BUILDING'S VALUE ASSESSMENT USING THE UTILITY AND THE LCC

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Summary

The paper is concerned with questions how to asset the value of a building. It is the value, not only the low cost, that the clients or public should be interested in during deciding among projects. Value of a product is basically defined as the quality in relation to its cost or as the function in relation to its cost. The "satisfaction of needs/use of resources", rather "utility/life cycle cost" ratio of the project, where the value can cover many diverse aspects, is not easy to quantify. There are a lot of criteria which we evaluate to get the utility of the project. The utility is composed of the quality of human life, the impact on the environment, sustainable construction, the project stakeholders' satisfaction, economic benefits, strategic goals and objectives implementation. There are a lot of cost items during the life cycle of the project which we have to take in account. Investment costs, operating, maintenance and repair costs, and cyclical renewal costs have to be expressed in their present value and calculated. It is not easy to quantify the value of the project but this should not discourage us in general from quantifying and measuring the value.

Keywords: Value, utility, life cycle cost (LCC), building

1 Introduction

How can we choose the best alternative of a project? Most frequently, alternatives of a project based on estimated costs are compared. Less commonly, the life cycle costs of alternatives are calculated and compared. Number of a financial indicator calculation become commonplace. Customers are interested in investment costs of a project and their rate of return. In case a customer will be a user, she or he is interested in the amount of cost she or he will spend during the life cycle of a project, too. There are mostly replacement costs, operation costs, service costs, and disposal costs. Beside this, a customer should be interested in the needs satisfaction, the utility, and the value of the project, if you like a building structure. The value of the project can be the base for the project alternatives comparison. And what is the value? The value of a product is basically defined as the quality in relation to its cost or as the function in relation to its cost, if you like "satisfaction of needs/use of resources". Building structures are characterized with a long lifetime, so we should quantify the "utility/life cycle cost" ratio of the project, where the value can cover many diverse aspects.

2 Value of the Building

The value (V) for a customer or a user is the key conception in business. The value is described as a relationship between satisfaction of needs (SN) and resources (R) used to satisfy these needs. The more detailed information could be found in [1] or in [4].

$$V(X) = \frac{SN(X)}{R(X)} \quad (1)$$

2.1 Needs and recourses

A need is the psychological feature that arouses a customer to action toward a goal and the reason for the action, giving purpose and direction to behaviour [2]. A need is a sense of absence of anything what a customer needs to be in being, to exercise special activities, and to meet requirements. It can be a customer sense of storage absence, shop absence, and deficient workstation. The process of needs satisfaction expressed as a feel of a benefit (utility) and a measure of users needs satisfaction. It means, for example, purchase and use of a factory building, offices, and a store. Utility in this case is a measure of how well the building meets the involved needs and the added desires of customer or user.

In economics, resources are commodities and human resources used in the production of goods and services. Building structures are specific goods, they are used during their all lifetime. Therefore, the resources are putting out during the life span – while purchasing, using, and demolition. Resources can be expressed in the life cycle costs.

Consequently, the value (V) of building structures for a customer or a possible user is expressed as a relationship between the building structure’s utility (U) and its life cycle cost (LCC). The more detailed information could be found in [3].

$$V(X) = \frac{U(X)}{LCC(X)} \quad (2)$$

2.2 Utility

In economics, utility is a measure of the relative satisfaction gained by consuming of goods. Individual consumption of goods and services primarily links to the consumer's level of disposable income, and budget allocations are made to maximize the consumer's marginal utility. Economists assume the consumer is rational and will thus maximize his/her total utility. Total utility is the aggregate sum of satisfaction or benefit that an individual gains from consuming goods. The amount of a person's total utility corresponds to the person's level of consumption. Usually, the more the person consumes, the larger his or her total utility will be, in more detail in [2].

In economics, the consumers´ optimum is the situation, when a consumer chooses the optimal goods combination depending on the level of disposable income and goods prices and, finally his/her preferences. An investor (customer) chooses the alternative of building structure project; it means the specific combination of building parts, with different quality and quantity. This selection results from the customer’s preferences and purse.

The utility of a building structure project involves many features. The most common cited are: benefits received, services obtained, satisfaction of the project performance, quality, safety, and convenience. The utility of the project is a measure of what is involved in it for the customers. It is a measure of how well the project meets the involved essential needs and the added desires of those that have a voice in the building project alternative selection or its use. A project must always supply the essential need, or its utility will be poor.

2.3 Function and utility

One of the useful approaches to describe the activity or product being studied is use of functions. This approach breaks a project or a building structure into components to avoid misunderstanding of the planned intents for a project, see Fig.1. Then a functional analysis is conducted on each component. The main functional purpose for the component being studied is the primary function. Of course, things often happen as a result of the choice of a component, or something must be done to make the selected component work as needed. These functions are called supporting or secondary functions.

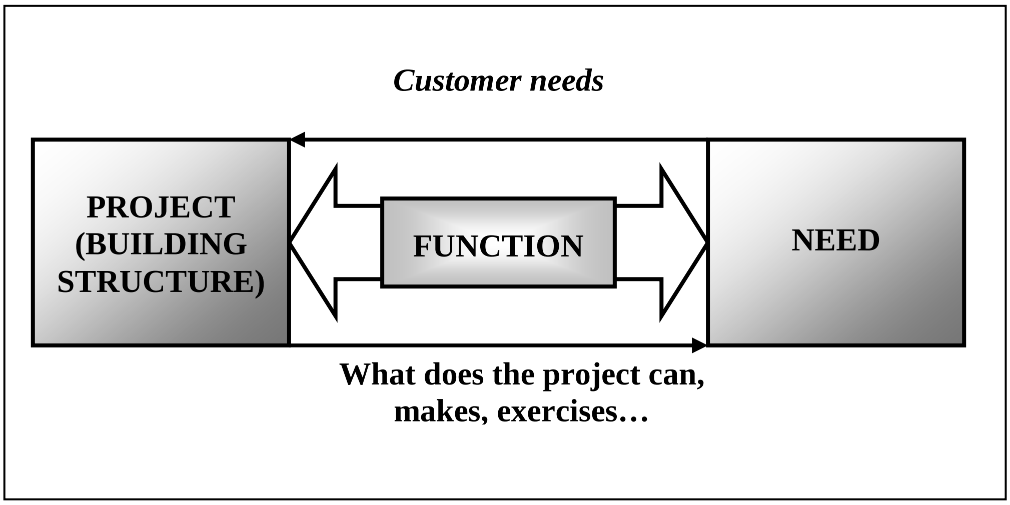

Fig. 1 The role of the function in the function definition

The size of utility can be calculated using the methods of multiple criteria decision-making. This is an approach that is developed to choose between a large number of alternatives, each alternative defined by multiple criteria. Many factors go into a decision. There is any organized way that customer might think about determining the relative importance of these factors and then go about comparing alternative project. We can use very simple calculations to try to put numerical values on factors and alternatives.

$$U(X) = \sum_{i=1}^{n} w_i * u_i(x_i) \qquad (3)$$

Where:

- *U* utility of the project X
- *w* weight of the i-factor (criterion)
- *u(x)* utility of the project X in i-criterion
- *n* number of factors (criteria)
- i = 1 n

2.4 Life cycle cost

The true cost of a project is not just the amount of money that we pay when we "buy" it. Much more is involved. When we buy something, we also buy its long-term effects. The initial costs plus these long-term costs are called life cycle costs. This includes things like the time involved to get the project done, the people needed (number, expertise and so on), the degree of difficulty involved, availability of money or other resources, the amount of maintenance needed, and the money that must be expended and kept in reserve.

Life cycle costing (LCC) is a method for analysing the total cost of the acquisition, operation, maintenance and support of a product throughout its useful life, and including the cost of disposal. This LCC analysis can provide important inputs for the decision making process, especially in

- evaluation and comparison of alternative investment strategies;
- assessment of economic viability of projects;
- evaluation and comparison of different maintenance or reconstruction concepts;
- choosing between different building materials, components and systems,
- improvement in or change of operation.

LCC can be applied to any capital investment decision. It is most relevant when the high initial costs are traded for reduced future cost. In order to estimate the total life cycle cost, it is necessary to breakdown the total LCC into its constituent cost elements. These cost elements should be individually identified so that they can be distinctly defined and estimated. This cost analysis depends on values calculated from other reliability analyses like failure rate, cost of spares, repair times, and component costs. The more detailed information could be found in [6]. A life cycle cost analysis is important for cost accounting purposes. In deciding to realize a project, a timetable of life cycle costs helps show what costs need to be allocated to a project.

$$LCC(X) = PC(X) + CC(X) + OC(X) + SC(X) + DC(X) \tag{4}$$

Where:

LCC	life cycle cost
PC	purchase cost
CC	capital cost
OC	operation cost
SC	service cost
DC	disposal (demolition) cost

3 Value maximization

Customers´ needs and financial recourses (purchasing power) differ that is why a value is relative quantity. It is a natural economic effort of customer or user to get the maximum value. Otherwise, a customer wants to provide a required utility and at once to spend as few as possible cost. The maximum value can be achieved with utility and cost optimization. The value of a project or building structure is a relative quantity that grows up, compared to an alternative project, when:

- size of utility grows up faster and total cost grows up slower
- size of utility grows and total cost is constant
- size of utility grows and total cost goes down

- size of utility is constant and total goes down
- size of utility grows up slower and total cost grows up faster

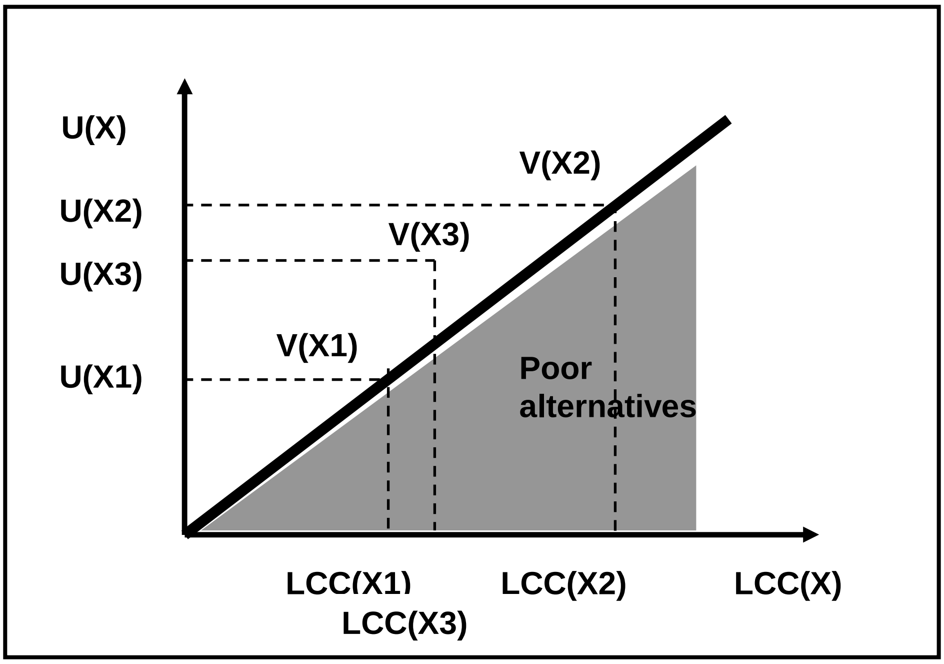

Fig. 2 Value (V) of an alternative as a relationship between the building structure's utility (U) and its life cycle cost (LCC).

4 Conclusions

How can we choose the best alternative of a project? The selection based only on the estimated total costs is not sufficient. The selection based on the life cycle is not a bad approach. In case a customer will be a user, she or he is interested in amount of cost she or he will spend during the life cycle of a project, too. There are mostly replacement costs, operation costs, service costs, and disposal costs. Beside this, a customer should be interesting in the needs satisfaction, the utility, and the value of the project, if you like a building structure. The best alternative of the building structure project could be chosen using the utility of a project and its life cycle cost. The value of the project can be the base for the project alternatives comparison.

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