

CONSTRUCTION EXPERTS' PERCEPTIONS OF SCHEDULE DELAYS IN CONSTRUCTION PROJECTS

Ph. D. Student Rinat GRINBERG

“Alexandru Ioan Cuza” University

Iași, Romania

Rinat.Grinberg@maytronics.com

ABSTRACT

The constantly changing reality is posing great challenges to construction these days. Management teams are facing the need to control the flow of information, coordinate all factors, understand an up-to-date picture of planning versus execution, and manage unpredictability. Those scenarios, therefore, call for creative solutions and a continuous search for the necessary work material. There are many types of research studies investigating the causes of construction delay. However, research on the influence of frequent changes on a construction project's schedule is lacking.

This paper is a part of a Ph.D. thesis addressing the significant factors of delay in a construction project in a changing reality. It contains a representative quality sample of concepts of construction industry experts' views regarding frequent changes during the construction project, concepts of management, and impact on the project's conduct and the time of the project. The study will list the cases in which changes during the project affect its schedules.

In many studies, the causes of delays in building projects were analyzed, but there was no analysis of the effects of changes that were introduced during the project, which would be potentially beneficial to stakeholders and professionals. The Ukraine- Russian war, the Covid-19 pandemic and the closure in China and their impact on global materials and the impact on organizations with changing needs have influenced the ability to manage a rigid construction project in flexible methodologies; hence, the goal of this research is to examine project managers' perception of causes of delay in construction projects in an uncertainty reality.

Keywords: project management; construction industry; changing reality; organizations change, Hybrid model.

1. INTRODUCTION

At any instance where the project entrepreneur changes plans or scope of work (SOW), the project manager is to return to the programs and plan all projects from the first step. This changes the original timeline (T.L) of the project.

Over the years, various project management techniques have been developed in a constantly changing reality to meet the need of project managers. Some of this method, such as Agile methodologies, are based primarily on the manifest for agile software development (Beck et al., 2001) and on the belief that primary programs are ineffective and an evolutionary, iterative, more efficient process is critical for meeting the project needs during its life cycle (Dingsøyr, 2008). Agile Project Management differs from traditional projects and product management, such as the waterfall model, by emphasizing continuous design, flexible scope, coping with uncertainty, constant customer interaction, and modifications in the project team's structure (Serrador & Pinto, 2015). Figure 1 illustrates Traditional Waterfall Construction Project Process (Von Rosing et al., 2014)

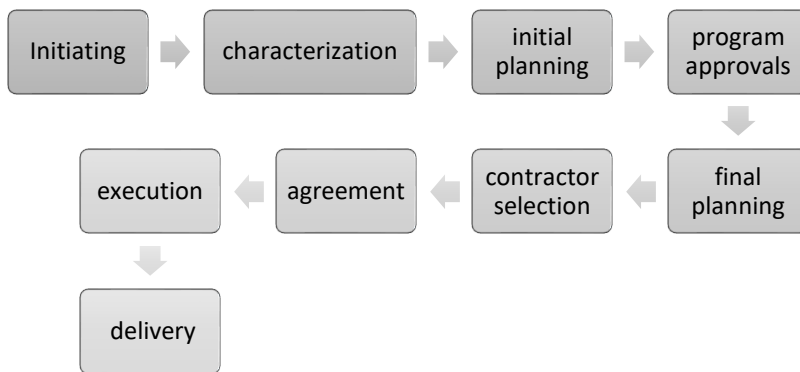


Figure .1: Traditional Waterfall Construction Project Process – Von Rosing et al. (2014)

The Western world has realized the crisis in the industry, and in many countries, the governments have recruited to help their construction and infrastructure industry accomplish their missions. For example, in Italy, the government passed in mid-May 2022 legislation to determine that existing contracts held during the year shall receive an immediate payment of 90 percent of the project's materials increase. At the same time, it has provided 7.5 billion euros for new and expensive contracts that have not yet been released.

According to the Emergency Regulations of the Ministry of Greek infrastructures, the Greece Government has updated the construction costs since the last quarter of 2021. The government paid benefits to contractors upon completion of the projects.

In France, new rules have been established for public hours, facilitating changes in tenders due to unforeseen circumstances while cancelling fines.

Often, things change unexpectedly during the project. The initial design, design, and project estimates are ready and established, and the contractor has a detailed and realistic plan. However, some core project team members can leave the organization with no forewarning

during the project. Either a new technology has surfaced, or there is a problem providing equipment or raw materials when working professionally. It is more appropriate for use than the one in the original plans.

These events might severely jeopardize the success of your project, and at this point, we need to go back to the previous project stages, rethinking them and considering these new realities. Project management is the guidance and coordination of personnel and materials resources throughout the project period by implementing management techniques to achieve pre-defined goals of content, quality, time, cost, and satisfaction of stakeholders. Project management involves the art of achieving goals effectively and efficiently. Some project methodologies, such as Agile and Lean construction (Lean construction, has the purpose of meeting customer needs effectively. Lean construction rests on the principles of production management of construction. The result is a new project delivery system that can be applied to any type of construction but is particularly suitable for complex, unclear, and fast projects, focusing on planning and effectively managing the construction project.

Agile has been effective in hardware and software projects rather than in traditional construction projects. The Lean Construction Methodology involves reducing the waste produced by a given project. Although companies take the waste of material, which benefits the environment, they will waste time and labor by providing efficient supplies and use of materials (Lean Construction Institute, Iris D. Tommelein 1999).

Building Information Modelling (BIM) addresses an interactive design that sees all the structural systems during the planning to synchronize all interfaces and make quick decisions as a decision-making tool. The full Ph.D. research shall explore an Objective Schedule Model – that can manage the changes during the project from the perspective of resources, schedule, and budget. This research aims to examine project managers' perceptions regarding the cause that will or will not cause schedule delays in construction projects. Hence, the research question was: What factors will or will not cause a schedule delay?

2. LITERATURE REVIEW

Unplanned changes in construction projects may yield disruptive effects, resulting in project delays, cost overruns, and quality deviations. More effective management of the changes may reduce the disruptive effects and limit the cost overruns from rework, reaching 10-15 percent of the contract value (Senaratne, S., & Sexton, M.G., 2009). Construction projects are likely to deviate from the original schedules due to changes in the project characterization caused by the project manager, the developer, or the owner. Delay in schedules causes great financial loss and frustration for most of the project. In recent years, the number of changes in the characterization of needs has been increasing significantly during a project due to the speed of changes in the environment, leading to projects often not meeting their set goals of budget, schedule, and quality.

Unfortunately, there are numerous causes of construction delays, and the plethora of studies available in the research landscape testifies to this fact. Thus, it can be argued that there is no consensus on what constitutes a major delay cause, resulting in a varied perspective on the subject matter by researchers (Sweis et al. 2008). One of the earliest studies into the causes of construction delay was presented by Baldwin et al. (1971), who presented 17 causes of construction delays in the United States.

Most research has focused on the key causes of delays in building projects, and in recent years, the changing reality and the frequency of those changes are the central causes of delays. The focus group discussion conducted for this article addressed the question of how the changing reality affects the conduct of the project and what solutions are offered by experts from the construction industry to this issue.

Global construction industry data indicates a good steady growth. Some regions witness upward movement, while others show signs of slowing down. There are indeed some challenges. However, countries and cities will always need infrastructures to support development, services, social activities, and economies. Building repairs and improvements will always be around. Thus, the construction industry will always be in need.

However, construction professionals should keep up with the shifts in paradigms—the mindsets and technology that comes with it. These and other external market forces would shape the industry's future in the years to come.

Several factors are responsible for overcoming costs and delaying schedules in construction projects. Previous studies have defined the cost of the project as the difference between the total cost required to complete the project and the estimated/budget cost at the time of the agreement or contract (Sharma S, Gupta AK (2019), Doloi H, Sawhney A, Iyer KC, Rentala S (2012)). According to the literature, the time to flood is defined as the difference between the time required to complete the project and the time agreed upon by consent or contract to move the entire project (Yang JB, Wei PR (2010)). The literary review shows that ownership and project times negatively affect the project and its associated construction companies. Companies sometimes watch bankruptcy because of this flood (Kazaz A, Ulubeyli S, Tuncbilekli NA (2012)). Therefore, a systematic study of these streams should provide clarity on the critical and floating factors involved and adjust the work processes to address these industries. The first step in a literature proposal is identifying the factors involved in construction projects. This is an important step because we can't move forward without knowing what factors are (Doloi H (2013)). After evaluating identified flood factors and analyzing critical factors that have the maximum impact on flooding, a hybrid model can be built to manage building projects concerning delays and frequent changes.

According to Memon et al. (2011), time overrun is ultimately a cost overrun, one of the important performance indicators for a project. Delays are characterized as a loss of efficiency and productivity in the construction industry (Sanni-Anibire MO, Mohamad Zin R, Olatunji SO. 2020).

According to "The Israeli Center for real estate," from June 2022, it took more than 350 days to have a permit in Israel, and 25 different procedures are required for a typical warehouse construction permit in India (Press reports; World Economic Forum; The Boston Consulting Group (2021)).

Figure .2: Average time for a building permit, "The Israeli Center for real estate"

Country's name	→	United States	England	Israel
Average time for getting a permit	→	81 Days	86 Days	368 Days

A change in construction is to be anticipated. Innovation may help reduce design and material costs, for instance, recycling materials, reducing costs in finished materials due to innovative manufacturing technologies, and more. Also, regarding construction automation, it should be assumed that robots will enter more building projects. Of course, they will probably start with lighter structures and scale into more complex structures like multi-story buildings, maintenance repairs, 3D construction, and other technologies.

Furthermore, in terms of productivity, large and small construction companies are expected to adopt modern productivity technologies such as project management solutions. These will help manage business processes that support building correctly. All these developments in the construction industry will directly affect the need to adapt to changes and execute construction projects in hybrid (Barbosa Franco, Ana Mariele Domingues, Nelson de Almeida Africano, Rafael Mattos Deus, and Rosane Aparecida Gomes Battistelle (2022))

Delays may arouse multiple issues in the construction industry, like legal battles, increases in costs, further project delays, productivity, financial losses, and contract failures (Hamzah Abdul-Rahman, Roshana Takim & Wong Sze Min, 2009). According to Trauner (2009), delays adversely affect the interests of project stakeholders by increasing the cost associated with the project. Delays are considered influential factors damaging most projects' success profiles (2013). Various studies have been conducted to identify significant causes of delays in different regions of the world. Faridi & El-Sayegh (2006) surveyed UAE (United Arab Emirates) and found that late approval of drawings, delayed decisions, and improper planning are the major causes of delays. According to Assaf & Al-Hejji(2006), the unavailability of workers and financial issues were the major causes of delays in KSA (The Kingdom of Saudi Arabia). At the same time, Rahman et al. (2014) identified inflation and political instability as significant causes of delays in Bangladesh. There is no consensus among authors as the essential reasons vary based on project type, region, nature of construction industry, firm size, experience, cultural differences, technical expertise, etc. This lack of consensus is due to the unique characteristic of construction projects (2022).

other significant factors for delay in a construction project are a change by the Client, Delayed payments, Contractor's Poor planning and scheduling, Contractor poor management, Labor availability, and Contractor's financial issues (Assaf SA, Al-Hejji S. 2005)

This study examines through a focus group discussion the perceptions of experienced project managers and other experts from the construction world regarding the impact of the incoming changes during project execution, the effect of changes on schedule, and the delay in project delivery.

3. METHODOLOGY

As established earlier, within the framework of a mixed-methods approach, this paper is based on the perceptions of a representative group of experts from the construction industry. The qualitative research population consists of seven construction project practitioners, including experienced construction project managers, architects, and real estate developers. They have signed an informed consent form before their entry into this study. The participants' responses were recorded during the discussion, and the responses underwent content analysis.

Despite involving a small number of participants, they represent the phenomenon under this study and, therefore, can account for the sample population, as focus group discussions can produce large amounts of data on the research topic. The interaction between the participants

in the focus group discussion may be a precious source of data that cannot be gathered during the individual interviews. The collection of this data may be enhanced by notes recorded by the researcher about the context of the discussion. Qualitative analysis of these rich, contextual details could uncover the themes and patterns in the participants' responses, which become the focus of the qualitative research analysis.

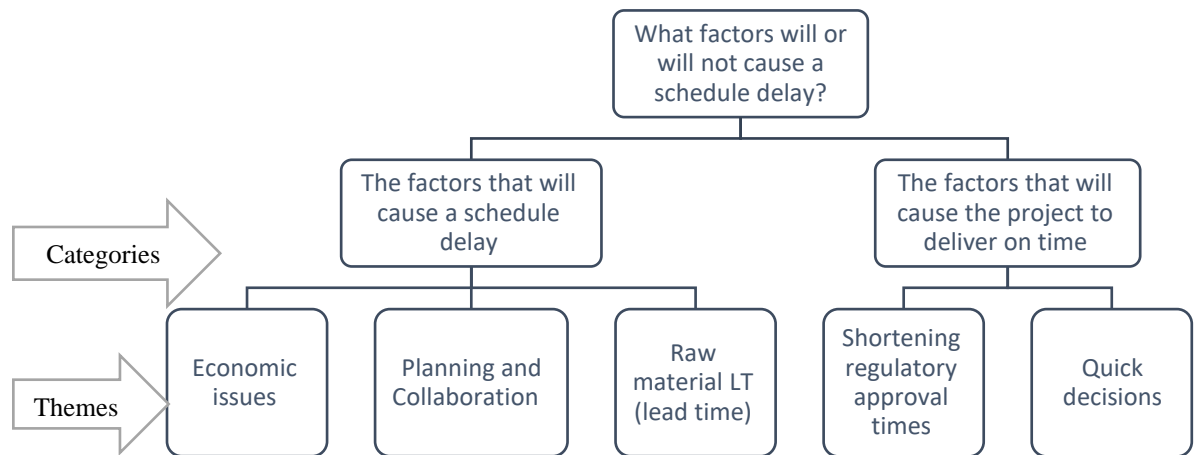
In the book by Prof. Michal Krumer-Naboo and Leah Ksen: "Quality Research Content Analysis" (2010) lists the steps in collecting and analyzing the data in a qualitative study. Content analysis is an essential step in quality research and is based on content as text. Depending on the method of analyzing the data collected in the group discussion, the conversations will be fully tabulated and sorted into categories and themes. The qualitative analysis focused on the question asked in the group: "What factors will or will not cause a schedule delay in construction projects?"

The content analysis yielded five categories to identify the participants' responses' central themes. Each category was divided into four themes.

We chose and marked a quote or two that demonstrated that same perception or experience. This stage helped us immensely in the last step – presenting the findings.

Figure .3: Project managers' perceptions Regarding schedule delays in construction projects: What factors will or will not cause a schedule delay?

Findings emerging from the content analysis



The analysis of the experts' answers indicates that the key contributions to the schedule-shortening of the construction project given frequent changes are a temporary shortcut to issuing building permits and authorities and making quick decisions on the construction site by the project manager and the team.

Table 2 lists the responses of focus group participants as they are divided into both categories after parsing the answers according to keywords.

The content analysis shows that a delay in project schedules is affected by various factors rather than one element. The factors do not necessarily depend on each other and often require a standing up of several criteria to deliver the project in time.

In addition, internal factors such as co-workers and owners and external factors such as permits or other regulations, getting quick or detailed design answers from external advisers such as architects, conservators, safety consultants, and fast project managers can cause delays.

Table 1: Quotes from the words of the focus group participants on the central question and the themes

Themes	Categories	
	The factors that will cause a schedule delay	Factors that will cause the project to deliver on time
Economic Perceptions	<p><i>"Financial problems of the developer who doesn't transfer funds in time to the contractor."</i></p> <p><i>"When the amount closed in agreement with the contractor does not fit the workability."</i></p> <p><i>"The materials costs are rising"</i></p> <p><i>"Lack of skilled workers"</i></p>	<p><i>Cooperation between all interfaces in the project</i></p> <p><i>"As the project manager gets along with the developer and the contractor, things go easier and help the project advance quickly."</i></p> <p><i>"Poor relationship between the project manager and the contractor can cause the worse delays."</i></p>
Planning and collaboration	<p><i>"There are many changes during the project."</i></p> <p><i>"No one understands what they want."</i></p> <p><i>"We don't have a clear-cut plan."</i></p>	<p><i>"Everyone is signing the plans and approving them."</i></p> <p><i>"The program and SOW of the project were very clear."</i></p>
Raw material lead time	<p><i>"All the furniture is delayed at the port."</i></p> <p><i>"Raw material lead time is long."</i></p>	<p><i>"Ordering raw material and furniture right away with a contract signature</i></p>
Regulation		<p><i>"If the local committee quickly approves the plans, the whole project will run swiftly and smoothly."</i></p>

During the project, many changes are made. Some changes are caused by internal reasons such as changes in the characterization of needs by the work order, changes in plans, or organizational changes that require planning change.

Some of the changes are caused by external reasons that are independent of the contractor, project manager, or work order, such as raw material lead times, the rise in prices of raw

materials and furniture, delays in the ports due to Covid 19, and additional building permits or regulation permits.

Because the factors that change do not always depend on decision-makers or labor campaigns, the construction industry needs a project management model that should be more flexible and adaptable to frequent changes and prevent deviations that may result in high costs and delays in the project schedule.

3. RESULTS AND DISCUSSION

This paper explored the perspective of construction experts on schedule delays in construction projects. Also presents a literature review relevant to today's changes and innovation in construction projects and delaying factors that affect budgetary anomalies and building project schedules. The research contributes to the field in several ways. Through a focus group, a list of factors affecting scheduling delays and factors that can make the project ready at the scheduled time. This has implications for project managers that look for project delays' impact on the construction industry. Researchers have access to the survey of the literature and the findings of the quality research done through a focus group and professionals the reasons and the actions that can be done to deliver the project on time.

Although there are similarities between the causes of delay in building projects in the review of the literature (Sharma S, Gupta AK (2019) and the factors that have emerged from the focus group (money problems of the entrepreneur, a delay in payment for the contractors, delays in permits, lack of skilled workers at construction sites), there has also been a difference in factors affecting delays that are part of the uncertainty that has increased since the beginning of the Covid 19 outbreak and affects decision making and supply times, for example, *"All the furniture is delayed at the port."*

Frequent organizational changes, affected by the new hybrid working model and zoom meetings, all affect the required planning, for example, *"No one understands what they want."*

As well as a lack of skilled workers at construction sites *"Lack of skilled workers"* and general contractors' distress in the construction industry. These are all evidence that innovative solutions need to reduce these inhibitors.

The Ukraine war also changed the rules of the game on providing raw materials to the construction sites, and unexpected costs as well as long supply times; in the focus group, for example, the experts discussed the cost of the raw material *"All the furniture is delayed at the port."* And their long lead time.

Analysis of the focus group answers found two main categories. The factors that will delay the schedule and the factors that will allow the project to be delivered at the planned time.

Each category is divided into several key subdivisions.

The themes are independent of each other, and there is a need to study the impact of each of them.

The factors that will cause a schedule delay:

- Economic issues - As part of the factors that cause schedule delays, it has been revealed that financial problems and lack of payments to contractors in time can

cause a problem with a lack of skilled employees on the site, raw materials lead time, purchasing, and timely delivery.

- Planning and Collaboration - A lack of on-site communication between the teams, between the project manager and professionals, and programs that are not updated and frequently modified due to work order changes also cause delays in the project schedule. Part of the project manager's skills is to communicate with all the factors, entrepreneur, contractor, and architect, and make quick decisions. The clarity of job orders and approved programs to advance according to schedule. Any changes on the work plans and any changes in the project characterization require repeated communication among all factors, additional material orders, and sometimes a complete stop to the project. The implications of advanced technologies reviewed in the literary Review section affect the rapid decision-making and automation of construction through software and ground elements that come to the site ready to assemble have not yet been entered into the construction operations of power.
- Raw material LT (lead time) - The World Bank: "The Ukraine conflict has triggered the biggest commodities price shock in nearly 50 years, and the impact on food and energy is set to last until 2024". As of April 2022, the journey from the Asian factory to the Europe port is 118 days = more than double the trip days in 2019. That challenge requires the careful planning of material orders for the site and meticulous management of the schedules. If there is a delay in materials, including the project, the project manager must find an alternative in coordination with the entrepreneur and contractor that is suitable for the project budget and does not delay the schedule.

The factors that will cause the project to deliver on time. the second category is Factors that will cause the project to be ready on time. In that category, two themes can affect a schedule delay: regular and quick decisions. In most countries, a permit process takes several months; in Israel, it may take sometimes more than one year. Therefore, if the decision is quick, all permit processes can be more effective. Every change that comes during the contractor work needs a wide answer that gathers the budget, timeline, and the costumer's needs – and all of that without stopping the workers.

Entering a new method into the construction industry needs change in management and innovation perspective.

- Shortening regulatory approval times – the project execution depends on the municipal permit. According to "The Israeli Center for real estate," from June 2022, it took more than 350 days to have a permit in Israel.
- Quick decisions - In this study, all participants raised problems with frequent changes and primarily a lack of quick decision-making when different delays arise in the field.

According to the focus group discussion, it is suggested that there is indeed a need for a more extensive and comprehensive study to be conducted in the framework of the doctoral dissertation, reflecting the problem of delays in building projects in changing reality, especially in finding management tools that encompass all changes from planning to delivery in a hybrid and flexible manner.

This article is part of a doctoral work that will combines more quantitative and quantitative studies to produce a hybrid project management model that responds rapidly and cost-effectively to frequent changes in the life of the project.

The study shows that innovative delivery methods and essential real-life sharing are changing, and information management, while the project is being conducted transparently, may affect the project's schedule performance. These methods improve communication and coordination between stakeholders in the project, which can solve common scheduling issues (Sendar Durdyev, M. Reza Hoseini 2018)

A future study can explore the skills required for employees in the construction industry today due to the changing reality and innovative technologies and the impact of various delay factors on project schedules.

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