Chapter 2
The Impact of Risks and Uncertainty in the Life Cycle Cost Analysis of Construction Projects:
The Case of Energy Analysis on Construction Projects

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ABSTRACT

Construction projects are subject to risks and uncertainty that make the final cost of the investment difficult to predict. A life cycle cost analysis incorporating the risks involved could prove useful in the decision-making process. This analysis should be done at the start of the conception phase of the project and work itself along the project's realization. This chapter presents a specific approach for the implementation of a risk-based life cycle cost analysis. The proposed approach covers the risk-based life cycle cost analysis of a construction project, through the incorporation of well-

established risk identification and risk analysis methods. The risk identification process regarding the energy-based risks of a residential construction project is performed. Finally, the proposed method is showcased on an illustrative case of a residential building with multiple different energy-based investment scenarios, and its results form the basis for the decision-making of the project.

1. INTRODUCTION

Urban construction and infrastructure projects are some of the most successful businesses where investors fund substantial amounts of money, and therefore the prosperity of many nations, including Greece, is highly dependent on the size of their construction industry (Abdelkhalek et al., 2020, Antoniou, 2021). While infrastructure projects tend to be more significant to the nations' Gross Domestic Product and economies due to their larger size, urban construction projects tend to have higher profit margin (Bilal, 2019). Moreover, because of their lower initial costs they are more attainable by individual investors, compared to infrastructure projects which are typically funded by public investments (Antoniou, 2021). The large-scale urban construction projects consume massive amounts of resources and energy all throughout their life cycle, while also having significant environmental and socio-economic impacts (Georgiadou et al., 2012). Although nowadays the environmental impact of projects can be highly regulated, this is not the case with their economic evaluation which still remains a business risk (International Organization for Standardization 14001:2015). Therefore, it is important for the stakeholders of the project to have a tool which is capable of giving an answer to the project's viability and longevity. This tool is Life-cycle cost analysis (LCCA) which is able to take into consideration all of the expenses of the project, covering it from cradle to grave (Petroutsatou et al., 2021, Boussabaine & Kirham, 2008).

LCCA is a method used to assess the total cost of a project taking into consideration all the costs from its design phase, up to its disposal at the end of its life cycle. While covering the area of construction projects, it is based on Life-cycle costing (LCC) which according to ISO 15686-5:2017 can be defined as:

Methodology for systematic economic consideration of all significant and relevant initial and future costs and benefits of a whole building or structure or unit of construction works, or a system or a component or part thereof, throughout its life cycle, while fulfilling the performance requirements

At the same time according to ISO 15686-5:2017 and ISO 14040:2006:

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