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Life cycle costing as an important contribution to feasibility study in construction projects

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Abstract

The purpose of this paper is to highlight the role of life cycle cost (LCC) analysis in the feasibility study of construction projects, especially in the public sector. Feasibility study is usually conducted in the early phase of construction projects when the greatest benefit of LCC can be obtained. The commonly used construction cost minimization approach should be replaced with LCC optimization. In order to achieve the maximum value for money, all costs incurred over the whole life span must be evaluated. Life cycle costing is a method of economic analysis directed at all costs related to constructing, operating, and maintaining a construction project over a defined period of time. The optimization of the LCC of a project, construction or equipment, is essential for the complex decision-making process. It is then at this point that the solution with the minimum value of LCC can be chosen. The public sector in the Czech Republic is now beginning to require quantification of LCC when deciding on construction. In addition, LCC has become a criterion in public tenders. This paper summarizes the experience of assessing building designs in terms of LCC. Not only public sector benefits are identified and summarized but also some significant difficulties. Case studies are provided.

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Keywords: construction project; feasibility study; life cycle cost; public sector

1. Introduction

Buildings as the outcome of construction projects are long-lasting goods and decisions connected with construction projects have long-term consequences [1]. Yet often, building owners or investors focus only on the purchase cost when they make decisions about such matters as building design, equipment, energy systems, and they

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then tend to ignore future operation or maintenance costs [2]. They lose a holistic view of real cost in a building, and this can result in selecting a rather cost-inefficient solution. Life cycle cost (LCC) in general consists of an initial investment (usually construction costs) and the follow-on costs (ordinary payments - energy, utilities, cleaning and maintenance, irregular costs for renewal or replacement), while some LCC methods also include the costs of demolition. [3]. Life cycle costing is a commonly recommended method for searching out cost-optimal solutions for product design and it has also turned into one of the more often used tools in the design phase of building generally.

The early design phases (programming and pre-design) play a crucial role for the future performance of a building throughout the life cycle – at this early stage the optimization potential can be enormous at a very small cost. Bogenstatter points out that these early design stages influence up to 80% of building operational costs[4]. In the later design phases the possibility of change rapidly decreases with simultaneously increasing costs. The operating costs proceed to overstep the construction costs by a multiple. The exact exceeding point as well as the proportion of purchase to operating costs depends on the quality of construction, the intensity of use and the type of building, as well as on the designated life span. Both academic research and the industry itself claim that an integrated design process, including life cycle costing and optimization, can significantly reduce the operating and maintenance costs [3]. The utilization of LCC analysis allows an early estimate of the operational saving potential and/or collection and assessment of alternatives.

2. Literature review

2.1. Life cycle costing

The history of LCC began in the US Department of Defense in the mid-1960s. RICS (The Royal Institution of Chartered Surveyors) introduced a method of collecting data concerning running costs of buildings in 1971 (BMCIS - Building Maintenance Cost Information Service). The British Ministry of Industry published a document “Life-cycle costing in the management of assets” in 1977. In 1983, a framework for data collection was published applicable to establishing a project LCC by Flanagan, Norman [5]. In the mid-1980s attempts were made to relate LCC more towards construction projects [6]. Recently several research projects have been carried out targeted at establishing the LCC methodology for the construction industry. One example is Abraham and Dickinson’s [7] study of the disposal of a building in which LCC calculation is used to quantify disposal costs. Aye et al. [8] used LCC to evaluate a range of property and construction options for a building. Bogenstatter [4] promoted the usability of active LCC calculation in the early design phase. He developed a model adopting specific characteristic values of LCC, i.e. standardized typological figures.

The concept of LCC has been accepted as a British Standard since 1992. The LCC definition was revised in 2000 and incorporated in the ISO 15686 Part 1 - Service Life Planning. LCC is cautiously described by the building and construction assets standard ISO15686 as: *“a technique which enables comparative cost assessments to be made over a specified period of time, taking into account all relevant economic factors both in terms of initial costs and future operational costs”*.

Recently, a Center for Whole Life Performance has been established at the Building Research Establishment (BRE) to provide the Secretariat with an industry-led Whole Life Costs Forum (WLCF) [9]. This Forum is intended to enable members to pool and receive typical WLC information through a members-only database, and produce industry-accepted definitions, tools, and methodologies. The TG4 group [10] was established as a part of the working group for sustainable construction in 2001. This was done to prepare a report on calculation of LCC in construction and to formulate a recommendation as to how LCC should be implemented at the level of European policy. The outcome is a report “Task Group 4: Life cycle costs in construction“. The latest initiative is the project of Davis Langdon [11] “A common European methodology for Life Cycle Costing”.

Despite a rapidly developing interest in recommending the LCC approach as beneficial, the acceptance and utilization of LCC in the construction sector remains limited [12,13,14]. Cole and Sterner [15], Flanagan et al. [16] as well as Norman [17] suggest that incomplete understanding of LCC’s advantages among industry professionals is the main cause of the limited acceptance of LCC. These authors pointed out that there exists a gap between theory and practice. However, neither of them adequately clarifies possible reasons for this gap.