An Analysis Of Architectural (Full Design) Project Development Phases: From An Idea to The Construction Works

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Abstract. The paper presents a useful algorithm which can be applied in the development of a design and construction project, in order to reach a pertinent conclusion on investing or not in it. The algorithm describes the chronological process through which any investor should go through. Every step of this process implies additional costs and will be taken only if the algorithm indicates so. Firstly, the paper enlightens the main steps in developing a design and construction project financed through public resources. In this case, the process has a clear path due to the legislation in the field imposed in Romania. After that, it continues with defining the steps for a similar project but financed through private resources. This is a more complicated case because the private investor has fewer financial resources and in the opportunity stage, for the most part, he does not own the site for the future project. Therefore, a private investor has to pay more attention to every step taken in the investment decision, especially in the construction domain. The interest in studying these processes derived from my observations on my company’s clients’ needs when taking decisions related to design and construction projects. It is obvious that the standard business plan is not sufficient in developing such a project. In addition, these specific projects have different involvements from other types of projects that were taken into account when proposing the algorithm. Consequently, the algorithm from this paper was elaborated based on my personal experience in over 40 design and construction projects as an entrepreneur and on the literature review I carried out.

1. Introduction
The objectives of this paper are related to identifying the essential steps in developing a design and construction project in pursuance of taking the right investment decision.

2. Literature review
The latest writings in the field approached in this article emphasize the special features of design and construction projects in comparison with the other types of project. Thus, within the project life cycle, construction projects normally implicate fragmented and complex multi-tasks, carried out by professionals and non–professionals, including architectural, procurement, engineering, construction, phases. In order to meet success, construction projects contain building and infrastructure projects and need rigorous coordination. [1] For a private investor, low efficiency and productivity convert to loss of time and cost. Therefore, "14% of project contract sum is consumed by cost overruns, while time
overrun happens to more than 70% of all construction projects” [1, 2] while 10% of projects materials turn to waste. [1, 2]

The investor’s success depends mostly on the implementation of construction projects in the growing competitive market. Hence, every step he takes in the investment process can convey in an accurate economic decision or in an additional cost. [1, 3]

In addition to the costs involved, the recent writings deal with the importance of harmonization between all the specialized knowledge of all the experts involved in the process of design and construction. Jim Woong Lee, Kyuman Cho et al. centralized some of the most relevant writings related to constructability in the following table 1:

| Author (year)               | Content                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Yoon and Kim (2014)         | Analysed factors affecting constructability and verified their impact on productivity                                             |
| Othman (2011)               | Proposed an innovative framework to facilitate the integration of construction knowledge and builder experience at the design phase |
| Park et al. (2010)          | Proposed a design management process between design activities and constructability knowledge                                     |
| Lam et al. (2006)           | Analysed factors influencing constructability in the design phase through questionnaires                                           |
| Pulaski and Horman (2005)   | Proposed a conceptual model for organizing constructability knowledge for design                                                   |
| Fisher et al. (2000)        | Proposed a constructability review process for the efficient use of analytical tools to improve constructability                  |
| Fischer and Tatum (1997)    | Classified the knowledge into construction methods and structural elements to ensure appropriate and specific constructability input |

The expertise involved in this type of project has to be adequately distributed in development stages of design, considering all the design disciplines involved; architecture, structure, M&E (mechanical and electrical) and fire/disaster prevention.

Any omission, error or mismatch in this course affects the entire process in terms of productivity, quality, costs and time.

Before proposing the algorithm for developing design and construction projects (Figure 1), from the perspective of the private investor, the article presents some of the existing models and processes outlined so far.

The same authors (Jim Woong Lee, Kyuman Cho et al.) mentioned above proposed a very complex process model that integrates the logical and chronological connection between the activities and the associated expertise.
**Figure 1.** Design and Constructability Process [4]
Another important aspect that should be taken in consideration is represented by the sustainability goals in design because "successful implementation of sustainability goals not only provides economic benefits from fully exploiting life-cycle costs, also holds the promise of providing a healthier working environment." [5]

All in all, the main factors that have to be examined in the process of design and construction project development are: costs, as the forecast of costs through the life cycle of a project is essential, because "investors can optimize the project design to minimize the total project costs." [6]; knowledge and expertise of all design disciplines involved, chronological steps to be taken and sustainability goals.

3. Public design and construction projects
In Romania, public design and construction projects are carried out following the legislation in this field, the Government Decision no 907/29.11.2016 referring to the elaboration stages and the content of technical and economic documentation related to investment objectives and projects financed through public funds.

These documentations are elaborated following the stages presented below (Table 2):

| Stage | Documentation | Content |
|-------|---------------|---------|
| I     | Conceptual Note | It is elaborated by the Beneficiary of the future investment in order to justify the necessity and opportunity of developing an investment objective |
|       | Design Theme   | Outlines the investment directions and the Beneficiary’s functional needs, mentioned in the Conceptual Note. The theme establishes the development of the investment objective, according to the technical and urbanistic requirements. |
| II    | Pre-Feasibility Study | This study reinforces the previous documents and includes a preliminary analysis of the necessity and opportunity of the objective development, identifies potential technical economic scenarios and at the end of it, several scenarios are selected. |
|       | Feasibility Study/Documentation for the Approval of the Intervention Works | This study analysis substantiates and proposes minimum two different technical economic scenarios. At the end of it, one scenario for the investment implementation is recommended accompanied by a rigorous justification. Documentation for the Approval of the Intervention Works is similar to the Feasibility Study and is elaborated based on the technical expertise of the existing building |
III Design Documentation for Construction/ Demolition Works Approval
This documentation is part of the one developed for obtaining the construction or demolition permit. It respects the Law no 50/1991.

IV Technical Design Project for Execution
This project represents the documentation elaborated by the designer in order to develop, depict and optimize, through technical proposals the selected scenario in the Feasibility Study. It respects the previous documentation for obtaining the building permit.

The stages presented above can slightly differ from a project to another. They are an inspiration source for the design and construction projects financed through private funds.

4. Private design and construction projects
Starting from the stages described in the previous chapters, I drafted an algorithm that can be efficiently applied in the case of design and construction projects financed through private funds.

4.1 Market research to select the business idea
The first step is the market research for selecting the right sphere of activity for the future investment. Apart from the statistical data available for most of the industries, in this type of research, the investor should verify that the future service has a repeat buy in order to achieve long-term business success. In addition, the investor should take in consideration to work with high profit margin in order to self-finance the future business growth. Moreover, a professional support team is essential for any business to increase. [8]

4.2 Selection of the location
The next step in the algorithm is the selection of the future investment location. In this phase, the investor should thoroughly examine the correlation between the characteristics of the location and the image for the future business, zoning and approvals, future development plans in the area, proximity to the potential clients, suppliers or competitors, facilities related to transport, parking and delivery. [9]

4.3 Geographical segmentation of the market
The geographical segmentation of the market from the location selected consists of dividing the market into geographic areas, considering that people living in different areas also have different purchasing behaviours, lifestyles, incomes or occupations. This type of analysis indicates a more precise location of the future investment.

4.4 Analysis of the site investment
After deciding on the future location of the investment, the investor searches for a site or an existing building in order to design and build the objective. When choosing a site it is very important to calculate the total costs of procurement/rental, design and construction related to potential incomes, per one square meter. Furthermore, this ratio has to be less than 1 so that the investment will not become a debt generator.

4.5 Customer profiling
An important defining step is customer profiling in order to create a portrait of the potential clients. This portrait will help the investor make appropriate design decisions as concerns the future services.
4.6 Due – diligence Study
Before starting the design and construction work, the investor will develop a due-diligence study being helped by a specialised enterprise. This study is fairly expensive, time-consuming and is carried out only if all the previous steps were taken and reached a positive conclusion. The study analyses all types of implications for the future investment such as legal, technical and economic aspects.

4.7 Concept Design
In this very important stage from the process, the main role is played by the architect. "The influence and professional significance of an architect are nowhere near that of a general contractor." [10, 11]

Akash Angral stated in his study "Architect–client relationship and value addition in private residential projects" that "the predicament of the profession and the marginalisation of architects is due to their detachment from clients". In addition, clients will always "prefer to invest their trust in architects who can deliver from concept to completion." [10] The architect an investor should search for should not feel "intellectually above the concerns of the client’s world" [10, 12]. Therefore, a professional architect is indispensable in this design stage and any investor should accept to spend more time and resources in order to find the perfect architect for them and develop an excellent Concept Design for the future investment objective.

4.8 Design Documentation for Construction Permit
The documentation for obtaining the construction permit cannot vary from the one imposed in the case of construction projects financed through public funds. It has a standard content as it has to respect the Law no 50/1991 in Romania. It includes architecture, structure and M&E technical descriptions, drawings and a general build-out. The documentation has to include all the approvals imposed by the urban planning certificate obtained for the future investment.

4.9 Design Project for Execution
This design project for execution consists of the technical detailing of the scenario discussed and agreed with the client. It serves as a "user guidelines" for the constructor to build the future objective in accordance with the client’s demands and the applicable legislation. The project contains a more detailed version of the design documentation for obtaining the construction permit.

5. Results and discussions
The algorithm resulted from this research is illustrated in the following figure 2:
Figure 2. Algorithm for developing a design and construction project

The algorithm for developing a design and construction project presented above is detailed in accordance with the private investors’ necessities, taking into consideration to minimize costs as much as possible and to successfully create the perfect investment objective for the targeted business.

6. Research methods

One of the methods I used in my research was the documentary analysis of the specialty literature. Therefore, I studied the available articles on the Web of Science database, Scopus, Elsevier, Emerald Management Journals 200 and others.

A principle I followed in developing the algorithm was Divide et impera. Applying this principle provides the elimination of the risk of consuming a significant quantity of resources (time and money), so that the costs related to developing the project are structured by different stages and the algorithm allows the analysis of every stage, concluding if the investor may continue, having a profitable process so far or may not continue if the costs generate loss. Hence the principle implies coordinating the process by stages and sub-stages.

The opposite principle Junctis viribus was involved in the process because I had an overall vision when I carried out the literature review and I considered all the design disciplines in the algorithm as a whole.

Using the two principles mentioned above I applied the model of zooming. "The best leaders work the zoom button in both directions. They can zoom in to see problems while zooming out to look for similar situations." [13].

Furthermore, I applied the observation in my practical activity as an entrepreneur from a scientific perspective I could notify similar necessities among private investors. These necessities were considered as well in the algorithm.

This type of observation may be integrated in the future in a decision making model using artificial intelligence to assist investors to make the appropriate decision eliminating the present uncertainty in the process.
7. Conclusions
The algorithm drafted in the present paper will be part of the final design methodology I intend to develop in my PhD thesis. The next step in my research will be to propose drafts of useful documents that can be used in order to advance a successful design and build project.

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