant, despite the various forms that energy may have, the total "value" of that same energy also remains constant. Therefore, any mutation in the energy form, like solid changing into liquid, does not affect the total value, as there is no loss of energy in such mutation. Consequently, the universe and nature in its basic form do not use or apply the concept of value, at least not as implicitly defined by the equation "value=benefits/sacrifice".

However, any form of existing life on Earth seems to understand and apply the above principle of value. Any tree, being placed between dry and wet land, directs its roots mainly towards where the water is, reducing the effort of sending roots all around in full length. Animals only fight for food when the reward is higher than the effort (sacrifice) spent to get it. Humans do the same, even at the sub-conscious level, when making the least important decision in their lives. It seems that "value" is in any decision making process.

I argue that, based on such evidences, "value is the absolute criteria used in any decision making process, based on the relationship between expected benefits versus potential sacrifice to be made". Therefore, in terms of the disciplines of Value Management and Value Analysis, "Value is the relationship between the output(s) and/or outcome(s) [expected benefits] provided by a thing or event, to an individual person or group of people, and the effort [potential sacrifice] consumed to acquire, use or make it happen" [23], as previously stated. This conceptualization still maintains value as the result or expression of a measurement, staying in accordance with existing accepted definitions.

B. Attributes

An attribute is a permanent or timely condition of a solution (product) to some consumer need. An attribute is not defined by any action in particular, like functions, but rather by a given status quo that is intrinsic to the solution/product. Attributes are properties, predicates, features, dimensions, characteristics or even independent variables, depending on the context that defines the product. An attribute is not necessarily defined by a verb, but if so, it is likely to be a passive one such as to be, to have, to cost, to give, to enhance, or to seem.

Starting from the concept that consumers or users understand value as represented by the equation "value=benefits/sacrifice", we may accept that attributes can be related to benefits and to sacrifices. Attributes that are benefits

may be "resistance", "duration", "design", "accessibility", "taste", "sound" or "pleasure". Attributes that are sacrifices may be "cost", "assemblage", "transportation", "storage", "disposure", or "displeasure".

However, some of these attributes, depending on the context, can transform from benefit into sacrifice, like sound that becomes loud noise, or from sacrifice into benefit, like making the assemblage of a product that becomes pleasant entertainment. A color, like (being) blue, is an attribute. This can be a benefit to some or a sacrifice to others, depending on the context and of what one does with that attribute.

We also need to bring into play other conditional factors of value to understand attributes. Before, we identified four types of value: economic value; use value; cultural value; and perception value. Economic value is mostly related to (monetary) costs, therefore a sacrifice, from a purchaser point of view, but it can be seen as a benefit if the cost, or price, represents accumulation of value of some kind to the holder. Economic value can also be a benefit to the seller if a thing is sold at a profit. Therefore, economic value is related to different and almost all attributes, being at the same time a benefit and a sacrifice, depending on the standing point of each interested party. Perception value, like economic value, also very much depends on the standing point of each interested party and can be simultaneously a benefit or a sacrifice to different interested parties. These two types of value are very much diffused in any set of attributes of a solution (product) and they can transform into any of the next types of value that we will see next, as they lose their own independent definition in the context of attributes.

Use value is connected to most attributes in a solution (product). Consumers or users, and any other interested party, perceive the value of a solution based on the use value that it may deliver. In other words, the utility of the solution is fundamental for the existence of value in it. A product with no utility has no use value or no "value" at all, for this matter. The level of use of a product, expressed in its set of "utility attributes", may affect the economical value or the perception value of the whole product. The utilities of a product are, most of the time, benefits to some interested parties, mainly consumers or users, but can also be a sacrifice in some contexts to other interested parties. Therefore, we may find that utility attributes can be benefits or sacrifice, and that must be clearly identified in any value analysis exercise.

Cultural value may be connected to some attributes of a solution (product). Consumers and users, or any other interested party, may find cultural value in some attributes of a product. A given design style applied to a product may provide it with cultural value. The cultural value is mostly felt at the emotional level or sphere of any consumer or user, or of any other interested party. The level of cultural value in a product, expressed by "emotional attributes", may affect the economic value or the perception value of the same product.

In conclusion, we may find some attributes in a product that are benefits to someone, and other attributes that are sacrifices to the same person or to somebody else. At the same time, those attributes can be of utility or emotional.

Attributes are what the consumer or user, or any other interested party, sees in a solution (product) to solve a need. In order to deliver the desired solution to a need, the product must perform some functions. This logical path connects attributes to functions. I will discuss this issue next.

C. Functions

Starting from the attribute side of a solution (product), and taking for good that there are some direct connections between attributes and functions, we can rapidly arrive at the functions that are representations of the former.

If we consider the utility attributes, then we must find a service function that performs in such a way that the need implicitly connected to the attribute is conveniently answered. I call this the “use related function”. The same happens if we consider an emotional attribute, where some service function must provide the required answer to some need. In this case, I call it “esteem service function”. However, if on the one hand a utility attribute is answered mostly by a use service function, on the other hand, an emotional attribute can, and is likely to be answered by both types of service function – use service functions and esteem service function. Occasionally, an esteem service function may turn into a utility attribute. The use service function provides some tangible answer, measurable and predictable. The esteem service function provides some intangible answer, very difficult, if not impossible to measure and unpredictable.

Continuing from the service functions point of view of a solution (product), and taking for good what literature refers, we can arrive at another level of functions that answer the first. These are the product related functions, also known as internal or secondary functions.

Following the same rational previously used, a use service function must be connected or answered by one or more product functions, which I call “hard-product/technical function” as most answers are given through a technological solution. An esteem service function, following the same logic, should be answered by one or more product functions, which, in this case, I call “soft-product/cultural function”, as the answers are provided through human actions, with or without the support of technology, that induce human behavior as part of a given culture. However, esteem service functions may also be connected to hard-product/technical functions, as used service function may be connected to soft-product/cultural function, and that will affect function cost, as we will discuss later.

Summarizing, we may establish connections between attributes and service functions, and between service functions and product functions, as in Figure 1. Examples of these types of attributes and functions will be provided ahead.



Fig. 1. Connections between attributes and functions

D. Function Analysis

I have been using, for a while now, a combination of techniques to execute functional analysis. The first step is defining, with the organization sponsoring the project, the composition of the working team in such a manner that the team includes someone representing each and every interested parties, taking into special consideration the consumer’s voice, who must represent the needs and wants of consumers and users. This is, anyway, a step taken by everybody working in functional analysis. Then, I start, with the project team, by identifying all potential interested parties in the value subject under study, even if not represented in the project team. That covers all entities, internal and external to the organization or holder of the value subject, under study. To find all interested parties, we ask four questions: (i) who interacts directly with the value subject?; (ii) who reaps benefits from the value subject?; (iii) who can be affected negatively by the value subject?; and, who has to provide effort (sacrifice) for the value subject to exist? For that purpose, I use an adaptation of Allee’s Value Network methodology [31].

Once all the interested parties are identified, the team identifies the potential transactions that may occur between those entities. Transactions are understood as an exchange, in one or both directions, between two or more entities. Transactions can be tangible if they are measurable, like transacting products, money, services, data or information, or intangible if they are not measurable, like transacting behaviors (i.e. misuse of an equipment, avoidance to use a product, or referring a service to someone else) and feelings (i.e. happiness, trustfulness, or confidence).

The next step is identifying all interactions that the entities (interested parties) may have with the value subject. For this purpose, three questions are asked: (i) what are the direct interactions between each interested party and the value subject?; (ii) what are the interactions between the value subject and any other system or sub-system?; and, (iii) what are the interactions between the value subject and the environment (the whole physical context). This follows the “Roseta” method previously identified. The questions are mainly placed in reference to all identified transactions. Normally, this exercise uncovers other transactions not considered until that point in time.

Out of each transaction, tangible or intangible, and related interactions, the team identifies corresponding attributes that may be considered by each of the interested parties in their own judgment in classifying the value subject (product).

After listing all transactions, related interactions, and consequent attributes, the team identifies the needed corresponding service functions that answer those. At the same time and for each service function identified, either use service functions or esteem service functions, the team identifies the needed corresponding product function or functions, hard-product/technical functions or soft-product/cultural functions, respectively.

In order to follow the logic flow, from transactions, at one end, to product functions, at the other end, the team always has to ask the question “how”, as following: – (i) Question: how is

such transaction solved? Answer: by such interaction; (ii) Question: how is such interaction answered? Answer: by such attribute; (iii) Question: how is such attribute answered? Answer: by such service function; (iv) Question: how is such service function answered? Answer: by such product function. This technique follows the previously mentioned FAST method. We can also use the “why” question to validate the sense and correctness of the answer to the “how” question, but inverting the direction of the flow. We should note that this process of questioning and answering is very dynamic and often we can work with multiple transactions, interactions, attributes, service functions and product functions at one time.

When the full exercise is completed and all service functions are identified, isolated, and validated, the project team connects them to the identified interested parties, following the value creation stream flow by this order: (i) who has to provide the function; (ii) who is served by the function. This provides a view of the relevance and level of interest of each interested party. For better visualization of such relevance and level of interest, the team builds a pyramid with all interested parties. At the top of the pyramid is the last interested party or parties to be served by a service function, normally the user. At the bottom of the pyramid are all interested parties that have to provide functions to others, normally the manufacturer or service provider.

Then, two exercises of relative importance evaluation must be performed: (i) an exercise with all the identified service functions, taking into consideration the relevant participation or level of interest of each identified interested party, and (ii) one individual exercise by an interested party, only including the service functions related to the same interested party.

As a note of precaution, the team must make sure that only service functions are included in the exercise of measuring the relative importance. The inclusion, in this relative importance evaluation, of attributes or product functions, to be compared with service functions, completely destroys the accuracy of the evaluation.

E. Function Cost

The function cost exercise can be of some complexity in some cases, when a deeper understanding of the “real cost” is required. We must keep in mind that we are not looking only at the monetary cost of functions but also at all other resources used or applied to obtain those functions.

In my activities, I take the project team to do the service function costing in two stages: (i) the cost of a service function (use or esteem) is in the product functions (technical or cultural) that provide answer to the former. The hard-product/technical functions are provided by the application of some kind of technology, through the utilization of components: parts – material, labor and other direct and indirect costs like R&D or design; and, services – storage, shipping, installation, advertising or guaranty, therefore subject to monetary costing. Then, the cost of each component (part or service) is proportionally assigned to the service functions to which the hard-product/technical function is related. This first stage of monetary costing of all hard-product/technical

functions is calculated according to the costs of the holder of the study (i.e. manufacturer); (ii) using the previously established use service functions cost, there is a need to adjust it to each individual interested party, taking into consideration the extra resources applied or used by the same interested party, if we want to do a comparison of the relative importance with the relative cost of service functions by each individual interested party. These costs may be related to shipping, storage, assemblage, distribution, communication and others within the exclusive relationship to each of the individual interested parties.

This exercise will calculate costs for components (parts and services) that may be assigned, according to their contribution, to the corresponding use service functions and esteem service functions. The cost of the handle (component) of a kettle (value subject) may be assigned exclusively to a use service function (facilitate pouring water) if it only has that purpose (utility attribute), or it can also be assigned to an esteem service function (providing sign) if it is made of some noble material (gold plated), or in case it also has a special uniqueness meaning (emotional attribute).

The soft-product/cultural function cost calculation was left out of the above exercise description because that needs a special narrative. Normally, a soft-product/cultural function is associated with the brand name of the product and the pride or other feelings that users may have in using it, or the confidence that the brand transmits to users. But it can also be associated with some design style, artistic connection, compliancy assurance and novelty. All those sources for any soft-product/cultural function are intangible, which makes these functions impossible or almost impossible to be a cost. In some cases, the project team establishes a cost for those “cultural” sources that can be imputed to the value subject. Using the above example of the kettle, the design style of the handle and its authorship may induce some extra esteem value to the product (enhance collection), which is impossible to cost in accordance with any economic monetary term, therefore a “value” has to be put on it as representing the extra value that the feature adds to the value subject.

F. New practice

The introduction of the concepts of tangible and intangible transactions and utility and emotional attributes are new and unexpected for many professional practitioners and scholars. The introduction of such concepts in my professional practice are due to the necessity of bringing a better understanding of needs to all interested parties, and of expressing functions in a common day-to-day language understandable to most people, mainly for consumers and users.

The tangible and intangible transactions extracted from the value network exercise are the expression of implicit needs of each and all interested parties. This exercise avoids the potential missing of interested parties and needs that normally are not expressed in brainstorming exercises.

The utility and emotional attributes are the expression of the use and esteem service functions of any product. The wording of attributes is used to reach consumers and users in

clearer and more understandable marketing and communicational activities. The attributes description is mostly used in marketing activities, reaching the target in their language terms, therefore easier to be understood and assimilated. This is one of the most appreciated results that participants take out of value analysis exercises, according to my experience.

The recent work led me to standardize the value study process, as shown in Figure 2.

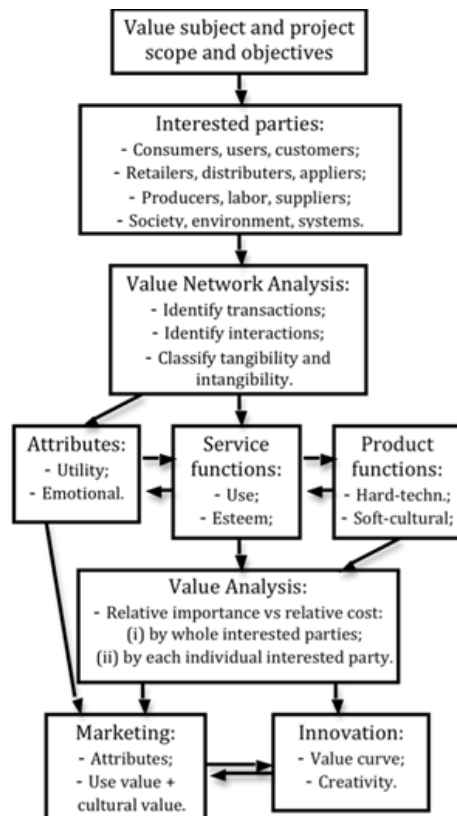


Fig. 2. Value study process flow

IV. CONCLUSIONS

Going back to Miles's [1] initial question: "what do we really have in Value Analyses?", we may conclude that it goes far beyond the simple "cost cutting" objective that served the creation of value analysis. In fact, value has a major and vaster scope of application than the simple cost cutting exercise that is still used in many cases. Value is strategic to every business: either they produce or sell commodities or premium products. In the first case, even if the importance of costs cutting is unavoidable, there is much more to consider, like identifying the value of the product for each interested party and work improvements from that status quo position. In the case of premium products, their value is based on the intangibilities that are attached to them by many different emotional attributes and esteem functions. And that brings value into a different and further dimension.

This article, reflecting my professional work, is part of an ongoing challenge since I was once questioned "if value is so important, why isn't the value management methodology used by everyone in business?". Despite the work already developed and the conclusions extracted, there is still a great need for further practice in the utilization of the concepts and methods explored in this article. Professional practitioners and scholars must apply, evaluate and discuss this issue further, in the same fashion that I have done, or in any other manner, always keeping in mind that we need to progress in the development of value analysis in order to answer the Miles's initial inevitable question.

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