

# Optimization of Public Building Projects in Design Phase

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## Abstract

*Currently, governments are deeply involved in public investment projects to promote economic growth from the recession. Public building projects (such as museums, universities, theatres and so on) compared with private investments, have a row of specialties. Among other requirements, the project should serve political, cultural, social and urban interests. In the preparation phase, those interests are dominant and overall cost-efficiency is only a secondary level decision factor. However, this factor must be taken into account and - together with all other requirements - must be the significant part of the project design phase. This process must be a part of a well-established feedback mechanism, which incorporates public requirements, building cost calculation, and other decision making factors related to the public investment project.*

*A number of methods are well known for operational cost optimization as LCC analysis, Value Engineering, benchmarking and others. After close investigation of the scientific literature, the author will describe potential organizational models, which are applicable to incorporate evaluation and optimization of building operational costs. The article suggest further research direction.*

## Keywords

*Facility Management, operational cost, optimization public building, public investment, project preparation*

## 1 Introduction

Present article is about the preparation works of public investment projects and in particular, the organizational integration works of preparations for further operation and facility management.

Nowadays, the public investments are in increasing focus. Governments frequently choose to increase the volume of community investments as a tool of recovery from recession, let it be either the development of infrastructure or construction of welfare facilities. Such public investments like hospitals, museums, stadiums have numerous special attributes in which they differ from the business development of the private sector. Because of these specialties, the preparation works of investments cannot be managed according to the usual business standards. There is no doubt that in case of business aimed investments – even if it would be more required –, the demand system of future facility management is not in focus. The still slightly known FM standard, EN 15221<sup>1</sup> places the financial budget in the middle of the planning of facility management. Basically, such approach corresponds with the method of the business planning. The ‘business case’ is searching the optimum of the overall all-time investment and facility management costs and the net present value (NPV) of the future income. In the interest of the reach of this optimum, the construction works are planned iteratively, decisions are made on the concept of the utilization and plans are made of the overhead cash-flow. Firstly, I make an overview of the literature on preparation works of facility management of private investments in my article. I will introduce the observations of certain studies that are already made during elaboration of facility management of infrastructural public investments. At the end of my article, I will put down the steps of the further research.

## 2 Public Investments

The method of the preparations of public investments does

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<sup>1</sup> The EN 15221 standard was started to be composed in 2002 and nowadays has seven sections which were launched between 2006 and 2011, that are obliged to apply in all member countries of the European Union.



consideration in private sector investments; facility management, in general, has never been in focus during the course of design. The scientific researches in this field have lived up as the question of sustainability came into view, since more and more decisions had to be made during the planning works on further utilization.

In many of his articles, Both (vide f.e. Both and Kohler, 2005) discusses the questions of effects of the engineer's programme planning on the total life-cycle of the building. According to the author, the project can only meet with the highly complex sustainability requirements if all expectations of all stakeholders are structurally and in details collected. Both suggests to use a spatial data collection software for the survey of requirements. Vainer (Vanier, 2001) certified the well-known fact of the necessity of regular maintenance works by statistics, in the interest of the keeping of the planned utilization period of time.

Lu and his associates (Lu et al., 2004) in their article call to the attention that in the interest of providing sustainability, the functional, environmental and economic requirements of the full life-cycle are supposed to be integrated among the targets from the beginning of the planning process. Not only physical but life-cycle parameters are needed to be optimized. For this purpose, they worked out a model for the flow-based evaluation system, suggesting that in case of certain planning assignments, this approach is to be introduced in the early phases according to users' demands. The flowchart in Lu's article explains the process of the designers' feedbacks. (Fig. 2.)

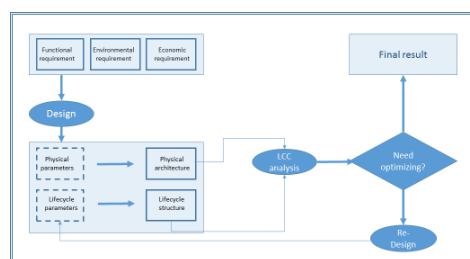


Fig. 2 Flowchart of Designer's feedback mechanism

#### 4 Optimisation of the project

Every (private) investment is preceded with a business plan containing incomes and expenditures and their risks. The numbers of the business plan are suitable to determine the total costs, namely, the whole-life cost of the total of the establishment, considering the forecasts in respect of the whole-life period of the building. The ISO standard [BS ISO 15686-5:2008] discusses the life-cycle of the buildings; Part 5 covers the life-cycle planning. According to BREEAM assessment method, the above standard is to be applied in the process of the 'green' life-planning.

The first part of this mentioned standard introduces the so-called 'Factor Method'. Within this method, the average expected lifetime is modified with factors like the quality of the components, the level of the planning or the method of the maintenance. Hoyde in his article (Hoyde, 2002) discusses the practical utilization of the theoretical environment of the standard, more specifically, he writes about the difficulties and states that the wider introduction can only be happen in parallel with the wide spreading of the integrated life-cycle planning. Many models are suitable for the calculations of the life-cycle costs (LCC); Plebankiewicz and his partners examined the study cases in the scientific literature according to their chosen methods (Plebankiewicz et al, 2015). They stated that the differing results of the different methods caused by the fact that the examined criteria are different at the certain methods even if their aim is to calculate the LCC.

Kohler and his co-author suggests the early introduction of the integrated life-cycle model during the planning and preparation works in the interest of the higher success of green investments (Kohler and Lützkendorf, 2002). During their examinations, they illustrate the objective as a complex, 'n' dimension matrix of sources as input and planned emissions. For this purpose, they developed a program called 'LEGOE'. From the early runs they realized that integration needs more time and claims, therefore they believed that the spread of their approach would have taken approximately 10 years. Unfortunately, today we have to believe that the concept will be widely known only within another decade.

Lizzarde and his counterparts still emphasize in 2011 that within the acquisition processes of investments, the complexities of points of view and the organisation of the clients are regularly disregarded (Lizzarde et al., 2011). They suggest constructing different organisational models that can be changed according to the inner power relations of the organisation of the client, according to the combination of the 'internal pressure group'.

Australian researchers investigated the collaborative efforts and issues arise between designers and facility managers at conceptual design phase (Wu and Lim, 2015). They found, that use of BIM, which should be a common platform of collaborative work, still at is infancy.

#### 5 Experiences in public investments

The scientific literature discusses less on public investments as their preparation works of investments, their 'business plans' are prepared along a complex target system Rostás, 2007). The researchers completed the examinations of less complicated, infrastructural investments, where the target system, the social utility is easily interpretable and can be matched with a one-dimension financial criterion. Mery and his colleagues, for example, developed a software environment for LCA-based optimisation of planning of water treatment

plants. (Mery et al., 2013). Bridges as public investments, for instance, can be easily estimated in the point of view of the amount of maintenance costs. Safi in his PhD thesis presents that which optimisation potentials stand for which preparation phases within the life-cost planning (Safi, 2013). His table on bridge structures might be a good start in case of working out public investment project with more complicated targets. (Fig 3).

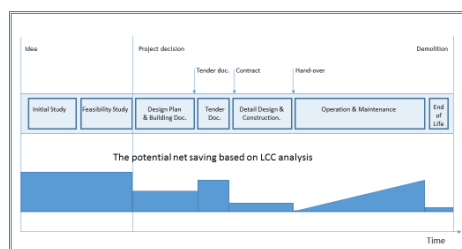


Fig. 3 Optimisation potentials in several preparation phases

The study of Perera emphasizes the necessity of LCC analysis in case of public investments as well (Perera et al, 2009). Among more complex targeted projects, Lee and his colleagues (Lee et al., 2010) prepared the renovation alternatives of a museum. It was an one-dimension, cost based examination by analyzing life-cycle costs. The study case examining only economical points of view highlights that in case of public investments, along with the cost dimension, the other dimensions of target implementations should be integrated into the procedure such as visitors' experience, public values or increasing knowledge capital.

## 6 Conclusion

A certain mutual learning process can be observed between private and public sectors. Within the public sector, the measurement of value had always been a discussion topic, namely, whether the Market Value can be an unequivocal decision-making criterion. This question arose only after the real estate recession among the private sector actors, referred by the article of Oliomogbe and others. Parallel to that, theoreticians of the public sector turn more and more towards economy-based decision making, within this, the complete life-cycle planning of investments, vide the quoted writings of Perera, Plebankiewicz, Mery, Safi and Lee.

This learning project in present topic is to be continued. The already explored connexions of private investments are to be transferred to the field of public investments as well. At the same time, we cannot disregard that the target criteria of the public investments have multiple dimensions and even though the cost analysis is very important among these dimensions, not the net present value is the sole decision-making criterion. There are a series of "switches", all of them are important criteria. (Fig. 4.)

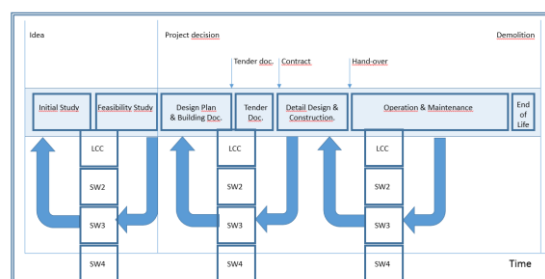


Fig. 4 Optimisation potentials in several preparation phases

As it is important at private investments, it is also important in case of public investments that, the preparation process be integrated phase by phase and the feedback is ensured in every phase.

I suggest that the research be extended in the interest to explore the connections (switches) between variables of the maintenance and the 'values' of the multi-dimensional target criteria. Planning, calculating and feedback of the life-cycle costs in every step of the process of investment preparation works, just like a switch, help to optimise the present value of the cash-flow. Further switches explaining contexts of aims and maintenance during the preparations of public investments can optimise contexts between multi-dimensional target criteria and maintenance costs within an appropriately sectioned process supplied with feedback mechanism.

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