

Value Analysis, Value Engineering and Value Management in Global Competition

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Abstract

Cost analysis is a method to enhance the costs efficiency by evaluating the corporate profitability. In today business environment of global competition, war pressures, new markets and demographics, firms are changing their approach to cost control. In fact, the strategic cost analysis provides useful information for the short and long-term decision-making in order to achieve the growth corporate goals.

In the current phase of global competition (Global Shortage Management) corporations must adapt their strategic cost analysis (Value Analysis, Value Engineering or Value Management) to specific competitive policies adopted in certain markets, which may concern 'Planned Obsolescence', 'Total Quality Management (TQM)' or 'Zero Defects Productions' objectives

Keywords: Global Competition; Value Analysis; Value Engineering; Value Management; Global Product Design; Global Corporations; Planned Obsolescence; Zero Defects Productions; Total Quality Management

1. Value Analysis and Competition

In a competitive market, costs (fixed and variables), price, quality and timing have critical roles in the durable success of a firm.

Management choices regarding price-quality-timing derive from specific analyses focused on sales forecasts in a given competitive context.

□ *Value analysis originated in 1942 at General Electric Co. under the direction of Larry Miles, who set himself the problem of analysing products line by line in order to reduce their costs. In these products, about 50 percent of the total direct cost was made up of materials purchased externally (raw materials, semi-*

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finished products, components). Value analysis was so successful that GE wanted to keep the new method of operation secret for many years (Miles, 1972).

The purchase, use and sale of products depend on numerous technical, economic and psychological elements that require a continuous task for a balance between costs to be incurred and quality levels to be respected for the function of use. Moreover, prices, quality and timing do not identify absolute concepts but relative ones, with respect to the function to which a good is intended and the degree of satisfaction expected.

□ *The best quality from: the purchaser's point of view is the quality which is best adapted to his particular. need... Quality buying does not mean. buying supplies, materials, and so forth, of a grade better than that demanded by the particular use to which it is, to be put. To fail to understand this is to misinterpret entirely' the insistence of the industrial buyer on quality...the determination of the proper quality constitutes the most important factor sought after by the procurement officer (Levis, 1933).*

The 'value' of a product/service is, in a nutshell, the performance/cost ratio ($V = P/C$). The value therefore increases if the relative cost decreases, with the same performance; or if performance increases, at the same cost; or, finally, if performance increases, but the customer is willing to pay higher costs. Value analysis improves the value ratio (function/cost) by focusing on all components of the product cost. This analysis includes the manufacturing process cost and proposes solutions to increase value or functions at the existing cost or remove costs while preserving quality and functions.

Value analysis is a method to enhance the costs efficiency by evaluating the functions of a product. Value analysis searches for alternative solutions that allow costs reduction with change, or modifications in the existing components and functions.

Value analysis refers to an existing product with many complete design and production cycles for insights into potential value improvement. The result solves problems and reduces life cycle costs while improving performance and quality.

The alignment of the value to certain needs involves examining the consistency between the cost of the asset and its fundamental characteristics, also in relation to the substitutability of the elementary factors that contribute to qualifying the required quality standard. Managers' decisions to maintain the resource allocations due to product market competition can be costly, especially during periods of sales decreases. Under the traditional model of cost behavior, costs are assumed to be either fixed or move proportionately and symmetrically with sales changes (Rounaghi et al., 2021).

In a global competitive world, cost analysis focused on competition is a management critical factor oriented to reduce costs and increase customer satisfaction.

2. Costs, Value Analysis and Global Competition

In today business environment of global competition, war pressures, new markets and demographics, firms are changing their approach to cost control and structuring. Globalisation has radically modified the traditional basic principles of industrial output, constituted by: the static localisation of manufacturing facilities; the presence of workers on the manufacturing plants; stocks of raw and semi-finished materials and finished goods stored close to the manufacturing plants and consumer markets (Brondoni,2008).

On global markets, businesses pursue growth objectives according to logics of 'market-space competition'. Competitive boundaries are not a given, a known and stable element of the decision-making process, but rather a changing factor, whose profile is modified as an effect of the actions/reactions of global firms and governments (Brondoni,2014).

In the nowadays competitive globalisation, the global business model based on the progressive disappearance of marginal global companies (oversize economy, characterized by lower production and sales costs, and by large company size) is now inadequate for aggressive global corporate policies focused on global shortage management (Brondoni,2019).

The Russian-Ukrainian war is producing a new major economic shock, pushing the biggest corporations towards an outburst of the basic drivers of global capitalism. The Russian-Ukrainian war determines the transition to new production structures (smart factories) characterized by digital and interconnected processes and production systems able to make the best use of available resources (global shortage management) (Brondoni, 2022).

In fact, the strategic cost analysis provides useful information for the short and long-term decision-making in order to achieve the growth corporate goals.

In the mid-1940s, value analysis was applied by large US corporations operating in national markets with very limited competition and controlled innovation processes. In uncompetitive markets, value analysis is only focused on analysing existing products and evaluating them to improve their functioning or reduce costs. A step-by-step plan helps assess different aspects of a product, such as functions, alternative components, design, and costs. Value analysis includes function analysis, during which a product is broken down into components that are reviewed later.

In today's global markets, however, corporations must adapt their strategic cost analysis to specific product competitive targets for certain markets, which in different circumstances may concern 'Planned Obsolescence', 'Total Quality Management (TQM)' or 'Zero Defects Productions' objectives (Brondoni, 2018).

3. Value Analysis in Planned Obsolescence. The Costs Primacy (Focus on Short-Term Profit)

The planned obsolescence concept was introduced into corporate culture as business policies aimed at sustaining sales in saturated and stagnant markets.

□ *The planned obsolescence concept was introduced into corporate culture by Brooks Stevens, a US designer active in the furniture, automotive, and rail transport industries. Brooks Stevens defined planned obsolescence as business policies aimed at sustaining sales in saturated and stagnant markets as, “instilling in the buyer the desire to buy something a little newer, a little better, and a little sooner than necessary” (Adamson & Gordon, 2003).*

□ *Planned obsolescence developed with the fierce competition in the US automobile industry, which saw Henry Ford, founder of the Ford Motor Company, and Alfred Sloan, CEO of General Motors in direct opposition. Large US companies, starting with General Electric, began to invest in R&D with the mission to produce and design “the next best thing”, and at the same time, design ways to make previous products useless (Reichwald & Bullinger, 2008).*

With planned obsolescence, a product is deliberately designed to have a specific and usually shortened lifespan. The product is designed to last long enough to develop a customer's lasting need (Bulow, 1986). The role of design in the management of obsolescence can be very important. As technology moves towards faster, better, more efficient devices and products, designers are faced with the difficult choice of whether to use a component that is readily available, but runs the risk of becoming obsolete more quickly (Brondoni, 2018; Swan, 1972).

In summary, the value analysis involves the preliminary study of the functions assigned to a given product or production, the economic quantification of the characteristic elements, and finally the search for alternative solutions, suitable for performing the same functions at a lower cost and without compromising other relevant aspects, such as availability in the desired time, degree of reliability, etc.

Value analysis procedures require considerable effort and show appreciable results when they concern goods purchased in large quantities; cost reductions, even of small unit amounts, can on the whole make a positive contribution to product profitability (Lewis, 1933). However, value analysis is also applicable to goods purchased in limited quantities, particularly when the unit cost is high and the lack of a recent design review foreshadows significant opportunities for better profits.

The use of value analysis with very close time intervals requires careful evaluation of the medium-long term effects. In fact, interventions of limited magnitude are usually hardly perceptible to buyers, while the cumulative effect of a series of changes may lead to a progressive variation of the expected function over time, with non-reversible consequences for the characteristics of the processed products.

4. Value Engineering in Total Quality Management. The Client Primacy (Focus on Market-driven Costs)

Design management focused on total quality refers to an engineering design method used to enhance quality and productivity in organisations. By improving quality, companies will reduce costs and increase productivity (Brondoni,2018).

The costs of implementing a design management approach focused on total quality management (TQM) are less important than the direct and indirect costs linked to problems of quality non-conformance. The costs that firms may avoid can be identified in prevention (quality planning; product specifications; training), appraisal (vendor approval; quality audits; inspections and verifications of incoming materials), internal failure (waste and scrap; failure analysis; removal of errors or defective materials; reworks), and external failure costs (complaints; warranty claims; returns; transportation; repairs) (Sung et al, 2010).

Product design focused on total quality compare actual costs to market-driven target costs. Target costs are established somewhere between standard costs and allowable costs which are determined by subtracting a target profit margin from the target price.

□ *The target price is the price that would provide the company with a competitive edge in the market. This approach is dynamic since the target costs are continuously reduced, both during and after the design stage to promote continuous improvement (Martin et al., 1992).*

Japanese corporations introduced, since the 70', the new total quality approach focused on a vision of international design product engineering. Rather than relying purely on product inspections, Japanese manufacturers focused on improving all organizational processes through those who use them, introducing a new concept of value analysis called 'value engineering'.

Value analysis itself concerns goods already existing on the market and differs from value engineering, which specifically concerns detailed comparative technical and economic studies conducted before starting the production of a certain good, and specifically applied to 'Total Quality Management' projects.

Value engineering appears during the development of new goods. A company uses teamwork to analyse and evaluate the product to improve its functions and

reduce costs. This process is conducted before any investments in tooling, equipment, or plant are made. Value engineering applies to the initial design phase, where a component model may contain features the designer used to perform functions still in an approximate and not definitive way.

The different phases of value engineering include: the feasibility study of the project; the evaluation of the price-cost; the identification of alternative solutions; and finally the verification of the competitiveness of the identified solution.

The analysis of the project is aimed at identifying the characteristic design elements of certain products and estimating the limits of variability in compliance with the tasks to be performed.

Value engineering can improve the profitability of an initial launch that can carry sunk non-recurring engineering costs. Value engineering is focused on alternative solutions in the initial design to avoid excessive costs into a product launch.

The opportunity to apply value engineering can be traced back to various causes, including: the periodic analysis imposed by the development of technologies; or the need to verify the level of obsolescence of certain products in comparison with competitors' offers.

Value engineering surveys are also very useful for limiting the short-term effects of inflationary phenomena on the structure of prices and production costs. Moreover, when the phenomena of disturbance of the economic environment take on a structural character, the limits in the application of subsequent analyses of the project value to the same asset become apparent.

In the project analysis, the price-cost checks primarily aim to assess the economic coherence between the characteristic factors of specific goods and their costs, to identify factors and costs considered excessive; value engineering's surveys also make it possible to deepen the knowledge of the product costs of the main competitors, and therefore to be able to prepare suitable competitive supports.

Value engineering surveys often attribute a privileged role to price analysis, especially when sudden and large environmental changes stimulate to focus value engineering on containing production costs through a critical study of the project. In reality, the critical examination of value is a technique that can be applied systematically and independently of contingent market and competition phenomena. Indeed, periodic reviews of the value structure of projects can show significant opportunities in the adoption of new materials, techniques, and methods.

Value engineering is aimed at identifying new solutions to enhance the basic functions of a company's offer. The idea development activity therefore aims to identify possible alternatives with which to achieve the expected function at lower costs.

The identification of alternative solutions usually considers:

- the product design elements, e.g. the effects of an increase in tolerances, the use of less valuable materials, etc.;
- the characteristics of the production process, whether the adoption of a given component allows for a more advanced or less expensive process, whether the introduction of suitable technical means improves its performance, etc. Often,

new material choices require additional detailing and, potentially, new parts for installation;

- purchasing policies, examining whether the same component can have different uses, in order to achieve significant cost savings.

Due to the many elements to be considered, the preliminary technical verification of feasibility is often carried out in close collaboration with potential bidders up to the realization of the prototypes in order to make the maximum use of the respective technological and market knowledge. Value engineering can have a positive outcome for all stakeholders. When everyone actively participates in value analysis, creativity can be deployed in different ways to meet project goals.

□ *Buyers and sellers often work closely together in developing new products. Sellers can obtain valuable reactions to product features by presenting their proposed working specifications to potential users. It is usually not too difficult for a manufacturer to obtain answers from users, because the latter often have a lot to gain as a result of the development work.. Potential buyers are often willing to test new industrial products under actual operating conditions. Some buyers conduct these tests on their own premises and encourage members of the seller's development group to be present during long periods of testing. (BOYD & MASSY, 1972).*

□ *Brembo is an international leading company in the production of high-performance braking systems for cars, motorcycles and commercial vehicles. Brakes designed for high-performance automobiles offer superior performance to traditional brakes. The alloy used for sports brakes was developed by Brembo in collaboration with some of the best experts in the metallurgical sector.*

Finally, the analysis of the design value (value engineering) involves the verification of possible alternatives. This phase of the investigation highlights a considerable complexity and delicacy, as the verification involves a joint analysis of the technical, economic and functional aspects of the product. In these analyses initial costs are important, but firms must also consider the long-term costs of a project. Long-term costs often outweigh the initial cost of design and production, and firms must consider three types of long-term costs at the start of a project, and especially: equipment costs; material costs; and personnel costs.

Value engineering is used to solve problems, identify and eliminate unwanted costs and improve function and quality. The value engineering process is meant to optimize initial and long-term investment, seeking the best possible value for the lowest cost.

5.Value Management in Zero Defects Productions. The Competitors Primacy (Focus on Competition-driven Costs)

Zero defects management program is focused on the reduction of defects through prevention in industrial production. Zero defects production is a design engineering philosophy aimed at increase profits by increasing revenues and eliminating the costs of failures. Every defect represents a cost and these costs include wasted materials, working and inspection time, rework, lost revenue, etc.(Crosby, 1979; Halpin, 1966). A lower quality material can also increase long-term replacement costs. Replacing materials can be costly, especially later in the design or in the production process.

The philosophy of production management focused on zero defects reinforces the basic tenets of lean production for waste minimization and continuous improvement; a concept originally developed in Japan in the mid-1970s by the Toyota Motor Corporation (Brondoni, 2018; Levitt, 1983).

In the current phase of global competition (Global Shortage Management 2020-today) (Brondoni, 2014), the major Japanese corporations are aiming at changing the rules of the competitive game by adding extra value to their products and re-focusing corporate efforts on customer service.

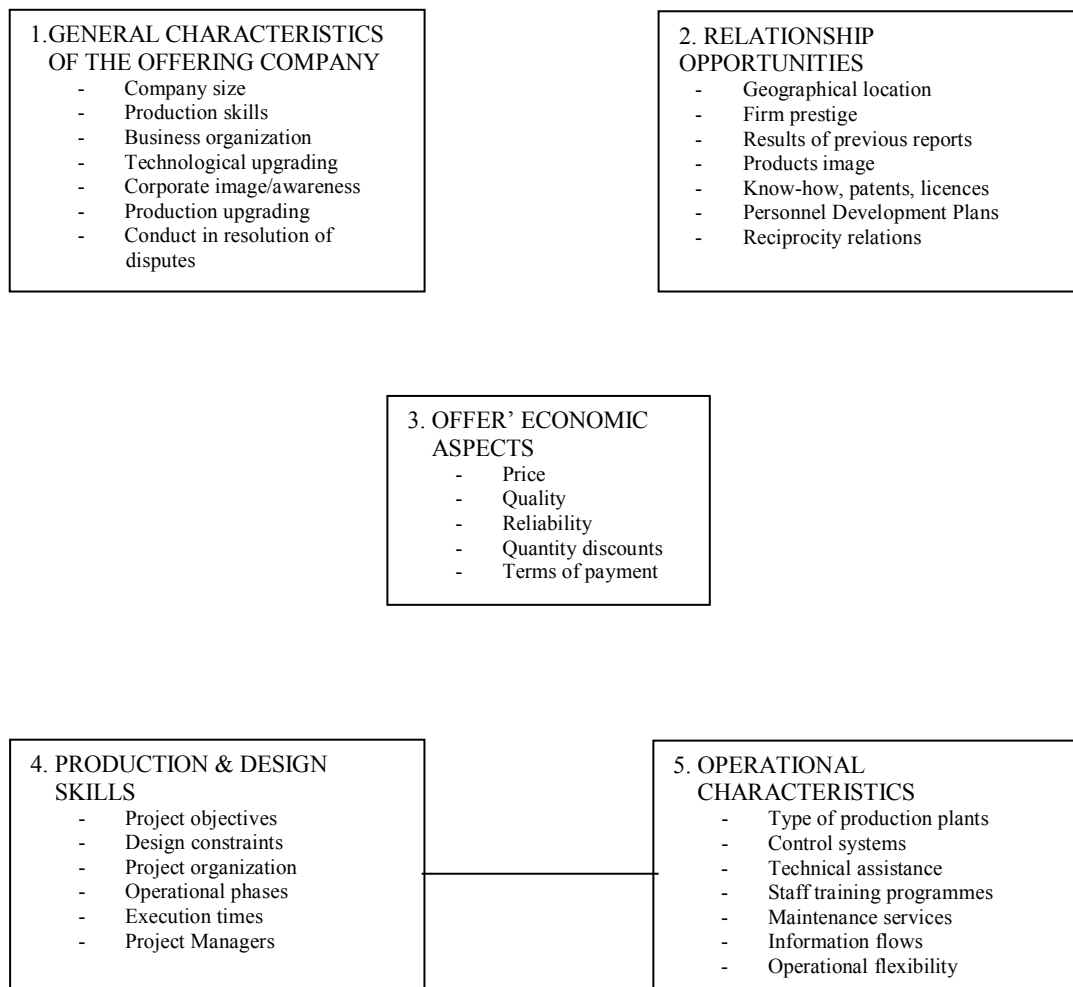
From the 1980s, competition among Japanese firms was centered on reaching a zero defects level in product quality; today the emphasis is on achieving zero defects also in customer service, beginning from the network product concept⁹, i.e., network industrial design engineering.

With zero defects productions, companies do not limit the evaluation of process and production costs to the restricted scope of different combinations of price, quality and operations management, attributing specific relevance to the individual key factors. This behavior focuses attention on the elementary economic factors of the offer, and therefore neglects that in the evaluation of alternative solutions other criteria may exist, deriving from network negotiations, conducted on the basis of official standards or known and accepted conditions.

From a Global Shortage Management view, cost management focuses on the differential value of solutions suitable for carrying out defined functions when the production processes highlight marked uniqueness, or require complex planning and in-depth validity checks.

The elements that can be used for comparing alternative offers produced by outside firms is indicated in Figure 1, which identifies the following evaluation criteria: general characteristics of the offering company; opportunities for collaborative relationships with particular units; economic aspects of the offer; design, technical and production capabilities of potential suppliers; operational characteristics of the offering company. The various criteria are therefore divided into multiple attributes, which represent the factors that can be adopted in concrete terms. particular, a global company's success is conditioned by its ability to manage the system of intangible product assets (product design, brand, pre/after-sales services) and intangible corporate assets (corporate culture, corporate identity, and information system) in a competitive or market-driven perspective.

Figure 1: *Value Management for Comparing Firms' Alternative Offers*



Design management focused on zero defects endorses continuous product improvements by creative imitation. This is the never-ending effort to totally eliminate all forms of error, including reworks, over-design, unproductive time, inventory, idle facilities, and many intangible factors (Schneiderman, 1986).

□ *Strategic value analysis (SVA) integrates decision analysis with well-known principles of business strategy to develop spreadsheet-based models that select among alternative paths to competitive advantage. These models rank strategic alternatives by evaluating in one spreadsheet the competitive intelligence about rivals, customers, and suppliers, together with the value of the business position on key resource factors for success (Young, 2001).*

Finally, cost management analysis focused on zero defects production aims to estimate the overall differential of individual offers, by sending a defined production outside the company and therefore eliminating the related fixed production costs, as well as the related direct variable costs. The possible alternatives must therefore be examined extensively, integrating the elementary economic factors with specific criteria on the degree of coherence between the expectations of the purchasing organization and the 'capabilities' of the offering companies (SHETH,1973; Willets,1969).

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