Learnings from IPAT Assessments that can be used for improving future infrastructure projects.

Author

Sahana Rajanna Reddy

Delft university of technology

Construction Management and Engineering

Student number- 4747437

Committee

Chairman:	Prof. Dr. Ir. M.J.C.M. (Marcel) Hertogh Delft university of technology
Supervisor:	Dr. Ir. Marian Bosch-Rekveldt Delft university of technology
Supervisor:	Dr. Ivana Burcar Dunović University of Zagreb
External Supervisor:	Geertje van Engen NETLIPSE / AT Osborne

TU Delft

Summary

Scope of research

Most of the large infrastructure projects (LIPs) are characterized with significant time delays and cost overruns. In order to be able to deploy the LIPs more effectively, make optimal use of the resources and investments and timely deliver the projects, NETLIPSE was set up. The primary objective of NETLIPSE was to set up a continuous and interactive network for the LIPs throughout the European Union for the sole purpose of dissemination of experience and knowledge, specifically focused on the management and organizational aspects of the LIPs. NETLIPSE developed a project assessment tool called the Infrastructure Project Assessment Tool (IPAT) which helps in evaluating and assessing the LIPs to identify the vulnerabilities present and measure the capability of the project at all stages of its development and delivery. The IPAT assessments provide valuable insights to client organizations to improve their project performance.

With the IPAT tool, several infrastructure projects in Europe were assessed. Since the data of the individual IPATs is owned by the different clients, no thorough comparisons were made so far. The goal of the research was to identify learnings from assessment reports that can be used for improving future infrastructure projects by thoroughly comparing the data obtained from individual IPATs. Additionally, the effectiveness of the tool was evaluated. The primary focus of the research was in line with one of the main objectives of NETLIPSE i.e., learning from projects. This thesis also presents research related to the common theoretical basis identified in various assessment tools and the trends that evolved in best practices and lessons learned over the years and in different project phases.

Methodology of research

The research started with a literature study to identify the common basis of the assessment tools. Here different project assessment tools were evaluated to comprehend the influence of various elements in the assessment tool and process. This was followed by the analysis of data from the assessment reports which were one of the main components of the research as it provided information for the compilation of the research findings. Thirty-one assessment reports were available for the research. These reports were further divided into two data sets based on different version of the assessment tool used. NETLIPSE team had proposed the development of an Infra Maturity Tool which was used to assess first fifteen projects and the IPAT tool was used to assess projects 16 to 31.

The data was analyzed using both quantitative and qualitative methods. For the quantitative analysis, the data from the assessment reports i.e., the scores were clustered according to the project phase. The scores were then graphically illustrated to identify patterns or trends that evolved in different project phases. The qualitative data analysis used comparative cross-case analysis i.e., comparing the data of individual assessment reports of the second data set to the first data set, in order to determine the trends that evolved in best practices and lessons learned over the years. The findings from the data analysis were validated and enriched with examples from practice using expert sessions. Finally, all the information was compiled, and the conclusions of the research were formulated by answering the main research question i.e.,

What learnings from IPAT Assessments can be used for improving future large infrastructure projects?

Research results

The research aimed to elaborate on three aspects to gain a more comprehensive understanding i.e.,

i. The theoretical basis of the assessment tool which helped in recognizing the various elements influencing the assessment tool and the process.
ii. Trends in best practices that evolved over the years and in different project phases.
iii. The effectiveness and the applicability of the assessment tool and the process.

These aspects helped gain an all-round picture of the value of the IPAT tool and the process. By analyzing the insight gained from these aspects helped in identifying the main learnings from the IPAT Assessments that can be used for improving future execution of the large infrastructure projects. The conclusions of the above-mentioned aspects are explained in detail below.

Literature study was performed in order to find the common bases of the assessment tools. The assessment tools analyzed were- the EFQM model, the Spiegel, The Infra Maturity tool and both the versions of the IPAT. Five common elements were identified i.e., themes and scores, context of the project, learning environment, knowledge exchange and the significance of reflection. The IPAT includes all these elements which were also deemed vital in the project assessment tools that were researched. Thus, the elements identified served as an essential basis on which project performance was measured.

The data analysis comprised of analyzing both quantitative and qualitative data from the assessment reports. The quantitative data analysis yielded inconclusive results in order to identify the trends that evolved in different project phases. This was due to the limited data available in each project phase i.e., only a maximum of three projects were analyzed in each phase. From the limited data available, the graphs of projects that deployed IPAT in later phases did not show large deviations in scores when compared to the graphs of the projects that deployed IPAT in the earlier phases. Based on this observation, it was concluded the IPAT assessments are more effective and beneficial when introduced in the early phases of project execution as it provides more opportunities for improvements.

The qualitative comparative cross-case analysis dived into in-depth analysis of the best practices and provided a thorough understanding of how trends evolved over the years presented in the table below. The first column presents the best practice that was identified in the first fifteen projects and the second column presents how this best practice evolved over the years and was identified in projects 16 to 31.

Table i: Trends that evolved over the years

Best Practices Identified	Evolved best practice
Formulate a vision	Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.
Use configuration management to assess the impact of scope changes	Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.
Facilitate liaison with local stakeholders and critics	Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.
Communicate a project management policy	Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.
Include risks and risk reservations in cost estimations	The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.

Best Practices Identified	Evolved best practice
Use a risk database	The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.
Use incentives in the contract	Align the incentives to the project objectives and incentivize the liaison between the contractors.
Be careful with experiments	Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.
If new technology is applied, organize the management of innovation	
Organize expertise and knowledge exchange within the project organization	Extend the knowledge exchange beyond the project organization i.e., national and international projects.

The expert sessions organized with various experts, furnished information regarding the effectiveness of the tool and its applicability in real life practice. The experts acknowledged that the assessments gave the project team an opportunity to take a step back, review the project and learn from it. It also helped the project management team to discover the areas that required more attention. The experts agreed in unison that even if the recommendations were not used in that certain phase or project, the knowledge and insight gained would definitely put to use for the better execution of the project in the next phases and future projects. The experts stated that the introduction of the IPAT at the beginning of the execution phase will prove to be very beneficial to the project and also the conclusion of the quantitative data analysis also supports this claim. Although the IPAT can be introduced in all phases, it is recommended to be introduced at the completion of one phase or the beginning of the next phase. This provides more opportunities where changes can be implemented since not a lot can be changed in the middle of any phase or process.

The IPAT assessments aid in the exchange of knowledge in the form of best practices and lessons learned in the field of project management in order to efficiently deploy LIPs. The research identified five main learnings from the IPAT assessments that can be used for improving future large infrastructure projects. They are-

- The best practices and lessons learned in the field of project management are continuously evolving with time. Being aware of these evolvements are vital for the execution of projects.
- The best practices in the field of project management have broadened to include the overall context of the project and not just focus on the technical aspects.
- The opportunity to improve the project's performance, progress, the processes involved, and outcomes/deliverables exist in all project phases.
- The IPAT assessments promote knowledge exchange. This gives the project management team an opportunity to adopt some of the best practices and customize them according to the requirements of their respective projects.
- The IPAT assessments gives the project team an opportunity to take a step back, review the project and learn from it. Continuous learning from projects facilitates better execution of the upcoming phases or future projects.

Table of Contents

List of Figures

List of Tables

1. Introduction

'"The best way to predict the future is to create it."
- Abraham Lincoln

In a study, Flyvbjerg, Bruzelius, and Rothengatter (2003) found that nine out of ten large infrastructure projects (LIPs) face significant time delays and cost overruns and the troubles with infrastructure governance are particularly well-documented at the delivery end. These delays and cost overruns have a major impact from an economic as well as political point of view. In the twenty-first century, Infrastructure plays a very critical and essential part in global economic growth and productivity. There is extensive evidence that infrastructure development can increase economic growth and reduce levels of inequality (Mwase and Yang, 2012). The delay in the implementation of the project will result in people waiting for the provision of goods and services that are vital for day to day living. The services provided by LIPs also serve as an input for other sectors, and hence the budget overruns in the projects will be responsible for the increase in the capital-output ratio for the entire economy. Large projects by their nature demand more on the project resources than smaller projects. They are demanding due to their size, complexity, schedule, urgency or demand on existing resources and know-how (Morris & Hough, 1987).

Once the initiation of any infrastructure projects begins, the entire timeline of the project from planning, construction to completion is planned ahead of the development phase. An expected date for the completion of the project is also announced. In most cases, the expected date of completion and the actual date of completion doesn't coincide. This time difference of the initially planned dates and the actual completion dates are defined as 'time overrun'. The time difference is measured in days, months or years. Similarly, the difference between the initially projected budget for the project and the final budget that is spent on the project is called 'budget overrun'. The quality of the infrastructure is defined as the document which specifies the quality standards, practices, resources, specifications, and the sequence of activities relevant to a particular product, service, project, or contract.

Large Infrastructure Projects (LIPs) must avoid project delays, budget overruns and poor quality because these factors reduce the efficiency of available economic resources, limit the growth potential and reduce the competitiveness of the economy. Special attention must be paid to the whole life-cycle management of the LIPs, to not only enhance the structural and the functional performances but also improve the durability and the efficiency of the maintenance systems. In 2017, Wegrich, Kostka, and Hammerschmid found that, the governance of the entire life cycle of the infrastructure—from planning and contracting to delivery and maintenance—poses major challenges for governments in both developed and developing countries, and there is ample evidence that the state of affairs is rather far from showing an efficient utilization of inherently limited resources and the taxpayers' money. The management of public infrastructure assets is seen to gain complexity caused by technical, economic, environmental, political and social factors (Godau, 1999). The European Commission (EC) in 2003, reported that there was a need for massive investment in the field of infrastructure, especially in the countries that recently merged with the European Union (EU). In order to be able to deploy the LIPs more effectively, the EU needed a tool which would assist in monitoring and evaluating (both ex-ante and ex-post) these projects (Hertogh, Baker, Staal, Westerveld, 2008). The research into the evaluation of these projects was made possible with the help of NETLIPSE and DIMI which are explained in the following sections.

1.1.1 NETLIPSE

NETLIPSE started as a two year research project in the Sixth European Framework Program 6 (FP6) of the European Commission whose primary objective was to set up a continuous and interactive network for the LIPs throughout the European Union for the sole purpose of dissemination of experience and knowledge, specifically focused on the management and organizational aspects of the LIPs. NETLIPSE is the acronym for: NETwork for the dissemination of knowledge on the management and organization of Large Infrastructure ProjectS in Europe (Hertogh et al. 2008). NETLIPSE started earlier: in 2003, but the name NETLIPSE was introduced in 2004 because of the European Commission proposal. The organization aims to learn by analyzing the successful projects (which are delivered on time, within budget and constraints of quality) and the projects which encountered difficulties in doing the same.

By evaluating and assessing the LIPs to identify the vulnerabilities present, any infrastructure project can learn from them and make use of the lessons to improve the deliverables in the subsequent phases or future projects. An accurate understanding of the current capabilities and requirements of the project is imperative for facilitating a fact-based assessment tool. Hence the IPAT (Infrastructure Project Assessment Tool) was developed by the NETLIPSE network, to measure the capability of the project at all stages of its development and delivery. After completion of the research program in May 2008, the European Commission TEN-T Executive Agency provided funding for the continuation and expansion of the NETLIPSE initiative (June 2008 - December 2010). Besides continuing the networking activities, the development of the 'Infrastructure Project Assessment Tool' (IPAT®) as well as training program was supported. The results of the IPAT assessments help in improving the factors that are hampering the projects' success and also help in identifying the strengths. Thus, these assessments help in enhancing the quality of the management of the LIPs and boosting the chances of the project's success in the subsequent phases. (Staal-Ong, Kremers, Karlsson and Baker,2008).

1.1.2 DIMI

To learn about the infrastructure projects from the research and also help prepare students better to practice and understand the infrastructure systems as a whole, this research is supported by Delft Deltas, Infrastructures & Mobility Initiative (DIMI) who are developing integral solutions for urgent societal problems related to vital infrastructure for water safety and smart mobility, which are intrinsic to the natural and built environment. An integral approach, in which different disciplines cooperate, provides the best guarantee for finding these solutions. TU Delft's Deltas, Infrastructures & Mobility Initiative effectively contributes to sustainable social welfare and economic prosperity in many ways, one of them includes facilitating and stimulating students to conduct research. DIMI aims to continue stimulating innovative student projects and research despite limited resources.

1.2 Problem Formulation

For the sustainable development of society, LIPs must be executed effectively. Due to the scale and complexity, a large percentage of the LIPs in Europe share similar characteristics but are also unique at the national level. Since these projects are often characterized by immense budgets, rising demands and expectations, new technologies and legislation developments, stakeholder involvement and the time elapsed from the inception to the realization of the project, the scope of the LIPs tend to keep altering throughout. All of the aspects contribute to the diverse challenges that are being faced by infrastructure projects. Kostka and Anzinger (2016) have reported average cost overruns in the transportation sector of 29 percent for Germany, 17 percent for the Netherlands, and 22 percent for northern European countries.

Since the data of the individual IPATs is owned by different clients, no thorough comparisons have been carried out so far. The NETLIPSE will help in facilitating the information of the assessment reports and by analyzing and comparing the information obtained, the key stakeholders i.e., NETLIPSE member organizations will not only benefit from the lessons learned but also make use of them to deploy LIPs more effectively, fulfill the demands and meet the stated ambitions of the project that are being executed and for the future projects that will be undertaken. The identification of critical factors that affect a project's successful outcome in a dynamic and multiple stakeholder context has a huge impact on the project delivery organizations. In-depth research and comparisons of the assessments and the success factors will paint a clearer picture of the 'Best practices' and address the issues that are challenging today: contracting and procurement, partnering, stakeholder engagement, Human Resource Management: finding the right people to do the work and funding and various other contributing factors. Hence the IPAT Assessments will solve today's needs and help prepare for tomorrow's needs.

The IPAT assessments do provide valuable insights to client organizations to improve their project performance. The IPAT has been developed from extensive literature research and practical knowledge. However, the extent to which the transferred knowledge and insights from the assessments have been utilized are unknown and this prompted the need to evaluate the IPAT assessments and review the effectiveness of the assessment tool.

1.3 Research Objective

With the IPAT tool, several infrastructure projects in Europe were assessed. The IPATs were performed in different countries, for different clients, in different project phases and with different teams of assessors, but the common goal of the assessments was that the assessed projects (and their assessors) would learn from the assessment sessions. Since the data of the individual IPATs is owned by different clients, no thorough comparisons have been made so far. By thoroughly comparing the data obtained from the individual IPATs, the research aims at identifying the trends and common lessons learned from the IPAT assessments to improve the future execution of the LIPs. The main focus of the research is the effectiveness of the assessment tool in improving project delivery and the influence it has on the project management team, client organization and project managers of the LIPs.

1.4 Research Question

NETLIPSE mainly aims at gathering, analyzing and disseminating the information about the lessons learned, best practices and the experiences in both organization and the management of the LIPs in Europe which is made possible by using the project assessment tool that they developed. From the 31 assessment reports that are available (Table-4), the research intends to establish an emphasis on the success factors, elaborate the benefits of learning from the past and the present projects and also recognize the trends that have evolved since the start of the assessment process. The effectiveness of the IPAT assessments will also be evaluated based on the themes since the project's success is dependent on them. To achieve the research objectives stated in the previous section, the main research question can be formulated as follows:

What learnings from IPAT Assessments can be used for improving future large infrastructure projects?

To answer the main research question, a series of sub-questions will be answered to gain a broader understanding of the generalized findings of the assessment tool and hence answer in detail the various aspects of the main research question. The sub-questions can be framed as-

1. What are the theoretical bases for the project assessment tool?

This question will help set strong theoretical foundations for the project assessment tool. The literature research on the existing project assessment tools will help to investigate the potential effect of all the contributing factors based on scientific literature available which relates to these elements.

2. What are the trends identified in the results of IPAT assessments in terms of focus areas?

a. Over the years
b. In different project phases

As assessments have already been performed for 31 projects, by analyzing the final reports of the assessments if there are any gradual or sudden changes in trends, it can be noticed from the diverse projects over the years and also in the different project phases. This will help derive any general trends in project management.

3. How effective are the IPAT assessments and when is the best time to introduce it in the project lifetime?

This sub-question will help in finding the practical use of the assessments in real-life projects and also find to what extent the recommendations are implemented in the project. With the help of expert insight, the best time to introduce the assessment tool in the lifetime of the project in order to obtain maximum benefits will be answered.

4. What findings from the assessments can be generalized and used for improving future LIPs?

After analyzing the data obtained from the literature study, assessment reports and the expert sessions; the general findings of how the lessons learned can be used to improve the future LIPs will be elaborated.

1.5 Report structure

The overview of the report and a short description of all the chapters included are discussed in this section.

Chapter 1: Introduction

The report opens with the introduction to the context of the research and then discusses the characteristics of large Infrastructure projects and how they are of vital importance to society. It discusses the crucial problems the infrastructure projects face and the necessary actions that are taken to solve the problems. This is followed by the introduction of the organizations- NETLIPSE and DIMI that support and fund the research and also elaborate on the main focus of the research i.e., IPAT assessments.

Chapter 2: Research design

This chapter discloses the scope of the research and the different approaches and the methods the research follows during literature study, data collection and analysis, expert sessions and finally the compilation of the results.

Chapter 3: Literature study

The findings from the literature study are elaborated in this chapter where the elements of the assessment tool are evaluated, and the theoretical bases are researched by comparing it to the existing project assessment tools that are in use. This chapter also presents of the structure, elements and key definition of terms used in the assessment tool and the reports.

Chapter 4: Document analysis

This chapter presents the results of the qualitative and quantitative document analysis. The discussion of the quantitative data from the documents i.e., scores will demonstrate the trends that developed in different ProJet phases. The evolution of trends over the years are identified by comparing all the similar characteristics identified in the IPAT reports (Projects 16 to 31) per theme to the best practices and lessons learned from the Infra maturity tool reports (Projects 1 to 15).

Chapter 5: Expert sessions

The expert sessions are very vital to evaluate all the perspectives of the project managers and the client organizations to gain insights into practical knowledge. The information is also used to validate the findings and clarify any doubts regarding the specific area of knowledge.

Chapter 6: Discussion

The discussions regarding the methodology used for the research and all the findings, outcomes from the research are elaborated in this chapter. The challenges encountered and limitations of the research are enclosed in this chapter.

Chapter 7: Conclusions

The findings from the research are presented in this chapter by answering the sub-questions and then reiterating and compiling the information obtained to answer the main research question and then wrap up the research with final comments. The recommendations for future research and practice are also formulated in this chapter.

2. Research Design

This chapter will give the structure and the design of the research. It also elaborates on the research approach used and the research methods used in every step.

2.1 Scope of research

The learnings from assessment reports that can be used for improving future infrastructure projects are the central focus of this research. Since the lessons learned from the initial protocol to evaluate the projects, were available (Hertogh et al. 2008), the research focused on the learnings from the IPAT reports. There are a total of 31 projects (Table- 4) analyzed with both versions of the tool. NETLIPSE team had proposed the development of an Infra Maturity Tool which was used to assess the first fifteen projects and the IPAT tool was used to assess the rest of the projects.

The assessment tool has been applied to projects all over Europe and large amounts of data had to be analyzed. Due to the international aspects of the data available, some inconsistencies were noticed regarding the structure of the gathered data. Therefore, the research followed a post-positivist approach i.e., the method to be applied in the research was selected based on the research question being addressed (Wildemuth, B. M., 1993). The projects assessed are in the geographical scope of Europe and the focus of the research is the application of the learnings from the assessments in the context of large public infrastructure projects.

2.2 Research Approach

Since there are no prior researches done on the learnings of the IPAT, exploratory research provides flexibility (Ben Baarda, 2010) in analyzing the broad and scattered data. By determining the best design for the research, methods for data collection and subject selection, this research has been characterized as exploratory research.

The research approach and the steps followed are shown in figure 1. The first part of the research focused on data gathering and structuring. The second part of the research focused on the interpretation analysis of the collected data with the help of expert sessions. The method of research used will be elaborated in this section.

Figure 1:Research approach

2.2.1 Literature research

The main purpose of a literature review is to evaluate the existing knowledge on a certain topic. This helps in recognizing the gaps in knowledge where further research is needed by critically analyzing the limitations of the information available. The literature research will also provide the foundation on which the research can build on.

In this research, the literature study focused on evaluating the existing project assessment tools and identifying the common elements that characterize any project assessment tool. An in-depth study of a

few of the extensively used assessment tools not only provided insights into the common elements of the tool but also elaborated on the characteristics of these elements based on management and engineering literature. This step aids in answering sub-question 1 of the research.

2.2.2 Data collection

After identifying the research gap and defining the problem, accurate information from relevant sources and databases was necessary to answer the problem, compile the findings and then evaluate the outcomes. Data collection plays a very crucial step when the research depends on a qualitative approach.

The fundamental data that the research used was obtained from the assessment reports of all the projects. These assessment reports were compiled by NETLIPSE assessors who gathered all the individual project data, analyzed it and then presented their conclusions in the assessment reports. These assessment reports are confidential and were disclosed for the sake of research after obtaining the required permission from the respective NETLIPSE member organizations. Since the reports consisted of large amounts of data, it had to be summarized and structured so the analysis of all the data would be easier. So, this step not only focused on gathering the data but also condensing and structuring it. The assessment reports provided both qualitative and quantitative data. Since the research includes expert sessions, data will also be compiled from these sessions. The experts share their knowledge, experiences and opinions which provides a practitioner's perspective in real-life projects.

2.2.3 Data analysis

The data related to the project facts and figures, stakeholder analysis and the project history will be obtained from case study reports from open sources on the internet and from the members of the NETLIPSE organization. A desk study was the first step in the analysis of the data collected where all reports were studied in detail. The large volumes of data were condensed into short meaningful insights that acted as the base document for answering sub-question 2. The results in this type of case study research can be improved by working with a comparative element that enhanced the external validity of the research. Hence the analysis of the collected data is done through a qualitative comparative cross-case study i.e., comparing the data of individual assessment reports.

The interviews with the experts were used as a means to collect information and validate the findings of the research. The data obtained will further be analyzed using an Inductive analysis. The primary purpose of the inductive approach is to allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies (D. Thomas, 2006). The inductive analysis comprised of looking for patterns, developing theory and identifying themes by studying documents, recordings and formulated hypotheses. Researching the case studies was one of the best ways to gain information and knowledge pertaining to the best practices of management and organization of the large infrastructure projects. The analysis of the knowledge gained from the above steps mentioned will be evaluated based on qualitative cross-case analysis and this information will then be used to develop a prioritized approach to addressing the issues identified through the IPAT assessments and therefore answer the stated research questions.

The assessment reports not only provided the project facts, figures, stakeholder analysis and the project history, it also provided the best practices and lessons learned and the areas of improvement per theme for every project assessed. The analysis of this data is done in an open, direct and structured way. The

focus of the data analysis was to draw inference from the reports and the expert sessions on how the trends are evolving over the years and in different project phases.

2.2.4 Expert sessions

The expert sessions are vital when the empirical evidence available is insufficient to validate the proposed hypothesis and findings (Kane, 2013). The knowledge and experiences shared by the experts give valuable insights as they have practical experiences and exposure to their specific areas of knowledge. Expert opinions are instrumental to validate findings and may modify previously established theories and concepts, which may lead to more accurate versions. The theories that are backed by many experts have a small percentage of uncertainty and doubt. The combined testimony of many experts from one or many areas of knowledge leads to an overall better understanding of the solutions to the problems defined.

The combination of literature and the insights received on the application of the IPAT was used to analyze the IPAT assessments in its totality. The findings of the data analysis were validated during the expert sessions with a carefully curated set of questions regarding the projects. The expert sessions mainly comprised of skype meetings, face to face meetings and discussion with the experts. The statements made by the interviewees described several perspectives on project success which was analyzed and compared.

3. Literature Review

This chapter will give a brief overview of existing project assessment tools i.e., the EFQM model, the Spiegel model and the IPAT. These models are quality management models used in assessing the infrastructure projects in the recent years of project assessments and are extensively used in recent years.

3.1 EFQM Model

The European Foundation for Quality Management Excellence Model (EFQM) has become a very popular tool for not only assessing organizational performance, i.e. business excellence, but as an operational framework for implementing Total Quality Management (TQM) (Curkovic et al. 2000; Yong, Wilkinson 2001; Lee et al. 2003; Bassioni et al. 2004, 2005). EFQM was originally developed as a quality management system in 1991 (Hillman 1994) by the European Foundation for Quality Management (now known as just EFQM). The EFQM Excellence Model was also modified to make it fit project organizations. In 1999 Eddy Westerveld developed the 'Project Excellence Model' (Westerveld, 2003). Westerveld uses the five project types in his model but disregards the normative idea that level 5 is always the best possible level. Instead, the characteristics and context of the project determine which project type fits best. The basic use of the Project Excellence Model is for measuring and improving project organizations. EFQM is a non-profit foundation formed by a group of leading European organizations to develop a framework to help improve the effectiveness, efficiency and competitiveness of organizations in Europe. It is a platform that enables the members to share their knowledge, experience and learning. The main purpose of EFQM is to assess a company's business excellence by identifying deviations of performance from best practice and generating a stimulus in the form of improving activities (Beatham et al. 2004).

3.1.1 Components of EFQM model

To efficiently utilize resources and deliver quality products, organizations need to effectively understand and manage drivers, people and processes beyond their organizational boundaries. The model comprises of three components- the fundamental concepts, the nine criteria and the RADAR logic. The EFQM excellence model provides a holistic assessment tool that can be applied to any organization. It helps the project organization to understand how effectively they understand the needs and expectations of their key stakeholders? how robust their strategic planning processes are? how effectively and efficiently they implement their strategy? The key strengths that will help the organization to achieve its objectives and the priority improvement actions that will help them perform better. The excellence model is regularly reviewed to ensure it continues to reflect the challenges, thinking and practice organizations face.

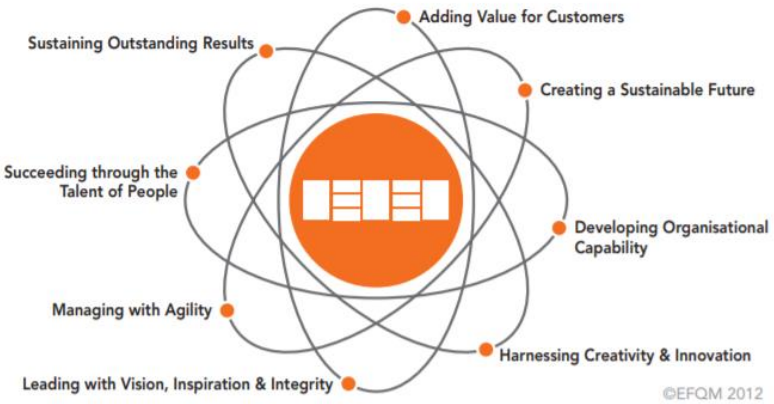


Figure 2: Fundamental concepts

There are eight fundamental concepts (Figure 2), these are the basic values and principles that form the foundations for the EFQM excellence model. The model defines the behaviors, actions and outcomes that are expected in an excellent organization. However, as it's a nonprescriptive framework, it does not say how these should be achieved. The RADAR is a simple but powerful management tool, that helps to drive continuous improvement (Figure 3). At its highest level, the RADAR states that the organization needs to define the results they need to achieve so that they can achieve their strategic objectives. The organization has to develop approaches that will deliver these results and then systematically deploy these approaches. Lastly, they have to assess and refine the impact of these approaches based on analysis and learning.

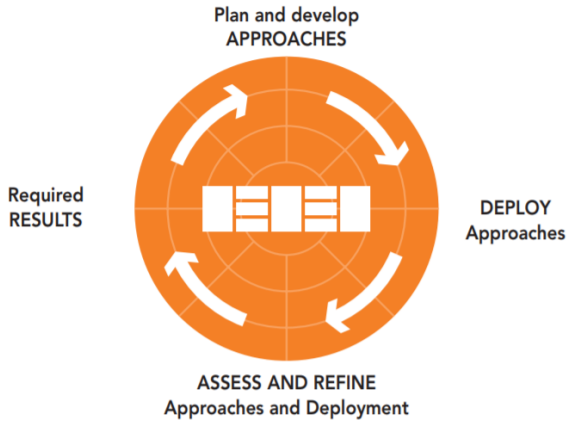


Figure 3: RADAR

The nine criteria are probably the most recognizable part of the EFQM excellence model. Basically, it works as a cause-and-effect relationship between the enablers and the results as shown in figure 4. If there is a need for change in the results then, something must change within the enablers. To achieve sustainable excellence there must be clear alignment between the different parts of the organization, this is represented by the lines between the boxes in figure 4 as none of the criteria can be viewed in isolation. Regardless of size or sector, the leaders must clearly define and communicate their vision, they must develop strategies that turn this vision into concrete actions and objectives and they must focus their people, partners and processes and other resources on delivering products and services that create value for their customers. They must also achieve a balanced set of results aligned to the needs and expectations of their key stakeholder groups. That is the logic behind the EFQM excellence model.

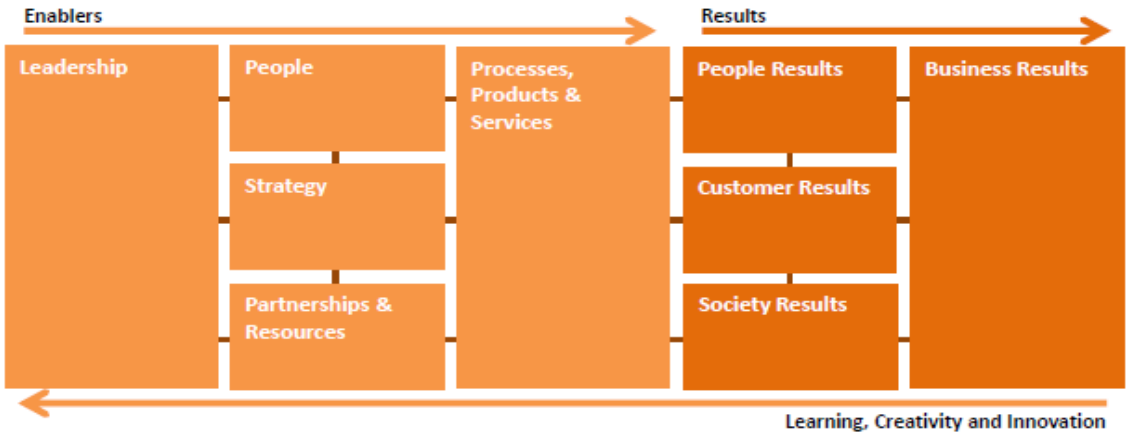


Figure 4: Criteria of the EFQM model

3.1.2 The Evolution of the EFQM Excellence Model

The nine-box model is perhaps the most recognizable symbol of EFQM. The theoretical and the practical nine-box framework was the result of years of research and development and still forms the heart of the EFQM excellence model. This is now a familiar framework i.e., five enablers that represent the policies, processes and practices that an organization uses to develop and deliver its strategy and the four key result areas that track the progress against the needs and expectations of their stakeholders. However, when it was first unveiled in 1992, the inclusion of impact on society amongst those four result areas raised more than a few eyebrows but this is perhaps the most visual example to support the view of something once considered excellent becoming the norm. Back then there was much debate about the need to consider society as a stakeholder, only a handful to question the need for an organization to take its social responsibilities seriously.

Past studies show that regular use of performance management (PMM) models, i.e. the EFQM Excellence model (EFQM), positively influences business results (Qureshi et al. 2009; de Leeuw, van den Berg 2011; Bayo-Moriones, Merino-Díaz de Cerio 2001), especially in encouraging continuous improvement through self-assessment and benchmarking (Niven 2006). While the nine-box framework has remained, the contents within have evolved over the years to ensure that the model remains as relevant today as the day that it was launched. Introduced in 1999 the fundamental concepts of excellence, now form the foundation on which the model is built. Indeed, during the review cycle of the model, this is the first aspect to be discussed to ensure the emerging trends and challenges that are being faced, are included in the framework. The final part of the EFQM excellence model is the RADAR. The cycle of continual improvement that drives organizations forward. As with many things the EFQM, RADAR is an acronym. The concept is simple- define the results that must be achieved, determine the approaches that would deliver that result, deploy the approaches, assess the progress with appropriate measures and refine what has been done based on learning and innovation. Whilst the RADAR concept was there from the beginning, the RADAR scorecard was not introduced until 1999. Since then it's undergone its own improvement cycles to produce a tool that guides management decisions with insightful feedback. So, three components that make up the EFQM excellence model- the concepts, the criteria and the RADAR.

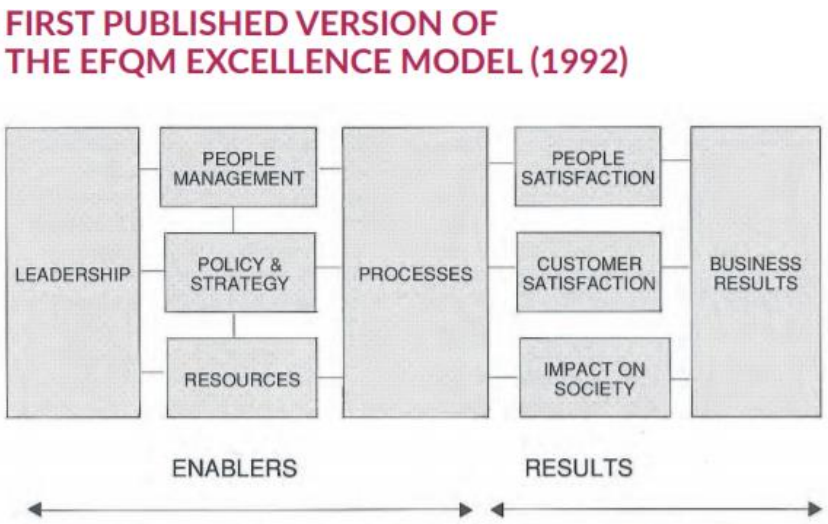


Figure 5: European model of self-appraisal

3.2 Spiegel

The Spiegel is an interactive team reflection method that was developed around 2011, which is facilitated by the Neerlands diep. It is short for 'projectmanagementspiegel'. The master thesis of Thomas Hustinx,2017 stated that the main essence of this tool is discovering various perspectives on how a project can be controlled and managed. The Spiegel contains multiple steps which consist of peer meetings which facilitate the project management team to evaluate themselves by self-reflection and also be evaluated by the network of peers from Neerlands diep i.e., peer reflection. The project team is scored individually by the members of the project team and collectively by the peers on ten aspects of the management themes which in turn consists of five sub-aspects. The interim report presents the captured scores and views of both the groups which will serve as a basis for the discussion on different viewpoints. This report also guides the team to formulate the improvements that can be incorporated into the project. During this process, new insights are gained into how improvements can be achieved by the exchange of experiences and perceptions. The final report will present the main outcomes of the Spiegel.

Two parties benefit from the project management Spiegel i.e., the project team and the peers. When the Spiegel is performed during the project, it focusses on learning for the project team whereas the evaluation Spiegel which is executed at the end of the project, focusses on peers learning from it. The aim of the Spiegel is to raise the level of the project management by facilitating the peers to reflect on the actions of the project team and the project team to reflect on their own actions. To focus the learnings, Spiegel constitutes of ten management aspects i.e.,

1. Politics and government: This aspect includes all the relations and connections to the client of the government and politics.
2. Organization and control: The structure in which the organization is set up and manged is dealt with this management aspect.
3. Culture: This management aspect deals with the significance of culture and the influence it has on the project.
4. Area/Stakeholder: This aspect mainly represents the impact of and on the directly related environment of the project.
5. Communication: The aspect exhibits how communication in the project takes place and managed.
6. Innovation: The innovation involved in the project is dealt with under this aspect.
7. Project Control: The way of management and control of the project is discussed in this aspect.
8. System integration: This aspect deals with the integration of various processes and sub-projects within the project.
9. Contracting: All matters regarding contracts and cooperation with the contractors are dealt with in this aspect.
10. Conditioning: All issues and affairs related to the prep of the construction site.

The management aspects further consist of five sub-aspects. They are- the base, functioning, risks, people and a management aspect specific subject. The management aspects of the project are scored individually by the members of the project team and collectively by the peers. A combination of a central question and several sub-questions help in explaining each sub-aspect per management aspect. The main input of Spiegel is the experience and the views of people participating in the process i.e., the project team members and the peers.

3.2.1 Formal procedure of the Spiegel

The Spiegel consists of three important roles i.e., the facilitator, the coordinator and the project manager. The facilitator is responsible for the participation of the peers in the process and also plays a crucial role in the Spiegel process as she/he is responsible to set up an open, interactive and informal environment where learning is most effective. The coordinator is responsible for coordinating all the activities that take place during the Spiegel process and make sure all the activities run smoothly. The project manager is responsible for the setting up of the project team who will participate in the Spiegel process. The Spiegel consists of six steps (figure 6) and the participants do not take part in all the six steps. The peers will participate in steps two, four, five and six whereas the project team members will participate in steps one, three, four and six.

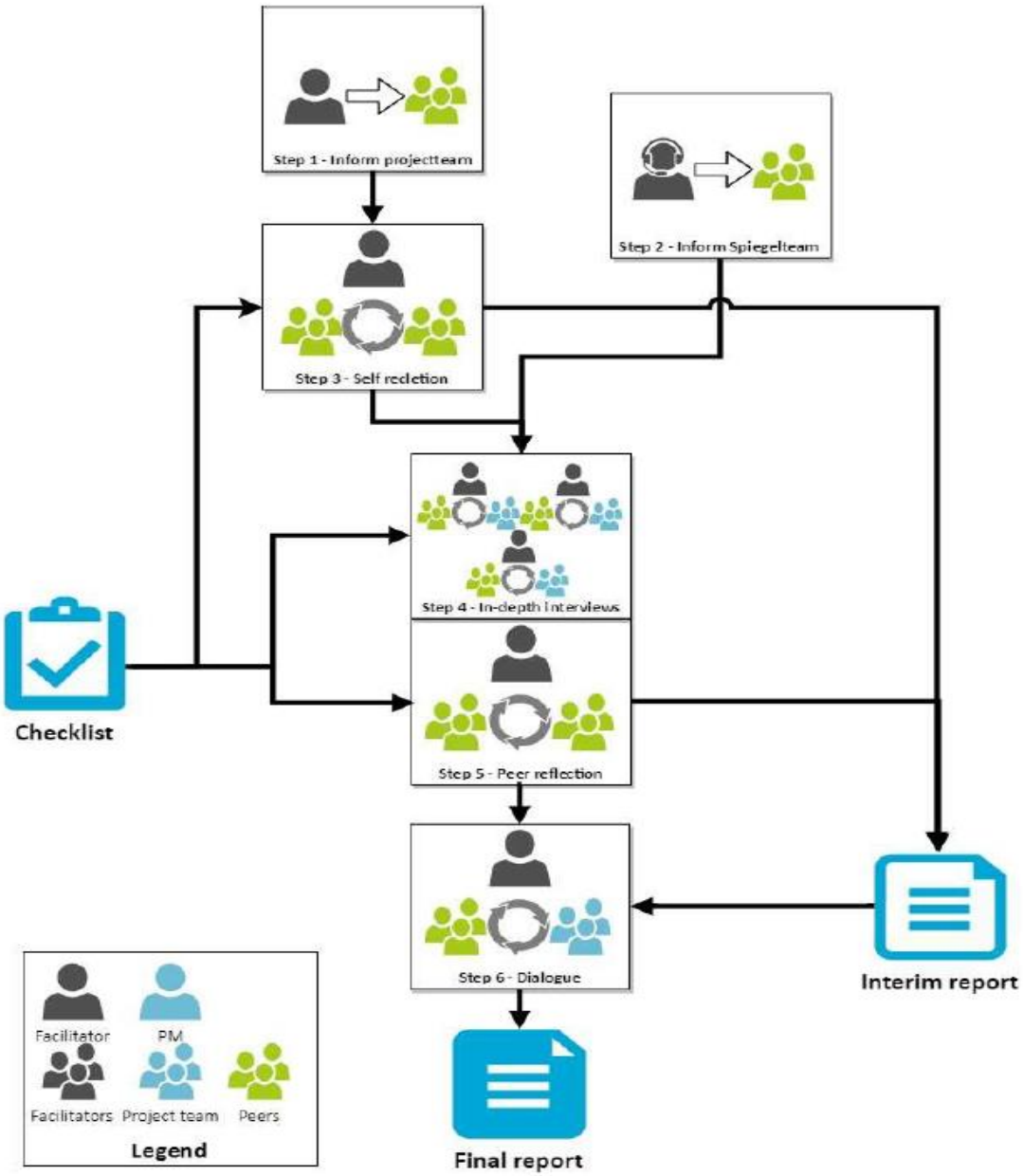


Figure 6: Schematic representation of Spiegel

As shown in figure 6, the Spiegel procedure follows six steps, at the end of which the deliverables i.e., the final report will be produced. The six steps are explained below.

Step-1: Inform project team

This step is comprised of organizing the project team and informing them about the procedures and processes involved. It also helps the participants to get acquainted with each other and prepare themselves for the upcoming steps. During this meeting, the participants from the project team will have to assess the organization of the project individually and then score the management aspects and sub-aspects corresponding to the project at home based on a checklist given. This must be submitted to the coordinator of the Spiegel by the start of step three.

Step-2: Inform Spiegel team

A meeting in the form of a webinar is used to inform all the procedures and the process to the peers and also clarify any doubts about the same. At the end of this step, the peers receive a set of documents that contains all the information regarding the project.

Step-3: Self-reflection

The meeting focusses on discussing the scores of each individual team member accompanied by exchanging all the considerations and arguments with the whole team. All the information and the insights shared during this process are recorded by a scribe.

Step-4: Interviews

To gain a clear understanding of the project organization and then assess the project with the given checklist, the peers will be given a chance to interview the members of the project organization in this step. These interviews will be done in three rounds by three groups where the aspect in focus for each group is different every round. The Spiegel coordinator will divide the participants into groups based on their expertise and their preference.

Step-5: Peer reflection

The meeting focusses on discussing the scores of the peers who assess and score project organisation based on the different management aspects and sub-aspects. This is accompanied by exchanging all the considerations and arguments with each other. All the information and the insights shared during this process are recorded by a scribe.

After the completion of this step, the arguments presented, and the scores shared by both the peers and the team members are used to prepare the confidential interim report. This report will be sent to the peers and the project team members before the commencement of step six.

Step-6: Dialogue

The formulation of the recommendations and conclusions on the relevant themes are done in this step based on in-depth discussions of the scores and insights shared by the peers and the project organization. This information is then presented in a final report to the project manager which will later be accessible to the public after relevant permissions are granted. The final report could be more effective if the presented information gave more context on the project and the process.

3.2.2 Spiegel elements

The Spiegel is characterized by several elements within the learning process to aid maximum learning and knowledge sharing. These elements and their effects are explained below.

- Learning Environment
  This element is very vital in providing the ideal situation for the entire project team to learn during the Spiegel process. It is aimed to create an open, interactive and an informal setting of the environment to assist the participants to speak out freely.
- Learning from experiences
  As the Spiegel focusses on taking lessons from both the peers and the project team, this element provides valuable insights gained from direct experiences or experiences gained by other team members that can benefit the learning process.
- Peer reflection
  During the peer reflection, Spiegel uses both internal and external peers from other organizations. The use of peer reflection from the outside facilitates the project to shift focus from action to reflection for a moment and also generate an innovative approach to reflect. However, the downside to external peers is the presence of boundaries due to cultural and organizational differences which makes it difficult for the reflection process and procedures between the organizations.
- Facilitator
  The main responsibility of the facilitator is to assist the process of the Spiegel in a neutral direction. The use of an external facilitator aids in incorporating a success factor in learning i.e., the external facilitator is unbiased and not influenced by personal gains or relationships. Thus, more critical to the entire Spiegel procedure.
- Deliverables
  The main deliverable of the entire process is the final report which contains the important lessons learned and the finding of the process. This report is also published on the internet to provide access to the public. However, the context and considerations are not explicitly mentioned in the report. The context can be ambiguous and hence misunderstood, this poses a difficulty for people who want to apply it to their own project.
- Timing
  The Spiegel process can be applied at any time i.e., during the project (PM Spiegel) or at the completion of the project (evaluation Spiegel). Though there are no strict rules on when the Spiegel should be applied during the project, it is very crucial to deploy it at the right moment. When it is performed too late, the team can be disbanded or focussed on something else, which makes them less motivated to participate. It could also be performed too early before the team could really determine what could have been improved.

The combination of all the elements mentioned above will aid in the maximum learning and sharing of knowledge. The Spiegel is a unique interactive approach to learning, where all its participants working on any construction and infrastructure projects benefit from the (practical) knowledge developed. Though this process ensures learning, the extent to which it is done is unclear.

3.3 Assessment tool developed by NETLIPSE

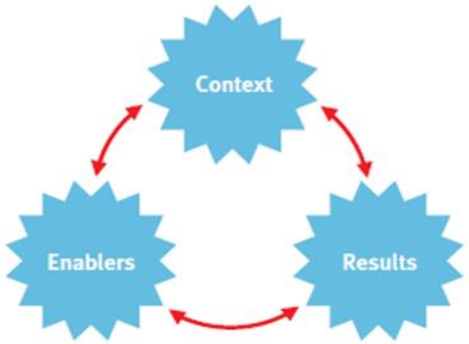
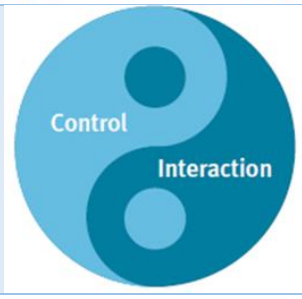
As most of the large infrastructure projects realized in Europe ran into unforeseen cost overruns and time delays, the huge amount of investments of the European Commission (EC) funds seemed ineffective. This resulted in the need to improve the insights of EC regarding the execution and the feasibility of the infrastructure projects so that the capability of funding becomes more effective. To fill the gap that exists between evaluating the management and organization of projects, NETLIPSE developed the project assessment tool with the primary goal of efficiently deploying LIPs. In 2006-2008: NETLIPSE research protocol developed an Infra Maturity Tool and later in 2009-2010 a different version of the assessment tool was developed called the IPAT (Infrastructure Project Assessment Tool) with existed of 12 themes. From 2018 to date the IPAT version 2 has been in use with existing 8 themes.

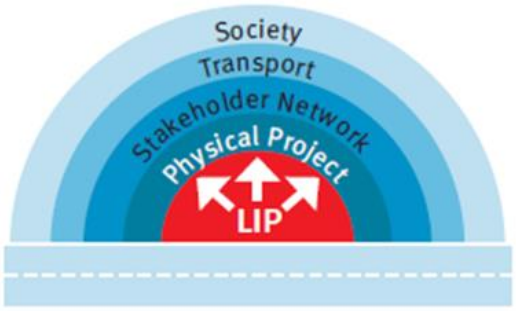
The research protocol developed an Infra maturity tool which was set up as a quality model that can deliver input for designing project organization and processes during the execution phases of the project. It can be used from an early project phase to judge the feasibility of a project; as a monitoring tool during the successive phases of execution, towards the delivery of the project and the start of operation; and in ex-post evaluation (Hertogh et al. 2008). The IPAT can help assess, monitor, benchmark and evaluate transport projects, before, during and after implementation in a complete and uniform manner. The IPAT measures the capability of a project at all stages of its development and delivery. The results give an independent peer assessment of the project organization, identifying strengths but also any areas for improvement that need to be addressed to ensure success (Staal-Ong et al. 2008).

3.3.1 Elements of the assessment tool

The assessment tools were developed on the same foundation of the project management principles. The theoretical bases of the project assessment tool can be formulated based on the core elements identified and the relationship between them. These elements and their dynamic relationships form the basis of the project evaluation. By evaluating the performance of the project based on these fields, the success or the failure of the management of the project can be determined. The basic elements (table-1) identified are-

Table 1: Basic Elements of the assessment tool (Hertogh et al. 2008)

	**1. Relationship between context-enablers-results** The 'Enabler' criteria consist of all actions that the organization adopts or uses, and 'Results' criteria consist of what the organization achieves. The enablers cause results and to see any changes in results: the enablers must be modified. This relationship is dynamically dependent on the 'Context' of the project.
	**2. The level of control and interaction in project control** The balance between flexibility (the openness and the ability to adapt) and rigidity (control) of project control is a key success factor in organizing and managing the infrastructure projects. The aim is to find a balance between the two extremes.



3. The level of shared perceptions

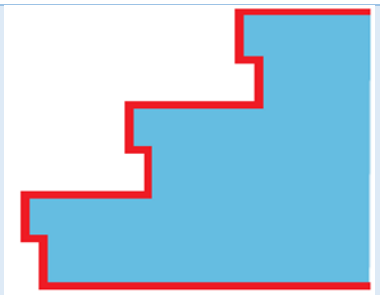
The infrastructure project should not only be seen as a physical project that needs to executed based on the time, money and scope constraints, but should also consider the bigger picture of how it can satisfy all the stakeholders, improve the transport link and hence contribute to the social and economic growth of the society as a whole.

4. The relationship between hard factors and soft factors

- In the 'enablers' criteria WBS, legal consents, etc form the hard factors and leadership and teamwork form the soft factors.
- In the 'results' criteria time, funding and scope are hard factors. Satisfaction of stakeholders and the project team are soft factors.
- In the 'Context', the legislation is a hard factor and culture is a crucial soft factor.

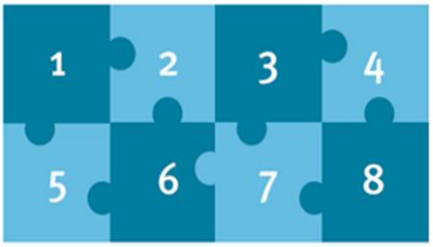
5. Model and Expert Judgement

The expert's views and experiences in the form of discussion, scores and arguments are the source of inputs in the evaluation process, the expert judgement and desk research plays an important role while considering the dynamic relationship between the context-enablers-results.



6. Levels of maturity

During the benchmarking and evaluation, the projects assess, it is convenient to define the level of maturity of the project. This will provide insight into what level of focus is required in the internal and external, hard and soft factors to improve the organization and management of the project.



7. Themes incorporated in the assessment model

The themes characterize the infrastructure projects. By evaluating the project's progress both quantitatively and qualitatively based on pre-defined themes, areas of improvement for the project can be analyzed.

The assessment tool does not guarantee project success. However, when the quality of the management of a LIP is high, the chance of project success increases significantly. The above elements aid in improving the quality of management in projects which influence the outcomes of the project.

3.3.2 Themes of the assessment tool

The main distinction between the different versions of the tool is mainly the composition of the management themes that the project is scored on. The different themes and the sub-themes used in the tool are given below.

1. The management themes in the tool developed by NETLIPSE i.e., Infra Maturity Tool are –
    - Theme 1: Objectives and Scope
    - Theme 2: Stakeholders
    - Theme 3: Finance
    - Theme 4: Project Organization and Management Processes
    - Theme 5: Risks (Threats and Opportunities)
    - Theme 6: Contracting
    - Theme 7: Legal Procedures
    - Theme 8: Knowledge and Technology

2. The management themes in the IPAT version 1 are-
    - Theme 1: Political Context
    - Theme 2: Objectives, Purpose and Business Case
        - Sub-theme 2a: Objectives and Purpose
        - Sub-theme 2b: Business Case
    - Theme 3: Functional Specifications
    - Theme 4 Interfaces
    - Theme 5 Stakeholder Management
        - Sub-theme 5a: Stakeholder Identification
        - Sub-theme 5b: Strategy and Management
    - Theme 6: Finance
        - Sub-theme 6a: Funding Plan
        - Sub-theme 6b: Cost Control
    - Theme 7: Legal Procedures
        - Sub-theme 7a: Project Purpose
        - Sub-theme 7b: Identification and Mapping of all Procedures
        - Sub-theme 7c: Management of Legal Procedures
    - Theme 8: Technology
        - Sub-theme 8a: New Technology
        - Sub-theme 8b: Technical Uncertainty
    - Theme 9: Knowledge
        - Sub-theme 9a: External Knowledge Management
        - Sub-theme 9b: Internal Knowledge Management
    - Theme 10: Organization and Management
        - Sub-theme 10a: Organization and Structure
        - Sub-theme 10b: Human Resource Development
        - Sub-theme 10c: Culture
    - Theme 11: Contracting
        - Sub-theme 11a: Contract Strategy and Plans

    - Sub-theme 11b: Contract Management (CM)
    - Sub-theme 11c: PPP-projects
- Theme 12: Risks (Threats and Opportunities)

3. The management themes in the IPAT version 2 are-
    - Theme 1: Political Context
    - Theme 2: Objectives, Purpose, Business case (value) and scope
        - Sub-theme 2a: Objectives and Purpose
        - Sub-theme 2b: Business Case (Financial Feasibility)
        - Sub-theme 2c: Scope
    - Theme 3: Stakeholder Engagement and Communication
        - Sub-theme 3a: Stakeholder Engagement
        - Sub-theme 3b: Stakeholder Communication
    - Theme 4: Risk Management and Project Controls
        - Sub-theme 4a: Costs and benefits
        - Sub-theme 4b: Planning
        - Sub-theme 4c: Risk (Opportunities and threats) Management
    - Theme 5: Organization and Management
        - Sub-theme 5a: Organization and Structure
        - Sub-theme 5b: Human Resources
        - Sub-theme 5c: Project team and culture
        - Sub-theme 5d: Knowledge Management
    - Theme 6: Permits, Authorizations and Consents
        - Sub-theme 6a: Identification and mapping of all permits, authorizations and consents
        - Sub-theme 6b: Management of all permits, authorizations and consents
    - Theme 7: Technology
        - Sub-theme 7a: Functional Specifications
        - Sub-theme 7b: Choice of technology
    - Theme 8: Contracting and Procurement
        - Sub-theme 8a: Contract Strategy
        - Sub-theme 8b: Procurement Strategy
        - Sub-theme 8c: Contract Management

The themes play a major role in evaluating factors that contribute to the success or failure of the project. The themes also consist of several sub-themes that contribute to the entirety of the management theme. By splitting the themes into sub-themes, it gives a clearer picture of all the influencing factors and also addresses them in detail.

3.3.3 Scores

Every project assessed is scored on management themes, receiving a score of 1, 2, 3 or 4 points (see Table-2). As a backbone to the assessment, the assessors use a questionnaire consisting of possible topics (per theme) to be discussed in order to be able to score the themes. The total score is calculated and presented in the assessment report, as well as a score per management theme as well as the relevant weighting for the milestone (phase of the project) scored.

Table 2: Explanation of the scores

Score	Label	Reflects
1	Very negative contribution to a successful project	An immediate need to review and improve
2	Negative contribution to a successful project	An urgent request to improve (weakness)
3	Positive contribution to a successful project	Generally good with areas for improvement
4	Very positive contribution to a successful project	Very good and incorporating best practice

3.3.4 Project Phases

The IPAT assesses primarily the current and future performance of a PDO and C/S. Therefore, the IPAT is applicable from the initiation of a project until after completion. The IPAT distinguishes seven project phases that are defined in terms of Milestones (M) that mark the start of the next project phase. Around these milestones, the IPAT is to be applied. The weighting factors of the management themes differ over the project phases (= milestone) as different themes are relatively more or less important at each milestone stage of a project. The milestones are clearly defined in table 3 and the project phases distinguished in the IPAT are explained below:

Table 3: Project Phases

Description	Project Phase
Initiation of the project	M1
Funding assembly	M2
Planning application	M3
Tender	M4
Execution	M5
Test operations	M6
Operation	M7

1. M1: Initiation of the project
   The Initiation phase involves defining the objectives, purpose and business case of the project. Although in this stage a defined solution is not a requirement, but identification of strategy with a preliminary understanding of societal and transport benefits.

2. M2: Funding assembly
   Funding is the most crucial part of a project and to obtain the grant for the funds it is necessary to have well-drafted notes on project justification (scope, costs and benefits for the society), support, confirmation on affordability and knowledge of how it is to be funded, delivery and contract strategy, interactive feedback with stakeholders, support and consents.

3. M3: Planning application, as a basis of land acquisition
   This phase includes obtaining consents and functional specification, preliminary design (by PDO) which includes the choice of preferred design and final decision to build. Followed by an official approval by the planning authorities to march ahead.

4. M4: Tender
   The detailed design aspect of the project up to construction, tender of the project, preparation to start the operations and ongoing asset management has to be well presented. The end of this phase marks the start of execution.

5. M5: Execution
   Execution of the project to meet the functional specifications and further establish the operators and maintainers to physically complete the project.

6. M6: Test operations
   Series of operations and defined maintenance have to be completed to obtain the approval to operate. After the successful commissioning, the operations can start.

7. M7: Operation
   Post Project Review: (1) the results itself (versus scope), (2) how the results have been achieved and (3) how project experiences have been passed on. This evaluation may be done approximately five years after the start of operations.

3.3.5 Assessment process

Since the focus of the research is the IPAT tool, this section will present how the assessment process transpires. The IPAT assessment takes place for three days, where a feedback session is organized on the third day. On the first morning of the assessment, the assessor team is introduced to the project team and then the assessor team gives a presentation about the IPAT and the forthcoming three days. The rest of the first day interviews are organized with the PDO and the SPV. On the morning of day two, a site visit takes place and, in the afternoon, the remaining interviews with the contractor and the PDO will be completed. During the last day of the assessment, the assessor team draft their conclusions and presented the preliminary results of the assessment to the PDO.

The IPAT analyzes the background documents related to the project and the context in which it has been realized. In order to gather relevant project information, interviews were organized with project team members. Interviewees were questioned in an atmosphere of an open discussion covering many themes of the project. The assessors facilitated the discussion over the three days, ensuring that they obtained clarity of responses on all of the questions within each of the IPAT themes and sub-themes. The project is then scored on the management themes on a score of 1-4 by using the IPAT Assessment Form. The total score is calculated by the scores of the management themes and weight factors. The weight factors of the management themes differ over the project phases. After a thorough analysis of the project documents, interviews and the scores; the assessment report is prepared. This document first presents the overview of the project and then describes the assessment results in terms of an overall result, strengths, weaknesses and areas for improvement per management theme.

The IPAT assessment process can be utilized as an “improvement” tool, to help define strong areas and areas for improvement in the management of a project. In many cases, the information provided was backed up through presentations and by consistent responses across those interviewed. However, the IPAT-assessment is not a formal audit but an assessment (“health check”) of the likelihood of the project entering the next project phase successfully or succeeding in its outcomes. Since the core purpose of the IPAT assessment is to enable those leading the project to be able to improve the delivery of the project, interview answers were taken in good faith – there is no motivation for those commissioning the IPAT assessment to do other than portray the project as it actually is and to learn lessons and act on the recommendations to make the delivery better.

3.4 Conclusion of literature study

The literature study aided in understanding the overall assessment process and also interpret the influence of various elements of the tool/process. From the literature study of the existing project assessment tools, there exist several similarities either in the assessment process or the elements that characterize the assessment tool. The main goal of all project assessment tools is to improve the overall execution of the project and thus optimize the outcomes or project deliverables. Five common elements were identified in the models and are mentioned below:

- Themes and scores
  The assessment tools use themes like stakeholder management, risk management, political context etc, as the basis on which the project's progress and performance are measured. They also use quantitative data like scores to analyze these aspects and hence compile the assessment results with both qualitative and quantitative results.

- Context of the project
  Since the large infrastructure projects have various cultural, social, environmental, economic characteristics, it is vital in understanding the context in which the project is realized. Context can be viewed as both a constraint and an opportunity. For the assessment process, context plays a significant part in comprehending the role of diverse factors that contribute to the successful realization of the project.

- Learning environment
  The assessments provide an opportunity for the project team to learn. It also gave them a better direction in terms of focus areas where they could optimize the outcomes. The assessment results also help create more awareness of certain aspects for the next phases and future projects.

- Knowledge exchange
  A key function of knowledge exchange is to promote the use of the most effective practices and also gain more perspective on the project's progress and problems faced. It allows people to access and apply the most appropriate knowledge when it is needed and broaden their horizons. Knowledge exchange aids in achieving greater certainty and more effective decision-making processes.

- Significance of reflection
  The concept of continuous improvement drives most organizations, and this is facilitated by reflection. Reflection also maximizes learning, which increases ownership of new knowledge and skills. The assessment tools stress on the importance of reflection as it helps assess and refine the impact of the approaches used for future projects.

The project assessment tools confer to the above-mentioned characteristics as they serve as the theoretical framework on which the performance of the project is measured. The IPAT includes all these elements which are also deemed vital in the project assessment tools that were researched. Thus, the elements identified served as an essential basis on which project performance is measured.

4. Document analysis

This chapter will explain in detail the procedure used for data analysis and present the findings of the qualitative and quantitative analysis. An overview of the projects assessed and the reports that are used for the analysis phase is presented in Table-4. The aim of document analysis is to provide information to answer the sub-question 2.

Table 4: Overview of the project assessed

Sl.no	Projects Assessed	Country	Year of IPAT assessment
1	Betuweroute	The Netherlands	2007
2	West Coast Mainline	United Kingdom	2007
3	Motorway E18	Finland	2007
4	HSL-South	The Netherlands	2008
5	Øresund bridge	Denmark and Sweden	2008
6	Gotthard Base Tunnel	Switzerland	2008
7	Nuremberg - Ingolstadt HST	Germany	2008
8	Unterinntalbahn	Austria	2007
9	Lötschberg Base Tunnel	Switzerland	2008
10	Ring road Bratislava	Slovakia	2007
11	Motorway A2	Poland	2007
12	Motorway A4	Poland	2007
13	Maaswerken	The Netherlands	2007
14	Lisbon-Porto HST project	Portugal	2007
15	Lezíria Bridge Lisbon	Portugal	2008
16	Koper-Ljubljana	Slovenia	2010
17	Fehmarnbelt	Denmark	2010
18	West Coast Mainline	United Kingdom	2010
19	D3 Svrčinovec – Skalité Motorway	Slovakia	2014
20	Schiphol Amsterdam Almere A6	The Netherlands	2015
21	Stockholm Metro Expansion	Sweden	2015
22	MXP-AT Railink	Italy	2016
23	Lake Mälaren	Sweden	2016
24	Mälarbanan	Sweden	2017
25	E18 Hamina – Vaalimaa	Finland	2017
26	Tvärforbindelse Södertörn	Sweden	2017
27	Transpennine Route Upgrade	United Kingdom	2017
28	A99 - Munich Ring Road	Germany	2018
29	Riihimäki Rail Renovation	Finland	2018
30	Skurubron	Sweden	2019
31	Lahti Southern Ring Road	Finland	2019

The analysis phase of the research was focused on collecting, summarizing and structuring all the data acquired from the assessment reports of the individual projects (Table-4). For the analysis, the IPAT reports and the assessment reports of the projects that used the Infra Maturity model have been analyzed. Each assessment report presented large amounts of data i.e., the details of the project like the project facts and figures, history of the project, stakeholder networks, organization and management along with individual assessment results per the theme. To facilitate an in-depth analysis of the available information and to ensure that vital information is not lost during the analysis, efficient handling of data is done by the following procedure.

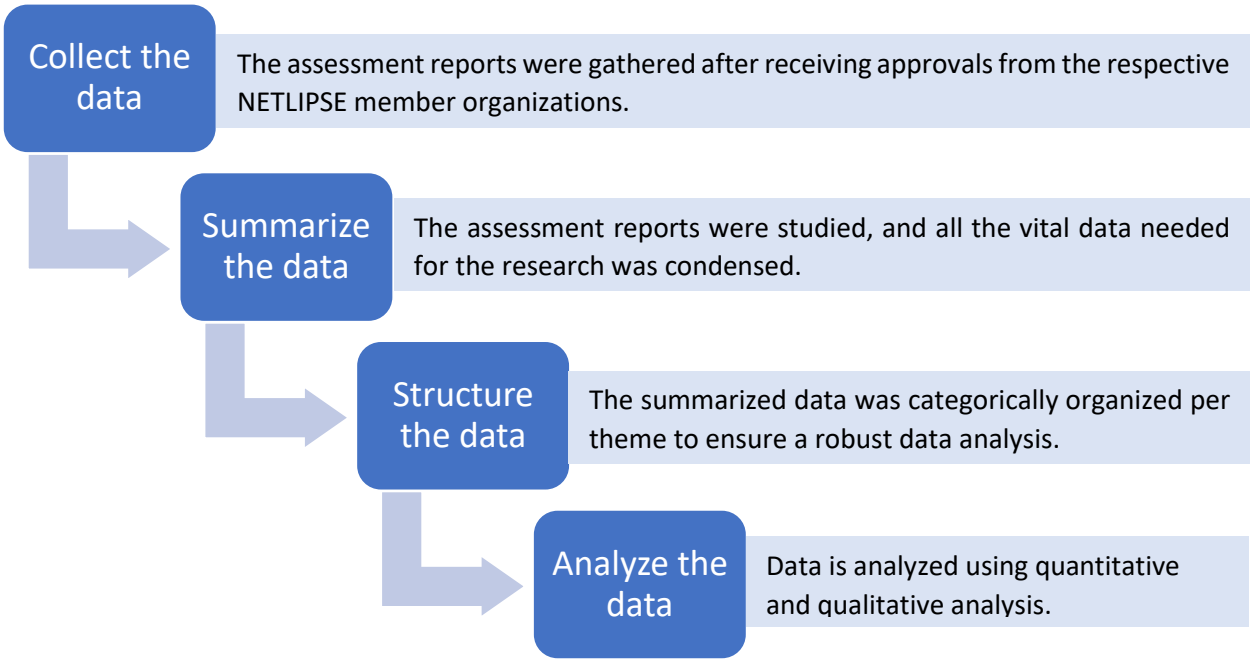


Figure 7: Data analysis (own illustration)

The assessment reports are split into three data sets based on the different versions of the tool used to analyze the large infrastructure projects i.e.,

- The research protocol set up an Infra Maturity Tool which was used in the analysis of the first fifteen projects. So, the first data set consists of the projects 1 to 15.
- The second data set is composed of projects from 16 to 27 i.e., The IPAT version 1 is used in the analysis of these projects.
- The third data set is composed of projects from 28 to 31 i.e., The IPAT version 2 is used in the analysis of these projects.

By scanning all the assessment reports, it is seen that different formats have been used in the analysis of the projects. This together with the different contexts of projects makes it difficult to compare the analysis results. To maintain uniformity in the analysis process of the final results, the data is split into three sets. From reading the reports it can be concluded that some of the management aspects are interpreted differently i.e., the sub-themes are categorized in a different manner. To obtain the necessary information the document analysis is split into two i.e., quantitative and qualitative data analysis.

4.1 Quantitative data analysis

This section provides information regarding the analysis of the quantitative data that were present in the IPAT reports. Since the IPAT could be introduced in various milestones of the project, the quantitative scores of the individual projects are based on the project phase when the IPAT was introduced. Hence to uniformly compare the scores, the project was clustered according to the phases and then analyzed. The project phases are described below-

Table 5: Project Phases

Description	Project Phase
Initiation of the project	M1
Funding assembly	M2
Planning application	M3
Tender	M4
Execution	M5
Test operations	M6
Operation	M7

The themes have different levels of importance based on the phase of the project. In each project phase (milestone) all management themes are relevant. However, the relevance of a theme changes over the project phases. In the IPAT, the level of importance of a theme per specific project phase has been predetermined by the experts who developed the IPAT tool. The themes are classified into very important, important and less important according to the phase of execution of the project. These levels of importance are used as a weight factor in the calculation of the overall score of a project. Since the different versions of the IPAT consist of different themes and subthemes, the research did not make use of the weighted scores but only considered the direct scores of the themes to make the comparison more uniform. The levels of importance of the themes are summarized in table 6.

Table 6: Levels of importance

Theme	Project Phase						
	M1	M2	M3	M4	M5	M6	M7
Political context	Very Important	Very Important	Important	Important	Important	Less Important	Important
Objectives, Purpose, Scope & Business case	Very Important	Very Important	Very Important	Important	Important	Important	Important
Stakeholder Engagement & Communication	Important	Important	Important	Important	Important	Important	Important
Risk Management & Project Controls	Important	Important	Very Important	Important	Very Important	Very Important	Very Important

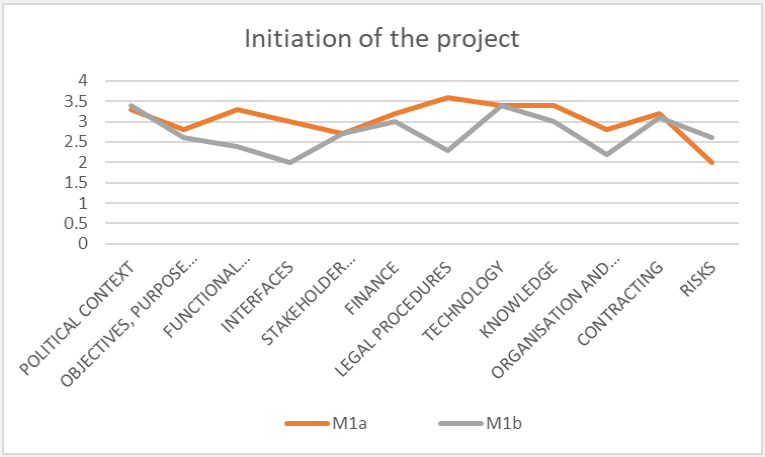
Theme	M1	M2	M3	M4	M5	M6	M7
Organization & Management	Important	Important	Important	Very Important	Very Important	Very Important	Very Important
Permits, Authorizations & Consents	Less Important	Important	Important	Important	Important	Important	Important
Technology	Important	Important	Important	Important	Important	Important	Important
Contracting & Procurement	Less Important	Important	Important	Very Important	Very Important	Very Important	Very Important

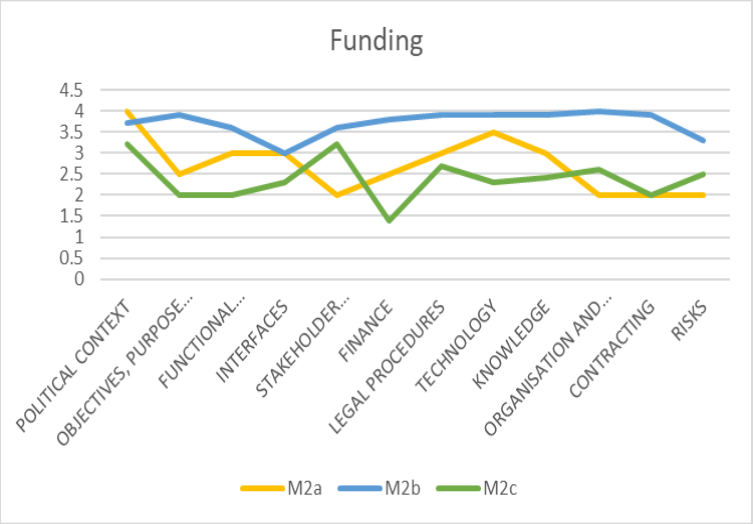
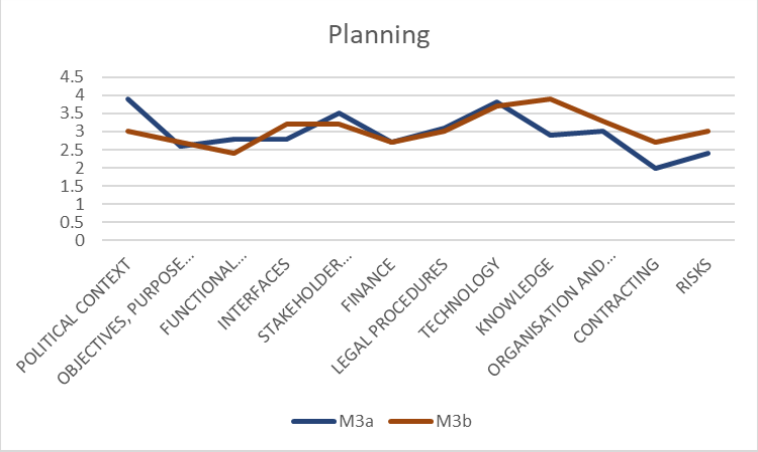
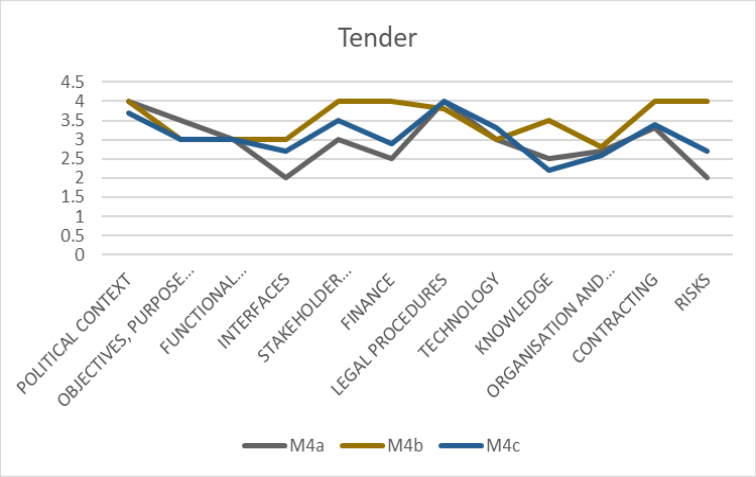
For the quantitative data analysis, the scores of 16 projects were analyzed. The scores of the projects 16-27 were plotted using 12 themes whereas the projects 29-31 were plotted using 8 themes. The detailed list of themes and scores is presented in Appendix-1. For the quantitative analysis, two projects were not considered i.e.,

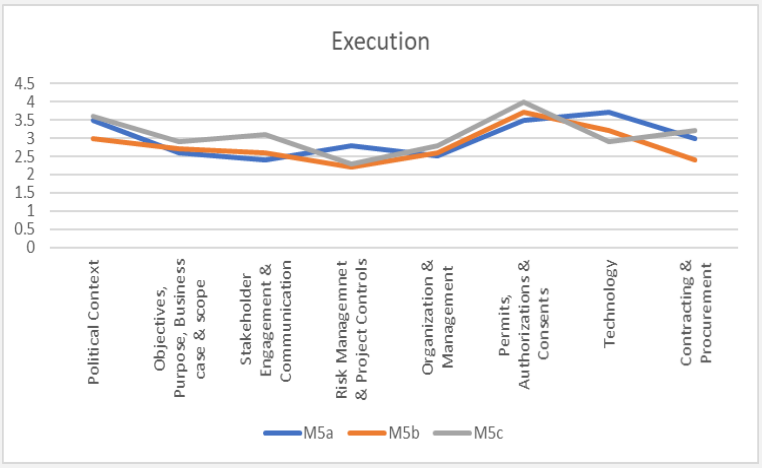
- 'E18 Hamina – Vaalimaa' project because this was the only project assessed in the M5 phase using version 1 of the IPAT that consists of twelve themes.
- 'A99 - Munich Ring Road' project because this was the only project assessed in the M3 phase that using version 2 of the IPAT that consist of eight themes.

The scores were plotted on a graph where the x-axis represented the themes on which the scoring was performed, and the y-axis represented the scale of the scoring used. The graphs are presented below

Table 7: Quantitative data analysis

Graph per project phase	Observation
	In the M1 phase, the graph shows that the scores are scattered and large differences between the scores of 'legal procedures', 'interfaces' and 'functional specifications' are observed. These themes play an important role in the M1 phase and the level of uncertainties present in the initial phase of the project might've influenced the deviation of scores. These themes must be revised to improve project performance.

Graph per project phase	Observation
	In the M2 phase, the graph shows a bigger variation of scores. The theme 'finances' has scored the lowest whereas 'political context' has successively scored high in all projects. In the funding phase, the main focus is to obtain funding. The theme 'objectives, purpose, scope & business case' plays a significant role in this phase and differences between the scores must be reduced in order to improve the project performance and also obtain the means of funding from various parties.
	In the M3 phase, the graph shows that the scores follow a similar pattern and the outcome can be predicted because the level of uncertainties is gradually reducing. Since only the data from two projects are available, explicit conclusions couldn't be drawn. The theme 'risks' and 'objectives, purpose, scope & business case' play a significant role in this phase and more attention should be paid to it, in order to improve the project performance.
	In the M4 phase, the graphs almost follow a similar pattern. However, there are some large deviations in the scores of the themes like 'stakeholder engagement' and 'risks' which play an important role in the tendering processes. The 'organization and management' and the 'contracting' themes play a more significant role in this phase and more attention has to be paid to these areas in order to better execute the phases.

Graph per project phase	Observation
	In the M5 phase, the graph shows that the scores follow a more stringent pattern and the outcome can be predicted because the level of uncertainties has reduced. The introduction of the IPAT assessment in this phase might be less effective than in an early stage because implementing changes is harder. The project is in the completion phase and all the processes and plans are already in place. Implementing changes to these processes can pose a difficulty in the final phases.

4.1.1 Results of quantitative data analysis

The introduction of the IPAT in the later phases of the project execution may not be beneficial because the graphs of these projects did not show large deviations in scores. Based on the observations it was concluded that the IPAT assessments prove to be more effective when introduced in the early phases. Since there are only maximum of three projects in each phase, the analysis of the quantitative scores did not provide conclusive results but gave some interesting insight into the applicability of the IPAT in the initial phases when compared to the later phases. Due to insufficient data, the quantitative analysis of the scores has been inconclusive. The shortcomings of the quantitative analysis can be compensated by switching to qualitative analysis which can provide a thorough understanding of the data from the assessment reports.

4.2 Qualitative data analysis

In the individual IPAT reports, the assessment results are presented in terms of strengths, weaknesses and areas for improvement per management theme. In the analysis, these findings are presented in the form of characteristics per theme, that contribute to the successful execution of LIPs. These characteristics are obtained from the IPAT assessment reports of the projects i.e., the recurring best practices under each theme are translated into characteristics of the respective themes that aid in better execution of projects. If the characteristics repeat twice or more, they have been shortlisted in the compilation of the best practices under each theme. The results compiled from the document analysis provides an extensive list of best practices identified from the IPAT assessment reports which are presented in Appendix-2.

Figure 8: Condensing data for analysis (Own illustration)

4.2.1 Results of comparative cross-case analysis

This section will present the results of the qualitative comparative cross-case analysis. Comparative case studies involve the analysis and synthesis of the similarities, differences and patterns across two or more cases that share a common focus or goal in a way that produces knowledge that is easier to generalize. Hence the comparative cross-case analysis will identify the change in trends by listing all the similar characteristics identified in the IPAT reports (Projects 16 to 31) per theme to the best practices and lessons learned from the Infra maturity tool reports (Projects 1 to 15). In this section, projects 1 to 15 are considered as the first data set and the projects 16 to 31 are considered as the second data set.

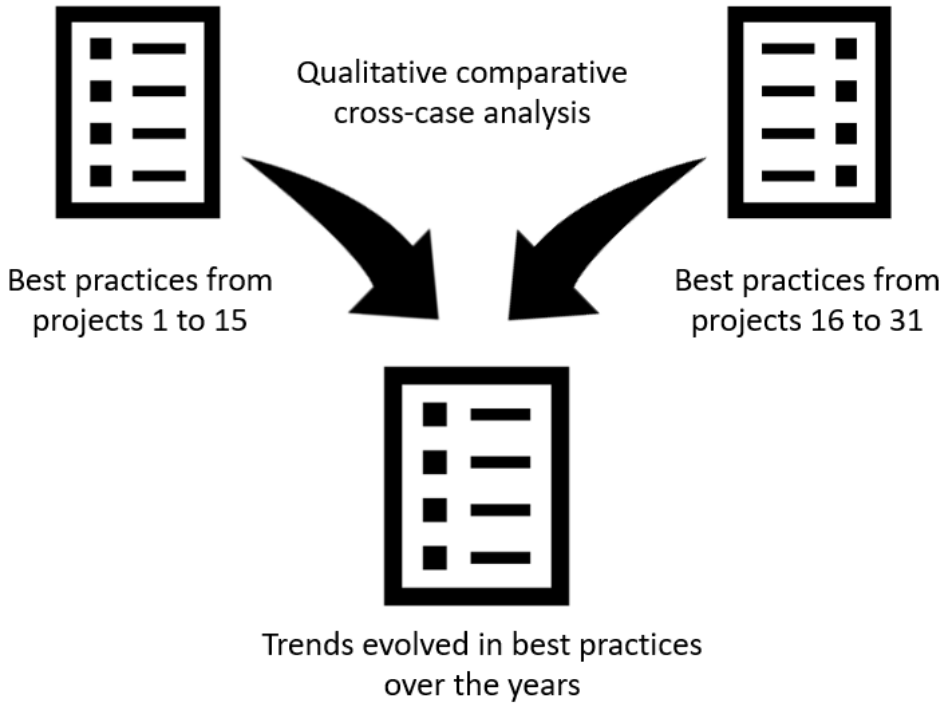


Figure 9: Compilation of results from qualitative cross-case analysis (own illustration)

The table below will summarize briefly the findings from the comparative cross-case analysis i.e., themes that evolved over the years and the themes which did not identify a lot of evolvement. The detailed explanation of how the evolution of trends were identified are explained in detail after the table.

Table 8: Trends status

Themes	Status of the trends
Objectives and Scope	Trends evolved
Stakeholders	Trends evolved
Financial Management	No Significant trends evolved
Organization and Management	Trends evolved
Risks (and opportunities)	Trends evolved
Contracting	Trends evolved
Legal Consents	No Significant trends evolved
Knowledge and Technology	Trends evolved

4.2.1.1 Objectives and Scope

1. Linking scope to objectives

   The linkage of scope to objectives, has often proved difficult in the assessed projects 1 to 15 that used the Infra maturity tool. Most of the infrastructure projects encompass more than one goal which cannot be linked on a one-to one basis with the scope. Hence by linking the scope to objectives, it provides a framework that aids in all discussions with the stakeholders and also ensures reference points for decision making are clear.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Scope addition should be clearly linked to the outcomes/objectives for the project.
   - Translation of the project objectives into scope should be available, to avoid creating confusion for the consultant, the client and PDO members.
   - The definition of required outputs and outcomes should be well known within the team. The project team members should have a clear scope definition from the C/S to meet the objectives of the plan.

   The linking of scope to the objectives of the project still remains as one of the best practices in both the sets of data.

2. Define the objectives in interaction with the stakeholders

   In the assessed projects 1 to 15 that used the Infra maturity tool identified the importance of defining clear objectives for both the PDO and the project team. The definition should also allow for some variation in the objectives. It is essential to make the objectives of the project clear to the stakeholders, while keeping in mind that some external changes will make some changes to the objectives unavoidable. Internally motivated changes may also be required. In such circumstances it is crucial to manage the changes proactively and also keep open communications with all the involved stakeholders.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The definition of purpose and objectives of the project should be clear among the stakeholders.
   - Stakeholders should be involved in the definition of objectives and the required outputs.
   - Translation of the project objectives into scope, realistic milestones, specific work packages and clear responsibilities should be available, to avoid creating confusion for the consultant, the client and PDO members. During this process the PDO should involve relevant stakeholders.

   The involvement of the stakeholders in defining the objectives is considered beneficial and thus remains as one of the best practices in the execution of infrastructure projects in both versions of the assessment tool.

3. Formulate a vision

   A project must embody a readily understandable vision. In the assessed projects 1 to 15 that used the Infra maturity tool identified that any project must readily embody a comprehensible vision. The project will have decreased chances of success, if the goals of the project are only based on achieving abstract or technical numbers while lacking the physical indication of ‘winning’.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - There should be a clear project vision.

- The PDO should have a clear vision on how to align and integrate its organization with the contractor's organization.
- The definition of a strategic vision of the project should be clear among the stakeholders.

Having a clear vision for the project being undertaken is still one of the best practices identified in the assessment reports. This practice has evolved to include aligning and integrating the vision of the project with the PDO and the contractor organization.

4. Translate objectives into scope, work packages and milestones

   The objectives have to be translated into scope, work packages and milestones. To ensure planning reliability, milestones are essential. In the assessed projects 1 to 15 that used the Infra maturity tool noticed that the developments in the project's context affects reliability. Starting point should be that the work packages should not be changed.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Translation of the project objectives into scope, realistic milestones, specific work packages and clear responsibilities should be available, to avoid creating confusion for the consultant, the client and PDO members.

   The translation of the objectives has played an important role in realizing the project. From both the sets of the assessment reports it is still identified as one of the best practices.

5. Assess and authorize scope changes

   Managing scope means obtaining a balance between flexibility and rigidity. In the assessed projects 1 to 15 that used the Infra maturity tool established that by segregating technical and functional demands, the changes to the scope can be processed quicker and the decisions regarding the same can be taken at the proper level. This division clarifies responsibility and authority.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Scope addition should be clearly linked to the outcomes/objectives for the project.
   - The PDO must have a structured process for scope changes in place to avoid scope creep.
   - The PDO should have a clear view of the additional scope opportunities in case the contingency budget becomes available during the delivery.

   The scope changes are one of the crucial aspects in keeping the project on time and under budget. Hence assessing and authorizing any scope change is identified as the one of the best practices and is identified in both sets of data.

6. Use configuration management to assess the impact of scope changes

   In the assessed projects 1 to 15 that used the Infra maturity tool found that configuration management or making sure that all effects on various parts of the scope of the project are taken into consideration accurately and are essential in identifying the impact of all possible changes.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The drivers and procedures for change management by the C/S should be formal and well-articulated and should be managed within the project between the PDO and the C/S.
   - There should be a review of the economic benefits where the scope changes have resulted in increased costs.

- Reviews should be organized in order to update processes and challenge financial and time information provided by the project teams. The time pressure to deliver products should not refrain the organization from being critical.

The effects of any scope changes should be thoroughly assessed in order to analyze the impact it has on the project as a whole. Hence this best practice is identified in both sets of data. However, this theme has evolved to include reviews in order to update processes and challenge financial and time information provided by the project teams.

7. Implement a variation procedure

   In the assessed projects 1 to 15 that used the Infra maturity tool found that the projects should have a scope variation procedure, in order to be able to control and manage justified, random or invalid scope changes. By implementing a variation procedure, it facilitates tight tracking of the development of scope and also aids in the decision-making process.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Change management procedure (including C/S and PDO responsibilities) should be available to deal with possible scope changes.
   - The drivers and procedures for change management by the C/S should be formal and well-articulated and should be managed within the project between the PDO and the C/S.

   Change management procedure is essential in order to smoothly deal with the necessary changes and aid smooth running of the project. Hence it is identified in both sets of data as one of the best practices for the execution of the projects.

8. Organize adequate expertise to be able to deal with scope changes

   In the assessed projects 1 to 15 that used the Infra maturity tool realized that sometimes scope changes are essential due to external influences. In order to be able to competently analyze and comprehend the consequences of a certain change, it is imperative to have available the right expertise to analyze the effects of the change on timescales, outputs or costs.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Definition of required outputs in terms of solutions to transport, economic or social needs and environmental impact, should be available. There must be quantitative targets and information available on these topics.
   - Make sure there is enough technical, engineering and construction expertise within the PDO to cope with the innovative elements and address practical parts of the most complex structures.

   Adequate expertise is required throughout the lifetime of the project from the initiation to the maintenance to efficiently deploy the infrastructure. Hence it is identified in both sets of data as one of the best practices.

4.2.1.2 Stakeholders

1. "To tailor and organize stakeholder involvement"

   In the assessed projects 1 to 15 that used the Infra maturity tool found that soft skills like communication, getting in dialogue and cooperation is just as useful as focusing on contracts, technique, technology and other internal concerns. Understanding and knowing the interests of the parties involved will boost collaboration and also help in avoiding misunderstandings. A tailored

approach is needed in dealing with each group of stakeholders which has been embedded in structures that facilitate liaison with the PDO. In this way, communication becomes more efficient. However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- Stakeholders should be well identified from the start of the project and the project should have an overview of the different interests and priorities of the stakeholders in the area of the project.
- Provide clarity for key stakeholders on their role and responsibilities at all phases of the project.
- A strategy should be in place to deal with unexpected stakeholder demands and a clear communication strategy.
- There should be a clear understanding of the priorities of stakeholders, and changes should be monitored on a day-to-day basis.
- In the case of a lengthy decision-making process, it is recommended to place additional efforts in keeping the stakeholders engaged in the program. In other words, attention should be paid to managing expectations.
- By considering the project from different perspectives when making important decisions in order to understand conflicting interests and create synergy, the risks can be converted to an opportunity.
- The most important stakeholders should be involved early on in the project and thereby are informed during the process and have the opportunity to share their knowledge and view on an operational level.

The theme stakeholder involvement has evolved to identify more specific aspects in order to effectively involve all categories of stakeholders and placing additional efforts to keep them engaged during lengthy decision-making periods. The significance of early involvement of important stakeholders, conversion of risks to opportunities and keeping track of the changes on a regular basis was also identified in the IPAT reports.

2. Involve operators and industry

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that an open approach to a project and cross-industry, i.e., involving the industry enables a better and clearer specification, which results in reduced costs, additional benefits, a robust design and an effective implementation. However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The most important stakeholders should be involved early on in the project and thereby are informed during the process and have the opportunity to share their knowledge and view on an operational level.
   - Stakeholders should be involved in the definition of required outputs.

   This theme has evolved from involving the industry and operators to share their knowledge in the design phase to involving them in defining the required outputs for the project. However, both the data sets identified this as one of the best practices and lessons learned.

3. Facilitate liaison with local stakeholders and critics

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that one of the most difficult tasks in stakeholder management is dealing with the demands of local stakeholders.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The suggestions of the local authorities and interest groups need to be more frequently discussed with them, in order to create win-win situations for both the project as well as the local authorities. This could lead to more support for the project but requires a proactive stakeholder management approach.
- Looking into opportunities to involve local business and people can create more social and economic benefits for the community.
- There should be a clear stakeholder strategy for all phases and as the project progresses there should be a more proactive behavior towards private and public stakeholders.

This theme evolved to find more specific solutions in order to encourage the liaison i.e., frequent consultation of the interest groups and the local authorities will help find favorable solutions for the problems defined and involving local businesses. The best practices and lessons learned identified in the first data set are supported by the findings of the second data set.

4. Avoid mixed messages

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that consistency is essential in all forms of communication from C/S and the PDO i.e., the same message and information should be delivered within and across the organizations. This enables the C/S and the PDO to be perceived as reliable partners. It creates transparency and trust, thereby reducing the stakeholder resistance.
   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - There should be open communication with stakeholders and a proper communication strategy should be set in place by the PDO.
   - Contingency plans should be in place to brief stakeholders if there is a problem with the project.
   - The project team can make use of many ways of interacting with the stakeholders, both online and offline: a website including FAQ's, regular meetings with the main stakeholders, brochures, targeted newsletters, attendance at public events and the shipping forecast. A telephone number for inquiries and complaints and at the construction site installations of information signs are beneficial. The project organization can also be active on social media channels like Instagram and Facebook etc.
   - There should be good information flow to the local inhabitants and a dedicated project website to inform them regarding the project progress.

   The communication strategies, contingency plans in case of emergencies and the different methods that can be utilized to interact with the stakeholders and thus communicate information are specified more clearly in the second data set. However, the best practices and the lessons learned are retained from both the sets.

5. Reach consensus with stakeholders before tendering

   In the assessed projects 1 to 15 that used the Infra maturity tool identified the benefits of completing the administrative processes prior to the tendering phase. It is easier to discuss various options with the stakeholders in the pre-tendering phase, without facing complicated contractual consequences. However due to tender regulations or spatial planning constraints, this is not always possible.
   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The PDO should define clearly the functional specifications and requirements for the tender phase before the start of execution. Stakeholders and users should be engaged in the definition and authorization of specifications and changes.

Reaching consensus with stakeholders before tendering is essential and hence identified in both sets of data as one of the best practices for the execution of the projects.

6. Enable the political branch to supervise the project

   In the assessed projects 1 to 15 that used the Infra maturity tool identified an effective way to ensure long term political support. This can be achieved by tailoring the project communication towards the responsible politicians. It is very crucial to reach a mutual agreement on the nature of relationships both formal and informal. Nevertheless, it is important to understand that the life cycle of most of the large infrastructure projects is longer than the politicians – too close identification with one party or group can be counterproductive.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Good communication between the client and the political parties can increase the level of involvement/commitment to the project and can also be utilized as an opportunity to exploit the possible solutions to the problem.
   - The project must ensure local political stakeholder expectations are well managed.
   - The project needs to ensure that political support continues to exist by sustaining excellent liaison, especially during construction phase while traffic disruption is more prevalent.
   - Be aware where there are different views or if there are different political parties and avoid the project being a pawn in these situations.
   - If the political consensus changes in the future, an alternative plan and risk mitigation measures must be in place.

   The need for political support for the execution of any project is vital and has been identified as one of the lessons learned in both the data sets. The means to increase the level of commitment of the political parties to the project are identified as the best practices in the research. However, this theme has evolved to find few aspects that ensure long term commitment i.e., sustaining liaison with the involved parties especially during construction phase, avoiding the project to be used as a pawn in political scenarios and also setting up alternative plans and risk mitigation measures in case of change in political consensus.

7. Formalize responsibilities with client/sponsors

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the PDO has to justify its actions to the C/S, who has the power to make key decisions relating to outputs and their value. A mutual agreement on the decided arrangement has to be signed to formalize the process. The formal decision making, daily working routines and the reporting structure can be addressed in the agreement. These speeds up decision making and facilitates dealing with scope changes. Explicit arrangements on responsibilities and mandates should be made even when there will be principles of delegation set out.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Provide clarity for key stakeholders on their role and responsibilities at all phases of the project.

- Roles and responsibilities need to be clarified at every stage of the project. It, however, is extremely difficult to do this in a top down management style. It is important to exchange ideas about who is responsible for what. Only after a well understood division of responsibilities is it helpful to make them explicit on paper.
- Organizational charts with delegated responsibilities should be available and there should be good clarity in the program plan. A clear organizational chart is essential in order to clarify the relationships, roles and responsibilities of all stakeholders involved.

The definition of the roles and responsibilities of all stakeholders proved beneficial and thus remains as one of the best practices in the execution of infrastructure projects in both sets of the assessment reports.

8. Brand the project

   In the assessed projects 1 to 15 that used the Infra maturity tool identified the significant benefits offered by branding the project i.e., maintaining a well-structured and frequently updated website, publish brochures, organizing events for stakeholders, such as guided tours around the construction site, opening an information center etc. Branding can reinforce efforts to inform the local and general public. Branding focuses on influencing people's perceptions in a positive way and also developing trust and creating enthusiasm for the project.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - It may be worthwhile explicitly branding the project. Create a brand according to the project objectives, create one logo to show an integrated project and to prevent the project being seen as parts. This also increases the recognizability of the project, which can be used to better support the project objectives.
   - City branding can also be beneficial for the project and the community.

   The branding of the project was identified in as one best practices in both data sets. However, the concept of city branding has been recognized as one of the best practices in the second dataset.

4.2.1.3 Financial Management

1. Use proper calculations to support decision-making

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that to make a business case for the project, it often involves decision-making on the viability of a project i.e., the calculation of revenues and costs, including the finances. The calculation of non-financial benefits and costs are also involved in the decision-making process. Four best practices and lessons learned indicate how to use a calculation to support decision-making on the project. They are-

a. Define criteria for calculation and decision making

   The decision-making process is based on many different criteria for infrastructure projects. Sometimes the politicians favor certain infrastructure project because the overall benefits are higher than the overall costs. Sometimes due to insufficient investments they turn down a highly beneficial project. They may even invest in an economically weak project instead of a challenging project located at a densely populated area which shows higher value for money. Therefore, the criteria and the calculations used to determine or aid the decision-making process must be clearly stated.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The clarity of the business case information helps in making a make more informed and strategic decisions backed with solid evidence. Hence the business case should be strong.
- Results from the decision-making processes should always be documented and retraceable.

b. Be aware that decisions are always debatable because of uncertainty and political interpretation
The data used for the calculations of the business case always involves uncertainties. For example, difficulties in estimating the future revenues of the project due to the changes in the market conditions. Due to subjectivity the wider economic benefits are more difficult to calculate. Some projects assessed by the NETLIPSE suggests that the infrastructure investments require political decisions where the business case plays a little or no roll at all. There are two biases for the calculations i.e., the optimum and pessimism bias. The overestimation of the revenues or benefits is called the Optimism bias whereas in Pessimism bias the projects are judged by their direct effects, leaving out non-financial benefits which, in any case, are often under-represented during the early stages of projects. Professor B. Flyvbjerg (2003) concluded from extensive research that decision makers themselves are well aware that they tend to overestimate benefits at go/no go decisions.
However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-
   - The business case should be used to support the key decisions as to whether if it is worthwhile to proceed with the project (go/ no go).
   - Financial versus non-financial benefits of the project should be evaluated.
   - Strengthening the Business Case would enable it to be used to support the project, particularly in helping to convince stakeholders of the need for the scheme and in understanding the current benefits against costs of the project. This is likely to be of benefit to the project during the disruption caused by construction.

c. Show the uncertainty and sensitivity of the calculations
The calculations unavoidably include uncertainty and sensitivity. However, the range of this uncertainty should be known in order to support decision-making. The insights of costs and revenues increase overtime, and this should be used to update the business case on an iterative basis.
However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-
   - Uncertainties must be translated to a business case.
   - The objectives of the project should be quantified, and uncertainties should also be considered, and the business case should be updated regularly with the information available (reducing uncertainties) and must remain fit-for-purpose.

d. Value for money is affected by varying scope
Any changes to the scope will directly influence the costs and the benefits. The pressure on the budget is high during the initial phases of the projects due to unanticipated demands of the stakeholders. Hence this factor should be taken into consideration. However, positive effects can be generated by varying the scope for the same outputs – value engineering.
However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The Project Steering Group must decide on the priority between quality, cost and time schedule to take account of possible future pressures on scope, time and cost. It would be desirable to have a strategy from the Project Steering Group in place in case of a possible budget overrun or significant time delay. This helps the PDO to make decisions when it comes to making decisions related with scope/quality, time and/or cost.
- There should be a review of the economic benefits where the scope changes have resulted in increased costs.

The above-mentioned best practices and lessons learned are identified in both the data sets and have proven to be beneficial in the realization of large infrastructure projects under budget and on time.

2. Search for financing and funding possibilities

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that there are various funding possibilities that can finance a project other than the national government funding.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practice and the lesson learned are-

   - Funding for the project should be secured even if the scope of the project might change over time.
   - The purpose of the project should align with the interests of the municipalities. This can help secure support and funding from the municipalities.
   - The communication plan that is being developed should contain a clear marketing strategy that will help reach all stakeholder groups and could help increase support for the project (funding).
   - The funding strategy should be linked to the procurement strategy and, ultimately, supported by the communications strategy which should include a strategy to ensure political support for the chosen funding route.
   - If the funding has not been finalized, the PDO should pressurize the parties responsible to secure the funding, else if there is a project delay due to insufficient funding, more loss in revenues will occur. However, If the project seems to be fully funded, there should be no deficit between the estimated budget that is approved and the sum of the different funds.
   - If funds are insufficient for the project, together with the planning department and/or Advisory Group develop a vision and strategy in order to obtain additional funding for the project.

   The means to obtain funding has been more specified in the best practices identified in the second data set. However, obtaining the financing and funding possibilities is seen as one lessons learned in both the data sets.

3. Control costs and budgets in relation to scope

   In the assessed projects 1 to 15 that used the Infra maturity tool identified four best practices and lessons learned that provide guidance on cost and budget control. They are-

   a. Always relate scope changes to budget changes

   The scope changes should consistently be related to the budget and should always be costed. The PDO should document and keep track of all scope changes that should be authorized by the principal and linked to the appropriate budget.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The scope and objectives must be quantified i.e., it should be measurable.
   - Scope addition should be clearly linked to the outcomes/objectives for the project.

- The PDO should have a clear view of the additional scope opportunities in case the contingency budget becomes available during the delivery.

b. Always relate actual scope, actual estimation of costs and actual budget

The current project scope comprises of the agreed upon original scope plus the agreed scope changes, as well as the allowance for inflation during the project. The actual scope of the project should be linked to the estimated costs required to build it, so that the actual budget can be linked to the estimated final costs. In this way it can be clear whether or not the project is under control.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The funding plan should match the expected costs based on real tender prices.
- Cost estimates are based on experiences with other projects and should be updated on a regular basis.
- During the detailed design it is very important that the project team make accurate cost calculations and forecasts in order to keep control over the budget.

c. Agree on indexation measures

The inflation corrections can make all the differences to the cost overrun or underrun. However due to the large magnitude of budgets of the infrastructure projects, even a small percentage of the budget can make up a large sum of money. Hence it is advised to work with indices as a means of forecasting and of taking account of price increases.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- Clarity should be available on price indexation.
- The project should have an index basket that is constructed especially for the project with a limited number of relevant price indices.

d. Budget risks for the project delivery organization and risks for the client/sponsor

Since all projects encompass risks and project management is about managing these risks and uncertainties, the projects assessed by NETLIPSE have some mix of risk allocation as between the PDO, contractors or the client/sponsor. However, in the project estimates the politicians and funders are often reluctant to include an allowance or risk reserves as they believe “every penny that is allocated to a project, will be spent”.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- There should be a sufficient amount of contingency budget reserved for the project.
- In order to justify the level of contingency reserve for the project it is important to make a good link with the risk file.
- Attention should be given to the contingency percentage which should be adjusted according to the complexity of a project. Also, there should be a clear connection between the project risks and the project contingency budget.
- Apply more flexibility in the project contingency percentage; increasing the percentage for more complex and high-risk projects. (It is better to deliver under budget than go back for re-approval)

The above-mentioned lessons learned, and best practices have been identified in both sets of data. Hence these aspects have positively contributed in controlling costs and budgets in relation to the varying scope in the assessed projects.

4.2.1.4 Organization and Management

1. Address roles and responsibilities clearly: client/sponsor, project delivery organization, contractors.
   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the C/S is the project's funder and the lead in terms of strategy and defining outputs. The PDO acts as a main supplier along with the other key suppliers for the realization of the project. The commissioning of the contractors and the running of the project is normally done by the project delivery organization. The projects assessed by NETLIPSE show that this method is very effective and also provides clear roles and responsibilities. The level of involvement of the political parties in the role of C/S is the main difference identified between the projects researched by NETLIPSE. Clarity in decision making is very essential in this structure. A top down management approach is not always effective where roles and responsibilities are unilaterally allocated and set out in an imposed organization chart. However, a collaborative approach where the roles and responsibilities of the parties involved are clarified by discussion and agreement, leads to more competent and reliable project delivery. The roles and responsibilities might change during the lifetime of the project and hence have to be reaffirmed at all stages of the project.
   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-
   - The role descriptions should be clear, but this must not lead to inflexibility (people working only within the boundaries of these descriptions).
   - Roles and responsibilities need to be clarified at every stage of the project. It, however, is extremely difficult to do this in a top down management style. It is important to exchange ideas about who is responsible for what. Only after a well understood division of responsibilities is it helpful to make them explicit on paper.
   - Organizational charts with delegated responsibilities should be available and there should be good clarity in the program plan. A clear organizational chart is essential in order to clarify the relationships, roles and responsibilities of all parties involved.
   - Provide clarity for key stakeholders on their role and responsibilities at all phases of the project.

   Addressing roles and responsibilities of all parties involved is imperative and also identified in both sets of data as one of the best practices for the execution of the projects.

2. Design and implement a structure for reporting and decision-making
   In the assessed projects 1 to 15 that used the Infra maturity tool identified that keeping the budget and time overruns to a minimum are one of the main challenges in the realization of large infrastructure projects. Although the project faces different kind of problems, they may not have financial consequences, but they are visible at the lowest levels of the PDO. However, these are not reported by the people responsible and thus it often results in relatively unexpected and large cost overruns which emerge as major shocks. To remedy this problem, it is essential to have clear procedures for processing requests related to changes in scope and the resulting variation of the budget as well as the bottom up reporting procedures which involve sufficient levels of authority both within the project and client organizations. By having clear responsibilities and mandates, it creates stability and facilitates smooth decision making.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- Results from the decision-making processes should always be documented and retraceable.
- Reporting structures across the interfaces should be formalized.
- Use the opportunity to call for an Advisory Group meeting on a short notice – do not wait for regular meetings that are to be held only 3-4 times a year – when decisions are needed.

The structure for reporting and decision making is vital and the lessons learned, and the best practices identified in the first data set are supported by the findings from the second data set.

3. Communicate a project management policy

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the project management policy adopted by any organization can stimulate a uniform project culture and also affect the whole organization.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - A 'project management culture' (in which the complete team thinks and works in a project managerial way), is essential in order to become a more professional project organization. This means that the project team does not only exist on paper, but that they cooperate as a project team as well. For example, by frequent project team meetings and reporting lines towards a single point of responsibility (Project Manager).
   - A transparent management style with functioning core values contribute to the successful organization of the project.
   - It is recommended to expand the construction management values with the project management values. This can be realized by a systematic framework for promotion and transfer of good project management practices and results to other projects.

   By expanding the construction management values with the project management values and the recommendation of a transparent management style, this best practice has stood out when the two data sets were compared. However, the best practices and lessons learned identified in the first data set are supported by the findings of the second data set.

4. Address and manage checks and balances within the project organization

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the PDO is linked to two important parties i.e., on one hand they are linked to the parent and client organizations and on the other hand they are linked to external stakeholders. The PDO is often under pressure from both sides. Hence the PDO can adopt balanced approach can help solve all the issues. For example, parent organizations can influence the structure of the project management organization. Traditional public sector organizational structures emphasize control and accountability but pay less attention to the ability to adapt and steer.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The Management Team should have a good and open relationship with the Steering Group and with the internal Client/Sponsor as well.
   - There should be a clear project vision and management style agreed upon by all stakeholders.

   The balance is obtained within the project organization, and these best practices and lessons learned that are identified in the first data set are supported by the findings of the second data set.

5. Stay in control in a decentralized project organization: quality management systems
   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the processes within the PDO can either be centralized or decentralized. Decentralization can help improving flexibility in the project but also runs the risk of encouraging autonomous thinking in circumstances where this is inappropriate. However, a balance has to be struck and to help make this decision key factors like the scale and geographic spread of the projects that are taken into consideration. Centralization helps in creating uniformity and also enables the steering and coordination of the interfaces by the senior management. Hence it is beneficial to set up quality management system in order to have best of both world and also describe all processes involved. To ensure that the information flows from the local levels and divisions to the center in a congruent way, reporting structures are designed to be consistent and coherent with each other. To ensure time is not wasted in searching for documents or having them translated for new systems, it is vital to have a document organizing management from the start of the project. But beware that the level of information in your quality system allows the project team members the freedom to operate, is not too detailed and rigid.
   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-
   - Analyze the load on different parts of the organization and create more redundancy for key team members.
   - If a new system for the efficient document management system is introduced, then tailor-made development and the implementation asks for enough attention in order to make it successful.
   - The project should use networking within disciplines (risk management, quality management, etc.) to exchange knowledge.

   The processes chosen i.e., centralization or decentralization within the PDO should be clearly described. The setting up of quality management system is proven beneficial in order to have best of both worlds. This balance in the processes were part of the best practices and lessons learned that were identified in the first data set and supported by the findings of the second data set and hence it is vital to the successful execution of the projects.

6. Work where the work is. Adapt the organization to changing circumstances.
   In the assessed projects 1 to 15 that used the Infra maturity tool identified that tailoring the PDO according to the objectives that need to be achieved at each phase of the project is beneficial i.e., the PDO should be capable of adapting to the changing circumstances. Throughout the lifetime of the project, the interests and the needs of the stakeholder's change, there might be some changes in the rules and legislations whilst new innovations and technologies become available in the market. The various phases of the project require different personnel and skills. For example, at the start of the project, pioneers and visionaries are needed who are able to think and operate outside normal, regular frameworks. Whereas in the realization phase, the focus shifts to the physical realization of the project i.e., skilled workers and project team members. Each stage of the project should have a clearly defined framework along with teams of experienced employees who are capable of working within the set boundaries. "Work where the work is" also becomes a more important issue as projects enter their delivery phase – a geographical focus becomes more important.
   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-
   - A formal process for skill retention should be deployed and there should exist a well-documented knowledge management strategy plan in place by the PDO.

- The resource allocation should be under the control of the Project Manager as the project will need to have the right technical skills and resources, that should be allocated at the right time/for the right amount of time.

The first dataset identifies the importance of recruiting the right personnel at the right time. This strategy is also good for technology, management of stakeholders, rules and regulations etc. These findings are supported in the second dataset as well and hence will remain one of the best practices and lessons learned for the successful execution of the projects.

7. Invest in human resources and internal knowledge management

In the assessed projects 1 to 15 that used the Infra maturity tool identified that the PDO and the employees should be capable of adapting to the changing circumstances and the various project phases. In some situations, employees are employed only for a certain period and when the tasks or job is completed, the specialties are no longer needed, and sometimes new personnel have to be hired. Hence flexibility is very important. In order to overcome difficulties in working relationships, it may be useful to reassign staff or 'to let a person go'. However, retaining experienced employees as long as possible is also beneficial to maintain the continuity. This challenge of retaining experienced project teams and encouraging the key personnel to stay and finish the project has been a challenge across the NETLIPSE projects. The experience and the knowledge have to be preserved and transferring of knowledge should also take place if key personnel leave the project. For example, a bonus can be paid to employees who stay until the end of the project.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- If there is a clear gap in time between the phases, it increases the possibility to lose knowledge and experiences of the personnel involved. The PDO needs to store key positions for a longer period of time in order to build further on the current level of knowledge in the next phase. Also, document lessons learned explicitly to manage transfer of knowledge between phases.
- It is important to register all information needed for the organization that will manage the project during the maintenance phase. Transfer of knowledge at the end of the construction phase will be very important for a successful maintenance phase. The PDO should plan this transition in a timely manner. At the end of construction, the contractor shares all of the knowledge with the maintaining organization. However, the same information should also be shared with the asset owner. This would facilitate easy transfer of asset information if any unforeseen circumstances would occur with the SPV or maintenance.
- The key positions (finances, legal affairs, project management) should be filled with people that have good experience in comparable scale or type of projects. Also, these key personnel should be retained at all project stages.
- Investment in a clear HR plan or approach is essential to make sure there will be (enough) experienced and competent personnel available for future projects.
- There should be a good variety of gender in the project team and in management positions.

The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset specify more clearly on how investment in human resources and internal knowledge management can be carried out in order to effectively deploy the personnel and manage knowledge to successfully execute projects.

4.2.1.5 Risks (and opportunities)

1. Position the responsibility for risk analysis within an independent group

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the inventories of the risk assessment including the opportunities should be considered as an independent task, in order to prevent the managers or employees who are responsible from keeping the information to themselves. The overall risks might be overlooked as the perspective of the staff in one area can be limited or while dealing with issues they could be biased about their importance or they would prefer to deal with it by themselves. By not seeing the bigger picture they might allow the risks to accumulate. Hence a dedicated team or a risk manager should have the authority to analyze and disclose the risks independently from the contract teams and other departments.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The roles and responsibilities of the risk manager (process) and management team (risk management) should be clear.
   - Organizing independent external reviews of the project and its processes, helps to identify areas for improvement that the project team may be overlooking.

   Delegating the responsibility of the risk analysis to an independent group helps in well-rounded approach to dealing with all the risks that the project can face. Hence this best practice is identified in both sets of data and has gained more significance in recent years for the successful execution of the projects.

2. Do not forget to identify opportunities

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that a restricted view on challenges of future project phases and a demotivating atmosphere is created by focusing on risks. Risk is just one element of uncertainty. Opportunities, as the research shows, is the other perspective that is often ignored. A broadening of perspective on uncertainties is accompanied with the generation of new energy in the organization through the incorporation of opportunities in risk analysis.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Identifying opportunities should also be a part of the risk management system and attention should be paid to utilizing them effectively.
   - Risks and opportunities analysis should become embedded in the project team culture.
   - Organize separate sessions to identify the opportunities for the project, especially in the design phase, in order to make a good analysis of the pros and cons and decide consciously on taking the opportunity.

   The opportunity analysis is considered a vital practice and hence it is identified as one of the best practices and lessons learned in both the datasets.

3. Share risk analysis with contractors and before tendering

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that to analyze the level of contractor awareness for uncertainties, and to compare bids on a qualitative basis, usage of risk analysis in the tendering and contracting phase of a project would make sense. Probability of later additional claims and the risk of contractor failing to deliver when faced with unexpected events is reduced using this approach.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- For every project across the program a risk analysis is executed before it goes out to tender. Part of the analysis is the assessment of which party can best manage the risk.
- The risk strategy from the contractor's point of view should be a part of the tender criteria. This could be a very interesting discussion point during tendering in order to stimulate the contractor to reduce risks and take advantage of possible opportunities.

The above-mentioned best practices and lessons learned are identified in both the data sets and have proven to be beneficial in the successful realization of large infrastructure projects.

4. Include risks and risk reservations in cost estimations

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that in the event that a foreseen risk occurs, how do projects handle the usage of risk reservation to cover the risk? The budget was overrun is what some NETLIPSE projects would claim. In other cases, it was claimed that the project did stay within the budget whilst using the risk reservation for its intended purpose. The presentations of project budget should or shouldn't include risk reservations, is an emergent point of discussion from the NETLIPSE project's consideration.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - There should be a clear connection between the risk analysis, financial forecast and planning.
   - Attention should be given to the contingency percentage which should be adjusted according to the complexity of a project. Also, there should be a clear connection between the project risks and the project contingency budget.
   - A clear and systematic cost control and risk management procedures should be in place.
   - Financial resources can be re-allocated creating opportunities for flexibility as long as the projects regularly reports updates to forecast costs and the portfolio has enough head room to accommodate changes.

   The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset stresses the importance of the contingency budget that should be available for the project and linkage of the risk analysis to the financial forecast that is necessary in keeping the project under the forecasted budget.

5. Use a risk database

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the setting up and usage of a risk database in order to structure and rank risks is advised. Risks from different parts of the project organization should be registered by a risk department. All NETLPISE projects seem to be convinced now that a database is essential for adequate risk management, though that wasn't the case for earlier projects.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - There should be an integrated risk identification and control system in place on project and program level and keep track of the applied risk handling measures. An integrated approach to risks will help the project management team focus on what is important and manage the interfaces better.

- Risk management mitigation should be SMART (specific, measurable, assignable, realistic, and time-bound). The mitigation measures should be clearly defined and should clarify who is accountable for the mitigation measures.
- Risks regarding the soft side of the project, like organizational and cultural aspects between parties should also be included in the risk files.

The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset specifies more clearly the elements that have to present in the risk database like the SMART mitigation measures, people accountable and many more. Attention is also shifted to the soft side in the execution of projects.

6. Rank and prioritize risks

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that It is not possible for project management to focus on all risks as project databases are easily filled. It has been stated by a few NETLIPSE projects that regardless of risk management being a useful tool, its use should be discretional and with a careful preset of priorities. There are several ways to conduct prioritization. A quantitative ranking of risk can be arrived at through the multiplication of the probability of occurrence of an event (threat or opportunity) with the impact the event has on the project objectives. Usage of expert judgement to identify the most important risks is another way risk can be ranked subjectively and qualitatively.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - A very extensive project risk file might lead to a lack of focus on key risks by the project management team.
   - There should be a clear risk escalation process in place. (Owners of the risk and mitigators)

   Ranking and prioritizing risks has helped focus on the important risks that have huge impact on the project. Hence the identified best practices and lessons learned are mentioned in both the data sets and have proven to be beneficial in the successful realization of large infrastructure projects.

7. Make risk management part of regular management routines

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that risk analysis should be seen as a mainstream management task and not as a meagre abstract tool. Research suggests, use of a systematic approach from the start of a project provides insight into the causes and effects of events and therefore, allowing for effective control. Essentially, risk management is about steering. To minimize the impact of an event, effects can be influenced, and prevention of the occurrence events can be done through a review of causation. ‘Risk awareness’ and the necessary attitude are created through the promotion of risk management by the management team. Nevertheless, employees have to be assured that open communication about risks will not lead to sanctions. Rewards should be given out for being forthrightness and lateral thinking in terms of innovation.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Risks should be included in regular project reporting and control structures.
   - Ensure that risks and mitigation strategies are reported in the Monthly Report and that the risks and actions to mitigate risks are reviewed frequently.

Including the risk management as part of the regular management routines provides systematic approach and hence the best practices and lessons learned are identified in both the data sets and have proven to be beneficial in the successful realization of large infrastructure projects.

4.2.1.6 Contracting

1. Customize the contracting philosophy to the characteristics of the project and country

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that there is no one 'best' contracting strategy. Various models are shown by both literature and NETLIPSE projects. Since subsequent maintenance is DBFMO's responsibility, incentives for constructors are contained in DBFMO contracts (Design, Build, Finance, Maintain and Operate) for design optimization. The ability to steer and adapt to evolving circumstances is offered by traditional contracts. A strong preference for a certain contract usually exists in project organizations. It is important to remember that transference of the best practice to another project cannot be made on a one-to-one basis. The complex context of the project needs to be taken into consideration and the project should also adhere to the national judicial system and culture while approaching contracting. To achieve a successful transfer of a best practice, it is imperative to understand the characteristics of the context in which it worked and the contextual difference in which it has to be used again.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - A formal procurement and contracting strategy are an essential basis for contracting. Apart from preferences in this strategy, the contract form always needs to be judged to the characteristics of the project.
   - The contract strategy should not be purely based on previous projects without alternatives being considered. This might exclude innovative contract strategies leading to further optimizations. In an international context several examples of a successful implementation of innovative contract strategies can be found.
   - There should be good awareness of the different approaches required for each contract. These different types of contracts (all-in contract, design and build and alliance) require also different contract management approaches: different client-contractor relationships, different contractual behavior, different payment requirements, etc. The PDO appears to be able to manage the three types of contracts through its approach.
   - The procurement strategy, choice of contract types and the tender procedures should be clear and should align with the project challenges. This will aid the project in choosing the most suitable contract type to match each part of the project.

   Customizing the contracting philosophy to the characteristics of the project are identified in both the data sets and have proven to be beneficial in the realization of large infrastructure projects.

2. Consider criteria other than price

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that price and planning shouldn't be the only criteria while comparing bids. Alongside the two, quality criteria should be considered as well. Hence, it becomes necessary to organize tenders in a manner wherein the quality criteria are clearly specified and applied. The creativity of contractors should be used.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The strategic contracting plan should be prepared based on the project needs and the procurement policy, including cost escalation, quality of delivered product, interfaces, traffic during construction and liability risks. In the strategic plan define if and how to tender early contracting involvement (ECI) and define how this is connected to other project activities. Be sure that this plan also takes into account the interface risks between the different contracts. Involve the Advisory Group in the design of the strategic contracting plan.
- A contractor who has bid on lowest price has different drivers than a PDO who is used to a collaborative working environment. However, the PDO should analyze the risks following the procurement on lowest price and also involve the client consultant in this process and take the results into account with the development of the contract management strategy:
    - o Where will the contractor focus on?
    - o What are the contractor's risks and challenges?
    - o What are unwanted effects of this way of procurement?

The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset specify more clearly the aspects like cost escalation, quality standards of the delivered product, interfaces, traffic during construction and liability risks etc. that should be considered other than price. This helps minimize risks following the procurement on lowest price.

3. Allocate risk to the party best suited to carrying it

In the assessed projects 1 to 15 that used the Infra maturity tool identified that the risk identification prior to tendering and listing down the risks concerned in the tender document is favored in the NETLIPSE research. The person or party best able to manage the said risks should be assigned the risks. It is easy for projects to be delayed and overrun its cost if risks are forced onto an organization. Therefore, it is important to not give responsibilities to parties that aren't capable of dealing with them. The client/sponsor may end up paying twice if that is the case – first the contract price and second if it is the case that the contractor cannot handle the risk. An understanding of the risks involved and the capabilities of other parties to manage the risks will keep the project from being delayed and avoid cost overruns. The uncontrollable financial implications of risks can be split between the client and contractor whenever deemed necessary.

However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The contract risks should be identified and assigned to whoever is best placed to manage them.
- The risk division between client and contractor should be clear as well as the procedure for dispute resolution. Dispute resolution arrangements are essential because it allows resolving disputes before the end of each Phase, which is beneficial for both the PDO as the Contractor. The dispute resolution process should not be too formal in the early stages of a dispute.
- Monitor continuously the financial situation for the contractor within the contract.

The risk division with the involved parties, and the above-mentioned best practices and lessons learned that are identified in the first data set are supported by the findings of the second data set. However, dispute resolution and constant monitoring of the financial situation of the contractor is specified in the IPAT reports.

4. Use incentives in the contract

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the usage of incentives in contracts for the contractors to drive the costs down, to push for best quality and to deliver on time is advised. Incentives can be in the form of bonuses or penalties. Nonetheless, bonuses can turn out to be more effective. Furthermore, incentives can be added to integrated contracts too wherein the contractor will not only be responsible to build the infrastructure but also maintain and operate it. Thereby, an incentive for design and financial optimization is created for the contractor keeping in mind the whole life costs.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The selected contract arrangement should include incentives and not only penalties. If not, the Client will not be incentivized to accept value engineering measures in the project (finding the solutions which have the same value for client and lower cost for contractor). The contract can include various cost incentives for the contractor: a cost-plus system in order to stimulate the contractor to execute the project within budget and a bonus system if the contractor excels at collaboration with the project organization.
   - The implemented incentive mechanism which should act as a bonus system and not seen as a penalty system by the contractor because it works more as a hindering factor in the relationship in the project than stimulating the performance of the contractor.
   - Ensure that the incentives in the project are aligned to the objectives and are available to properly mitigate the risks.
   - There should be incentives for the individual contractors to cooperate and liaise with each other in order to improve the collaboration between the contractors (and coordination of this collaboration)

   The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset specify more clearly the benefits of aligning the incentives to the project objectives, implementing a bonus system instead of penalty system and also the need to incentivize the liaison of the individual contractors.

5. Equip contract managers with adequate expertise

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that competence is key in being a good commissioner of work. It is important that the project delivery organization has the expertise to judge a contractor's performance and be capable of negotiating when disputes arise. Evaluation of contingency claims is to be done by experts on the subject matter only. For example, on technology or geology. Such expertise should be made available by any means necessary.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - In the tender appraisal there needs to be a process for ensuring the right caliber of staff are employed in the SPV/contractor organization.
   - The project organization should not be very dependent on the contractor regarding knowledge and resources. As long as the collaboration based on reliability and trust is going well this is no problem, but in case of e.g. cost overruns this might harm the relation. On the other hand, the client can contract an independent technical advisor. Herewith they can secure themselves necessary knowledge and capacity in order to assess the deliverables of the PDO.

- There should be flexibility to implement optimizations to take advantage of the knowledge of the contractor.
- The contract management team should have experienced personnel available. The size of the team and experience of core team members should be evaluated.

Equipping the contract managers with adequate expertise is imperative and also identified in both sets of data as one of the best practices for the execution of the projects.

6. Cooperation is essential to a good contract

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that being able to deal with complexity requires a good relationship between the contractor and the project delivery organization. It is rare to find complex projects which have perfect contracts. The differentiator can come down to the attitude and competences of the parties involved. Collaboration between the client and the contractor to troubleshoot problems in everyday work life should be sought out.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The interaction between the contractors on the interfaces is required on a practical level. A suggestion to foster interaction by organizing periodic informal meetings at a management level to build trust, exchange information and share possible risks towards overall project success. The presence of the PDO is not in all cases needed (to prevent strategic behavior towards the client).
   - If the project hires an international contractor, there should be proper awareness on the side of the PDO for potential impact of cultural differences, and the team should look at ideas for workshops and ways to ensure that this is not an obstacle. The PDO should also be open to innovation that might come from using an international contractor. Take time with the contractor in the beginning to fully understand cultural differences, build collaboration and trust, ensure shared goals. Also explain the host country's cultural approach to collaboration and conflict resolution.
   - If the contract strategy is composed of a lot of civil works contracts, it adds many interfaces to the project to be managed by the PDO. Coordination between those contracts will be the responsibility of the PDO, which could be time consuming and possibly adding unwanted risks.

   The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset specify more in detail the integration of international contractors and also good cooperation and communication at the interfaces which benefits the project as a whole.

4.2.1.7 Legal Consents

1. Link legal procedures and stakeholder management

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that effective management of stakeholders can reduce the potential influence that stakeholders and other outside parties have through laws and regulations that projects are subjected to, that can obstruct or delay the project. Chances of legal delays can be minimized through the positive impact of open communication with the stakeholders has.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - With regards to environmental consents, particular attention should be paid to the stakeholders (both governmental and non-governmental parties) to ensure that expectations are managed. If

there is any potential for political controversy, the project team needs to work closely with the relevant municipality staff to be transparent and manage the issues.

- Stakeholder management helps in the smooth process of getting all the necessary consents.

The above-mentioned best practices and lessons learned are identified in both the data sets. Linking the stakeholder management with the legal procedures have proven to be beneficial in the successful realization of large infrastructure projects.

2. Map procedures and keep them updated

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that quite often, at the start of the planning of a project, legal consents are required before the tendering. In some cases, procedures and regulations can influence each other. The chances of being surprised can be reduced by mapping procedures in advance. Furthermore, large infrastructure projects have a high execution times and within that period, fresh European or national laws can emerge. If possible, such changes should be anticipated through prudent monitoring to avoid any adverse impact on the project or delays. In any case, the impact of such sudden occurrences should be well recorded and documented to further project management and control.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The project must be aware of changes in rules and regulations, which occur often both nationally and internationally. This makes it hard to follow and implement every single change and adapt EU regulation to a national law.
   - There should be clearly defined process regarding identification and management of necessary permits, authorizations and consents (Planning Approval Process) needed by the project.

   The mapping of procedures and keeping them updated was an essential practices and lessons learned are identified in both the data sets and have proven to be beneficial in the successful realization of large infrastructure projects. The clear definition of identifying and updating processes will clear any misunderstandings and help avoid delays.

3. Ensure legal expertise is available

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that procedural mapping, anticipation of change through monitoring and providing support to contract teams are only a handful of responsibilities concerning legal consent. Every team within the researched NETLIPSE projects raised the need for acquiring legal counsel/expertise to perform these activities.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - The responsibility for organizing and managing the building permits should be assigned to a dedicated team member or group of team members.
   - The team should have good experience in managing legal procedures and know what is needed at what moment of time. It is also beneficial to identify a dedicated team for obtaining consents.
   - The PDO should be competent and capable of managing the complex and democratic processes of obtaining the legal consents.

   The need for legal expertise is well understood and the best practices and lessons learned are identified in both the data sets and have proven to be beneficial in the successful realization of large infrastructure projects.

4. Communicate with authorities proactively

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the compliance assessment with legislations and authorization of permits is often handled by multiple authorities. Organizing regular meetings with the concerned authorities is advantageous because the details of the application of the process can be agreed upon. Moreover, wherever necessary, processes and content for permit appeals can be made available.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Proactive collaboration should exist between the essential parties in order to obtain the necessary permits for the project.
   - The active management on necessary consents and compliance to rules and regulations with the responsible parties are to be considered after scope and schedule have been decided.

   The proactive communication with authorities has proved beneficial in the successful realization of large infrastructure projects as they aid in coordinating and managing the process of obtaining the permits on time. Hence these best practices and lessons learned have been identified in both the data sets and is realized as a vital best practice.

5. Coordinate the consents and tenders planning

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that the consent and tender planning should be planned in coordination with each other. There are several ways to achieve this. The project delivery organization can arrange all necessary permits and tender afterwards. Alternatively, the project can be tendered without the contractor having responsibility for the obtaining of permits.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - If the project has already successfully completed all the major legal procedures before the start of tendering procedure, it helps in avoiding delays.
   - There should be a detailed timeline for consents linked to project milestones and there should be a timetable for the agreements that are needed and legal procedures to undertake for the project.
   - If the overall planned time schedule for obtaining consents seems to be very tight. The PDO should develop a contingency plan in order to deal with delays or refusal of consents based on lessons learned from previous projects concerning legal procedures.
   - Timeline for delivery of the milestones should provide enough time to account for delays and backlog. Time available for approvals should not be tight and margins should exist for any re-work.
   - If there is a strong barrier between the planning and construction phase then the hand over from the planning department after the Planning Approval Order should be organized in an optimal manner because the teams do not take much time for the hand-over, information and knowledge can get lost. This could lead to unanswered questions and delays in a later project stage.

   The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset specify more in detail regarding the timeline for obtaining the consents and dealing with delays.

4.2.1.8 Knowledge and Technology

1. Be careful with experiments

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that there are several stages that technological developments go through. An idea may trigger the start of the development. On the other hand, an unforeseen incident (ex. an accident) may occur, requiring a new approach. Ideas are stimulated in such situations that could be translated into concepts and designs. Then comes a stage of experimentation and tests after which, emergent technology is used in a pilot project. Down the line, the technology matures and usually gets accepted. The challenges faced by some NETLIPSE projects while attempting to implement new technology have resulted in cost and time overruns. Implementation of new technology to a project is challenging due to the new risks it introduces.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - If new technology is introduced in a project attention should be paid to efficient incorporation of this technology. Innovation needs a 'bedding in' period of a few years to establish the system of operation and maintenance, including the training of personnel.
   - Make a conscious decision whether or not to include new technologies in and for the project and decide how to assess new technologies for the project. The monitoring of possibilities for new technology should be a continuous process.
   - It is recommended to make better use of the knowledge, expertise of contractors and consultants to stimulate innovation, optimize building processes and logistics. During the tendering process, PDO can discuss alternative technological solutions and within the tendering procedure bidders can be challenged to come up with technological innovations to earn extra quality points.

   Analyzing the technology to be used proved essential and thus remains as one of the best practices in the execution of infrastructure projects in both sets of the assessment reports. However, in the second dataset, attention has been paid to the 'bedding in' period of a few years to establish new technology to minimize risks introduced. The use of knowledge and expertise of contractors also plays a significant role in the successful introduction of new and innovative technologies.

2. If new technology is applied, organize the management of innovation

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that an intensive management approach is required in large infrastructure projects while trying to implement new technology. With private parties, the application of new technology frequently constitutes a part of the contracts. As and when problems arise due to uncertainties of the technological application, there is a tendency amongst the parties involved to blame each other. This undoubtedly leads to project delays but also damages relationships. It is shown in the best practices adopted by the NETLIPSE that any application of new technology can be well managed if they are treated as separate innovation projects. Nevertheless, it is important to make sure that they have close and clear ties if the main project is dependent on the technology. It is therefore understood that ample time should be allowed by the parties involved for its development and they should work together closely. The applicability of the technology should be studied by them and a process to deal with uncertainties should be arranged.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

- The PDO should have a clear strategy on the assessment and implementation of innovation in the project. There is a risk that implementing or (re)considering new technologies interferes with the project delivery or other important milestones.
- To prevent scope creep, new technologies should be managed as separate projects in the project.
- Make sure there is enough technical, engineering and construction expertise within the PDO to cope with the innovative elements and address practical parts of the most complex structures.
- The project should plan to make use of early contractor involvement for the design and construction contract. This enables innovative solutions and production methods.

The best practices and lessons learned from the fist dataset are supported in the second dataset. However, the findings from the second dataset stresses the importance of early contractor involvement for the design and construction contract. These practices prove to be effective in the deployment of new technology.

3. Organize expertise and knowledge exchange within the project organization

   In the assessed projects 1 to 15 that used the Infra maturity tool identified that drawing upon state-of-the-art expertise to assess technology strategies is recommended based on studies. Both the technology and expertise needed to assess it add to the cost, but they also create added benefits. Furthermore, organizing knowledge management in the project organization would be beneficial.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - Benefits realized with use of new technology within a project should be reviewed so the attributed cost savings can be verified as a reference for future projects, or the next phase of the project.
   - A formal lesson learned report should be prepared and actively shared after each project completion so that knowledge is passed from one project to another.
   - The focus of the knowledge transfer should be from both national and international projects.
   - The project should use networking within disciplines (risk management, quality management, etc.) to exchange knowledge.

   Organizing expertise and exchanging knowledge helps in the effective management of resources, personnel and equipment. Hence the best practices and lessons learned are identified in both the data sets and have proven to be beneficial in the successful realization of large infrastructure projects. However, The IPAT reports identified the benefits of also including the national and international projects for transferring knowledge and not just limit it within the project organization.

4. Connect with other organizations

   The first data set identified that while the exchange of knowledge can occur inside individual parties and with other parties, it can occur within and with organizations that are not involved with the project directly like the scientific networks and knowledge institutions.

   However, the components identified in the IPAT reports of projects 16 to 31 that support the above best practices and the lessons learned are-

   - It is recommended to apply a system of searching, collecting, analyzing and assessing the potential of latest global technological solutions and experiences from the fields of project application, innovation leadership and culture in similar projects.
   - The knowledge exchange from other projects can be improved by a systematic inflow of the latest national and international know-how related to economical, technical, organizational and

behavioral solutions and their potential implications. To make this information accessible it is recommended to create a knowledge base from previous projects.

- The focus of the knowledge transfer should be from both national and international projects.
- A formal lesson learned report should be prepared and actively shared after each project completion so that knowledge is passed from one project to another.

By connecting with other organizations and sharing information, the knowledge transfer becomes valuable during the execution of the projects. Hence the best practices and lessons learned are identified in both data sets and have proven to be beneficial in successful realization of LIPs.

4.2.2 Results of qualitative data analysis

The goal of qualitative analysis was to report the findings with as much depth and insight. Results of the comparative cross-case analysis yielded trends that evolved by comparing the best practices and lessons learned from the first and the second data sets. The findings from this analysis serve as a background document for the next phase of the research i.e., expert sessions. These findings are summarized in the table-8 and will be validated with the help of experts with regard to their practitioner's knowledge in the field of construction. Few of the best practices like financial management and legal consents did not identify significant evolution of trends in best practices. Hence the table below only presents the compelling best practices that have evolved over the years.

Table 9: Conclusions of qualitative document analysis

Theme	Best Practices Identified	Evolved best practice
Objectives and Scope	Formulate a vision	Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.
	Use configuration management to assess impact of scope changes	Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.
Stakeholder engagement	Facilitate liaison with local stakeholders and critics	Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.
	Enable the political branch to supervise the project	During the execution phase of the projects, efforts must be put to sustain the established relationships with the political parties and risk mitigation measures strategies should be prepared in case of change in political consensus to avoid the project being used as a political pawn.
	Brand the project	Brand the city along with the project to increase the benefits for the project and the community.
Organization and Management	Communicate a project management policy	Expand construction management values with project management values and apply a transparent management style for successful organization & management in project. *(Construction management is focused on the client needs and related to technical issues mostly. project management those views are extended by the needs of the overall business case and all directly or indirectly involved stakeholders.)*

Theme	Best Practices Identified	Evolved best practice
Risks (and opportunities)	Include risks and risk reservations in cost estimations	The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.
	Use a risk database	The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.
Contracting	Allocate risk to the party best suited to carrying it	Dispute resolution and constant monitoring of the financial situation of the contractor should be considered while allocating risks to the party best suited to carrying it.
	Use incentives in the contract	Align the incentives to the project objectives and incentivize the liaison between the contractors.
Knowledge and Technology	Be careful with experiments	Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.
	If new technology is applied, organize the management of innovation	
	Organize expertise and knowledge exchange within the project organization	Extend the knowledge exchange beyond the project organization i.e., national and international projects.

5. Expert sessions

This chapter will present the validations and insights obtained from the expert sessions. The chapter is divided into two sections. The primary focus of the first section i.e., 'expert validation' is to validate the research findings using experts. Using a panel of experts familiar with the construct is a way in which validation can be obtained (Kane, 2013). The second section i.e., 'expert insight' will elaborate on the value of the IPAT tool on a project level and discuss its significance based on the insights shared by the experts.

5.1 Expert validation of the identified best practices

In a research that deals in themes and context, questions like 'Does it make sense?' helps to measure the validity of the findings. After the completion of document analysis and qualitative comparative cross-case analysis, the findings from the analysis needed a more concrete basis. Hence interviews with experts were organized in order to obtain a reasonable level of validity for the findings. Although the research has been interpreted and condensed, if responses from experts are consistent across the presented questions, the data becomes more reliable.

To gain more practitioner's perspective on the findings of the research, expert validation was carried out in two sessions. In the first session two professionals who were experts in the field of project management were consulted. The detailed interview is presented in Appendix- 3. The interviews were characterized by both open-ended questions that helped extract more in-depth information; and close-ended questions that helped either confirm or deny the validity of the presented data. The interview questions discussed trends that have evolved in the field of project management; hence 12 best practices were presented to see if the experts could recognize them. If the trends were recognized, the experts were asked to give an example of a project in their practice where that particular practice was implemented. The meetings with the experts took place on-

- **Expert 1:** In-person meeting on 17 October 2019.
- **Expert 2:** Skype meeting on 16 October 2019.

In the second session, the participants were thirty delegates who attended the NETLIPSE biannual meeting held in Utrecht on 28 October 2019. The participant list comprised of a mixed audience which included project managers, directors, professors and advisors from all across Europe. For this session, the participants were first briefed about the research and the purpose of the expert session in the research i.e., to validate the research findings with examples from real-life practice and projects. Later the expert validations were obtained regarding the evolution of the trends. Initially, the best practice identified in the first data set was stated and then the evolution of the stated best practice over the years was explained. The participants were then asked to vote. The voting comprised of four options i.e., 'disagree', 'agree but only in theory', 'agree & have to implemented in practice', 'agree & have seen it practice'. The participants also shared their individual insights on some of the best practices based on their experiences. The results of the second session are discussed in section 5.1.2.

5.1.1 Results of the first session

The experts did recognize the evolution of best practices for the most part. The experts also suggested a few changes to some of the proposed best practices to better substantiate the findings from their real-life experiences in the field of project management. These suggestions are in the table-9 below and the detailed interviews are presented in Appendix-3.

Table 10: Expert insight

Best Practice Identified	Evolved Best Practice	Expert-1 insight	Expert-2 insight
Formulate a vision	Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.	Shared vision helps enormously to get the project running and to overcome disappointments.	Recognizable
Use configuration management to assess the impact of scope changes	Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.	Reflection is very beneficial in a project.	Integrated project management model uses this.
Facilitate liaison with local stakeholders and critics	Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.	Easily Recognizable and has become more prominent in recent practices.	Most Dutch projects are used to this type of stakeholder engagement.
Enable the political branch to supervise the project	During the execution phase of the projects, efforts must be put to sustain the established relationships with the political parties and risk mitigation measures strategies should be prepared in case of change in political consensus to avoid project being used as a political pawn.	It's not good for a project when the political influence is very high so try to avoid it as much as possible.	Recognizable
Brand the project	Brand the city along with the project to increase the benefits for the project and the community.	Sometimes difficult to execute.	Align the project's branding with the city because branding the city might be outside the scope of the project managers.
Communicate a project management policy	Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.	Should be implemented more in practice.	Depends on the phase of the project.
Include risks and risk reservations in cost estimations	The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.	The risk analysis should integrate the bottom-up approach with the top-down approach.	Recognizable

Best Practice Identified	Evolved Best Practice	Expert-1 insight	Expert-2 insight
Use a risk database	The risk database should provide SMART mitigation measures, people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.	More integrated in Dutch organizations when compared to southern Europe.	Most Dutch projects use this system.
Allocate risk to the party best suited to carrying it	Dispute resolution and constant monitoring of the financial situation of the contractor should be considered while allocating risks to the party best suited to carrying it.	Constant monitoring of the financial situation of the contractor is recently implemented.	Don't agree with constant monitoring of the financial situation of contractor.
Use incentives in the contract	Align the incentives to the project objectives and incentivize the liaison between the contractors.	Recognizable	Recognizable
Be careful with experiments If new technology is applied, organize the management of innovation	Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.	LIPs are the best environment to realize innovations in new technology. So, this practice is easily recognizable	Along with 'bedding period', the new technology should be managed as separate projects to prevent scope creep.
Organize expertise and knowledge exchange within the project organization	Extend the knowledge exchange beyond the project organization i.e., national and international projects.	NETLIPSE exists to promote this practice.	More organizations are incentivized to use this best practice.

Most of the best practices were recognized in the field of practice. However, few suggestions were given to adjust the best practices based on practitioner's knowledge to better elaborate the findings of the best practices like managing new innovations as separate projects, aligning the project's branding with the city and expanding the construction management values with the project management values based on the phase of the project.

5.1.2 Results of the second session

The detailed results of the second session are mentioned in Appendix-4. This section will present only the significant conclusions observed for the second session of expert validation. Out of the twelve best practices identified, the participants strongly agreed with six of the stated best practices by either voting for 'agree & have to implemented in practice' or 'agree & have seen it practice'. These are-

- Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.

- Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.
- Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.
- The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.
- Align the incentives to the project objectives and incentivize the liaison between the contractors.
- Extend the knowledge exchange beyond the project organization i.e., national and international projects.

Three of the best practices received neutral feedback because some of the experts did not perceive the best practice to be suitable in their respective countries. However, this was counteracted by a few other positive feedbacks to the stated best practices. The reason for these varied opinions was mainly due to the cultural aspects and also the management style adopted in their respective countries. These best practices are-

- Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.
- The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.
- Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.

Three of the best practices received strong criticism as they were not recognized in practice and in some cases, they produced unfavorable outcomes in the project that used the stated best practice. The main arguments provided by the experts are summed up in the table below-

Table 11: Expert comments

Best practice	Arguments
During the execution phase of the projects, efforts must be put to sustain the established relationships with the political parties and risk mitigation measures strategies should be prepared in case of change in political consensus to avoid the project being used as a political pawn.	The project team cannot have a political agenda to win the project. If there are strategies in place they might be perceived negatively, and the team should focus on working with the preconditions that are set in place.
Brand the city along with the project to increase the benefits for the project and the community.	Some projects don't want to advertise the city, and in most cases, it lies outside of the scope of the project managers.
Dispute resolution and constant monitoring of the financial situation of the contractor should be considered while allocating risks to the party best suited to carrying it.	The contractor can approach the banks to obtain money for executing the contract. Also, we lack the tools and knowledge to constantly monitor them. Even if external expertise is hired by spending more, it does not guarantee the extra value or extra security for the project

5.2 Expert Insight on the usage of IPAT

Since the value of the assessments and follow up of assessment reports were unknown, expert insight on the individual experience of the process was researched. The questions were mainly designed to gain insights into the effectiveness and applicability of the IPAT tool, to verify if the assessment process was actually making a difference in the management of projects and also seek suggestions to improve the process or the tool. The detailed interviews are presented in Appendix-3.

This expert insight was gained through 'semi-structured Interviews'. These interviews contain the combination of flexibility offered by unstructured interviews along with the preparation of structured interviews making it a suitable option for qualitative research to gather all the information necessary. In a semi-structured-interview the interviewees have a certain degree of freedom in the information they provide, also it is a very flexible technique for small scale research and case studies (Drever, 1995). The projects chosen for the interviews were selected pragmatically. The interviewees were project managers/directors whose projects were assessed using the IPAT tool. These interviews focused on gathering information pertaining to the value of the assessment on a project level and took place on-

- **Expert A:** Skype meeting on 22 October 2019.
- **Expert B:** Skype meeting on 15 October 2019.
- **Expert C:** Skype meeting on 21 October 2019.

5.2.1 Results of semi-structured interviews

The sub-question 3 was answered using the information obtained from the semi-structured interviews. The project managers and directors started by defining the value of the IPAT assessment in their respective projects and the described the insights that they gained from it.

- Expert A stated that the IPAT assessment helped prioritize various concerns and gave guidelines regarding where the project had to improve. As the project director, the assessment gave more acceptance on whether the project was on the right track and helped figure out what areas where the focus was needed.
- Expert B stated that the assessment gave the project team a chance to learn and at the same time the checked if there were any changes needed. The colleagues and the people involved in the project really appreciated the exchange of knowledge and experiences. The IPAT assessment gave the team a better direction for the next phase and pointed out the areas for improvement in order to optimize the implementation phase.
- Expert C especially appreciated the exchange of knowledge and experiences. The discussion regarding the assessment results was not an official audit but took place in a more informal setting where the project team received good feedback. It was also the perfect time for the project team to receive feedback. Some problems were noticed earlier, receiving feedback regarding these problems from external professional experts proved to be was very useful and also receiving solutions on how things can be done differently.

All the interviewees defined the process as an informal assessment which gave them a learning opportunity as it was not a formal audit. The assessment gave them the opportunity to reflect on the project's progress and with the help of an external perspective, helped them realize the areas where improvement could be made. They also described that the assessment gave them a better direction and focus areas in order to optimize the outcomes of the following phases. The interviewees appreciated the

exchange of knowledge and experiences from the professional experts in the assessor's team which helped them prioritize the problems they had to deal with, in the next phase of the project. The recommendations offered by the IPAT assessment report were implemented in the project to a certain extent. There were times when the project team did not have the authority, or the organization structure was not flexible enough to act on the suggested recommendations. This was also due to the cultural differences that prevailed i.e., the projects in the southern parts of Europe were not able to implement all the recommendations due to the constraints of politics and the structure of the organization itself. The recommendations were deeply analyzed by the project team to create more awareness for certain aspects that needed attention in the next phases and also future projects that they undertook.

The interviewees also suggested some improvements to the IPAT tool and the assessment process. These suggestions are mentioned below:

- The IPAT should focus on elements that more important nowadays like the societal, environmental and sustainability aspects of the project so that the project can receive more feedback regarding these prospects.
- A translator is essential during the assessment process so that no information is lost during translation and also all the members of the project team participating will have an in-depth understanding of the assessment and also exchange information more freely instead of worrying about translation.
- Including a local assessor in the team so that the assessor team can have insight regarding the context of the project and also beware of the cultural differences that prevail.
- It might also be beneficial if the assessors could meet and share their experiences and get to know each other. This would be a good idea as the assessors would get an opportunity to discuss the assessments in order to learn from each other.
- Clearly characterize the phases based on the individual project being assessed i.e., ask the client to describe the stage in his/her country.

5.3 Conclusion of expert sessions

The data gathered from experts have not only provided validation to the findings of the research but also helped gather information pertaining to the value of the assessments and its significance in projects. The validation of the trends evolved in the best practices are made more accurate with the combination of expert knowledge in real-life projects and their proficiency in the field of project management. The confirmation received on some of the best practices and lessons learned helped prove the evolution of the trends and also better substantiate why few practices trends are not practical.

The expert insights aided in better establishing the purpose of the assessments and the added value that the IPAT recommendations had on the individual projects. It was an informal assessment that gave the project team a learning opportunity as it was not a formal audit. I also served as an opportunity to reflect on the project's progress which further gave the management team a better direction and focus areas to optimize the outcomes. Hence expert sessions helped give a more concrete basis to the conclusions of the trends i.e., sub-question 2. The IPAT assessment provides valuable and interesting insights for participants on how to optimally organize and manage the construction projects which could be integrated into real-life practice.

6. Discussion

This chapter will present a critical overview of the methodology used for the research and the findings obtained. The limitations of the research are also discussed in this chapter.

6.1 Discussion on the used methodology

The exploratory research used different approaches to analyze data and adapted to changes as the research progressed. Not all data from the IPAT reports followed the same structure, due to the varying themes in the different versions of the assessment tool. Hence the used methodology was suitable in choosing the approaches to analyze the data and then validate them. To better understand the effectiveness and the applicability of the IPAT assessments, data analysis was performed using both quantitative and qualitative approaches.

For the quantitative analysis, the assessment reports provided the base information i.e., the scores and the weighted factors. For this research, the weight factors were not considered because few of the projects assessed had different themes and sub-themes. The projects were clustered according to the phase that the IPAT assessment was performed. The scores of projects according to each theme were plotted on a graph to provide more illustrative data in order to easily find patterns and trends. However, the analysis delivered inconclusive results due to the limited amount of data that was available for each phase.

To gain a thorough understanding of the data, the research used qualitative methods to analyze the data. Since the data used mainly came from the assessment reports of individual projects, a qualitative comparative cross-case analysis was performed i.e., comparing the data of individual assessment reports. The methodology chosen helped obtain the information relevant to the research.

Following the data analysis, expert sessions were organized to gather insight and validations from a practitioner's perspective. This helped strengthen the research findings and also collect information regarding the effectiveness and applicability of the IPAT assessments.

The chosen methodology did influence the research and findings. The interpretation of the research findings is based on the knowledge and experience of the researcher. However, the information gathered from the expert sessions ensured a check on the interpretation of the results, added validity to the findings and minimized the researcher's bias.

6.2 Discussion on findings

This section will elaborate on the discussions on the findings from the qualitative, quantitative data analysis and the expert sessions.

6.2.1 Discussion of findings of quantitative data analysis

The quantitative data analysis provided some interesting insight into the effectiveness of the IPAT in the initial phases of the projects, but no conclusive results could be drawn. This was mainly due to the clustering of projects according to the project phase. If another method was used to analyze the scores which even included the weight factors for each theme, there might've been a chance to obtain more conclusive results. Even if the quantitative data did not provide concrete results, they were used as a background document to formulate the questions used in the expert session. Hence the quantitative data was used to guide the expert interviews and also guide them when the interviewees were deviating from the topic of discussion or sidestepping the questions asked.

The variability in the scores can be influenced by the context in which the project has been realized like cultural differences, the phase of the project i.e., the level of uncertainties present/the level of maturity of the project and the level of scrutiny from the assessor team. All these factors influence the results and open the quantitative data for different interpretations.

6.2.2 Discussion of findings of qualitative data analysis

The research findings established the trends in best practices that evolved over the years. No major evolvement in the best practices was identified in the theme 'legal procedures', mostly because of the standardized procedures all the project organizations have to follow in order to obtain the needed permits. The theme 'political context' has however emerged as a separate theme which signifies the importance of the political context in the realization of the projects. The other six themes did identify the evolvement of trends in best practices and the project organizations should be aware of these changes.

The qualitative document analysis identified an extensive list of best practices and lessons learned from projects 16 to 31 (Appendix-2) whereas the qualitative comparative cross-case analysis focused on identifying the trends that evolved after comparing the two data sets of best practices from projects 1 to 15 and projects 16 to 31. Since identifying trends was the primary focus of the qualitative comparative cross-case analysis, few of the best practices that were identified in the document analysis from the second data set were not analyzed in-depth or validated in the expert sessions. These best practices and lessons learned omitted from the research are mentioned in this section and require more in-depth research and validation. The notable best practices and lessons learned per theme are mentioned below-

1. Political Support
    - The Project will gain high political support when they are a part of the National programs and supported at the parliamentary level and also the project should have support from previous, current and the future governments.
    - Obtaining support from the neighboring countries tends to increase the chances of success if the project is of cross border nature.
    - There should exist a strong collaboration between the PDO and the municipality. Even concerning technical aspects, the municipality could be consulted.
    - Attention should be paid regarding the handover process from the responsible parties to the municipalities. Clear communication during this process is of vital importance.
    - Funding for the project should be secured even if the scope of the project might change over time.
    - Clear plans to align approaches on working level should be in place, when there is a change in personnel at local municipalities, partner organizations and the involved political parties.

2. Objectives, Purpose, Business case (value) and scope
    - The scope and objectives must be quantified i.e., it should be measurable. The definition of required outputs should be tied to a measurable problem and not to a specific solution.
    - Definition of required outputs in terms of solutions to transport, economic or social needs and environmental impact, should be available. There must be quantitative targets and information available on these topics.
    - To ensure that original benefits are realized, the client could act in a more proactive role to continue to measure the benefits case during construction and then test that benefits are realized post completion.

- In case of events like recession or financial crisis, the business case needs to be reviewed and updated.
- Strengthening the Business Case would enable it to be used to support the project, particularly in helping to convince stakeholders of the need for the scheme and in understanding the current benefits against costs of the project. This is likely to be of benefit to the project during the disruption caused by construction.

3. Stakeholder Engagement and Communication
    - Periodic stakeholder satisfaction measurements could be useful to implement in the projects to regularly monitor the relationship with the stakeholders and to organize effective stakeholder participation and communication.
    - Contingency plans should be in place in order to brief stakeholders should there be a problem with the project.
    - The project delivery organization should investigate how to communicate to the end user and measure the end user's satisfaction before, during and after the implementation phase.
    - The communication plan that is being developed should contain a clear marketing strategy that will help reach all stakeholder groups and could help increase support for the project (funding).
    - Alert politicians about difficult issues so that they have time to plan a way to manage these.

4. Risk Management and Project Controls
    - The funding strategy should be linked to the procurement strategy and, ultimately, supported by the communications strategy which should include a strategy to ensure political support for the chosen funding route.
    - The budget should not be set too early in the project. Bi-yearly cost calculation method and cost saving meetings are beneficial.
    - The interest rates, VAT and inflation should be a part of the financial analysis. The PDO should visibly take into account the budget costs that are unknown or uncertain.
    - The PDO should focus on total spending (across the total project lifecycle) rather than annual spending. In the end - annual spending is a liquidity issue.
    - The PDO should deal with critical interfaces in the planning phase and the reporting structures across the interfaces should be formalized.
    - Organize separate sessions to identify the opportunities for the project, especially in the design phase, in order to make a good analysis of the pros and cons and decide consciously on taking the opportunity.
    - Organize reviews of risk assessment plans and mitigating measures. Also, organizing independent external reviews of the project and its processes, helps to identify areas for improvement that the project team may be overlooking.

5. Organization and Management
    - The resource allocation should be under the control of the Project Manager as the project will need to have the right technical skills and resources, that should be allocated at the right time/for the right amount of time.
    - If there is a clear division between the planning phase and the execution phase. The division between departments and phases might lead to many interfaces in projects, which could lead to

a decreased efficiency or problems during the execution phase of the project. It is recommended to look for ways to reduce the strong barrier between both phases.

- There should be a good variety of gender in the project team and in management positions.
- By working in project teams, the number of interfaces between the different departments will reduce and could lead to a more efficient organization of the project. A matrix organization could be used as an example.
- Cultural differences between involved parties are a danger for cooperation in the project. Hence this issue should be dealt directly from the start of a project after the contract is signed. Take time during the project with project follow-ups between the PDO and the SPV/Contractor to discuss the relationship. Include all persons who have an important role in the interface management and those who are responsible for keeping up the positive spirit.
- A market consultation should be organized to gather input from private organizations.
- A formal lesson learned report should be prepared and actively shared after each project completion so that knowledge is passed from one project to another.
- If there is a clear gap in time between the phases, it increases the possibility to lose knowledge and experiences of the personnel involved. The PDO needs to store key positions for a longer period of time in order to build further on the current level of knowledge in the next phase. Also, document lesson learned explicitly to manage transfer of knowledge between phases.

6. Permits, Authorizations and Consents
    - The responsibility for organizing and managing the building permits should be assigned to a dedicated team member or group of team members.
    - If the overall planned time schedule for obtaining consents seems to be very tight. The PDO should develop a contingency plan in order to deal with delays or refusal of consents based on lessons learned from previous projects concerning legal procedures.
    - If there is a strong barrier between the planning and construction phase then the hand over from the planning department after the Planning Approval Order should be organized in an optimal manner because the teams do not take much time for the hand-over, information and knowledge can get lost. This could lead to unanswered questions and delays in a later project stage.

7. Technology
    - On the level of contractual specifications, the PDO should develop true output based functional requirements.
    - The contractor and the PDO organization should work close together to fulfil the specifications by translating the project objectives into functional specifications and then into a robust design that will be agreed upon with the client.
    - It is recommended to apply a system of searching, collecting, analyzing and assessing the potential of latest global technological solutions and experiences from the fields of project application, innovation leadership and culture in similar projects.
    - To prevent scope creep, new technologies should be managed as separate projects in the project.
    - The lessons learned through the adoption new technology should be captured and shared for the benefit of future schemes.
    - There should be few incentives for the contractors to improve sustainability of the project.

8. Contracting and Procurement
    - The contract strategy should be supported by a very thorough market analysis.
    - The contracting strategy of the project should not only be based on receiving the full budget, but an alternative strategy should also be prepared in case only a partial budget becomes available.
    - The contracting and procurement strategy should be adapted and incentivized in order to stimulate the private sector to suggest and implement innovative (technical) solutions.
    - There should be flexibility to implement optimizations to take advantage of the knowledge of the contractor.
    - There should be good awareness of the different approaches required for each contract. These different types of contracts (all-in contract, design and build and alliance etc) require also different contract management approaches: different client-contractor relationships, different contractual behavior, different payment requirements, etc.

6.2.3 Discussion of findings of expert sessions

The expert sessions were used to validate the research findings and also gather information regarding the applicability of the IPAT assessments. The expert's shared their practitioner's knowledge and helped validate the trends in best practices that evolved over the years. They also suggested some adjustments to the stated best practices which are discussed below-

- 'Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.' This best practice is suitable in certain phases of the project and not ideal for the entire lifetime.
- 'The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.' The risk analysis should integrate the bottom-up approach with the top-down approach
- 'The risk database should provide SMART mitigation measures, people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.' This best practice is more integrated in Dutch and Nordic regions when compared to southern Europe. Thus, this best practice should be promoted in countries like them.
- 'Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.' Along with 'bedding period', the new technology should be managed as separate projects to prevent scope creep.

6.3 Limitations of the research

Based on the approaches used, the nature of the study and the validity of the findings, some limitations of the research were identified and are discussed in this section.

- One of the general of the research is that if the IPAT assessment wouldn't have been introduced in a certain project, what the outcomes would've been. If this data was available, the success or the failure of the assessment could've been measured to give a more substantiated conclusion regarding the effectiveness of the assessment tool with full certainty.
- Another limitation of the research is the quantitative data analysis and the inconclusiveness of the results it provided. Based on the results it is not yet possible to give an explicit conclusion on

how the trends evolved in the different project phases. A different method to analyze the quantitative data could yield conclusive results.

- In the literature study only two project assessment tools were researched to obtain the theoretical basis of the assessment tool. This causes the literature study to be focused and narrow and lacking specific international aspects.
- The research is restricted to an engineering and management perspective of the researcher. Since the assessment is also characterized with social interactions it would very beneficial to look at the effectiveness and the applicability of the tool from a social science perspective.
- The document analysis did identify certain best practices and lessons learned from the project 16 to 31. These best practices were not research in depth or validated as the primary focus of the research was to identify the trends that evolved.
- The expert interviews can be extended outside the scope of NETLIPSE. This may provide an unbiased opinion on the applicability and effectiveness of the assessment tool.

7. Conclusions

This chapter will present the findings of the research in pursuance of answering all the sub-research questions and subsequently conclude the research by answering the main research question. The recommendations for further research are also discussed in this chapter.

7.1 Research conclusions

This research sought to explore the learnings from the IPAT assessments that could be deployed for the future execution of large infrastructure projects and also examine the effectiveness of the assessment tool and the process in real-life practice. This was done by studying the theoretical bases of the assessment tool, the trends that evolved over the years of project assessment and applicability of the tool. By evaluating the effects of the IPAT assessments from different perspectives, the main research question can be answered i.e.,

What learnings from IPAT Assessments can be used for improving future large infrastructure projects?

7.1.1 Sub-research questions

This section will state the sub-research questions and then use the findings of the research to answer them. Each of these answers will contribute in answering the main research question, which will be presented in the next section.

1. What are the theoretical bases for the project assessment tool?

Literature study was performed in order to find the common bases of the assessment tools. The assessment tools analyzed were- the EFQM model, the Spiegel, The Infra Maturity tool and both the versions of the IPAT. Since the primary focus of the assessment tools were to improve the management and hence optimize the overall execution and outcomes of the project. Five common elements were identified which formed the theoretical basis of the assessment tool because the influence of these individual elements impacts the performance of the project. They are-

- Themes and scores
  Management themes serve as the basis on which the project's performance is measured. The tool also uses quantitative data like scores to analyze the themes. Ultimately the assessment results are compiled producing both qualitative and quantitative insights.
- Context of the project
  For the assessment process, context plays a significant part in comprehending the role of diverse factors that contribute to the successful realization of the project or its failure. The impact of various characteristics like cultural, social, environmental, economic, etc., are conducive to all the phases of the project i.e., form development to delivery.
- Learning environment
  The assessment provides a learning opportunity for the project team and all parties responsible for the management of the project by giving them a better direction in terms of focus areas where they could optimize the outcomes of the project. The assessment results also help create more awareness on certain aspects that were neglected or overlooked but were hampering the project's success.
- Knowledge exchange
  A key function of knowledge exchange is to not only promote the use of the most effective management practices but also gain more perspective on factors affecting the project's performance.

This element allows people to access and apply the most appropriate knowledge when it is needed and broaden their horizons. Knowledge exchange aids in achieving greater certainty, external insight and hence reinforces effective decision-making processes.

- Significance of reflection
  This is one of the most important elements that drive the assessment tool as it stresses the significance of reviewing the project's performance and its progress. Reflection maximizes learning, helps assess and refine the impact of the approaches used for the upcoming phases or future projects.

The project assessment tools confer to the above-mentioned characteristics as they serve as the theoretical framework on which the performance of the project is measured. The IPAT includes all these elements which are also deemed vital in the project assessment tools that were researched. Thus, the elements identified served as an essential basis on which project performance is measured.

2. What are the trends identified in the results of IPAT assessments in terms of focus areas?

a. Over the years.

Qualitative data analysis identified that 'Political context' evolved as a separate management theme on which the project's performance was measured whereas in the theme 'legal procedures', no new trends were identified. The cross-case document analysis identified twelve trends in best practices that had evolved over the years. However, the expert sessions validated only nine of these trends identified based on the practitioner's knowledge. The table below presents the nine trends, which reveal how the best practices have evolved over the years.

Table 12: Evolution of trends in best practices over the years

Theme	Best Practices Identified	Evolved best practice
Objectives and Scope	Formulate a vision	Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.
	Use configuration management to assess the impact of scope changes	Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.
Stakeholder engagement	Facilitate liaison with local stakeholders and critics	Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.
Organization and Management	Communicate a project management policy	Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.
Risks (and opportunities)	Include risks and risk reservations in cost estimations	The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.
	Use a risk database	The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.

Theme	Best Practices Identified	Evolved best practice
Contracting	Use incentives in the contract	Align the incentives to the project objectives and incentivize the liaison between the contractors.
Knowledge and Technology	Be careful with experiments	Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.
	If new technology is applied, organize the management of innovation	
	Organize expertise and knowledge exchange within the project organization	Extend the knowledge exchange beyond the project organization i.e., national and international projects.

b. In different project phases

In the quantitative data analysis, only a maximum of three projects were assessed in each project phase. Due to the limited data available, identifying trends that evolved in different project phases was futile. Based on the observations it was concluded that the IPAT assessments prove to be more effective when introduced in the early phases. The interpretation of the limited quantitative data in each phase did identify that the IPAT is more effective when it is deployed in the initial project phases. However conclusive results were not drawn from the analysis and compelling trends were not identified that evolved in the different project phases. When a sufficient number of projects are assessed in a phase, there are better chances of identifying trends or patterns. Ultimately inference can be drawn from them, and conclusions can be substantiated.

3. How effective are the IPAT assessments and when is the best time to introduce it in the project lifetime?

From the expert interviews, insight was gained into the applicability of the IPAT assessments and the effectiveness of the assessment reports in real-life projects i.e., in the assessed projects. The experts stated that the assessments gave the project team an opportunity to take a step back, review the project and learn from it. In a few projects, some of the proposed recommendations were implemented whereas in the other projects many recommendations could not be implemented due to technical and organizational constraints. It also helped the project management team to discover the areas that needed more attention as they were neglected or overlooked. The experts agreed in unison that even if the recommendations were not used in that certain phase or project, they would definitely use this knowledge for the better execution of the next phases and future projects.

The quantitative analysis of the scores showed that the project profits from the IPAT assessment when introduced in the early phases. Since the quantitative analysis did not have compelling evidence to prove the same, experts were consulted. The experts agreed that by introducing the IPAT at the beginning of the execution phase will prove to be very beneficial to the project. Although the IPAT can be introduced in all phases, it is recommended to be introduced at the completion of one phase or the beginning of the next phase. This increases the opportunities where changes can be implemented since not a lot can be

changed in the middle of any phase or process. Also, when there is a lot of doubt and uncertainty regarding the project's progress and performance, an IPAT assessment could provide more clarity and better direction for the project to progress. So, based on the ultimate purpose of the assessment, IPAT can be introduced more than once in a project's lifetime.

4. What findings from the assessments can be generalized and used for improving future LIPs?

The main findings from the assessments that can be generalized and used for improving future LIPs are-

- The opportunity to improve the outcomes/deliverables of the project exists in all project phases. Assessing the project with the help of experts, aid in gaining a different perspective on the problems faced by the project. In some cases, the assessments even provide better guidance to reinforce the decision-making processes and simplify troubleshooting areas.
- The best practices in the field of project management have broadened to include the overall context of the project and not just focus on the technical aspects. This shift has rendered a more desirable setting for the optimal execution of projects.
- The best practices and lessons learned in the field of project management are continuously evolving with time. Being aware of these changes are vital for the execution of projects. Some of the main trends that evolved through the years of IPAT assessments are-
    - Formulating the vision for the project and then aligning and integrating it with the PDO and the contractor organization.
    - Organizing periodic reviews in order to update processes and challenge financial and time information provided by the project teams.
    - Involving local businesses and frequently consulting the interest groups and local authorities to find favorable solutions for the problems defined.
    - The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extending the technical risk management with a focus on the non-technical aspects of the project.
    - Aligning the incentives to the project objectives and incentivizing the liaison between the contractors.
    - Extending the knowledge exchange beyond the project organization i.e., national and international projects.

7.1.2 Main research question

This section will consolidate all the necessary information from the sub-research questions to finally answer the main research question which is framed as-

What learnings from IPAT Assessments can be used for improving future large infrastructure projects?

The IPAT addresses how the PDO and C/S manage and plan to manage all relevant aspects of a LIP. The objective of the IPAT is to assess the totality of management quality relating to the project, including plans to reach the agreed objectives and to implement the outputs and not just the physical construction (Staal-

Ong et al. 2008). The IPAT assessments aid in the exchange of knowledge in the form of best practices and lessons learned in the field of project management in order to efficiently deploy LIPs. The research identified five main learnings from the IPAT Assessments that can be used for improving future large infrastructure projects. They are-

- The best practices and lessons learned in the field of project management are continuously evolving with time. Being aware of these changes are vital for the execution of projects.
- The best practices in the field of project management have broadened to include the overall context of the project and not just focus on the technical aspects.
- The opportunity to improve the project's performance, progress, the processes involved, and outcomes/deliverables exist in all project phases.
- The IPAT assessments promote knowledge exchange. This gives the project management team an opportunity to adopt some of the best practices and customize them according to the requirements of their respective projects.
- The IPAT assessment gives the project team an opportunity to take a step back, review the project and learn from it. Continuous learning from projects facilitates better execution of the upcoming phases or future projects.

7.2 Recommendations

The research not only provided a better understanding of the effectiveness and applicability of the IPAT assessments but also elaborated on the significance of continuous learning, reflecting and knowledge sharing for better execution of projects in the field of construction. This section will discuss the recommendations formulated for both research and practice.

7.2.1 Recommendations for research

This section will elaborate on the aspects that require more research in order to improve the findings. The chosen perspective might've impacted the outcome of the research. This serves as a basis for further research to build on. Few recommendations are formulated below:

i. Although the research tried to take into consideration various perspectives, not all perspectives were analyzed. This research was done from an engineering and management perspective, complemented by the insights shared by project managers and engineers. Though the management aspect was analyzed, the IPAT assessment results were broadly characterized by the social interactions of the people involved. Hence the research lacks a social science perspective and more focus should be placed in comprehending the influence of people and their social interactions.

ii. Extend the research outside the scope of NETLIPSE i.e., obtaining the insight of experts who are not involved in the organization can offer an interesting evaluation to the research findings. This will also help make apparent if there were any biased opinions or information shared by the experts.

iii. The analysis of the quantitative data from the IPAT assessments used only the scores of all the management themes. Further research is recommended to analyze the scores along with their weight factors which differ over the project phases.

iv. The IPAT assessments are carried out in different countries in Europe. This gives the tool an international trait. Further research can dive into assessing the influence of the cultural aspects in the organization, management and execution of the projects.

v. To establish the theoretical basis of the assessment tool, only three project assessment tools were analyzed. Investigating more tools can offer more data to determine the theoretical framework on which the assessment tools are developed.
vi. Follow-up research is recommended to see if a project has used the recommendations proposed by the assessment. After the completion of the project, the research can dive in to find out if the project became a success, and if this was related to the focus on the success criteria mentioned in the assessment reports.
vii. Future researches can try to incorporate the perspective of the contractors, political parties and other stakeholders regarding the effectiveness and applicability of the IPAT assessment.

7.2.2 Recommendations for practice

More projects are being assessed using the IPAT, hence the tool is gaining more exposure to diverse projects all across Europe. The research recognized some areas for improvement of the tool and the process in order to obtain better assessment results. The recommendations formulated are a combination of both the research findings and expert insights.

i. The process of reviewing the project and learning from it, should become a standard practice in the execution of LIPs. This can aid in deploying the LIPs more effectively.
ii. The IPAT assessments should be promoted to not only improve future project executions but also obtain more data which can help make research more advantageous.
iii. The assessment tool should clearly characterize the phases based on the individual project being assessed as the project phases vary over different regions.
iv. A local assessor should be part of the assessor team so that the team fully understands the context and the cultural differences which prevail in the project.
v. A translator is also essential in the assessment process in order to create a more relaxed environment for the project team to discuss the assessment results. This will aid in the exchange of information more freely instead of worrying about translation.
vi. It might also be beneficial to organize forums where the assessors could meet and share their experiences and get to know each other. This would provide an opportunity for the assessors to discuss the assessments in order to learn from each other's experiences.

8. References

Agénor, Pierre-Richard and Blanca Moreno-Dodson (2006). Public Infrastructure and Growth: New Channels and Policy Implications, World Bank Policy Research Working Paper 4064.

Baarda, B. (2010). Research. This is it! Guidelines for setting up, doing and evaluating quantitative and qualitative research. Noordhoff Uitgevers B.V.

Bassioni, H.; Price, A.; Hassan, T. 2004. Performance measurement in construction, *Journal of Management in Engineering* 20(2): 42–50.

Bassioni, H.; Price, A.; Hassan, T. 2005. Building a conceptual framework for measuring business performance in construction: an empirical evaluation, *Construction Management and Economics* 23(5): 495–507.

Bayo-Moriones, A.; Merino-Díaz de Cerio, J. 2001. Quality management and high-performance work practices: do they coexist? *International Journal of Production Economics* 73(3): 251–259.

Beatham, S.; Anumba, C.; Thorpe, T.; Hedges, I. 2004. KPIs: a critical appraisal of their use in construction, *Benchmarking: An International Journal* 11(1): 93–117.

Curkovic, S.; Melnyk, S.; Calantone, R.; Handfield, R. 2000. Validating the Malcolm Baldrige National Quality Award framework through structural equation modelling, *International Journal of Production Research.*

de Leeuw, S.; van den Berg, J. P. 2011. Improving operational performance by influencing shop floor behavior via performance management practices, *Journal of Operations Management* 29(3): 224–235.

Drever, E. (1995). Using semi-structured interviews in small-scale research: a teacher's guide. Scottish Council for Research in Education.

Flyvbjerg, B., Bruzelius, N., and Rothengatter, W. (2003). Megaprojects and Risk: An Anatomy of Ambition. Cambridge: Cambridge University Press.

Godau, (1999). The changing face of infrastructure management. Systems engineering. Vol. 2, Issue 4, pp. 226 - 236.

Hammerschmid, G. and Wegrich, K. (2016). 'Infrastructure Governance and Government Decision-making', in Hertie School of Governance (ed.), The Governance Report 2016. Oxford: Oxford University Press, 31–54.

Hertogh, M., & Westerveld, E. (2010). Playing with Complexity. Management and organisation of large infrastructure projects.

Hertogh, M.J.C.M., S.K. Baker, P.L. Staal, E. Westerveld (2008) *Management of Large Infrastructure Projects, Research Based on Best Practices and Lessons Learnt in Large Infrastructure Projects in Europe* NETLIPSE.

Hillman, G. 1994. Making self-assessment successful, *The TQM Magazine* 6(3): 29–31

Kane, M. T. (2013). Validating the Interpretations and Uses of Test Scores. Journal of Educational Measurement, 50, 1–73.

Kostka, G. and Anzinger, N. (2016). 'Large Infrastructure Projects in Germany: A Cross sectoral Analysis', in G. Kostka and J. Fiedler (eds), Large Infrastructure Projects in Germany: Between Ambition and Realities. London: Palgrave Macmillan, 15–38.

Lee, S.; Rho, B. H.; Lee, S. G. 2003. Impact of Malcolm Baldrige National Quality Award criteria on organizational quality performance, *International Journal of Production Research* 41(9): 2003–2020.

Lian Steal-Ong, P., Kremers, T., Karlsson, P. and Baker, S. (2008). *10 Years of Managing Large Infrastructure Projects in Europe*.

Morris, P.W.G. & Hough, G.H. 1987.The Anatomy of Major Projects: A Study of the Reality of Project Management. Chichester: John Wiley and Sons.

Mwase, Nkunde and Yongzheng Yang (2012). BRICs' Philosophies for Development Financing and Their Implications for LICs, IMF Working Paper WP/12/74.

Niven, P. 2006. *Balanced scorecard step-by-step: maximizing performance and maintaining results. Chichester: Wiley*. 327 p.

Qureshi, T. M.; Warraich, A. S.; Hijazi, S. T. 2009. Significance of project management performance assessment (PMPA) model, *International Journal of Project Management* 27(4): 378–388.

Singh, A. S. (2014). Conducting Case Study Research in Non-Profit Organisations. Qualitative Market Research: An International Journal, 17, 77–84.

Stationery Office. (2017). *Managing Successful Projects with PRINCE2*. Retrieved from https://www.academia.edu/35930440/Managing_Successful_Projects_with_Prince2_2017_6th_Edition

Straub, Stéphane (2008). Infrastructure and Growth in Developing Countries: Recent Advances and Research Challenges, World Bank Policy Research Working Paper 4460.

Thomas, D. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data. American Journal of Evaluation, 27(2), 237–246.

Wearne, S.H., 1995. Engineering project management. London: Blackwell Science.pp.3-8.

Wegrich, K., Kostka, G., & Hammerschmid, G. (2017). *The Governance of Infrastructure*. Oxford, United Kingdom: Oxford University Press.

Westerveld, E. (2003) 'The Project Excellence Model(R): linking success criteria and critical success factors', International Journal of Project Management, Volume 21, Issue 6, 1 August 2003, p. 411 – 418

Wildemuth, B. M. (1993). Post-positivist research: two examples of methodological pluralism. *The Library Quarterly*, *63*(4), 450-468.

Yong, J.; Wilkinson, A. 2001. Rethinking total quality management, *Total Quality Management & Business Excellence* 12(2): 247–258

9. Appendix

Appendix-1: Quantitative data analysis

The detailed list of scores per theme for projects 16 to 31 are presented in the table below. The projects are arranged according to the phase in which the IPAT assessments were done.

Sl.no	Projects Assessed	Phase	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Theme 7	Theme 8	Theme 9	Theme 10	Theme 11	Theme 12
22	MXP-AT Railink	M1	3.3	2.8	3.3	3	2.7	3.2	3.6	3.4	3.4	2.8	3.2	2
27	Transpennine Route Upgrade	M1	3.4	2.6	2.4	2	2.7	3	2.3	3.4	3	2.2	3.1	2.6
16	Koper-Ljubljana	M2	4	2.5	3	3	2	2.5	3	3.5	3	2	2	2
17	Fehmarnbelt	M2	3.7	3.9	3.6	3	3.6	3.8	3.9	3.9	3.9	4	3.9	3.3
26	Tvärforbindelse Södertörn	M2	3.2	2	2	2.3	3.2	1.4	2.7	2.3	2.4	2.6	2	2.5
21	Stockholm Metro Expansion	M3	3.9	2.6	2.8	2.8	3.5	2.7	3.1	3.8	2.9	3	2	2.4
24	Mälarbanan	M3	3	2.7	2.4	3.2	3.2	2.7	3	3.7	3.9	3.3	2.7	3
19	D3 Svrčinovec – Skalité Motorway	M4	4	3.5	3	2	3	2.5	4	3	2.5	2.7	3.3	2
20	Schiphol Amsterdam Almere A6	M4	4	3	3	3	4	4	3.8	3	3.5	2.8	4	4
23	Lake Mälaren	M4	3.7	3	3	2.7	3.5	2.9	4	3.3	2.2	2.6	3.4	2.7
25	E18 Hamina – Vaalimaa	M5	4	3	3	1.6	3.5	3.3	3.5	3.7	2.6	2	2.3	2.6
29	Riihimäki Rail Renovation	M5	3.5	2.6	2.4	2.8	2.5	3.5	3.7	3	-	-	-	-
30	Skurubron	M5	3	2.7	2.6	2.2	2.6	3.7	3.2	2.4	-	-	-	-
31	Lahti Southern Ring Road	M5	3.6	2.9	3.1	2.3	2.8	4	2.9	3.2	-	-	-	-
28	A99 - Munich Ring Road	M3	3.5	2.9	3	2	2.1	3.3	3.3	2.5	-	-	-	-

Appendix-2: Qualitative data analysis

The results from the analysis of the documents i.e., the analysis of the IPAT reports are presented in this chapter. This chapter also gives the framework around which the interviews with the experts are formulated.

2.1 Political context

The IPAT defines this theme as follows- '*The political context is about the level of political consensus on the purpose and outcomes of the project and the way the relation with the political influences on the project are managed (primarily by the Client/Sponsor). Large infrastructure projects usually last longer than governments and politicians and their success over the project lifecycle often depends on the degree of national and political acceptance that the project outputs are needed and are a priority.'*

The results of this theme are clustered into 'Political support', 'Collaboration and communication' and 'Dynamics of the project'. Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Political support
   The amount of political support received by any large infrastructure project has a huge influence on the chances of its successful execution. In the assessment reports the characteristics which support this claim are-
   - The Project will gain high political support when they are a part of the National programs and supported at the parliamentary level and also the project should have support from previous, current and the future governments.
   - The chances of success of the project is enhanced when all the countries involved consider it as a project of national importance.
   - The projects should have clear, strong political consensus on a national and local levels, on the need and the general purpose of the project and commitment over a long term from all the parties involved.
   - Government funding for the project also shows support for the project.
   - The project needs to ensure that political support continues to exist by sustaining excellent liaison, especially during construction phase while traffic disruption is more prevalent.
   - The purpose of the project should align with the interests of the municipalities. This can help secure support and funding from the municipalities.
   - If the political consensus changes in the future, an alternative plan and risk mitigation measures must be in place.
   - Obtaining support from the neighboring countries tends to increase the chances of success if the project is of cross border nature.
   - The communication between the client and the political parties can be improved to increase the level of involvement/commitment to the project and also use this opportunity to exploit the possible solutions

2. Collaboration and communication
   The collaboration of all the different parties involved at all levels and the method of communication used will characterize the successful execution of the large infrastructure projects. The characteristics found in the IPAT assessment reports are-

- Open and good relationships between the PDO and the client form a good basis for a successful project.
- There should exist an open culture in order to discuss strategic motivations and to achieve political goals.
- There should exist a strong collaboration between the PDO and the municipality. Even concerning technical aspects, the municipality could be consulted.
- Good communication between the client and the political parties can increase the level of involvement/commitment to the project and can also be utilized as an opportunity to exploit the possible solutions to the problem.
- Formal agreements need to be in place with all the municipalities involved.
- The project must ensure local political stakeholder expectations are well managed.
- Attention should be paid regarding the handover process from the responsible parties to the municipalities. Clear communication during this process is of vital importance.
- The communication between the client and the political parties can be improved to increase the level of involvement/commitment to the project and also use this opportunity to exploit the possible solutions.
- The views of the stakeholders about the outcomes of the project should be aligned.
- The roles and responsibilities of the national, regional and the local authorities must be clearly defined and communicated.

3. Dynamics of the project

   Since the large infrastructure projects take a long time for its complete realization, they have many factors that are characterized by constant change, activity, or progress. These changes must be taken into consideration and also measures should be in place to take care that the systems designed or delivered are adaptable to changing circumstances. In the IPAT assessment report the factors that help cope with the dynamics of the project are-

   - The funding for the project should be secured even if the scope of the project might change over time.
   - If the political consensus changes in the future, an alternative plan and risk mitigation measures must be in place.
   - It is desirable to have a strategy in place to define how to manage changes that might affect the project from other projects in the same geographic area. (e.g.- the municipalities' project portfolio for the development of the entire region. A lot of development is going on in the region which makes traffic management even more important. Make traffic management a central point in the project approach and communication on all levels)
   - If there is a change in personnel at local municipalities, ensure that colleagues in partner organizations are aligned to approaches on working level to ensure good communication when there might be political difficulties. Also, be aware of changes in personnel within partner organizations.
   - Attention should be paid to avoid incidents related to safety or environment that might alter the attitude of the stakeholders of the project.
   - The Project Steering Group must decide on the priority between quality, cost and time schedule to take account of possible future pressures on scope, time and cost. It would be desirable to have a strategy from the Project Steering Group in place in case of a possible budget overrun or

significant time delay. This helps the PDO to make decisions when it comes to making decisions related with scope/quality, time and/or cost.

2.2 Objectives, Purpose, Business case (value) and scope

The IPAT defines this theme as follows- *'How the objectives, project purpose and scope are defined, managed and updated by the Client/Sponsor and how the Client/Sponsor provides the funding for the project. This is usually the numerate analysis which underpins the consensus in Theme 1 (political context) that the project is needed, is a priority and is affordable.'*

The results of this theme are clustered into 'Objectives and Purpose', 'Business Case' (Financial Feasibility) and 'Scope'. Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Objectives and Purpose
   The objectives of any infrastructure project are defined as the benefits offered by the project to its stakeholders, society and the environment as a whole whereas the purpose of the infrastructure project is defined as to why the project is essential. The objectives are what should be done to achieve its purpose. From the analysis of the IPAT reports the recurring characteristics are-
   - The definition of a strategic vision, purpose and objectives of the project should be clear among the stakeholders.
   - Translation of the project objectives into scope, realistic milestones, specific work packages and clear responsibilities should be available, to avoid creating confusion for the consultant, the client and PDO members. During this process the PDO should involve relevant stakeholders.
   - Clarity of the objectives and the demands from the C/S will help to translate them into functional specifications and hence confirm the costs and the business case of the project.
   - The scope and objectives must be quantified i.e., it should be measurable.
   - The ability to align the objectives of different parties involved in the project repeatedly is a crucial factor generating the realization of the project within time and budget.
   - The definition of required outputs and outcomes should be well known within the team. The project team members should have a clear scope definition from the C/S to meet the objectives of the plan.
   - Definition of required outputs in terms of solutions to transport, economic or social needs and environmental impact, should be available. There must be quantitative targets and information available on these topics.
   - The definition of required outputs should be tied to a measurable problem and not to a specific solution.
   - Stakeholders should be involved in the definition of required outputs.
   - To ensure that original benefits are realized, the client could act in a more proactive role to continue to measure the benefits case during construction and then test that benefits are realized post completion.
   - Where the outcomes and objectives are well understood, there should also be a shared view on next level of priority within the triangle of time, money and scope. This is necessary in order to manage expectations and ensure that the best choices are made for the project during construction. Get clarity about the priorities within the triangle of time, money and scope. Ensure they are clearly agreed between the stakeholders and written down before issues arise.

2. Business Case (Financial Feasibility)

   It is defined as the justification for undertaking the proposed project and the corresponding affordability of the project usually based on the estimated cost of development and implementation against the risks and the anticipated business benefits and savings to be gained. The characteristics found in the IPAT assessment reports that support this theme are-

   - The clarity of the business case information helps in making a make more informed and strategic decisions backed with solid evidence. Hence the business case should be strong.
   - In case of events like recession or financial crisis, the business case needs to be updated.
   - Financial versus non-financial benefits of the project should be evaluated.
   - Uncertainties must be translated to a business case.
   - The PDO should have a clear view of the additional scope opportunities in case the contingency budget becomes available during the delivery.
   - Strengthening the Business Case would enable it to be used to support the project, particularly in helping to convince stakeholders of the need for the scheme and in understanding the current benefits against costs of the project. This is likely to be of benefit to the project during the disruption caused by construction and in strengthening support during the formulation of the National Transport Plan.
   - Formally agree and make explicit the importance of the strategic purposes of a project especially when there is a weak numerate business case.
   - The objectives of the project should be quantified, and the business case should be updated regularly with the information available and must remain fit-for-purpose.
   - There should be a reasonable amount of contingency reserve for the project.
   - The financial feasibility should be made certain and the risk reserves must allow for unforeseen events.
   - To review and update processes for the business case, a clear plan should be set in place.
   - The businesses around the project need to be informed to make sure that the increased capacity of the infrastructure is made use of and therefore the investment becomes profitable.

3. Scope

   The scope of the project is defined as the physical infrastructure that that has to be delivered at a set time scale and meets the required outputs through the functional specifications. With the purpose and objectives clearly spelled out, the scope of the project can be defined. However, from the assessment reports the characteristics which help in the successful execution of the projects are-

   - The scope and objectives must be quantified i.e., it should be measurable.
   - Scope addition should be clearly linked to the outcomes/objectives for the project.
   - Change management procedure (including C/S and PDO responsibilities) should be available to deal with possible scope changes.
   - The PDO must have a structured process for scope changes in place to avoid scope creep.
   - The drivers and procedures for change management by the C/S should be formal and well-articulated and should be managed within the project between the PDO and the C/S.
   - There should be a review of the economic benefits where the scope changes have resulted in increased costs.
   - The PDO should have a clear view of the additional scope opportunities in case the contingency budget becomes available during the delivery.

- Reviews should be organized in order to update processes and challenge financial and time information provided by the project teams. The time pressure to deliver products should not refrain the organization from being critical.

2.3 Stakeholder Engagement and Communication

The IPAT defines this theme as follows- *'Project organizations never act in complete autonomy. They often have strong links to external parties, such as parent organizations and other stakeholders, for example, local communities, private companies (operator, contractor, maintenance manager), related projects, non-governmental organizations (NGOs) and interest groups, all of which can influence the project. A stakeholder is any individual, group or organization who may affect, be affected by, or perceive themselves to be affected by, a decision or activity (source: ISO/IEC38500). This theme is about how all these stakeholders are dealt with by the C/S and the PDO and to what extent the C/S and PDO are aware that stakeholder engagement is a dynamic and continuous process that needs a clear and effective communication strategy.'*

The results of this theme are clustered into 'Stakeholder Engagement' and 'Stakeholder Communication.' Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Stakeholder Engagement
   Keeping the stakeholders engaged is an essential ingredient for the successful project delivery. The PDO can either seek to mitigate risks arising through the use of stakeholder management or exploit these new trends to identify and establish new opportunities through the use of meaningful stakeholder engagement. The stakeholder engagement not only develops relationships of mutual respect but also boosts collaboration to cope with the dynamics of the project. Few of the characteristics identified to ensure good stakeholder engagement in the IPAT reports are-
   - Stakeholders should be well identified from the start of the project and the project should have an overview of the different interests and priorities of the stakeholders in the area of the project.
   - All relevant stakeholders must be identified and If the project is mainly positioned on the border of two municipalities where both stakeholders could consider the project as being at the end of their 'backyard'. These stakeholders should be well informed about the project plans.
   - Provide clarity for key stakeholders on their role and responsibilities at all phases of the project.
   - Stakeholders should be involved in the definition of required outputs.
   - There should be a clear stakeholder strategy for all phases and as the project progresses there should be a more proactive behavior towards private and public stakeholders. A strategy should be in place to deal with unexpected stakeholder demands and a clear communication strategy.
   - There should be a clear understanding of the priorities of stakeholders, and changes should be monitored on a day-to-day basis.
   - Periodic stakeholder satisfaction measurements could be useful to implement in the projects to regularly monitor the relationship with the stakeholders and to organize effective stakeholder participation and communication.
   - Looking into opportunities to involve local business and people can create more social and economic benefits for the community.

- By considering the project from different perspectives when making important decisions in order to understand conflicting interests and create synergy, the risks can be converted to an opportunity.
- Identifying the level of importance of the stakeholder (groups) will help be aware of their level of influence on the project in each project phase and in order to design suitable communication and stakeholder management activities. Organizing regular reviews of the stakeholder overview to monitor changing needs, interests and/or level of influence are also beneficial.
- The most important stakeholders should be involved early on in the project and thereby are informed during the process and have the opportunity to share their knowledge and view on an operational level.
- In the case of a lengthy decision-making process, it is recommended to place additional efforts in keeping the stakeholders engaged in the program. In other words, attention should be paid to managing expectations.

2. Stakeholder Communication

   Different stakeholders have different attitudes, interests and priorities. Effective communication ensures that they receive information that is relevant to their needs and builds positive attitudes to the project. Good communication helps create a positive understanding and can aid in building effective long-term relationships with key groups. The important characteristics that support this claim are-

   - There should be open communication with stakeholders and a proper communication strategy should be set in place by the PDO.
   - Contingency plans should be in place to brief stakeholders should there be a problem with the project.
   - The project team can make use of many ways of interacting with the stakeholders, both online and offline: a website including FAQ's, regular meetings with the main stakeholders, brochures, targeted newsletters, attendance at public events and the shipping forecast. A telephone number for inquiries and complaints and at the construction site installations of information signs are beneficial. The project organization can also be active on social media channels like Instagram and Facebook etc.
   - There should be good information flow to the local inhabitants and a dedicated project website to inform them regarding the project progress.
   - The PDO should measure stakeholder satisfaction periodically through surveys with the public to find out the impact of the project and to mitigate negative influences.
   - The suggestions of the local authorities and interest groups need to be more frequently discussed with them, in order to create win-win situations for both the project as well as the local authorities. This could lead to more support for the project but requires a proactive stakeholder management approach.
   - The project delivery organization should investigate how to communicate to the end user and measure the end user's satisfaction before, during and after the implementation phase.
   - The communication plan that is being developed should contain a clear marketing strategy that will help reach all stakeholder groups and could help increase support for the project (funding).
   - It may be worthwhile explicitly branding the project. Create a brand according to the project objectives, create one logo to show an integrated project and to prevent the project being seen

as parts. This also increases the recognizability of the project, which can be used to better support the project objectives.

- City branding can also be beneficial for the project and the community.
- Be aware where there are different views or if there are different political parties and avoid the project being a pawn in these situations.
- The time necessary to deal with complaints and/or appeals should be considered in the planning.
- Alert politicians about difficult issues so that they have time to plan a way to manage these.

2.4 Risk Management and Project Controls

The IPAT defines this theme as follows- '*Project controls contain those activities generated and necessary to manage the project's cost and schedule. Project controls are the data gathering, management and analytical processes that the C/S and PDO use to predict, understand and constructively influence the time and cost outcomes of a project. They include processes for costs, planning and risks (threats and opportunities).'*

The results of this theme are clustered into 'Costs and benefits', 'Planning and interfaces' and 'Risk (Opportunities and threats) Management.' Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Costs and benefits

   This sub-theme describes the clarity about the available project budget and the cost estimates and budget forecasting that are updated with the respective scope changes. The important characteristics identified from the IPAT reports show-

   - There should be a clear funding plan and sufficient contingency budget available for the project.
   - In order to justify the level of contingency reserve for the project it is important to make a good link with the risk file.
   - The spent money should be monitored and clearly documented.
   - The funding strategy should be linked to the procurement strategy and, ultimately, supported by the communications strategy which should include a strategy to ensure political support for the chosen funding route.
   - The project team should have very clear understanding of the requirements to control and monitor costs carefully. This needs to be replicated within all the project phases.
   - The interest rates, VAT and inflation should be a part of the financial analysis.
   - The PDO should have a good understanding of the financial model and allow themselves to be supported by financial expertise where necessary.
   - If the funding has not been finalized, the PDO should pressurize the parties responsible to secure the funding, else if there is a project delay due to insufficient funding, more loss in revenues will occur. However, If the project seems to be fully funded, there should be no deficit between the estimated budget that is approved and the sum of the different funds.
   - If funds are insufficient for the project, together with the planning department and/or Advisory Group develop a vision and strategy in order to obtain additional funding for the project.
   - Apply more flexibility in the project contingency percentage; increasing the percentage for more complex and high-risk projects. (It is better to deliver under budget than go back for re-approval)
   - Cost estimates should be based on experiences with other projects and should be updated on a regular basis.
   - Bi-yearly cost calculation method and cost saving meetings are beneficial.
   - The budget should not be set too early in the project.

- Clarity should be available on price indexation.
- The PDO should visibly take into account the budget costs that are unknown or uncertain.
- During the detailed design it is very important that the project team make accurate cost calculations and forecasts in order to keep control over the budget.
- The PDO should focus on total spending (across the total project lifecycle) rather than annual spending. In the end - annual spending is a liquidity issue.

2. Planning and Interfaces

   Planning and scheduling of activities helps in the effective management of resources such as men, materials, machinery. It also helps to minimize the cost by optimum utilization of available resources. Interface management between different planned activities is also crucial to avoid problems during execution. The characteristics identified that support this claim are-

   - The main interfaces that has to be manage are the interfaces to other national infrastructure projects and the interfaces on the cross-border sections.
   - The PDO should deal with critical interfaces in the planning phase.
   - There should be a set up to agree and formalize a prioritized plan to resolve quality issues.
   - The identification and the management of interfaces should be done in a systematic way.
   - Reporting structures across the interfaces should be formalized.
   - The project should have relatively simple and clear interfaces with other projects. The interface responsibilities should be divided in an adequate way.
   - The traffic management during construction is very important.

3. Risk (Opportunities and threats) Management

   Risk management is necessary to identify the risks, assess the extent of the risk, provide measures to control and mitigate the risks identified and manage any residual risks. This step is imperative in the execution of projects. Few of the characteristics identified to ensure good risk management in the IPAT reports are-

   - A clear and systematic cost control and risk management procedures should be in place.
   - There should be an integrated risk identification and control system in place on project and program level and keep track of the applied risk handling measures. An integrated approach to risks will help the project management team focus on what is important and manage the interfaces better.
   - The roles and responsibilities of the risk manager (process) and management team (risk management) should be clear.
   - Risk management mitigation should be SMART (specific, measurable, assignable, realistic, and time-bound). The mitigation measures should be clearly defined and should clarify who is accountable for the mitigation measures.
   - Attention should be given to the contingency percentage which should be adjusted according to the complexity of a project. Also, there should be a clear connection between the project risks and the project contingency budget.
   - A very extensive project risk file might lead to a lack of focus on key risks by the project management team.
   - Risks should be included in regular project reporting and control structures.

- Remember to organize reviews of risk assessment plans and mitigating measures.
- There should be a clear risk escalation process in place. (Owners of the risk and mitigators)
- There should be a clear connection between the risk analysis and the financial forecast and planning.
- Ensure that risks and mitigation strategies are reported in the Monthly Report and that the risks and actions to mitigate risks are reviewed frequently.
- Good project control includes a transparent process of risk management by the project team during all phases.
- Risks regarding the soft side of the project, like organizational and cultural aspects between parties should also be included in the risk files.
- Organizing independent external reviews of the project and its processes, helps to identify areas for improvement that the project team may be overlooking.

2.5 Organization and Management

The IPAT defines this theme as follows- *'Because of the often-one-off character of large infrastructure projects, a PDO needs to be set up specifically for a particular project. A PDO has its own organizational structure, culture, knowledge, and needs for human resource development. This theme is about how these organizational aspects are managed by the PDO – in relation to the structure of the C/S.'*

The results of this theme are clustered into 'Organization and Structure', 'Human Resources', 'Project team and culture' and 'Knowledge Management.' Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Organization and Structure
   One of the critical aspects in any project is the way the organization is setup and the process of achieving a coordinated effort through the structuring of tasks, authority and workflow. The important characteristics that support this claim are-
   - There should be a clear project vision and management style.
   - The PDO should be critical towards its own actions and those of others, in order to achieve a full self-learning organization.
   - The Management Team should have a good and open relationship with the Steering Group and with the internal Client/Sponsor as well.
   - Roles and responsibilities need to be clarified at every stage of the project. It, however, is extremely difficult to do this in a top down management style. It is important to exchange ideas about who is responsible for what. Only after a well understood division of responsibilities is it helpful to make them explicit on paper.
   - The role descriptions should be clear, but this must not lead to inflexibility (people working only within the boundaries of these descriptions).
   - Organizational charts with delegated responsibilities should be available and there should be good clarity in the program plan. A clear organizational chart is essential in order to clarify the relationships, roles and responsibilities of all parties involved.
   - The creation of a master schedule to include key decision point milestones and stage gates is beneficial. The schedule needs to reflect a realistic end date for the entire program

- The PDO should have a clear vision on how to align and integrate its organization with the contractor's organization.
- A transparent management style with functioning core values contribute to the successful organization of the project.
- Evaluations and reviews of strategy, organization and processes should take place.
- Analyze the load on different parts of the organization and create more redundancy for key team members.
- The resource allocation should be under the control of the Project Manager as the project will need to have the right technical skills and resources, that should be allocated at the right time/for the right amount of time.
- Use the opportunity to call for an Advisory Group meeting on a short notice – do not wait for regular meetings that are to be held only 3-4 times a year – when decisions are needed.
- If there is a clear division between the planning phase and the execution phase. The division between departments and phases might lead to many interfaces in projects, which could lead to a decreased efficiency or problems during the execution phase of the project. It is recommended to look for ways to reduce the strong barrier between both phases, for example by appointing one project manager for both phases or organizing combined feedback sessions to stimulate the interaction and knowledge exchange between the phases.
- The PDO should have a clear crisis management plan in place, including responsibilities etc. The plan's suitability should be tested.
- A 'project management culture' (in which the complete team thinks and works in a project managerial way), is essential in order to become a more professional project organization. This means that the project team does not only exist on paper, but that they cooperate as a project team as well. For example, by frequent project team meetings and reporting lines towards a single point of responsibility (Project Manager).
- It is recommended to expand the construction management values with the project management values. This can be realized by a systematic framework for promotion and transfer of good project management practices and results to other projects.

2. Human Resources

   Human resource management is essentially one of the most important aspects that contribute to the successful delivery of the project. Any construction project relies on skilled manual labor supported by a management framework, which has to coordinate many professional, construction and supplier organizations. The integration of these wide occupational personnel characterizes the construction industry as one of the most complex project-based industries. Hence effective and efficient human resource management is of prime importance. The important characteristics identified from the IPAT reports show-

   - HR development (training of personnel) should be defined.
   - Hiring consultants with wider expertise strengthens the project.
   - There should be a good variety of gender in the project team and in management positions.
   - The key positions (finances, legal affairs, project management) should be filled with people that have good experience in comparable scale or type of projects. Also, these key personnel should be retained at all project stages.

- Investment in a clear HR plan or approach is essential to make sure there will be (enough) experienced and competent personnel available for future projects.

3. Project team and culture

   The personnel involved in construction project organizations hail from diverse backgrounds which causes different human behavior and different expectations for a project. Hence in the project team, culture should be treated as a significant aspect in controlling conflicts, improving quality outcomes, and encouraging innovation. The characteristics found in the IPAT assessment reports that support this theme are-

   - There is strong leadership and management style set in place for the project team.
   - By working in project teams, the number of interfaces between the different departments will reduce and could lead to a more efficient organization of the project. A matrix organization could be used as an example.
   - The cultural differences should not lead to strategic behavior of the different parties because it will hinder the focus between the parties to achieve a common goal. Hence, there should be good awareness of the potential for cultural differences and a willingness among all parties involved to solve potential problems before they arise.
   - There should be openness of communication in the triangle PDO, SPV and main contractor. The relationship should be partnership based instead of contract based. Even if the contract has clearly allocated responsibilities to and for each party in the contract, it should not prevent open conversation and attempts to resolve issues personally, rather than 'blindly' following the contract.
   - Cultural differences between involved parties are a danger for cooperation in the project. Deal with this issue directly from the start of a project after the contract is signed. Take time during the project with project follow-ups between the PDO and the SPV/Contractor to discuss the relationship. Include all persons who have an important role in the interface management and those who are responsible for keeping up the positive spirit.
   - Variety is important in a team but keep focusing on building a team that is "one" team. This will enable the team to support each other during times when pressure increases.
   - People with the right skills and knowledge should be involved in the team. There should be an open and positive culture for people to deliver a successful project.

4. Knowledge Management

   The project benefits enormously when it makes the best use of knowledge and information within an organization to achieve objectives. It allows people to access and apply the most appropriate knowledge when it is needed and supports learning. Hence effective knowledge management is vital in any project. Few of the characteristics identified to ensure good knowledge management in the IPAT reports are-

   - The focus of the knowledge transfer should be from both national and international projects.
   - A formal process for skill retention should be deployed and there should exist a well-documented knowledge management strategy plan in place by the PDO.
   - A market consultation should be organized to gather input from private organizations.
   - Results from the decision-making processes should always be documented and retraceable.

- A formal lesson learned report should be prepared and actively shared after each project completion so that knowledge is passed from one project to another.
- The risks of changing senior individuals in the ministry, because of ministerial or political changes, who need specialist knowledge of technical matters or the commercial relationship with the EU, should be carefully understood.
- It is important to register all information needed for the organization that will manage the project during the maintenance phase. Transfer of knowledge at the end of the construction phase will be very important for a successful maintenance phase. The PDO should plan this transition in a timely manner. At the end of construction, the contractor shares all of the knowledge with the maintaining organization. However, the same information should also be shared, the asset owner. This would facilitate the easy transfer of asset information if any unforeseen circumstances would occur with the SPV or maintenance.
- If there is a clear gap in time between the phases, it increases the possibility to lose knowledge and experiences of the personnel involved. The PDO needs to store key positions for a longer period of time in order to build further on the current level of knowledge in the next phase. Also, document lesson learned explicitly to manage transfer of knowledge between phases.
- If there is a lack of knowledge regarding construction methods or other aspects, invite someone who is considered to be the leading expert in that area to join the PDO as an expert that could help/advise them in critical situations.
- If a new system for the efficient document management system is introduced, then tailor-made development and the implementation asks for enough attention in order to make it successful.
- The project should use networking within disciplines (risk management, quality management, etc.) to exchange knowledge.
- (Systematic) Knowledge management will need more attention as the tasks and the team grows. Especially when people become more externally focused.
- The knowledge exchange from other projects can be improved by a systematic inflow of the latest national and international know-how related to economical, technical, organizational and behavioral solutions and their potential implications. To make this information accessible it is recommended to create a knowledge base from previous projects.

2.6 Permits, Authorizations and Consents

The IPAT defines this theme as follows- *'Permits, authorizations and legal consents are conditional for the successful realization of a project. This theme is about how the permits, authorizations and consents are identified, obtained and managed by the PDO throughout the duration of the project phase.'*

The results of this theme are clustered into 'Identification and mapping of all permits, authorizations and consents' and 'Management of all permits, authorizations and consents.' Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Identification and mapping of all permits, authorizations and consents
   Identifying and mapping all the required permits, authorizations and consents are essential to ensure that the project plans to comply with local standards for land use, zoning, and construction. These standards are intended to ensure the safety of all the workers, users and end users during and after the construction period. The IPAT reports identified the following characteristics-

- The project must be aware of changes in rules and regulations, which occur often both nationally and internationally. This makes it hard to follow and implement every single change and adapt EU regulation to a national law.
- There should be a clearly defined process regarding identification and management of the necessary permits, authorizations and consents (Planning Approval Process) needed by the project.
- Clear identification of the required legal consents for this project is critical. (by both the PDO and the contractor).
- All the necessary information for the approval process should be available.
- The PDO should be competent and capable of managing the complex and democratic processes of obtaining the legal consents.

2. Management of all permits, authorizations and consents
   Managing all the required permits, authorizations and consents to avoid events due to delays or refusal of legal consents are critical. The assessment reports show-
   - The responsibility for organizing and managing the building permits should be assigned to a dedicated team member or group of team members.
   - The active management on necessary consents and compliance to rules and regulations is something to be considered after the scope and schedule have been decided upon.
   - With regards to environmental consents, particular attention should be paid to the stakeholders (both governmental and non-governmental parties) to ensure that expectations are managed. If there is any potential for political controversy, the project team needs to work closely with the relevant municipality staff to be transparent and manage the issues.
   - Stakeholder management helps in the smooth process of getting all the necessary consents.
   - The details for land acquisition should be clear (size and budget).
   - There should be a detailed timeline for consents linked to project milestones and there should be a timetable for the agreements that are needed and legal procedures to undertake for the project.
   - The team should have good experience in managing legal procedures and know what is needed at what moment of time. It is also beneficial to identify a dedicated team for obtaining consents.
   - If the overall planned time schedule for obtaining consents seems to be very tight. The PDO should develop a contingency plan in order to deal with delays or refusal of consents based on lessons learned from previous projects concerning legal procedures.
   - The timeline for the delivery of the milestones should provide enough time to account for delays and backlog. The time available for approvals should not be tight and margins should exist for any re-work.
   - If there is a strong barrier between the planning and construction phase then the hand over from the planning department after the Planning Approval Order should be organized in an optimal manner because the teams do not take much time for the hand-over, information and knowledge can get lost. This could lead to unanswered questions and delays in a later project stage.

2.7 Technology

The IPAT defines this theme as follows- *'In large infrastructure projects PDOs often face technological challenges. This theme is about how the PDO translates technical and functional requirements into*

technology and how the PDO chooses a certain technology, given the technological innovations and uncertainties.'

The results of this theme are clustered into 'Functional Specifications' and 'Choice of Technology.' Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Functional specifications
   The theme functional specification as defined by the IPAT - '*How the project objectives are translated into functional specifications and communicated by the Client/Sponsor to the PDO*.' The functional specifications provide details of the operation, functionality, and deliverables for a project. In the assessment reports the characteristics which support this claim are-
   - On the level of contractual specifications, the PDO should develop true output based functional requirements.
   - The PDO should define clearly the functional specifications and requirements for the tender phase before the start of execution.
   - Stakeholders and users should be engaged in the definition and authorization of specifications and changes. The PDO must involve the operator in defining required outputs and involve the Client/Sponsor more in the dialogue with stakeholders regarding functional specifications.
   - The functional specifications in terms of environmental and social outcomes must be available and the safety outcomes and the requirements must be defined.
   - The contractor and the PDO organization should work close together to fulfil the specifications by translating the project objectives into functional specifications and then into a robust design that will be agreed upon with the client.
   - The functional specifications should be analyzed within the PDO to make sure that the organization is prepared if the suggestions from the contractor means that something must be negotiated.
   - Greater clarity of functional specification would underpin more robust change control and it also has a significant bearing on the project's costs and the business case. However, if the constructions are specified in high detail instead of in a functional way. Such an approach will probably lead to an exact execution of what is asked but will not lead to additional suggestions and innovations from the private party involved.

2. Choice of technology
   With the passage of time, construction industry has passed through advancements. One of them is the progress in technology towards more efficient and innovative solutions. However, the choice of technology used in a project is greatly influenced by many factors and this is one of the decisions very crucial to the successful execution of the projects. In the IPAT reports the following characteristics are identified that support this claim-
   - In a complex project with a very tight budget and time schedule, it is wise to make use of only proven technologies which the PDO is experienced in.
   - The project should plan to make use of early contractor involvement for the design and construction contract. This enables innovative solutions and production methods.

- It is recommended to apply a system of searching, collecting, analyzing and assessing the potential of latest global technological solutions and experiences from the fields of project application, innovation leadership and culture in similar projects.
- The PDO should consider areas and opportunities for technological innovations and improvements, while the geotechnical circumstances are quite challenging, and the latest innovations might offer time and cost reductions.
- If new technology is introduced in a project attention should be paid to efficient incorporation of this technology. Innovation needs a 'bedding in' period of a few years to establish the system of operation and maintenance, including the training of personnel.
- The PDO should have a clear strategy on the assessment and implementation of innovation in the project. There is a risk that implementing or (re)considering new technologies interferes with the project delivery or other important milestones
- To prevent scope creep, new technologies should be managed as separate projects in the project.
- Make sure there is enough technical, engineering and construction expertise within the PDO to cope with the innovative elements and address practical parts of the most complex structures.
- The lessons learned through the adoption new technology should be captured and shared for the benefit of future schemes.
- Realized benefits with the use of new technology within a project should be reviewed so the attributed cost savings can be verified as a reference for future projects, or next phases of project.
- Make a conscious decision whether or not to include new technologies in and for the project and decide how to assess new technologies for the project. The monitoring of possibilities for new technology should be a continuous process.
- During the tendering process the PDO can discuss alternative technological solutions and within the tendering procedure bidders can be challenged to come up with technological innovations to earn extra quality points.
- There should be few incentives for the contractors to improve sustainability of the project.
- It is recommended to make better use of the knowledge and expertise of the contractors and consultants to stimulate innovation and optimize building processes and logistics.
- Alliance contract model gives the opportunity to implement new technologies.

2.8 Contracting and Procurement

The IPAT defines this theme as follows- *'A large infrastructure project is delivered with the involvement of private companies (such as contractors, advisors, and operators). This theme is about how these external parties are contracted and how these contracts are managed by the PDO.'*

The results of this theme are clustered into 'Contract Strategy', 'Procurement Strategy' and 'Contract Management.' Based on the IPAT reports of projects 16 to 31, the characteristics which will help in the successful execution of the project are-

1. Contract Strategy
   "Contract strategy is the main components of the process used to determine how the project will be procured" (Wearne, 1995). When a good contracting strategy is applied it not only improves the supply management in order to deliver maximum value at minimum cost but also helps to develop and implement a best-practice process for the management of contracts. The important characteristics that support this claim are-

- A clear contract management strategy should be developed and available.
- The contract strategy should be supported by a very thorough market analysis.
- There should be a systematic evaluation of contract and procurement strategy in place.
- The contracting strategy of the project should not only be based on receiving the full budget but should also be prepared to provide an alternative strategy in case only a partial budget will become available.
- The strategic contracting plan should be prepared based on the project needs and the procurement policy, including cost escalation, interfaces, traffic during construction and liability risks. In the strategic plan define if and how to tender early contracting involvement (ECI) and define how this is connected to other project activities. Be sure that this plan also takes into account the interface risks between the different contracts. Involve the Advisory Group in the design of the strategic contracting plan.
- The contracting and procurement strategy should be adapted and incentivized in order to stimulate the private sector to suggest and implement innovative (technical) solutions.
- A formal procurement and contracting strategy are an essential basis for contracting. Apart from preferences in this strategy, the contract form always needs to be judged to the characteristics of the contract.
- If there is a tight time schedule to prepare and carry out the tender procedure, then the contracting strategy should be clear well in advance.
- The risk division between client and contractor should be clear as well as the procedure for dispute resolution. Dispute resolution arrangements are essential because it allows resolving disputes before the end of each Phase, which is beneficial for both the PDO as the Contractor. The dispute resolution process should not be too formal in the early stages of a dispute.
- The contract strategy should not be purely based on previous projects without alternatives being considered. This might exclude innovative contract strategies leading to further optimizations. In an international context several examples of a successful implementation of innovative contract strategies can be found.
- The contract risks should be identified and assigned to whoever is best placed to manage them.
- Decide on, document and communicate a clear contracting vision.
- The size of the team and experience of core team members should be evaluated.
- An early contractor involvement approach should be adopted.
- The selected contract arrangement should include incentives and not only penalties. If not, the Client will not be incentivized to accept value engineering measures in the project (finding the solutions which have the same value for client and lower cost for contractor). The contract can include various cost incentives for the contractor: a cost-plus system in order to stimulate the contractor to execute the project within budget and a bonus system if the contractor excels at collaboration with the project organization.
- The implemented incentive mechanism which should act as a bonus system and not seen as a penalty system by the contractor because it works more as a hindering factor in the relationship in the project than stimulating the performance of the contractor.
- Ensure that the incentives in the project are aligned to the objectives and are available to properly mitigate the risks.
- There should be incentives for the individual contractors to cooperate and liaise with each other in order to improve the collaboration between the contractors.

- The interaction between the contractors on the interfaces is required on a practical level. A suggestion to foster interaction by organizing periodic informal meetings at a management level to build trust, exchange information and share possible risks towards overall project success. The presence of the PDO is not in all cases needed (to prevent strategic behavior towards the client).
- The project organization should not be very dependent on the contractor regarding knowledge and resources. As long as the collaboration based on reliability and trust is going well this is no problem, but in case of e.g. cost overruns this might harm the relation. Onn the other hand, the Client can contract an independent technical advisor. Herewith they can secure themselves necessary knowledge and capacity in order to assess the deliverables of the PDO.
- There should be flexibility to implement optimizations to take advantage of the knowledge of the contractor.
- In the tender appraisal there needs to be a process for ensuring the right caliber of staff are employed in the SPV/contractor organization.
- If the project hires an international contractor, there should be proper awareness on the side of the PDO for potential impact of cultural differences, and the team should look at ideas for workshops and ways to ensure that this is not an obstacle. The PDO should be open to innovation that might come from using an international contractor. Take time with the contractor in the beginning to fully understand cultural differences, build collaboration and trust, ensure shared goals. Also explain the host country's cultural approach to collaboration and conflict resolution.

2. Procurement Strategy

   Procurement strategy is all about all the choices made in determining how best to achieve the defined project objectives. The important characteristics identified from the IPAT reports are-

   - The procurement team should be an integral part of the project team.
   - The procurement strategy should be linked to the funding strategy and functional specification/milestones. The interfaces should be carefully considered.
   - There should be a systematic evaluation of contract and procurement strategy in place.
   - The contracting and procurement strategy should be adapted and incentivized in order to stimulate the private sector to suggest and implement innovative (technical) solutions.
   - A formal procurement & contracting strategy are an essential basis for contracting. Apart from preferences in strategy, contract form needs to be judged to the characteristics of contract.
   - The procurement strategy, choice of contract types and the tender procedures should be clear and should align with the project challenges. This will aid the project in choosing the most suitable contract type to match each part of the project.
   - The PDO should have a bigger responsibility in defining the contract- and procurement strategy and allow more tailored strategies and also consider if the projects should have a quality assessment as well as a price assessment in the procurement decision.
   - A contractor who has bid on lowest price has different drivers than a PDO who is used to a collaborative working environment. However, the PDO should analyze the risks following the procurement on lowest price and also involve the client consultant in this process and take the results into account with the development of the contract management strategy:
     - Where will the contractor focus on?
     - What are the contractor’s risks and challenges?
     - What are unwanted effects of this way of procurement?

3. Contract Management

For the realization of any project, contracts play an essential role. Most of the times, the project may consist of a number of contracts that are responsible for the realization of different aspects of the project. Therefore, contract management is essential to ensure that the operational and the financial performances are maximized, and the risks are minimized. From the assessment reports, the following characteristics are identified-

- A clear contract management strategy is a key criterion for a successful project delivery and involve all parties on the side of the PDO. Clarify the role of all parties on the side of the PDO in terms of responsibilities and communication with the contractor. Be clear about roles at the outset. Take advantage of the opportunity of any delays to elaborate on this matter.
- The PDO should make it clear on who will be responsible for managing the contracts during the construction phase and how these contracts will be managed.
- The contract management team should have experienced personnel available.
- Keep the responsibilities between the contactor and the client according to the contract.
- Respond accurately and quickly on technical suggestions, and financial issues.
- Monitor continuously the financial situation for the contractor within the contract.
- If the contract strategy is composed of a lot of civil works contracts, it adds many interfaces to the project to be managed by the PDO. Coordination between those contracts will be the responsibility of the PDO, which could be time consuming and possibly adding unwanted risks.
- With respect to Contract Management, a dispute resolution procedure should be in place.
- There should be good awareness of the different approaches required for each contract. These different types of contracts (all-in contract, design and build and alliance) require also different contract management approaches: different client-contractor relationships, different contractual behavior, different payment requirements, etc. The PDO appears to be able to manage the three types of contracts through its approach.

Appendix-3: Expert Interviews

3.1 Interview of Expert 1

1. *In your experience what are the top 5 best practices in Project Management nowadays observed in practice?*

   Most important in Project management in my opinion is predictability and management of expectations. Because the more predictable you are the more trust you get form your environment, client and your contractor. This helps in creating more space for yourself so that if the circumstances ask for a different approach then you can create for yourself possibilities to do it in a different way than the usual approach and that is necessary to finish the project in proper way. Hence flexibility is very important in managing a project. But there also should also be an aspect of control in the project and there should be right balance of flexibility and control. Because not all project goes according to plan and 10% of projects may go in a different way due to circumstances or roadblocks. However, the conclusion at the end whether the project is considered as a success or a failure depends on the large extent on how project managers dealt with the 10%. To deal with the 10% in a proper way you should create the possibility for yourself to sometimes act differently than originally planned methods. Another best practice is to involve the stakeholders form the very start of the project and be open with them. It's better to inform them about the project risks and progress rather than them finding it out from other sources which is bound to happen in this day and age of technology. Another important aspect in project management is it's all about the people and so you have to invest in your people. Running a project is teamwork and you should realize this from the start. Sometimes people want the freedom to act, but in my opinion, as a project manager it's all about the mixture i.e., on the one hand give guidance to what the goals of the project and what is to be expected and on the other hand give freedom on how they do it. And this is the most important among the other best practices discussed.

2. *Do you recognize these best practices? If yes, please give an example for the same*

   a) *Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.*

      Yes, I have seen this in practice. Project like the North-South metro line and even the storm surge barrier i.e, Oosterschelde implemented this best practice. However, for some projects it's easier to formulate the vision and the goals than other projects. However shared vision helps enormously to get the project running and to overcome disappointments.

   b) *Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.*

      Yes, it's recognizable. It's even impossible nowadays that it's not done in projects especially the second part of the practice. It's unthinkable to not use this practice in real life. However, nowadays it is better.

   c) *During the execution phase of the projects, efforts must be put to sustain the established relationships with the political parties and risk mitigation measures strategies should be prepared in case of change in political consensus to avoid the project being used as a political pawn.*

      The Leon Railway connection in Italy is the first project that comes to mind. In Italy the influence of the politics is very large. It was necessary for the project to have a political basis, however it's

not good for a project when the political influence is very high. I know it's not always avoidable, but we have to try to avoid it as much as possible.

d) *Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project. (Construction management is focused on the client needs and related to technical issues mostly. In project management those views are extended by the needs of the overall business case and all directly or indirectly involved stakeholders.)*
This practice is in line with what I said about project management being all about people and management is important in that perspective. As a project manager you also act as an example for the rest of the people. People tend to do not what their boss says but what their boss shows or does.

e) *The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.*
I think you can view risk management in two ways and the mentioned practice is a more technocratic approach of risk management. In a risk analysis, you have to connect the bottom-up approach with the top-down approach which is easier said than done. In what I've seen in project, they mostly use the bottom up approach.

f) *The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.*
This is practice is more integrated in our organizations when compared to the southern part of Europe. However, it is very recognizable.

g) *Dispute resolution and constant monitoring of the financial situation of the contractor should be considered while allocating risks to the party best suited to carrying it.*
We have recently started using this approach in my project. Normally it's up to the contractor to monitor his financial condition. The SAA project i.e., Schiphol-Amsterdam-Almere have used this approach and discussed this in the early phases of the project to avoid any surprises and lose-lose situations in the project.

h) *Align the incentives to the project objectives and incentivize the liaison between the contractors.*
This is the case for when many contractors are hired for same projects, however in the Netherlands we try to avoid this by naming one contractor as the contractor for the entire project. However, in A99 Munich ring road project, there we saw a lot of different contractors for the client organization and the PDO to deal with all the interfaces between the contractors. So, this practice was used to incentivize the cooperation between the contractors. For instance- by making one contractor responsible for managing the interfaces with all the other contractors.

i) *Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.*

It's a matter of balance of introducing new innovative technology and using proven technology. Because infrastructure projects have a large societal impact, costs a lot of money and consumes a lot of time, so you can't afford to try out new technology. However large projects are the best environment to realize innovations in new technology. If you look at the history of projects, the most innovations in technology or organization or risk management took place in large projects. Example- The realization of the storm surge barriers involved implementation of a lot of innovations in many areas.

j) Extend the knowledge exchange beyond the project organization i.e., national and international projects.

This is what is being done with the IPAT and NETLIPSE. This is one of the main reasons why NETLIPSE exists to promote this practice. IPAT is not used only to give advice from one colleague to another but also help the community can improve their ways of dealing with projects and this is the goal behind NETLIPSE.

k) Brand the city along with the project to increase the benefits for the project and the community.

This is sometimes difficult as for some projects it is far easier than the others to show the benefits of the project and most of the time the benefits are seen only after a couple of years after completion. Of course, you need to communicate for what you are doing it for but don't expect too much form it.

l) Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.

Reflection is very important. What you see in projects are tight time schedule and people are always running around doing their jobs and at a certain moment they find out that something went wrong and have to deal with it. This happens mostly because people don't allow themselves enough time to reflect on what's happening in a project. Reflections along with the stakeholders, along with the contractor about what's happening in a project, what can we learn from it and what we do it make it even better. People should take more time do this and this will help execute the projects better.

3. *From the IPAT assessment reports I came up with 12 Best practices. Please prioritize these best practices based on your practitioner's knowledge in the field of project management.*
   - The cultural aspects in a project and project environment.
   - The way people in the organizations work together- The improvement is in the cultural approach of projects depending on how people manage to set aside their differences and work together not only within the project organization but also with the organizations around them. Also, because the projects are becoming more global and have to deal with international personnel and this has to be managed to the project's advantage than perceive it as a burden. However, this is not easy, but if efforts are put in the work will be very beneficial.

4. *To what extent do you think the clients made use of the recommendations form the IPAT sessions?*

As from my experience as an assessor and a client for the IPAT assessment, I noticed that the reaction was positive and very helpful. For the large part this is not a formal audit, in the sense we will not

check everything on paper. However, its more about knowledge sharing from one expert to another and that is the strength of the IPAT and hopefully that is what the client will notice.

5. *What is the best time to introduce the IPAT tool during the lifetime of the project in order to obtain maximum benefits?*
   At the start of the realization phase.

3.2 Interview of Expert 2

1. *In your experience what are the top 5 best practices in Project Management nowadays observed in practice?*
   My experiences are not only based on being the NETLIPSE director and IPAT assessor, but also my experience from the IPMA (International Project Management Association) project excellence award which is a global organization for the past 12 years. So, the best practices I've seen are-
   - Leadership style- It's not only about what the project manager does but also about all levels of leadership in the project team or organization.
   - Well implemented quality management system- After having agreed on certain processes, arranging internal audits to review them and improve them. The process of continuous improvement where the project is learning form others or if it's a long process learning from within its own project phases. The internal drive of the continuous improvement of the project where the purpose is not doing an audit but continuous improvement of the project.
   - Stakeholder engagement in the project- In some countries this theme is not yet as far developed as it is in the Netherlands the way that project teams deal with the stakeholders. So, the more involved the stakeholders are at the start of the project, the better it is. Communicating openly and transparently about the risks works better than trying to keep stakeholders in the dark.
   - Focusing on project team member development- Not only within different disciplines but also different teams in the project team. Taking out time in the rush of the project to focus on personal development or team development.
   - Focus on knowledge management- learning on the job, learning within the project team and also organizing learning from other projects or outside of the organization.

2. *Do you recognize these best practices? If yes, please give an example for the same*
   a. *Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.*
      Many projects in Scandinavia have cooperative and collaborative contracts use this best practice. Especially in collaborative contracts like the alliance contract, early contract involvement.

   b. *Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.*
      Finnish projects taking place in greenfield areas have insufficient stakeholders and hence the government is happy that local businesses are involved. Depending on the complexity of the project and the number of stakeholders involved. Karjala rail project did not have any local businesses in the neighborhood. The North-South line in Amsterdam, Netherlands is an example where it needed to happen due to the crisis that was in the previous project. Most Dutch project are used to this type of stakeholder engagement. Sweden, Netherlands, UK are few of the countries that follow this best practice.

c. *During the execution phase of the projects, efforts must be put to sustain the established relationships with the political parties and risk mitigation measures strategies should be prepared in case of change in political consensus to avoid the project being used as a political pawn.*
Rijkswaterstaat projects, North South metro line in Amsterdam, A27- A12 Ring Utrecht project

d. *Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.*
Depends on the phase of the project.

e. *The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.*
All large projects in the Netherlands like the A27- A12 Ring Utrecht project and North South metro line use this best practice.

f. *The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non- technical aspects of the project.*
A24 Blankenburg connection, A27- A12 Ring Utrecht project, Utrecht central station project and all the large station projects of ProRail use this best practice.

g. *Dispute resolution and constant monitoring of the financial situation of the contractor should be considered while allocating risks to the party best suited to carrying it.*
Considering which party is best suited to carrying the risk, that is something that happens especially in collaborative contracts but if it is done on a basis of continual monitoring of the financial situation of the contractor, I do not know. Ask Hans Ruijter. However, I do agree with the other aspects except the monitoring.

h. *Align the incentives to the project objectives and incentivize the liaison between the contractors.*
In the North South metro line, they signed an agreement to finish the project on a certain date. So even if one of the contractors did not meet the deadline, none of them would get the bonus. Hence, they were incentivized to reach the milestone together.

i. *Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.*
Along with the bedding in, I would've expected to see managing the new technology as separate projects to prevent scope creep.

j. *Extend the knowledge exchange beyond the project organization i.e., national and international projects.*
A27- A12 Ring Utrecht project have used this and the Rijkswaterstaat and ProRail are incentivized to use this best practice in their projects.

k. *Brand the city along with the project to increase the benefits for the project and the community.*
I find this strange as not all projects have cities involved. Branding the city is not a responsibility of the project team. The activity within their own scope is they can brand their project. Hence this is not generic. However, you could align the project's branding with the city because branding the city is outside the scope of the project managers.

l. *Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.*
In the integrated project management model that is implemented in the Rijkswaterstaat and ProRail, City of Amsterdam projects- quality management is part of the project controls and if you do quality management seriously then you will also have a system of internal audits leading to improvement where you have an improvement register. So, these will be internal audits that is organized which is similar to the periodic reviews. A24 Blankenburg connection and A27- A12 Ring Utrecht project are using this best practice.

3. *Comparing the best practices and lessons learnt from the Infra maturity tool and the IPAT, what type of evolvement of trends did you expect which were not discussed?*
   - Managing new technology and innovations as separate projects.
   - Focus on the focus of people because now the challenge for the government is to find the right people and keep them in the project.
   - Knowledge & technology, Organization and Management and stakeholder themes scored the lowest in the 10-year review. This is where the improvement areas are.

   If you're talking about best practices, I would hope to find them in the nontechnical sides of the project. Because according to me that's where the difference can be made. If you look at the technical project management tools and skills, they are already in place and happening really well. Hence the improvement areas are still in the organizational aspects of the projects.

4. *To what extent do you think the clients made use of the recommendations form the IPAT sessions?*
   It varies for all projects. However, the Finnish Transport Agency – Vayla, have finished a 3-year IPAT program where they had 6 of their projects assessed and have now hired a quality management consultant to build a database of all the improvement areas. Of course, it's a challenge and we don't monitor the implementation of the recommendations in the project, but what Vayla is doing is a good sign that they will actually do something with the improvement recommendations provided to them from the IPAT assessments and thus improving their project management of their projects.
   It also depends on the company culture as to what extent is the project management team able to adapt standard processes to fit their project which varies with every PDO.

5. *What is the best time to introduce the IPAT tool during the lifetime of the project in order to obtain maximum benefits?*
   The best time to do an IPAT review is when a project is ready to go into the next phase. So, the best time to do an IPAT assessment is at the end of any of the milestones and the beginning of the next one.

3.3 Interview of Expert A

1. *What did the project learn from the IPAT assessment report?*
   It helped us prioritize the questions and gave us more direction regarding where we had to improve the project. And also, more of an acceptance for me as a project director, that we were on the right track and figuring out what areas we had to focus on.

2. *Did the management team implement any suggested recommendations for improvement in the project? If yes, to what extent was it implemented?*
   After the IPAT assessment it was very clear I had to do something regarding the organization and the management of the project. So, we implemented a new organization as per the recommendations of the report. We also clarified the objectives of the project which were not very clear. We also worked on the strategy for the tender.

3. *What were the three main recommendations that was implemented in the project?*
   Organization and management, Objectives and business case, Finance

4. *Did the recommendations help the project? And how did it impact the execution of the project?*
   It very much did help the project; in the way it was very clear that these were actually the big questions of the project because there were many big questions on the table which the IPAT helped prioritize.

5. *Were the recommendations also used in future projects?*
   We tried but I think it is very hard because it is up to the different project directors of the project.

6. *When do you think is the best time to introduce the IPAT tool during the lifetime of the project in order to obtain maximum benefits?*
   I think you can introduce the IPAT in different stages actually. Because there are different types of questions in different stages. However, the main thing to focus is the phases, because it may vary per country. So, I think there is a need for discussion whether the phase described within the IPAT matches with the actual stage the project is in. After that the IPAT can be used in different stages

7. *Do you have any suggestions for improving the IPAT tool/process?*
   To clarify the different stages of the project so that you know which phases the project is being assessed for. And also ask the client to describe- this stage in this country means that. Clearly characterize the phases based on the project being assessed.

3.4 Interview of Expert B

1. *What did the project learn from the IPAT assessment report?*
   It gave us a chance to learn and at the same time the assessment checked if there were any changes needed. The project management team completely agree with the review report and it gave us a better direction for the project to progress on. The colleagues and the people involved in the project really appreciated the exchange of knowledge and experiences. The IPAT assessment gave us a better direction for the second phase and pointed out the areas for improvement in order to optimize the implementation phase.

2. *Did the management team implement any suggested recommendations for improvement in the project? If yes, to what extent was it implemented?*
   In Italy, there is poor attention paid to project management. They are used to running behind the problem i.e., only after the problem is known they try to solve it but don't actively put in efforts to avoid future problems. Not all recommendations were implemented. However, we did discuss the recommendations in the project team. Simple recommendations were implemented, and the complicated procedures were tried to be implemented.

3. *What were the three main recommendations that was implemented in the project?*
   The project team agreed and understood the proposed recommendations. However, it was difficult to go in that direction because of the complex working environment which consists of multiple stakeholders, actors and partners present in the implementation body. Hence, the process of implementing the recommendations was difficult in real project practice.
   But thanks to the IPAT assessment, the management team which was very small understood that we have to pay more attention to a lot of aspects starting from risk analysis. Because risk analysis is a fairly new concept in Italy which was introduced few years ago. In the initial stages risk analysis document was only prepared to fulfill the checklist for the EU commission. However, after the IPAT session, I realized the importance of risk analysis and pushed in this direction to view the risk analysis as a tool that will help manage the problems/risks especially in the future.

4. *Did the recommendations help the project? And how did it impact the execution of the project?*
   The recommendations and the assessment for sure helped the management team as the entire team became more aware of aspects that needed attention in the future. In real time the recommendations did not have direct impact on the project but indirectly influenced the management team to improve certain aspects in the future. Example- Phase 1 suggested to have a full-time board for the project, until now this recommendation was not implemented in the project. However, in the future thus recommendation will be implemented. The recommendations were important to us to help us realize there were other possibilities to improve the execution phase of the project.

5. *Were the recommendations also used in future projects?*
   I'm not sure if they were used by my colleagues. But speaking for myself, I totally agree that the IPAT assessment is a warning that provides recommendations to improve few aspects that require more attention which is for sure useful for the results of the project. Hence, I'd definitely keep them in mind and try to implement them in future projects.

6. *When do you think is the best time to introduce the IPAT tool during the lifetime of the project in order to obtain maximum benefits?*
   Since the project was huge and valued more than 350 million. Prior to the start of phase 2, having a check or to better call it a 'health assessment' was beneficial to the project. IPAT was not an audit rather a wealth assessment. If IPAT is done at the end of phase 1, there is something to learn for phase 2. However, if there is only one phase, the best time to perform an IPAT assessment is at the start or the end of the phase. If the wealth assessment is done in the middle of the project, in my country it is difficult to change or improve the project as it's not easy to change something that is not under your control. Probably it is easier for the Nordic countries and Holland as they have a more flexible system.

7. *Do you have any suggestions for improving the IPAT tool/process?*
   Nowadays we realized a few aspects that are more important like societal, environmental and sustainability aspects of the project. I wish the IPAT focuses on these aspects and they become one of the main aspects on which the project is analyzed, so that the we can receive some suggestions and recommendations regarding the same.

3.5 Interview of Expert C

1. *What did the project learn from the IPAT assessment report?*
   The aspect which was important to me was that I was able to talk to other project leaders from other countries. This helped me get more insights because they shared their own experiences and the problems that they faced. And this helped me as a project manager in benchmarking the common problems that we shared and discuss on how it can be solved. This discussion was not an official audit but took place in a more informal setting where I received good feedback. It was also the perfect time for the project team to receive feedback. We had noticed the problems earlier, however we received feedback from external professional experts which was very useful and solutions on how we could do things differently. We also had a deep analysis of the assessment report where we thought about areas we could change and optimize the project. However even if the big recommendations were not implemented in the project due to the constraints of the project, we did learn from the assessment and recommendations and tried to implement it in future projects.

2. *Did the management team implement any suggested recommendations for improvement in the project? If yes, to what extent was it implemented?*
   We couldn't implement all recommendations or change many aspects of the project as a lot of time had elapsed and it was too late to alter few areas. Some of the recommendations were implemented because the project team did not have the power to change something from the higher authorities.

3. *What were the three main recommendations that was implemented in the project?*
   The partnering aspect of the PPP contract, as the partnering was not going well and in organization and management, this was something we did send to the ministry of transport, but it was political decision to not implement the change as we have different style to manage the projects. However, we did try to change the system but unfortunately it was not in our hands to change it. Even in the theme risks, the recommendations were mostly for the service provider and not the management team. Whatever was in our power, we did try to incorporate them and the aspects that were implemented will be kept in mind for the execution of future projects.

4. *Did the recommendations help the project? And how did it impact the execution of the project?*
   The recommendations were absolutely right and when somebody confirms the same feeling you had about some aspects; it gave positive validation that we see the same problems witnessed as another external professional. This pushed us to do something about those aspects and hence the recommendations proved to be very helpful to us.

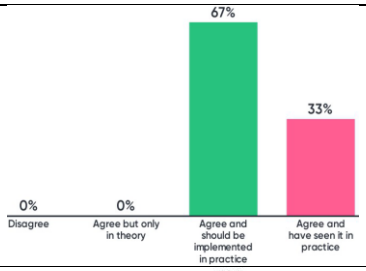
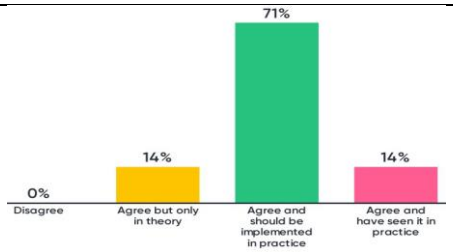
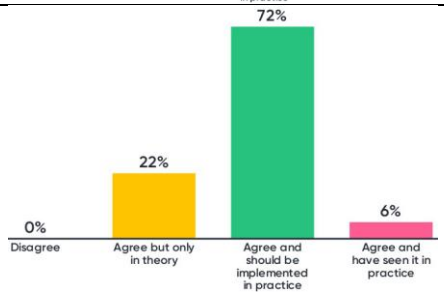
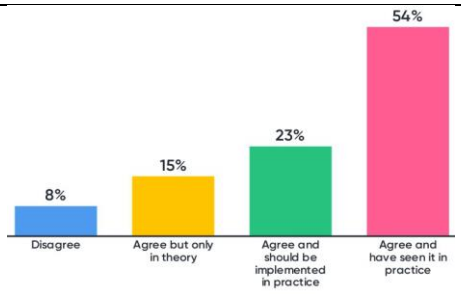
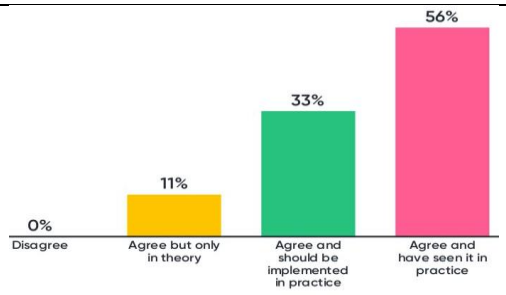
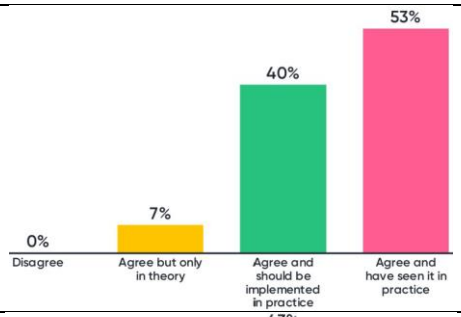
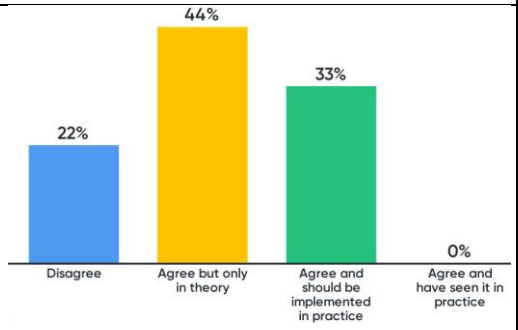
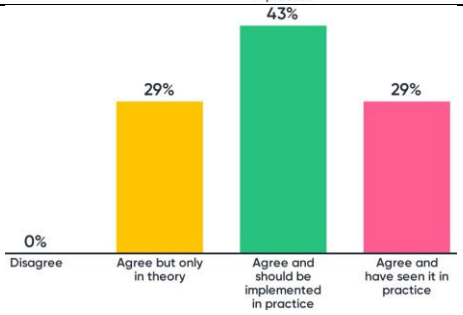
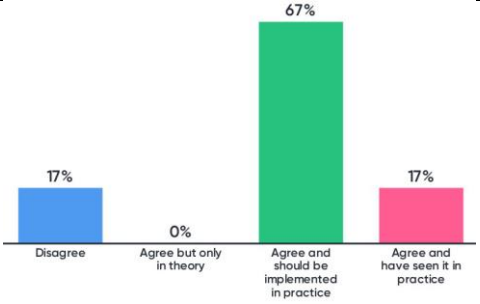
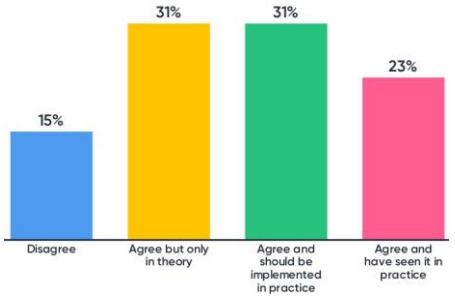
5. *Were the recommendations also used in future projects?*
   Yes, for example- when we started to do the next tendering in the PPP project in Finland, we will use those recommendation in the beginning of the tendering procedure to avoid the problems we faced in our previous projects.

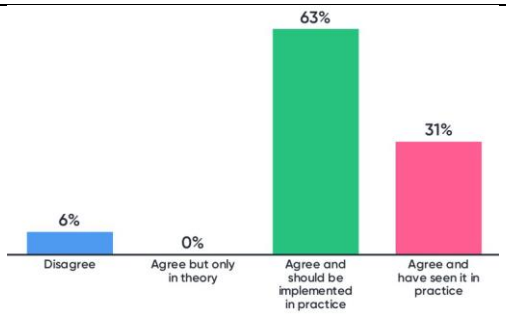
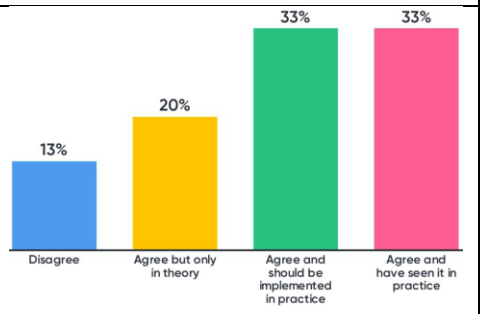
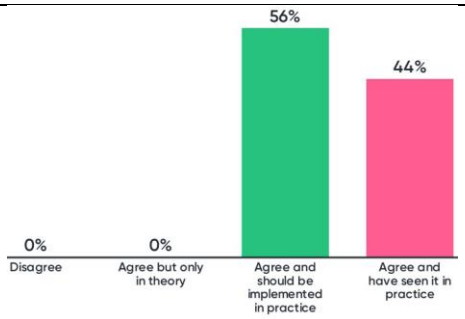
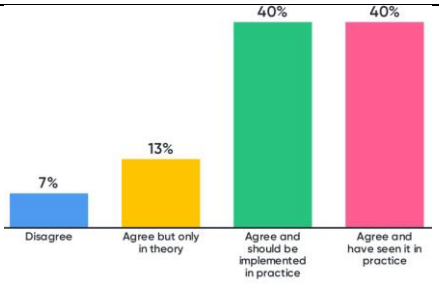
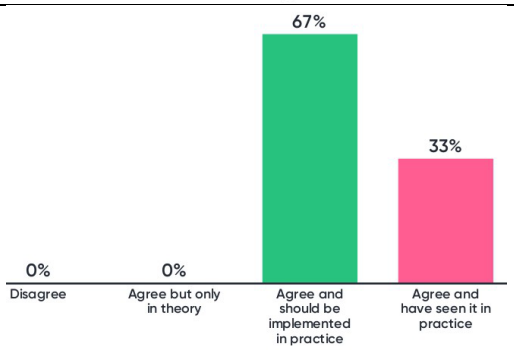
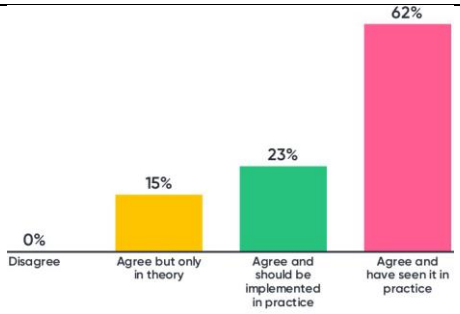
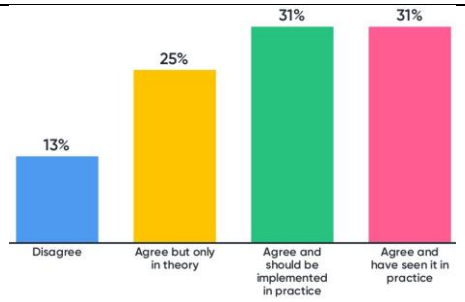
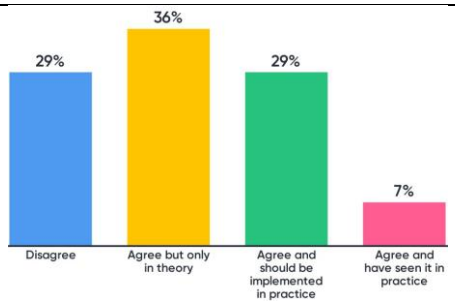
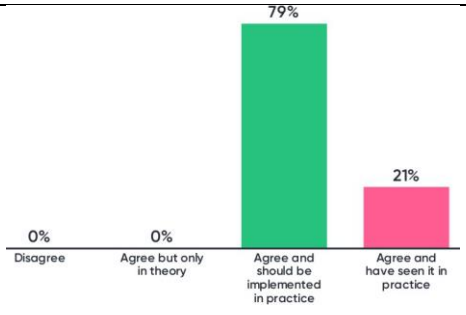
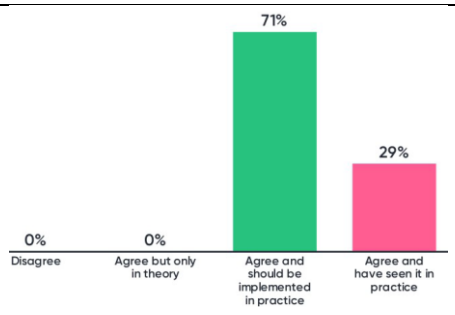
6. *When do you think is the best time to introduce the IPAT tool during the lifetime of the project in order to obtain maximum benefits?*
   If it is implemented too early, you lack experience in the project and if it is introduced too late, you cannot do anything about the suggested recommendations. So, in the middle of the construction phase is in my opinion an optimal time to introduce the IPAT tool. Because you also need time to implement the changes.

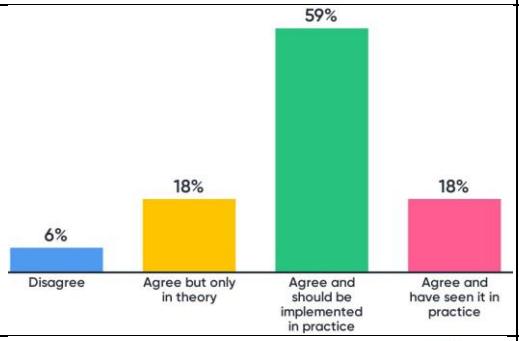
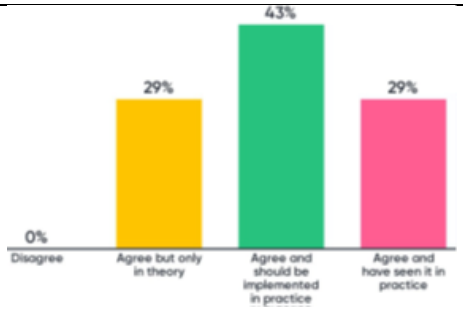
7. *Do you have any suggestions for improving the IPAT tool/process?*
   I think the need for a translator is essential so no information is lost in translation and also the all the members participating will in depth understand the assessment and also participate more freely.
   It might also be beneficial if the assessors could meet and share their experiences and get to know each other. I do not know many assessors apart from my tea. So, it would be a good idea to know other assessors and get an opportunity to discuss the assessments in order to learn from each other.

Appendix-4: Results of second expert session

The results of the second session of the expert validations are presented in two rounds. The graphs below show the percentage of the people who have voted each option.

Best Practice	Results of first round	Results of second round
Formulate the vision for the project and then align and integrate it with the PDO and the contractor organization.		
Organize periodic reviews in order to update processes and challenge financial and time information provided by the project teams.		
Involve local businesses and frequently consult the interest groups and local authorities to find favorable solutions for the problems defined.		
During the execution phase of the projects, efforts must be put to sustain the established relationships with the political parties and risk mitigation measures strategies should be prepared in case of change in political consensus to avoid the project being used as a political pawn.		
Brand the city along with the project to increase the benefits for the project and the community.		

Best Practice	Results of first round	Results of second round
Expand the construction management values with the project management values and apply a transparent management style for successful organization and management in the project.		
The risk analysis should be linked to the financial forecast and based on that sufficient contingency budget should be made available for the project.		
The risk database should provide SMART mitigation measures (Specific, Measurable, Achievable, Realistic and Time-Bound), people accountable and extend the technical risk management with a focus on the non-technical aspects of the project.		
Dispute resolution and constant monitoring of the financial situation of the contractor should be considered while allocating risks to the party best suited to carrying it.		
Align the incentives to the project objectives and incentivize the liaison between the contractors.		

Best Practice	Results of first round	Results of second round
Be careful with the use of new and innovative technologies i.e., consider a 'bedding in' period to establish new technology to minimize risks introduced and encourage the early involvement of contractors, experts and specialists.		
Extend the knowledge exchange beyond the project organization i.e., national and international projects.