

**DEVIATION(S) IN PROJECT LIFE CYCLE: CASE OF CONSTRUCTION
INDUSTRY***

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Abstract

Projects in the construction industry frequently demonstrates substantial deviation across the project life cycle. Construction projects, according to this study's interview analysis in Iceland, frequently suffer from inadequate project management, lack of scope, poor labor use, clients with insufficient finances, and excessive client intervention. Additionally, wider societal factors such as COVID-2019 can negatively impact deviation and undermine project success. The purpose of this study is to identify the factors, that impact deviation in project management and the phases through which it arises in the project life cycle of the construction industry. The paper presents a case study on project management deviation across the project life cycle based on the Icelandic construction industry. The research results identified that project deviation is primarily caused by four factors: 1) clients' ambiguous requirements; a lack of planning, which results in an extended execution phase, often at great expense; 2) Icelandic cultural attitudes; 3) a lack of standardization in project manager operations; and 4) unpredictable external factors that cannot be controlled. In this study revealed project management deviation reasons in relation to project life cycle phases in the Icelandic construction sector. The elimination of deviation factors can help project managers to successfully manage project implementation and ensure successful project life cycle implementation in the construction industry.

Keywords: Project Management, Project Life Cycle, Construction Industry, Project Management Score.

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1. Introduction

Each year, the construction industry invests more than \$10 trillion globally, accounting for 13% of global GDP. This industry employs 7% of the working population on the planet (McKinsey & Company, 2017). Despite its economic importance, however, the construction industry's productivity has developed slowly over the last 20 years, increasing by only 1%. (McKinsey & Company, 2017).

The construction industry has a \$1.6 trillion productivity gap, which means there is a 16 percent possibility to boost value (McKinsey & Company, 2017). This fact alone is reason enough to look into why the difference exists, and identifying the causes is a critical first step toward narrowing or even closing the gap.

The goal of the research is to determine the major elements that influence project deviation in the construction industry. The methodological framework is based on the project life cycle, making it easier to pinpoint exactly when difficulties start to occur. The case study is based on an engineering firm in Iceland.

The research questions:

- 1) Where do project management deviations originate in the construction industry in Iceland?
- 2) How have they manifested during the project life cycle?

2. The Construction Industry

Due to their scope, long execution periods, sophisticated procedures, high sensitivity to environmental factors, diverse interests of various stakeholders, and the dynamic structure of project teams, construction projects differ from projects in other industries (Zou et al., 2007).

Construction projects can be classified into the following categories based on their characteristics: 1) construction and real estate, as well as social infrastructure such as hospitals, schools, and stadiums; 2) civil infrastructure, such as transportation, power, water, and telecommunications projects; and 3) industrial construction, such as manufacturing, oil, gas, and mining facilities (McKinsey & Company, 2017). Construction projects, according to Bennett (2003), can be split into two categories: 1) general building construction is usually designed by architects or the owner; these are structures for human habitation, such as houses and apartments; 2) engineered construction is slightly more complicated, and the design is usually prepared by engineers; these are typically government projects requiring a high degree of mechanization and heavy equipment.

Because of the size of major construction projects and the number of people involved, the flow of information is frequently disrupted, with information being lost, particularly between phases of the project life cycle, which can have a negative impact on the project.

2.1. Project Life Cycle in Construction Industry

A project life cycle is a process that runs from the conception of an idea to the delivery of a completed project to the client (Guan et al., 2020), and it also serves as the foundation for project management (Patanakul et al., 2010). The project's phase separation makes it easier to improve management control and for the project manager to better arrange all of the complex procedures.

In this study we use four main project life cycle phases proposed by Larson and Gray (2017): 1) defining; 2) planning, 3) execution; 4) termination or closing, which can be used for construction project implementation as well. According to Bennett (2003), project life cycle phases should be adopted according to the specifics of the construction industry: 1) prior to commencement of the project, 2) planning and design phase, 3) contractors specification phase, 4) the project mobilization phase, 5)

project operations phase, 6) the project closeout. According to Archibald et al. (2012), the pre-project phase in which the idea is created and a post-project phase in which the project's results are evaluated has been questioned.

Goals, requirements, and task responsibilities are the major activities of the defining phase (Larson and Gray, 2017). The client takes the lead and creates tender documents, detailing the project's goals, specifications, tasks, and responsibilities; the necessary data is gathered and analyzed for potential projects; the client receives cost and time schedule estimates from various organizations that may be able to offer a deal; the client receives cost and time schedule estimates from various organizations that may be able to offer a deal to the client. The right people or firms are found for the clients' projects.

The planning phase's main activities are schedules, budgets, resources, risks, and staffing (Larson and Gray, 2017). The way activities are carried out is determined by planning, and a strong and decisive strategy will lead to a more effective execution stage. Poor planning is a sure sign that a project will fail (Westland, 2007). When the project's senior managers have granted their approval, the planning is finished (Pinto & Slevin, 1988).

The execution phase's main activities are reporting about status, changes, quality, and forecasts (Larson and Gray, 2017). Cost, time, and specification plans are used for oversight and controlling. The project manager monitors and controls the actions and informs customers about the processes and the implementation requirements.

The closing phase's main activities are: transfers of document, completing payments, releasing resources, and evaluation (Larson and Gray, 2017). When the project is delivered to the customer, the managers should analyze the use of resources and conduct a discussion about learning experiences.

2.2. Projects Deviation Factors

According to the literature analysis, the three main project deviation factors are environmental impact, project manager's role, and country and workplace culture.

Environmental impact. The external environment, according to Akinsola et al., (1997) and Sweis et al., (2008), is everything outside of the project, such as the nature of the product, customers and competitors, poor preparation, financial difficulties, too many changes made by the project owners during the implementation phase, political situations, the economy, geographical settings, and even the climate. COVID-19 is the most recent external project effect (Hall et al., 2020).

Bennett (2003) urged construction managers to consider the external environment when planning a project so that deviations have less of an impact.

Project manager's role. Crawford (2005) stated that the project manager's job and talents can have a significant impact on the project's outcome and organizational success. A successful project manager must have the capabilities to deal with many parties, and foreseeing different factors in the project depends on successful project implementation. Lack of experience and expertise may have an impact on projects deviation as well.

Country and workplace culture. The construction industry's project management can be influenced by a country's culture. Icelanders, according to Eyjólfsson and Smith (1996), are optimistic and happy people. The common Icelandic saying "things will sort itself out" reveals their approach to problem-solving. The Icelandic management style, according to Ladóttir and Jóhannesdóttir (2008), is characterized by fast decision-making and a lot of labor.

The ability of an organization to perform successfully and achieve exceptional results is influenced by its culture. It is based on the beliefs, attitudes, and values of the organization, as well as the connections and communication patterns that have developed inside it (Aalsteinsson et al., 2007).

2.3. Project Success Factors

An "iron triangle" or "triple constraint" can be used to show project success, demonstrating that a project should be successful in terms of time, money, and scope. Balancing these three criteria, as well as ensuring stakeholder satisfaction, has an impact on project quality (Kerzner, 2009; Larson & Gray, 2017).

According to Larson and Gray (2017), the longer a project takes, the more expensive it becomes, therefore it is often necessary to use less expensive equipment or people to bring the triangle back into balance. According to Tukel and Rom (2001), quality is the most important factor in project success. The lack of a clear description for the project's scope, according to Mirza et al. (2013), is the reason why most projects fail. Even if a project does not adhere to the iron triangle, it can still be successful, and the client still be pleased with the ultimate outcome (Collyer & Warren, 2009).

3. Methodology

3.1. Case Study Method

Case study approaches, according to Yin (2013), can aid in the discovery of answers to contextual challenges, particularly in the construction industry, because they incorporate and capture diverse perspectives. The academic community recognizes the value of case study research as a means of improving and distributing knowledge, particularly in professional and practical areas (Yin, 2013; Alwan, Jones, & Holgate, 2017).

This study is based on grounded theory. When investigating processes or developing a new theory, grounded theory is extremely useful (Merriam & Tisdell, 2009).

The case study is based on the experiences of one worldwide construction consultancy firm. The firm specializes in energy, industry, and infrastructure projects, as well as providing engineering assistance, preparing tender documents, participating in contracting, and reviewing design and other areas of project-related construction work. It is also certified to the ISO 9001 international quality management standard, ISO 14001 environmental management standard, and OHSAS 18001 safety management standard.

3.2. Data Collection Procedures

The research framework was prepared beforehand and later semi-structured interviews were implemented (Esterberg, 2002). In order to get more insights into the analyzed topic, additional questions were asked during the interviews.

Data were collected during March 2020. All of the interviews were scheduled through Microsoft Teams due to COVID-19. After obtaining the consent of the respondents, a video recording with sound was conducted.

All of the eight project managers who took part in the interviews work in the same department for an Icelandic construction firm, and all have formal project management training, either through project management courses or IPMA certification.

The interviews were transcribed using the Corbin and Strauss (2009) approach, and then open coded. The participants were given aliases to make the study more personal, thus their true identities were not used in this study. Table 1 shows the degrees of experience and length of the interviews, which

are characterized as follows: First level (experience ranges from 0 to 10 years), second level (experience is from 10 to 20 years), and third level (experience ranges from 20 to 30 years).

Table 1: The Degrees of Experience and Length of the Interviews

Respondent name :	Experience	Length of interview (h, min)
Respondent 1	First level	1:06
Respondent 2	Second level	1:01
Respondent 3	Third level	57
Respondent 4	Third level	1:22
Respondent 5	Third level	1:02
Respondent 6	Third level	1:10
Respondent 7	Third level	54
Respondent 8	Third level	38

The interviewee sample included 75% men and 25% women. Measures were taken to ensure the anonymity and confidentiality of the respondents because it was promised to the interviewees.

4. Findings and Discussion

In this section, we define the main factors impacting project implementation, as identified in the interviews and literature.

4.1. Factors Leading to Deviation in PM

4.1.1. Clients Undefined Requirements

According to the answers of the respondents, five factors were identified related to clients' undefined requirements.

Two managers. The research identified, that clients can bring their own manager into projects if they want to have a say in how they're run, resulting in two managers in charge of the same project. According to past studies, having two managers in control of a project can have a negative impact on its outcome (Yousaf et al., 2011). This finding correlates with previous research – when the client wants to change their approach during the implementation process, the activity has a negative impact on project efficiency (Chan & Kumaraswamy, 1997).

Constant changes of requirements. This research indicates that if the client often changes their requirements or is uncertain about the details of the project, this has a negative effect on the project's schedule and plan. Munns and Bjeirmi (1996) say it is important to have a strict plan and schedule before the execution stage of the project because by doing so the project is more likely to succeed.

Use of project management tools. According to all eight respondents, projects would have a better outcome if they were properly organized. According to Kerzner (2009), project management tools contribute significantly to project control and raise the likelihood of success. According to research (Müller & Turner, 2010), companies who employ project management software have a competitive edge in the market. Because project management tools are still a new product for Icelanders, one respondent stated that they are not suitable for clients.

The interviews revealed that the cost schedule is frequently misread or misunderstood by the clients, and that the clients is unlikely to listen to expert advise in this area. When the client hasn't decided on the project's requirements or design, predicting a price and timetable for the project is exceedingly difficult. It takes time to develop a cost schedule, and the expenses are usually stated as a range of uncertainty.

Fines. According to Icelandic law 120/2016 (Lög um opinber innkaup, 2016), the client can demand day fines if the project is not completed by a specific date. These elements could be one of the reasons why the company gives the client a lot of power and maintains a positive relationship with them. Munns & Bjeimi (1996) wonder if the organization would benefit from having tougher client standards.

4.1.2. Culture and Organization Impact

Every organization that operates within Iceland is definitely influenced by Icelandic culture (Minelgaite, et al., 2018). According to previous studies, Icelanders are willing to take risks and are at ease living in an uncertain world with unwritten rules (Minelgaite et al., 2018). One interviewee disclosed that sometimes the project manager approves the implementation of projects, even though the project manager was aware that the client's goals and expectations were unreasonable. This can be named by the Icelandic phrase "þetta reddast" (in the English language, "it will sort itself out").

Colleagues in Germany and Denmark who deal with Icelandic project managers were taken aback by their chaotic work styles and lack of preparation prior to the start of a project. According to Hofstede's (2011) dimensions, the Icelandic measure of uncertainty acceptability is 50% compared to just 23% for Danish people. This means that Icelandic people better are more willing to embrace uncertainty.

Workplace culture is influenced by Icelandic culture as well. As a result, respondents yearned for a more defined and formal project structure. According to research, initiatives in Iceland often have a clear vision, but the structure is poorly defined (Aalsteinsson et al., 2010). Icelandic managers are known for being casual, personable, and quick to make choices and solve problems (Aalsteinsson et al., 2010). This is echoed in the interviews, where respondents expressed a need for friendly answers to client problems.

4.1.3. Manager Role and Management

The success of project management implementation strongly depends on project managers and their capabilities to manage the implementation process.

Manager's role importance. The interview respondents and researchers (Crawford, 2005) indicated that a project managers' role is important in project management process. Interviews disclosed that projects have a structure which a project manager should follow, but each project manager determines how strictly they will follow the structure.

Manager's mood. The research disclosed that even the mood of a project manager can have an impact on his / her work. Munns & Bjeirmi (1996) place a greater emphasis on organizational abilities, stating that being a good project manager needs thorough preparation and a dedication to seeing the project through to completion while eliminating any emotional factors.

Management software. The most effective project managers, according to Stevenson and Starkweather (2010), have the necessary education and experience. The respondents agreed that using project management tools is critical for ensuring the project's progress.

Lessons learned. A meeting once a project has been completed, according to the responders, would be really beneficial. The lessons learnt from the initiatives subsequently become a part of the employee's own personal experience. According to previous studies, lessons learnt can have a significant impact on a company's success and possibly provide a competitive edge (Jugdev, 2012).

4.1.4. Unexpected Environmental Factors

Unexpected environmental events or internal company concerns should be factored into the project schedule. When unforeseen events emerged, the respondents stated that they would try to adjust

the schedule to fit the new scenario, alert the client, and work together to resolve the issues. The key variables in the unexpected environment, according to Hall et al. (2020), are currently bad weather and COVID-19, and these issues are relevant not just in Iceland but also in other nations.

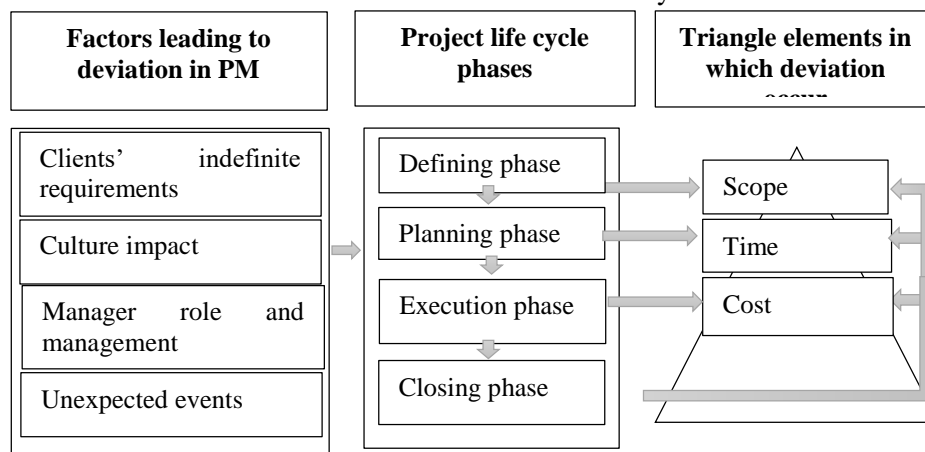
4.2. Deviation Manifestation Through Project Life Cycle Phases

There are typically four main project life cycle phases: defining, planning, execution, and closing, as discussed in the preceding sections. When a project is completed on time, within budget, quality, and scope, and the customers are satisfied with the outcomes, it is deemed successful (Collyer & Warren, 2009; Larson and Gray, 2017) (Figure 1).

This is the stage where you define yourself. According to the research, in this phase

Defining phase. According to the research, during this period, the client is frequently uncertain and presents continually changing expectations, often taking a commanding position. According to Patanakul et al. (2010), this leads to success when the consumer knows exactly what he or she wants and is able to articulate their desires properly. Indefinite clients result in a lack of scope and, as a result, a lack of planning. According to Turkel and Rom (2001), scope is the most important factor in project success. Mirza et al. (2013) agrees with this viewpoint, stating that most initiatives fail due to a lack of clearly defined project scope.

Figure 1. The factors impacting project management deviation during the project life cycle in the Icelandic construction industry



The defining and planning phases of the project life cycle are crucial. These phases have an effect on the execution phase, resulting in more time and money being spent on the project, improved quality, and the scope of the project being established.

The project goal is established during the defining phase. The goals should be SMART (specific, measurable, achievable, realistic, time-bound) (MacLeod et al., 2012). Pinto and Slevin (1987) emphasize, the most important aspect in project success is planning and target formulation. Everyone on the team, as well as other departments in the company, is clear on the objectives. According to the respondents, there is often a little turmoil about goal execution and scheduling after the kick-off meeting, which could lead to a scope departure.

Planning phase. When the design is complete, the cost schedule is often created without the involvement of engineers to compute load capacity and wall thickness. It is hard to construct an exact cost schedule without this information, and this lack of information may have a significant impact on variation throughout the execution phase.

According to the interviews, the planning step is occasionally bypassed and the execution phase is started without any planning. Clients want to start working on the project right away, but it is the purpose of construction businesses to bring the customer and their ideas back to the project.

Execution phase. These types of challenges will definitely show as variances in the execution phase's cost and time when there is a lack of organization and project schedule planning. In the execution phase, a poorly specified structure can lead to chaos, and too much money and time is necessary to execute the project.

The final documentation are finalized, and observations of the lessons learned are made during the closing phase. Analyses of time, scope, and cost deviation results can be valuable and lead to better results for all phases of a project's life cycle, increasing the likelihood of a successful project implementation in the future.

5. Conclusion

This study sought to fill the existing gap in research on identifying project deviation in the construction industry. A project life cycle is a term used to describe the process that each project goes through. This life cycle refers to the complete project process, from the beginning when the project is conceived to the end when the project's lessons have been learnt.

The empirical part disclosed that deviation in project management occurs mainly because to such factors as: 1) the client has too much power regarding projects and sometimes their own project manager's integration into the projects can lead to chaos; and the clients' indecisive requirements about the project have an impact on deviation; 2) the Icelandic culture affects project efficiency and undeniably impacts the organizational structure, with the deviation starting from the lack of structure in the first phase which may lead to deviation in subsequent phases; 3) the project manager plays an important role in project success, but there is a lack of appropriate education, work structure, and the need to change project managers after a project has started have negative impacts on project results and outcomes; and 4) unexpected and difficult-to-control environmental phenomena, such as COVID-19 and extreme weather, will undoubtedly have an impact on a project.

Deviations in projects appear throughout the project life cycle phases, beginning with the defining phase, in which the customer plays an important role. If the customer did not adequately describe the needs in the initial stage, the scope may be impacted, resulting in a lack of planning. Poor project planning and scheduling have an impact on a project's time and cost scheduling in the execution phase. The analyses of deviation results of time, scope, and cost can be useful and lead to better outcomes for all phases of a project's life cycle, increasing the probability of successful implementation of future projects.

This study's analysis was derived from just one company case study from the construction sector in Iceland, and any comparison of results with other companies may find similarities or differences.

There is still a research gap in the construction business when it comes to the results of Icelandic project managers vs foreigners. As a result, it's difficult to say how much Icelandic culture has influenced project success or failure, but this study clearly shows that it has contributed to project deviations.

Because of COVID-19, the semi-structured interviews were organized online. The interviews' organization offline can help to control the flow of interviews better, leading to better observations of human reactions during the interview process.

Author's Contributions

Conceptualization SMG and LZ; Methodology SMG and IM; Data Collection Procedures SMG; Data analysis SMG and IM; Findings and Discussion SMG, L.Z.-J, and IM; Writing—original draft L.Z.-J.; Writing—review & editing, L.Z.-J and IM. All authors have read the manuscript and agreed to the published version of it.

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Competing Interest

The authors declare that they have no competing interests.

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