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DECISION-MAKING PROCESSES IN MEGAPROJECTS: A MODEL PROPOSAL FOR TÜRKİYE

M. Sc. Thesis by

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MİMAR SİNAN GÜZEL SANATLAR ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

MEGA PROJELERDE KARAR VERME SÜREÇLERİ: TÜRKİYE İÇİN BİR MODEL ÖNERİSİ

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To my beloved family,

DECISION-MAKING PROCESSES IN MEGAPROJECTS: A MODEL PROPOSAL FOR TÜRKİYE

ABSTRACT

Megaprojects, with their transformative impacts on economies, technologies, societies, and environments, hold strategic importance for Türkiye and the global landscape. When executed successfully, megaprojects offer significant benefits, such as economic growth, technological advancement, social development, and environmental sustainability. However, these projects frequently experience cost overruns and delays due to inadequate planning and decision-making, where forecast errors have become the norm. This thesis proposes a novel model to improve decision-making for megaprojects in Türkiye, integrating global best practices and addressing critical deficiencies. The model prioritizes transparency, inclusiveness, and robust risk management by tackling key issues such as inadequate stakeholder engagement, lack of transparency, and insufficient risk management. It draws on international practices to ensure adaptability to the unique challenges of megaprojects.

This thesis also provides a comprehensive overview of the decision-making approaches for megaprojects in different countries. The research involves a comparative analysis of decision-making processes in the United Kingdom, the United States, and Türkiye, examining the laws, regulations, and standards governing these processes in each country. This analysis reveals critical insights into how different regulatory frameworks and cultural contexts influence project outcomes. By conducting this comparative analysis, the study highlights effective practices that can be adapted to Türkiye's unique context, underscoring practices that could benefit Türkiye's megaproject management. This study offers practical recommendations aimed at enhancing the planning and execution phases, ensuring sustainable success by merging local insights with global governing frameworks.

This research aims to advance the field of megaproject management by presenting a novel model that addresses key gaps in the existing frameworks of decision-making processes in Türkiye and enhances the global competitiveness of its megaprojects. By integrating insights from international approaches, the model strives to be robust and adaptable, facing the dynamic challenges of megaprojects. This thesis contributes to the literature by proposing a comprehensive framework that seeks to improve the effectiveness and efficiency of managing megaprojects in Türkiye, with potential applicability beyond.

Keywords: megaprojects, decision-making, project management, construction, infrastructure projects, feasibility studies, regulations

MEGA PROJELERDE KARAR VERME SÜREÇLERİ: TÜRKİYE İÇİN BİR MODEL ÖNERİSİ

ÖZET

Mega projeler, ekonomiler, teknolojiler, toplumlar ve çevreler üzerindeki dönüştürücü etkileriyle Türkiye'de ve küresel ölçekte stratejik öneme sahiptir. Mega projelerin başarılı bir şekilde uygulanması, ekonomik büyüme, teknolojik ilerleme, toplumsal gelişim ve çevresel sürdürülebilirlik gibi önemli faydalar sağlar. Ancak, planlama ve karar verme süreçlerindeki yetersizlikler nedeniyle sıklıkla maliyet aşımları ve gecikmeler yaşanmakta, bu durum da tahmin hatalarının yaygın bir norm haline gelmesine neden olmaktadır. Bu tez, Türkiye'deki megaprojelerin karar verme süreçlerini iyileştirmek amacıyla yenilikçi bir model önermektedir. Dünyadaki başarılı yaklaşımları birleştiren bu model, mevcut eksiklikleri gidermeyi amaçlamaktadır. Yetersiz paydaş katılımı, şeffaflık eksikliği ve zayıf risk yönetimi gibi temel sorunları ele alarak, şeffaf ve kapsayıcı bir yaklaşım ile güçlü risk yönetim stratejilerini ön plana çıkarmaktadır. Uluslararası uygulamalardan yararlanarak, megaprojelerin özgün zorluklarına uyum sağlayan bir model geliştirmek hedeflenmektedir.

Bu tez, farklı ülkelerdeki megaprojelerde uygulanan karar verme yaklaşımlarının kapsamlı bir incelemesini sunmaktadır. Ayrıca, Birleşik Krallık, Amerika Birleşik Devletleri ve Türkiye'deki karar verme süreçlerinin karşılaştırmalı bir analizini içerir ve bu süreçleri yöneten yasaları, düzenlemeleri ve standartları inceler. Bu analiz, farklı düzenleyici çerçevelerin ve kültürel bağlamların projelerin sonuçlarını nasıl etkilediğine dair önemli bulgular sunar. Bu karşılaştırmalı analiz, Türkiye'ye özgü etkili uygulamaları vurgulayarak, Türkiye'deki megaprojelerin yönetimine katkı sağlayabilecek yöntemleri ortaya koyar. Bu çalışma, megaprojelerin planlama ve uygulama aşamalarını geliştirerek sürdürülebilir başarıyı sağlamak amacıyla pratik öneriler sunar ve yerel yaklaşımları küresel düzenleyici çerçevelerle birleştirir.

Bu çalışma, Türkiye'deki karar verme süreçlerindeki önemli boşlukları gidermeyi ve Türkiye'deki megaprojelerin küresel rekabetçiliğini artırmayı hedefleyen yenilikçi bir model sunarak megaproje yönetimi alanını ilerletmeyi amaçlamaktadır. Model, uluslararası yaklaşımlardan elde edilen farklı anlayışları sentezleyerek etkili ve işlevsel olmayı hedefler ve megaprojelere özgü dinamik zorluklarla başa çıkmayı amaçlar. Bu tez, Türkiye'deki megaproje yönetiminin etkinliğini ve verimliliğini artırmaya yönelik kapsamlı bir çerçeve sunarak literatüre katkı sağlamanın yanı sıra, uluslararası alanda farklı ülkelerdeki megaproje yönetimi pratiğine de ışık tutmayı amaçlamaktadır.

Anahtar kelimeler: mega projeler, karar verme, proje yönetimi, inşaat, altyapı projeleri, fizibilite çalışmaları, yönetmelikler

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LIST OF ABBREVIATIONS

AHP : Analytical Hierarchy Process
CBA : Cost-Benefit Analysis
CE : Categorical Exclusion
CEA : Cost-Effectiveness Analysis
CHSRA : California High Speed Rail Authority
CP : Compromise Programming
EIA : Environmental Impact Assessment
EU : European Union
FHWA : Federal Highway Administration
FONSI : Finding of No Significant Impact
FTA : Federal Transit Administration Office of Planning and Environment
FTC : Fiscal Transparency Code
IGI : Infrastructure Governance Indicators
IMF : International Monetary Fund
MCA : Multi-Criteria Analysis
MCDA : Multi-Criteria Decision Analysis
NEPA : National Environmental Policy Act
NIA : National Infrastructure Assessment
NIC : National Infrastructure Commission
NPS : National Policy Statements
NPV : Net Present Value
NSIP : Nationally Significant Infrastructure Projects
OECD : Organisation for Economic Co-operation and Development
PBPP : Performance-Based Planning and Programming
PINS : Planning Inspectorate
PPP : Public-Private Partnership
PSO : Project System Organization
QA : Quality Assurance
QA1 : Quality Assurance Stage 1
QA2 : Quality Assurance Stage 2
ROD : Record of Decision
ROT : Real Options Theory
SCBA : Social Cost-Benefit Analysis
SEA : Strategic Environmental Assessment
SoS : Secretary of State
TAG : Transport Analysis Guidance
WPM : Weighted Product Model
WSM : Weighted Sum Model

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1. INTRODUCTION

Megaprojects are strategic investments that have the potential to significantly influence both national and global landscapes, owing to their vast scale, substantial costs, and prolonged implementation periods. By facilitating national progress, megaprojects make significant contributions to economic development. However, megaprojects are also complex and unique systems consisting of numerous stakeholders, and therefore, they contain various risk factors (Eweje et al., 2012; Li et al.,2018; Kardes et al., 2013; Van Wee & Priemus, 2017; Lessard & Miller, 2000; Vickerman, R., 2017; Flyvbjerg, 2017).

Recent research shows that global infrastructure investment needs are growing (Gundes, 2022). According to Global Infrastructure Outlook Report published by Oxford Economics, the need for infrastructure projects is projected to reach $94 trillion until 2040 (Global Infrastructure Hub, 2017). The challenges encountered in traditional construction models, such as stakeholder management and economic, political, social, and environmental issues, become even more critical in megaprojects, further deepening their complexity (Biesenthal et al.,2018). Megaprojects should not be viewed as mere extensions of smaller projects. They represent a unique project category with differences in scope, goals, duration, complexity, and stakeholders when compared to traditional projects. As a result, the traditional management approach is not appropriate for effectively managing megaprojects. However, solid rules for managing megaprojects have not yet been formulated (Flyvbjerg, 2014; Crosby, 2017). In this context, Leijten (2013) argued that decision-making in megaprojects does not proceed in a linear path and does not adhere to a rational sequence. This indicates a lack of predetermined pathways for megaproject decision-making.

The managerial difficulties of megaprojects lead to problems such as cost overruns, schedule delays, scope changes and technical problems (Flyvbjerg, 2017). Flyvbjerg et al. (2003a) argue that the inaccuracies in cost predictions persist in a manner identical to that of 70 years ago. In 2023, it can be seen that that megaprojects still experience the same fate. To clarify, a research evaluating 16,000 large-scale projects

shows managerial challenges in projects. While the rate of projects that meet cost and time estimates is 8.5%, the rate of projects that successfully meet both cost and time expectations and provide the expected benefits is only 0.5%. This means that nearly all projects, 99.5%, experience difficulties meeting their initial estimates (Flyvbjerg & Gardner, 2023a) Considering this scenario, the success of megaprojects would be even more unexpected. Moreover, as society becomes increasingly tolerant of the frequent prediction failures, cost overruns, and schedule delays that often plague megaprojects, these issues may increasingly be perceived as inevitable aspects of such projects. This change in perception could prove advantageous to political actors who might exploit this acceptance for their own benefit.

Building on this understanding of managerial challenges, it is crucial to recognize that the period from conceptualization to the construction of megaprojects spans a long timeframe involving various changes and challenges (Lessard & Miller, 2000; Levitt & Scott, 2017; Flyvbjerg, 2017). This implies that the key decision-makers may shift, and the project may not obtain support from new actors. Moreover, considering the rapid pace of technological advancement, a project could become outdated. Political conjuncture and social atmosphere could undergo alterations. Encountering unforeseen events like inflation, crises, societal unrest, or pandemics is within the realm of possibility. With all these considerations, it's clear that megaprojects involve substantial financial, technical, political, social, and environmental risks (Giezen et al., 2015; Kardes et al., 2013). Therefore, feasibility decisions for megaprojects necessitate the consideration of all these factors.

Recognizing these complexities highlights the need to develop methods and models for evaluating megaprojects. Optimism bias and planning fallacy are the terms used to describe the optimistic assumption that megaprojects will progress according to plans. However, this leads to an overly optimistic outlook on the project, exaggerating benefits and neglecting risks, rather than conducting a comprehensive risk assessment (Flyvbjerg, 2009; Kahneman & Tversky, 2013). Underestimating costs and overestimating benefits combine to inflate benefit-cost ratios, facilitating funding. As a result, projects that should not be carried out are implemented. Additionally, decision-makers involved in megaprojects can potentially influence public perception of the project's necessity by employing various tools (Flyvbjerg, 2009). Leijten (2013) argued that decision-makers may “approve large projects, only to regret them later.”

Therefore, ensuring transparency, democracy, reliability, inclusivity, technical proficiency and the establishment of a robust regulatory framework in the decision-making processes of megaprojects becomes essential to mitigate these risks and improve project outcomes.

Decision-making mechanisms for megaprojects involve numerous actors and diverse segments, as has been clarified. An effective feasibility phase is crucial for the successful execution of megaprojects and for realizing impactful and sustainable outcomes. Feasibility studies are pivotal in this context, serving not only to evaluate technical possibilities but also to ensure that projects make good business sense, assess risks, and provide assessments concerning resource and time management. These studies comprehensively assess the economic, environmental, social, operational, and technical aspects of a project. Such thorough evaluations are essential for informing go/no-go decisions (Mackenzie & Cusworth, 2007).

Alternatively, feasibility reports could also be employed to reinforce decisions already made and influence public opinion (Flyvbjerg, 1998). Different projects may adopt various feasibility approaches; for instance, feasibility studies in some projects may be "routine for pre-work", some may be the projects initial phase or be regarded as "separate, stand-alone projects" (PMBOK Guide, 2008). Feasibility studies conducted at the inception are crucial elements influencing the long-term outcomes of the project (Giezen et al. ,2015; Davies et al., 2017). Therefore, assessing feasibility studies in megaprojects and identifying the correlation between these studies and project outcomes are vital for formulating effective principles of megaproject management. Successful management of a megaproject is expected to contribute significantly to strategic and macro-level advancements (Chen et al., 2022).

1.1 Problem Statement

The attractiveness of megaprojects to decision-makers and their influence on the scale and frequency of these projects can be explained by political, technological, economic, and aesthetic "sublimes" (Flyvbjerg, 2014). "Technological sublimes" refers to the recurring admiration that political and public actors experience when confronted with great architectural forms and technical achievements. This phenomenon helps explain the psychology behind the adoption of large-scale projects (Nye, 1994; Frick, 2008). The remarkable progress in megaprojects from a technical perspective is impressive.

Complex structures like tunnels, bridges, and dams, which are technically challenging, are being constructed, and countrites are competing in the realm of advanced engineering. However, the construction sector faces criticism due to its deficiency in innovation (Brockmann et al., 2016). In the literature, evaluations of innovation predominantly center around standard projects, often neglecting or only assessing innovations in megaprojects through case studies rather than comprehensive evaluations (Cantarelli & Genovese, 2023).

Despite these innovations, megaprojects tend to experience cost overruns and schedule delays, resulting in deviations from their initial predictions (Flyvbjerg et al., 2003b; Flyvbjerg, 2017; Davies et al., 2017). These forecast deviations are due not only to technical inadequacies but also to deliberate actions by policymakers (Flyvbjerg et al., 2003b). Notably, significant failures are observed in cost and time predictions and this pattern is prevalent in many megaprojects regardless of the country or type of the project (Flyvbjerg & Gardner, 2023a). To illustrate a retrospective evaluation of the Channel Tunnel project showed that "overall the British economy would have been better off had the Tunnel never been constructed" (Anguera, 2006). While society is directly affected by schedule delays and cost overruns of megaprojects, the inadequacy of decision-making mechanisms in megaprojects comes to the fore.

Feasibility reports are used in the decision-making processes of megaprojects to evaluate their financial, technical, and managerial viability, identify risks and challenges, and provide an overview of the project's scope (Mackenzie & Cusworth, 2007). However, there may be discrepancies between feasibility reports and project outcomes (Flyvbjerg, 2009). Moreover, in various megaprojects, the evaluations emerge not as decision-making tools but rather to support existing decisions. As Flyvbjerg (1998) pointed out, assessments can be used as a manipulated tool to rationalize a project that has been politically predetermined. In other words, political actors have already made decisions, and feasibility reports are seen as a formality for approval. Taking all these into account, the feasibility studies of megaprojects could fail in terms of transparency, reliability, impartiality, and consistency, leading to the failure of the decision-making process itself.

Rather than approaching each megaproject as a separate experimental process, it is crucial to explore a common management language within megaprojects. Flyvbjerg (2017) argued that there are no classics in megaproject management. Given the scale

and complexity of megaprojects, there is currently no guideline or standardized structure for feasibility assessments and decision-making processes. Consequently, understanding the reasons behind the failures of megaprojects is a time-consuming endeavor. As this process unfolds, the methods, technologies, and models associated with these projects undergo continual evolution.

The relationship between the success of megaprojects and the regulatory framework is crucial for improving management processes. Identifying the strengths and weaknesses of existing laws, regulations, and standards can provide valuable insights. Such evaluations are critical for defining the technical, managerial, environmental, and social boundaries of megaprojects. Instead of relying on political decisions, countries could rely on solid rules. Given the scale, complexity, uniqueness, and global impact of megaprojects (Flyvbjerg, 2017; Biesenthal et al., 2018; Van Wee & Priemus, 2017; Brockmann, 2020) a thorough examination of the feasibility studies, decision mechanisms, and project outcomes of existing projects could significantly contribute to academic literature.

Megaproject construction involves substantial asset transfer within a country, that is, the decision to carry out the megaproject also requires making the decision about the abandoned projects. Instead of carrying out projects worth billions of dollars, alternative projects could have been done. For example, Glaister (2022) pointed out that taxpayers are unaware of the price of the HS2 project. Moreover, the project's per capita cost exceeds £1,000, and this payment includes those that would not directly benefit from the project. If presented initially with this cost, the project might not have been approved (Savage, 2022). Projects frequently do not conclude within the initially committed cost and timeframe. Projects frequently do not meet the committed costs and timeframes, raising uncertainty about society's willingness to bear the final costs.

The complexity and uncertainty of decision-making processes (Van Wee & Priemus, 2017) could impact the success of the megaprojects (Migilinskas & Ustinovicius, 2008). When large-scale projects fail, it's usually because of problems in how they're managed and organized, rather than design and engineering issues (Sykes, 1998). Furthermore, since megaprojects span over a very long time, decision-makers may shift, leading to a risk of non-implementation. Also, there could be insufficient assessment on how different actors handle the management of megaprojects from their

perspective (te Boveldt et al., 2018). In retrospect, when examining feasibility reports and project outcomes, shortcomings in the feasibility studies become evident.

Managerial problems, experienced even in developed countries, become more prominent in developing countries. Developing countries have different concerns and objectives compared to developed ones; their aim is to achieve maximum development with limited resources. As a result, they need a decision-making mechanism that differs from that of developed countries (Mawdesley et al., 2005). For instance, while developing countries may prioritize economic returns, advanced nations like the US may engage in discussions centered around net-zero emissions and sustainability principles, as seen in the California High-Speed Rail Project (Elam, 2022). Therefore, it is vital to discuss the decision-making principles of projects that impact the world.

ürkiye is actively involved in the planning, design, construction, and operation of megaprojects. The 2023 report "Investing in Infrastructure and PPP Projects" highlights that between 1986 and 2022, Public-Private Partnership projects worth $195 billion have been undertaken in various sectors. Key projects include the Istanbul New Airport ($6.5 billion), the Yavuz Sultan Selim Bridge ($3.5 billion), the Gebze-Orhangazi-Izmir Motorway ($6.5 billion), and the Eurasia Tunnel ($1.2 billion) (Presidency of the Republic of Türkiye Investment Office, 2023). Hence, the significance of researches on megaprojects in Türkiye emerges.

1.2 Research Objectives

The primary objective of this study is to propose a model for megaproject decision-making for Türkiye, reflecting a synthesis of best practices drawn from international comparisons. Recognizing the significant problems and complexities involved in megaprojects, as described in the problem statement, this research seeks to establish a robust, culturally and contextually adapted framework that mitigates the prevalent challenges and optimizes project outcomes.

To achieve this, the study begins with a thorough comparative analysis of the decision-making processes in the United Kingdom, the United States and Türkiye. By examining the laws, regulations, and standards that govern megaprojects in these countries, the research aims to identify best practices that align with Türkiye's unique characteristics. This comparative analysis lays the groundwork for understanding how

different regulatory environments influence project outcomes and highlights areas where Türkiye can improve its own practices.

In addition to the primary objective, the research has several secondary aims. One of these is to reveal the cross-country differences in decision-making processes and identify the best practices implemented in the United Kingdom, the United States, and Türkiye. This analysis evaluates how various national approaches impact decision-making processes, highlighting the strengths and weaknesses of each. By understanding these differences, the study aims to extract valuable insights that can inform and enhance Türkiye's practices.

Another secondary objective is to compare and identify similarities and differences in the laws, standards, and regulations in the UK, the US, and Türkiye. By doing so, the study evaluates the role of existing legal regulations in decision-making processes, providing insights into how these frameworks influence project success and offering recommendations for enhancing Türkiye's regulatory environment.

Finally, the study aims to contribute to the fields of decision-making, project management, and megaproject management by providing unique insights and practical recommendations. The research enriches the academic literature with findings from the comparative analysis and the proposed model, offering valuable guidance for future megaprojects in Türkiye and beyond.

By achieving these objectives, the study seeks to improve the decision-making processes in megaprojects, thereby enhancing their feasibility, efficiency, and overall success in Türkiye. This comprehensive approach not only addresses current challenges but also provides a roadmap for continuous improvement and innovation in megaproject management.

1.3 Method and Data

This study employs a comparative analysis to enhance decision-making in megaprojects in Türkiye, focusing particularly on the decision-making frameworks, laws, regulations, and standards utilized in the UK and the US. This comparative approach identifies effective strategies that have led to successful project outcomes, which could be adapted to improve the planning and execution of large-scale projects in Türkiye. Comparative analysis promotes in the creation of concepts by identifying

differences and parallels across instances, as well as enhancing descriptive abilities and assisting in the formulation of new hypotheses and theories (Lijphart, 1971). Comparative analysis enhances the understanding of how the cultural environment, political competition, and governmental structures influence the features of public policy, hence improving policymaking by examining similar initiatives in other nations (Cyr & deLeon, 1975). In this thesis, the comparative analysis of laws, regulations, and standards in the UK, the US and Türkiye will be beneficial for policy-making on decision making of megaprojects.

The research begins by providing a foundational overview of the characteristics of megaprojects, establishing a clear context for the analysis. It then explores the theoretical and practical aspects of decision-making within such projects, utilizing key sources including academic publications, industry and feasibility reports, and international policy documents. This approach offers a broader and more integrated perspective on how policy, governance, and management theory interact within the context of large-scale projects. According to Flyvbjerg (2006), there is a misconception that theoretical knowledge is more valuable than practical knowledge, ignoring the valuable perspectives that practical experiences can provide in understanding real-world experiences. However, this study recognizes the vital insights that practical experiences provide, particularly in understanding real-world situations. By incorporating an analysis of real-world decision-making processes documented in these sources, the research offers a broader and more integrated perspective on how policy, governance, and management theory interact within the context of large-scale projects. This approach not only enriches the theoretical framework but also grounds the insights in practical reality, enhancing the relevance and applicability of the findings. The impact of real-world responsiveness and human factors on all planning, technical, and management mechanisms can be derived from these data.

1.4 Organization of the Thesis

This thesis is structured into five chapters. Chapter 1 provides an overview of the study, including the framework, problem statement, research objectives, method and data, and the organization of the thesis.

Chapter 2 provides a broad perspective on the characteristics of megaprojects and their decision-making processes, integrating insights from various academic publications, industry reports, and policy documents.

Chapter 3 explores the legal frameworks affecting megaprojects through a comparative analysis of laws, regulations, and standards in the UK, the US and Türkiye.

Chapter 4 includes a model proposal for decision-making tailored to Türkiye, building on insights from the comparative analysis. This chapter incorporates best practices and adaptable strategies aimed at enhancing the efficiency and success of large-scale projects.

Chapter 5, the conclusion, evaluates the findings of the entire thesis. This chapter reflects on the implications of the research and discusses how the insights and methodologies applied could influence future megaprojects in Türkiye and potentially other contexts. It also offers recommendations for policymakers, project managers, and other stakeholders involved in the planning and execution of megaprojects.

2. DECISION-MAKING IN MEGAPROJECTS

2.1 Characteristics of Megaprojects

Megaprojects are described as “agent of change” (OMEGA Centre, 2012) that redefine the regions they inhabit and the lives of those within them. Often compared to untameable beasts in the management world due to their significant complexity, scale, costs, and prolonged timelines (Zidane et al., 2013), these projects are monumental undertakings. Flyvbjerg (2017) further defines megaprojects as "large-scale, complex ventures that typically cost $1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people."

Megaprojects are also described as “sociotechnical undertakings” (Biesenthal et al., 2018), containing "sublimes" (Flyvbjerg, 2014), and holding iconic value (Flyvbjerg, 2017). They are unique and singular (Brockmann, 2020), characterized by their complexity (Giezen et al., 2015; Kardes et al., 2013; Li et al., 2018) and inherent risks (Kardes et al., 2013). Megaprojects can also lead to unpredictable challenges (Giezen et al., 2015). As “massive, indivisible, and long-term artifacts” (Lessard & Miller, 2000), megaprojects hold the power to reshape economies and communities, as noted by Vickerman (2017). Furthermore, Flyvbjerg et al. (2003) describe megaproject as a “political and physical animal,” emphasizing their multifaceted impacts. Viewed as key elements in strategies for social, economic, technological, and urban growth (Li et al., 2018), megaprojects have a significant influence on the environment and society (Van Wee & Priemus, 2017) and can be controversial (Vickerman, 2017).

Altshuler and Luberoff (2003) have considered megaprojects as interpretations of governmental power. In other words, while megaprojects contribute to economic development, they also serve as a communication instruments utilized by authorities. According to the framework created by Li et al. (2018 through literature reviews, megaprojects represent significant investments in terms of both cost and scale; these projects surpass 0.01% of the GDP. Moreover, megaprojects captivate public attention, hold iconic value, and engage withn environmental, political, and cultural

variables. The research conducted by Li et al. (2018) also pointed out that megaprojects are characterized by their complexity, involving technology, organization, environment, culture, and finance. These unique projects often comprise several subprojects and a high level of uncertainty. Additionally, Frick (2008) categorized the traits of megaprojects as the "Six Cs": "Colossal, Captivating, Costly, Controversial, Complex, Control Issues." These qualities are interconnected and evolve as a project develops.

Major undertakings often present significant challenges that frequently result in unsuccessful outcomes (Rezvani & Khosravi, 2018). According to Davies et al. (2017), megaprojects often experiences cost overruns, schedule delays, and poor performance. Flyvbjerg (2017) further elaborates on this phenomenon with the “iron law of megaprojects”, a pattern of megaprojects that can be summed up as experiencing "over budget, over time, under benefits, over and over again.”

One of the greatest challenges is the high cost of megaprojects. Flyvbjerg (2014) noted that the world has transitioned into an era beyond "mega" projects, entering the "tera era." While megaprojects refer to projects worth 1 billion dollars, today, giga projects such as California High Speed Rail, which are worth more than 100 billion dollars, are being implemented. "Tera" projects exceed 1 trillion dollars, and when considering investments like economic plans or defense programs, it is evident that tera projects are also being developed. Investments on such a scale have the power to significantly impact the global economy and cost overruns in these projects can lead to severe problems (Flyvbjerg, 2009). The substantial allocation of funds to megaprojects affects the feasibility of other projects. Instead of investing in a single megaproject, smaller-scale projects could be implemented, or funds could be distributed in alternative ways. Therefore, significant opportunity costs arised from the high costs associated with megaprojects (Van Wee & Priemus, 2017).

Another challenge is the lengthy duration of megaprojects, typically spanning several years from inception to completion. These enduring endeavors often exceed the terms of service of companies, political parties, and legislative bodies (Levitt & Scott, 2017). The complexity of megaprojects is another significant challenge which closely related many variables, including the project's scope, participant variety, technological difficulties, interactions and and changes experienced at every stage (Bilgin et al., 2022). In addition to complexity, megaprojects involve considerable risks (Kardes et

al., 2013), presenting a major challenge. Flyvbjerg (2011) suggested that because megaprojects are complex and have lengthy development intervals, risk is inherent. Megaprojects often present considerable technical challenges and can be demanding in terms of technical expertise (Hassan et al., 1999; Brockmann, 2020).

The uniqueness of megaprojects is also highlighted among the challenges they face, as they occur in a specific locations, at a particular scales, and with unique features. Due to their unique nature, previous methods and equipment may not be suitable for new projects and might result in substandard results or even complete failure (Brockmann, 2020).

Megaprojects require the participation of a wide range of stakeholders with different alignments during the planning, decision-making, and management stages (Flyvbjerg, 2011). Managing these stakeholders poses significant challenges in megaprojects (Priemus, H., 2008; Levitt and Scott, 2017). Freeman (2010) defines stakeholders as "any group or individual who can affect or is affected by the achievement of an organization's purpose" and emphasized the concept of "stakeholder management" as a requirement for an organization to effectively manage its relationships with these groups. Levitt and Scott (2017) argue that engaging different stakeholders in global megaprojects with varying cultural and institutional backgrounds introduces cross-institutional complexity. The significant effects megaprojects may have on society and the environment are highlighted by Van Wee & Priemus (2017), constituting a difficult challenge to overcome.

2.2 Megaproject Planning and Decision-Making Processes

2.2.1 Overview of megaproject planning and decision-making

Given their billion-dollar costs, compexity, scale, advanced technical skill requirements, and associated environmental, social, economic, and political risks, major projects require careful evaluation. As it involves diverse and multifaceted impacts it could have on various aspects of life (Daniel & Daniel, 2019), deciding whether to proceed with a megaproject is a complex task.

Adopting a human-centered lens on megaprojects demonstrates their profound effects on real-world actors, making their influence clearer and more relatable to the daily lives of individuals (Flyvbjerg, 2006), rather than generically expressing these as "social, economic, and environmental" impacts. This nuanced perspective compels a

detailed examination of the diverse and interconnected impacts that megaprojects have on various aspects of society, economy, and the natural environment. For example, megaprojects have the capability to remodel urban landscapes, create or destroy green spaces, affect the all living creatures especially endemic species, relocate communities, influence commercial activities, among other considerable impacts (Altshuler & Luberoff, 2004).

For instance, examining a basic housing development illustrates that such projects not only provide essential shelter but also function as commercial hubs, significantly enhancing community life. Furthermore, these developments can both mitigate external noise and introduce their own sounds, thereby fostering dynamic and engaging social environments. This dual role underscores the complex impact that even modest housing projects can have on their surroundings. When scaled up to the level of a megaproject, the scope and intensity of these impacts increase exponentially. Unlike conventional projects, megaprojects introduce unique challenges; therefore, it is necessary to adapt management approaches to address these particular needs (Biesenthal et al., 2018).

Major project planning and decision-making are likened by Giezen et al. (2015) to a "big obstacle course," highlighting the persistent presence of challenges. Te Boveldt et al. (2018) argue that infrastructure planning involves complexities due to the participation of multiple stakeholders and the risk of conflicting political interests. Evaluating such projects from a single perspective is often inadequate, as it overlooks the broader political viability and demand assessment. Given the inherent complexities of megaprojects, it is unsurprising that planning them introduces unique challenges, mirroring the intricate nature of the projects themselves.

Moreover, in line with this complexity, Priemus (2010) emphasizes that decision-making of megaprojects can be chaotic. Furthermore, Flyvbjerg (2008) highlighted that planners could contribute to the problem rather than offering solutions. These projects require careful consideration of numerous technical, social, and cultural factors and selecting the best combination among countless options. Each project having its unique context makes developing a unique approach each time inevitable (Brockmann, 2020).

Miller and Lessard's research conducted in 2000 indicates that it remains unclear how megaprojects are managed, a finding that still holds true. Studies related to megaproject management are fragmented, and a holistic and systematic theoretical framework has not been established. Interdisciplinary collaboration is necessary for the formation of theory related to megaproject management. Contributions to this theory need to be made by advancing and updating studies, integrating the theory into practical applications, and ensuring the widespread dissemination of these efforts to reach a broader audience (Li et al., 2018). Because of the complex nature of megaprojects, it is impossible to completely define the project at its inception through generating complete data (Brockmann, 2020).

Despite the holistic and systematic shortcomings evident in the literature regarding megaproject management, there exist significant and noteworthy findings. These findings, drawn from a multitude of studies, play a crucial role in enhancing the comprehensive understanding of megaproject management. According to De Bruijn and Leijten (2008a), mostly government authorities manage and finance decisions regarding infrastructure and transportation systems. The study also exemplified a hierarchical management approach. In such a process, a problem like traffic congestion is identified, objectives such as reducing traffic congestion are established, and details about potential solutions are collected. A decision, like widening lanes, is then made and carried out.

Winch (2017) also argues that political processes frequently drive the execution of megaprojects. Despite the project's implementation being backed by Cost-Benefit Analysis (CBA), it is primarily shaped by political efforts that also influence the cost-benefit evaluations. Essentially, although megaproject feasibility determinations frequently include only a small group of stakeholders, these endeavors can affect a wide range of stakeholders, potentially catalyzing regional, national, or even global crises. To illustrate, Three Gorges Dam project has displaced 1.3 million people, harmed endemic species and habitats, raised earthquake and landslide risks, and strained political relations, remaining highly controversial (Jackson, 2000). Moreover, a failed infrastructure investment can have fatal consequences that ruin local and global economies (Flyvbjerg, 2009).

According to Bröchner (2022), while the term “tragedy” in construction projects is generally used for disasters that result in fatal accidents during the construction phase

or after construction, the catastrophic results of projects such as the Big Dig project are labeled project failures. However, the ineffective management and decisions made during the initial stages ultimately determine the fate of the project. In other words, just as large-scale endeavors carry the risk of catastrophic outcomes, the planning phase itself could indeed turn into a disaster.

It is crucial to determine not only the economic but also the environmental, political and social costs of the projects. The costs of large-scale projects cannot be measured with a mere budget calculation; all the environmental, political and social costs should be taken into account. Megaprojects have various inputs and outputs until they complete their life cycle. It is critical to take these costs into account in the feasibility phase of megaprojects.

Besides their vast scale and intricate nature, uncertainty poses a significant obstacle in managing megaprojects. These extensive undertakings include lengthy timelines, complicating the setting of exact long-term objectives and the forecasting of future shifts in technology, economics, and various other sectors (Davies et al., 2017). In the decision-making process for megaprojects, having accurate and detailed information is essential, especially when it comes to technical, economic, and environmental factors and associated risks that are highly dependent on information. There is a distinct correlation between the availability of precise information and the effectiveness of the decisions made. Nevertheless, many decisions related to large-scale projects frequently fail to acknowledge the significance of this information (de Bruijn & Leijten, 2008b).

2.2.2 The importance of Front-End Planning

Front-end planning of megaprojects stands as a critical juncture where the effective identification, assessment, and management of factors influencing their success or failure converge. Davies et al. (2017) emphasized critical researches demonstrating that the frequent failures of megaprojects often stem from flawed decision-making during the early stages. Moreover, Dasgupta and Sanyal (2010) underscored the significance of strategic planning and proactive early actions by referencing the phrase "A stitch in time saves nine," to highlight their essential role in preventing substantial failures in projects.

Megaprojects have significant impacts, necessitating a robust ex-ante assessment to ensure the caliber of the decision-making process (Van Wee & Tavasszy, 2008). However, in Front End Planning, deeper understanding and comprehensive guidance are often lacking (Hansen et al.,2018). As a result, the need for profound insight and strategic foresight in project planning becomes clear, linking decision-making with operational success. Williams & Samset (2010) echo this perspective, asserting that "doing the right project" holds as much weight as "doing the project right".

The diagram developed by Hansen et al. (2018) clearly illustrates the Front End Planning Phase of the project, covering the period from the initial project idea to the investment decision (Figure 2.1).

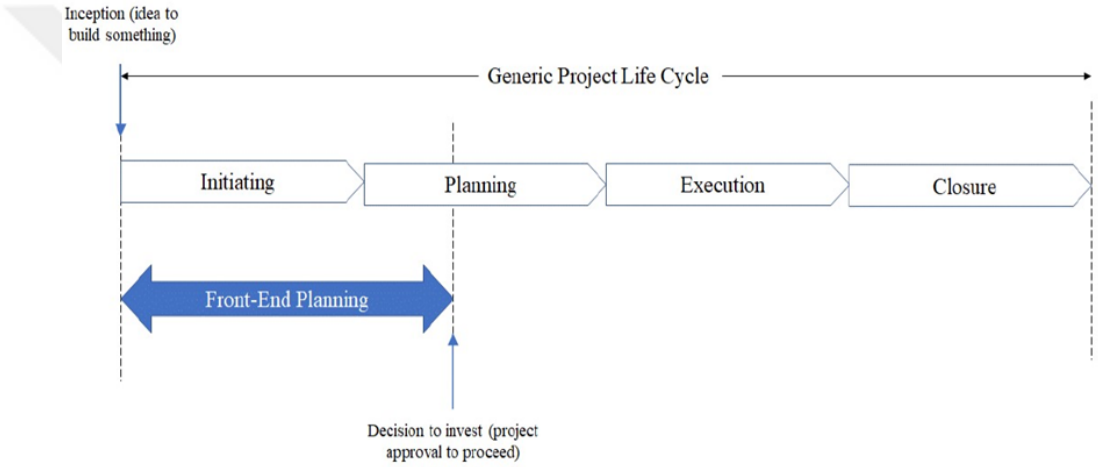


Figure 2.1 Front End Planning Phase in Project Life Cycle (Hansen et al., 2018)

At the onset of a project, it is more achievable to manage critical factors that will shape the final outcomes, and changes implemented at this initial phase can significantly impact the project's ultimate success (Migilinskas and Ustinovicius, 2008). Figure 2.2 highlights that the capacity to influence projects is at its peak during the initial stages of the project.

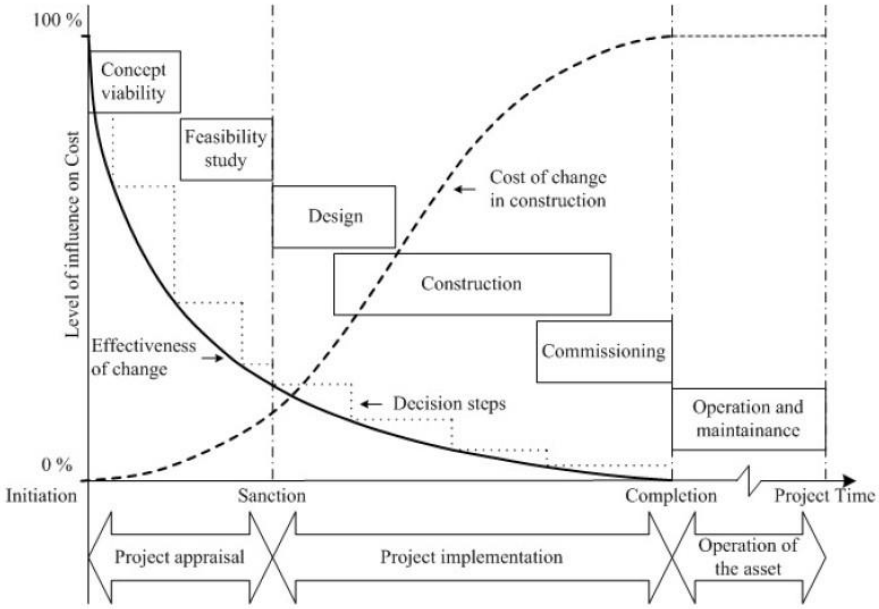


Figure 2.2 Capability to affect cost during the initial phase (Migilinskas & Ustinovicius, 2008)

2.2.3 Project evaluation methods and strategies

In the decision-making processes of megaprojects, various methods and strategies are employed. Among these, Cost-Benefit Analysis (CBA) and Multi- Criteria Analysis (MCA) are particularly prominent. Each assessment tool and strategy has its pros and cons. For instance, CBA is considered more neutral and less influenced by values compared to MCA, while altering the results of MCA is easier (Van Wee & Tavasszy, 2008). Tools may be selected not for their suitability but for their simplicity.

The typical CBA method employed in evaluating transportation infrastructure projects often neglects to consider broader benefits (Vickerman, 2008). The assessment methods and quality of assessment vary depending on the project type, such as dams, highways, Olympics, IT projects, tunnels, , each requiring distinct decision-making approaches. For example, CBA in transportation infrastructure projects often neglects to consider wider benefits (Vickerman, 2008).

Turner and Zolin (2012) argue that traditional measures of time, cost, and quality do not fully capture project success. It's essential for a project to not only meet these criteria but also to reach its specific targets. This underscores the need for a broader perspective that incorporates strategic business objectives and necessitates a

multifaceted evaluation approach. Assessing the perceptions of various stakeholders regarding a project's outputs, outcomes, and impacts at different stages is crucial for a comprehensive understanding of its success.

According to (Flyvbjerg, 2017), the decision-making and planning processes of megaprojects are typically shaped by Cost-Benefit Analyses (CBA) and assessments of social and environmental impacts. However, the reliability of these evaluation methods is often debated, especially when considering the relationship between cost overruns and benefit shortfalls in megaprojects and their associated inaccuracies in predictions.

2.2.3.1 Feasibility studies

Feasibility studies are essential for evaluating the viability of megaprojects by aassessing their costs, benefits, and impacts from diverse perspectives. These studies utilize various measurement methodologies to gather and analyze information, delivering a thorough appraisal of project feasibility (Mackenzie & Cusworth, 2007).

Feasibility studies form the critical basis for decision-making across projects of any size, whether large or small, by systematically comparing the anticipated benefits to the necessary sacrifices. People typically weigh the benefits of an action against what they must give up before proceeding, which is an essential consideration everyone undertakes (Basten et al., 2010). For example, starting a project might necessitate investments in time and money, but if successfully completed, it could bring long-term advantages to the business. This encapsulates the essence of human decision-making: choosing one option while disregarding others. The consequences of the chosen action can be positive or negative. In feasibility studies, the positive and negative impacts, as well as the potential outcomes of projects, are compared to determine their feasibility. Feasibility studies encompass a broad spectrum, gathering and analyzing a wealth of information such as site selection, technical, economic, financial, social feasibility, political, environmental, social impacts, cost, and time estimates (Marzouk et al., 2013).

A comprehensive feasibility study encompasses critical components, such as delineating the project's scope and alternatives, facilitating the selection of these alternatives, and uncovering new opportunities. The study also uncovers new opportunities, presents arguments for or against advancing the project, and defines

early mitigation measures. Furthermore, it provides robust data for decision-making, thoroughly documents the business plan, enhances project credibility for funding, and aids in attracting investors and securing financial backing (Raharjo, 2022).

2.2.3.2 Cost-Benefit Analysis (CBA)

Cost-Benefit Analysis (CBA) is a method in which the costs and benefits of a project are systematically determined, and their monetary values are numerically calculated (Van & Tavasszy 2008). According to Annema (2013), despite ongoing discussions CBA remains one of the most effective evaluation methods for public projects. It influences decisions and provides an overall perspective of the project. Conducting such an assessment instills confidence that environmental, social, economic impacts are considered and influence decisions.

The foundation of CBA is based on a dam project developed in the USA in the 1930s. However, it was not until the 1970s that CBA evolved and expanded its scope as an evaluation technique for projects (Harberger & Jenkins, 2002). By the 1980s and 1990s, CBA had become integral to many legal decision-making mechanisms in the USA. It later spread to developing countries and was adopted as an accepted assessment method. With the accumulation and transfer of experiences, CBA has turned into a crucial decision-making tool in various fields such as transportation, health, education, and construction sectors worldwide (Fuguitt et al., 1999). Recently, Cost-Benefit Analysis has been particularly effective in megaprojects.

According to Ackerman and Heinzerling (2002), performing a CBA involves three steps: estimation, monetary value calculation and determining the time effect on value. Firstly, the financial value of government policies is calculated. For example, if an energy project pollutes the sea, besides the construction cost of this project, the costs to prevent and respond to pollution should also be measured. Secondly, there is a need for calculation of the intangible costs and benefits (Propersi and Gundes, 2006) such as protecting the environment, global warming, pollution, loss of habitats, social inequity, which cannot easily be monetarized. In the case of marine pollution, the cost of equipment to prevent sea pollution can be calculated accurately. However, it is challenging to quantify the long-term costs of passing polluted seas and a damaged ecosystem on to future generations. This difficulty is one of the primary challenges of Cost-Benefit Analysis (CBA).

Some opponents argue that protecting the environment and ensuring human health are priceless. While the motto "make the project real when the benefits outweigh the costs" sounds logical and acceptable, many critics contend that it is ethically inappropriate to assign a financial value to human life (Frank, 2000).

Third, CBA considers the costs and benefits that occur at different times by converting them with a certain discount rate. The basic formula for CBA is B-C where B stands for benefits and C stands for costs. Moreover, these benefits and costs must be calculated by evaluating various parameters. One method used in CBA is finding the Net Present Value (NPV), which is calculated by subtracting the total present value of costs from the total present value of benefits.

The CBA formula is derived from the basic NPV formula by incorporating the benefits and costs, as shown in Figure 2.3. NPV is calculated based on the present value of future benefits and costs. If the result of the calculation is greater than 0, it is argued that the project should proceed. Another method involves calculating the benefits-to-costs ratio and making a decision based on the result (Boardman et al., 2017).

$$NPV = \sum_{t=0}^{n} \frac{B_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+i)^t}$$

Figure 2.3 NPV Formula (Boardman et al., 2017)

One of the significant advantages of CBA method is its simplicity and clarity (Boardman et al., 2017). Anyone can read and evaluate the costs, environmental impacts, and social consequences of megaprojects from a general perspective. Thus, CBA allows project stakeholders to express their opinions about the project.

It is crucial to evaluate the benefits and costs thoroughly, especially in large-scale public projects. Adapting CBA for public projects enables the project's impacts to be detailed, evaluated and shared openly with the public. This ensures that even the overlooked effects of the projects are considered, making public projects and processes more transparent. This method builds trust and facilitates making difficult decisions with greater assurance. Although CBA is a widely used method, it has some limitations, leading to debates about its reliability. First, there are concerns regarding

ethical values in cost-benefit analysis. In CBA, the evaluation tool mirrors the market, reflecting its dynamics (Mishan, 1982). Gillroy (1992) argues that the purpose of CBA is to justify projects and manipulate public perception regarding their necessity. In other words, projects that generate significant economic gains are often considered beneficial while ignoring social, political, and environmental risks. CBA is focused on monetization, so it typically aligns with policymakers' agendas.

Secondly, Vickerman (2008) noted that CBA is insufficient for complex and large-scale projects, suggesting that more complex and dynamic methods, such as system-thinking, should be adopted. That is to say, CBA may be becoming less effective in the evaluation of these projects due to evolving equipment and production methods, the slow adoption of new technological tools, and the varying parameters that influence project costs.

Thirdly, CBA is not a flexible approach. If a project's parameters change, CBA will not yield accurate results (Pearce, 1998). Fourthly, one of the inadequacies of CBA is that it cannot fully establish the relationship between time and monetary value. Understanding the effects of time on the value of a project is difficult with CBA because project completion can take many years, and people's wishes and expectations may change during this period. While there are formulas for calculating the present value of money, predicting future desires and expectations involves countless variables (Belay et al., 2016).

Fifthly, CBA often fails to evaluate the source of funds, which is crucial for accurate assessment. For example, in public projects funded by taxes, different factors come into play, and people's reactions can vary (Vickerman, 2008). Sixthly, although the CBA assesses the public interest, this assessment is not for "all"; some stakeholders are overlooked in these assessments (Pearce, 1998).

Seventhly, there are significant differences between cost-benefit estimates and actual costs. Most cost errors arise from inaccurate construction cost estimates, rather than from difficulties in determining the value of intangible effects (Boardman et al., 2017). This means that even the most measurable outcome in Cost-Benefit Analysis, such as construction costs, can lead to inaccuracies in the overall analysis. If there are substantial deviations in construction costs, where everything is planned and specific,

it may become even more challenging to calculate the monetary values of abstract concepts accurately.

Eighthly, public projects take years to construct and operate, making it problematic to accurately calculate costs and benefits for future users who are not yet born, as their wishes and expectations are incalculable (Trumbull, 1990). Considering all these critiques, CBA still has a long way to go. To illustrate, Boardman et al. (2017) examined three different Cost-Benefit Analyses of the Coquihalla Highway, where NPV for the same project were calculated as 40.2, 128.2, and 394.3 million Canadian dollars in different studies. While all analyses justify the construction of the project, the results are highly inconsistent. Given this unreliability, the use of CBA as a basis for the construction of large-scale projects needs to be questioned.

2.2.3.3 Multi-Criteria Analysis (MCA)

Multi-Criteria Analysis (MCA) is an essential method employed in the decision-making processes of megaprojects. Multi-Criteria Decision-Making (MCDM) process involves determining the criteria and alternatives, quantifying their impact and significance with numerical values, and then ranking the alternatives based on these values (Thakkar, 2021). MCA stands out for integrating diverse project objectives and establishing clear criteria to guide decision-making towards achieving targeted outcomes. This methodology spans a wide range of dimensions, including environmental, social, economic, and technical aspects, providing a "structured decision space" that enhances the strategic assessment of projects (Ward et al., 2016).

Traditional methods such as Cost-Effectiveness Analysis (CEA) and Cost-Benefit Analysis (CBA) concentrate on economic impacts, potentially overlooking broader social and environmental contexts. Social Cost-Benefit Analysis (SCBA) seeks a comprehensive assessment but may struggle to capture all economic values accurately (Macharis & Bernardini, 2015). Furthermore, effectively involving stakeholders poses a challenge for these assessment techniques (Macharis & Nijkamp, 2013). . Consequently, the importance of MCA's holistic strategy becomes clear. MCDM is effective in scenarios where different alignments exist and priorities need to be determined (Thakkar, 2021).

According to Macharis and Nijkamp (2013), the effects of megaprojects on various groups differ, with varying scales of impact, leading to the assumption that there will

be both "winners" and "losers." To accurately reflect the varying impacts on different groups and ensure effective stakeholder participation in decision-making processes, it is crucial to adopt MCA and its variations.

In practice, some countries apply MCA for the evaluation of megaprojects. For example, while the US mainly relies on CBA, some projects employ MCA to consider different impacts (Macharis & Bernardini, 2015). When comparing Multi-Criteria Analysis (MCA) with its primary rival, Cost Benefit Analysis (CBA), notable differences arise. CBA is seen as more impartial than MCA, which considers project impacts based on political preferences. Moreover, MCA is prone to manipulation, while CBA assesses project feasibility using monetized data. Combining the strengths of both methods can lead to a more effective assessment strategy (Van Wee & Rietveld, 2013). Table 2.1 shows comparison between CBA and MCA.

Table 2.1 Comparision of CBA and MCA (Van Wee & Rietveld, 2013)

	CBA	MCA
Systematic comparison of alternatives	Yes	Yes
Assessment of the viability of a project	Yes	No
Explicit formulation of weights in trade- offs	Yes	Yes
Basis for weights of various effects	Valuation by consumer	Political valuation
Opportunities for abuse by policy- makers	By manipulation of inputs	By manipulation of inputs and by manipulation of weights
Degree of compensation between various attributes of alternatives	Every unfavourable attribute can in principle be compensated by a favourable outcome for another attribute	Various degrees of compensation are possible by the possibility to incorporate minimum requirements
Risk of double counting	Limited	Yes
Opportunities to take into account attributes that cannot be valued in monetary terms	No	Yes
Possibility to attach weights to the interests of specific actors	Not in the standard form of CBA	Yes

According to Kabir et al. (2014), MCA is segmented into two distinct categories: multi-objective and multi-attribute decision-making. This analytical framework includes a diverse suite of methodologies, ranging from the Weighted Sum Model (WSM) and Weighted Product Model (WPM) to Compromise Programming (CP), Analytical Hierarchy Process (AHP), ELECTRE, TOPSIS, and PROMETHEE. The selection and application of these methodologies vary significantly, reflecting the unique requirements and strategic preferences of different project types.

MCA can be an effective tool in identifying the impacts of megaprojects on different groups, setting objectives and criteria, and demonstrating monetized and non-monetized effects. Compared to CBA, this technique offers a more comprehensive picture by providing a holistic viewpoint. Moreover, when considering Sustainable Development Goals, it is crucial to address the diverse parameters of megaprojects. MCA can effectively align with these goals, ensuring a multidimensional evaluation of their effects, as supported by research conducted by the OMEGA Center (Dimitriou et al., 2016).

Despite its advantages, it is essential to acknowledge the limitations of MCA, such as potential political interference, manipulation of metrics and weights, and the possibility of duplicate counting, to maintain a balanced perspective in project evaluation processes (Van Wee & Rietveld, 2013).

2.2.3.4 Cost-Effectiveness Analysis (CEA)

Cost-Effectiveness Analysis (CEA) involves comparing costs and outputs to determinine the cost needed for each unit of output. In CEA, expenses are translated into monetary terms, while costs are associated with outputs to assess effectiveness. To derive the cost-effectiveness ratio, the total cost is divided by the units of effectiveness (Riegg Cellini & Edwin Kee, 2015). CEA allows for evaluating various alternatives based on their costs and outputs. This enables the selection of alternatives that offer optimal results or minimize resource usage in different scenarios (Levin & McEwan, 2001).

According to Bertram et al. (2016), there is an ongoing debate regarding the use of CEA in decision-making. It is also argued that CEA should not be the only factor in shaping the decision-making process. CEA can be particularly valuable when it is

difficult to quantify costs in monetary terms or when policymakers want to identify which costs lead to the best outcomes for a particular objective. However, this method does not assign a value to the outcome; instead, it delegates that decision to policymakers (Riegg Cellini & Edwin Kee, 2015). One major drawback of CEA is its restricted comparison scope, allowing only the comparison of alternatives with similar aims, thus preventing a comprehensive evaluation of the project's value based on the outcome Levin & McEwan, 2001).

2.2.3.5 Reference Class Forecasting

It is argued that one of the main reasons behind inaccurate estimates is that they were overly optimistic (Lovallo et al., 2023). Researchers have revealed that a more pessimistic approach is needed to improve these calculations (Flyvbjerg et al., 2005). This pessimistic theory, called the "Reference Class" approach, was developed by Kahneman (1994) and provides an outside perspective. In this theory, a similar reference class is selected, and estimates are made for the project based on concrete data. For example, if a highway project is being carried out in Türkiye, projects of the same scale and similar locations should be compared. This approach allows the direct use of data from completed projects, which may lead to more accurate predictions Lovallo et al., 2023).

2.2.3.6 Real Options Theory (ROT)

Megaproject planning is a complex and uncertainty-laden endeavor, which is why Real Options Theory (ROT) has gained significant acceptance in the appraisal of megaprojects due to the incorporation of uncertainties (Machiels et al., 2021). This approach emphasizes the importance of moving beyond a simplistic, single-stage "go/no-go" decision framework and instead offers a diverse array of decision alternatives, including postponement, phased implementation, scalability adjustments, abandonment, alteration, expansion, and engagement (Martins et al., 2015).

Furthermore, in megaprojects, the application of ROT provides a groundbreaking strategy. Unlike traditional frameworks that lock in decisions at a project's inception, ROT adeptly navigates uncertainties and risks, dynamically adapting to evolving conditions with built-in flexibility (Machiels et al., 2021). Notable valuation techniques for ROT include the Black-Scholes Option Pricing Model (BSOPM), Risk-Adjusted Decision Trees (RADT), Binomial Option Pricing Model (BOPM), Monte

Carlo Simulation (MCS), and Hybrid Real Options (HRO). However, when evaluating infrastructure projects, the most effective techniques are RADT, MCS, and HRO (Martins et al., 2015). In contrast to inflexible decision-making instruments like CBA and the "predict and control" strategy, ROT offers flexible alternatives, as depicted in Figure 2.4 (Machiels et al., 2021).

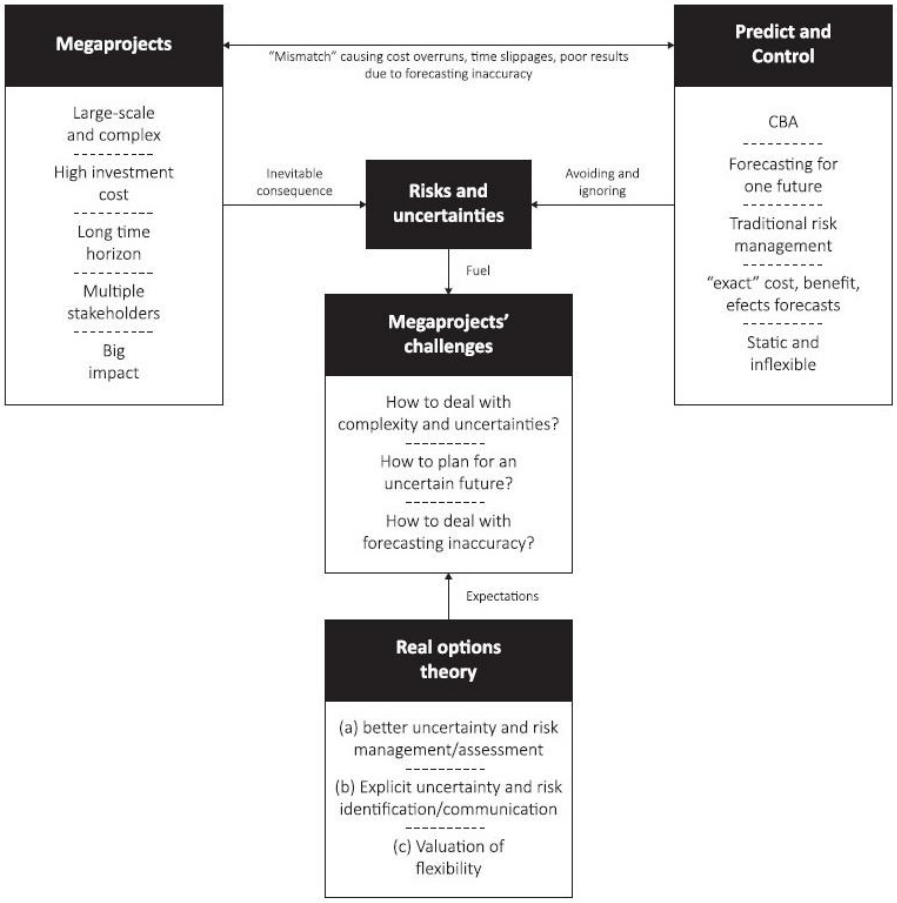


Figure 2.4 ROT in Megaproject Planning (Machiels et al., 2021)

2.3 Challenges of Megaprojects Decision-Making

Lasting for many years or even decades, the decision-making process for megaprojects involves significant uncertainty and shifting political preferences, with the potential for revisions in forecasts for future developments (Van Wee & Priemus, 2017). Megaproject decision-making is filled with numerous “pitfalls” including insufficient problem analysis, limited project alternatives, no established functional program, scope uncertainty, lack of process architecture, Social Cost Benefit issues, contested information, challenges in land acquisition, technology selection, market fluctuations, political instability, evolving standards and regulations. These challenges create

significant difficulties in the efficient planning and execution of megaprojects (Priemus, 2010).

The inadequacy of Front-End Planning can lead to the failure of megaprojects. There are three prominent reasons behind such failures: first, a tendency to downplay or disregard uncertainty; second, a lack of understanding or mismanagement of stakeholders; and third, rigid contractor management practices that often prioritize cost over other factors (Lenfle & Loch, 2017). Rothengatter (2008) sheds light on the failures in megaproject planning by advancing research on megaproject failures. The main reasons for the failure of megaproject planning can be summarized as follows: public procurements that frequently encourage optimism, inadequate risk assessments, differing evaluation principles between public and private entities during planning, consultancy firms that tailor CBA results to client preferences, and inflexible contracts that may not adjust well to changes (Rothengatter, 2008).

According to Miller and Lessard (2000), rather than technical difficulties sealing their fate, it is the complexity, the irreversible nature of decisions, and the dynamic instability that present the more formidable challenges to megaprojects. In project planning and decision-making, there is a trend towards streamlining processes and narrowing the scope to deal with complexity. Yet, this trend may hinder the projects' capability to adjust to changes and address challenges effectively (Giezen et al., 2015).

The institutions with which planners collaborate often lean towards decisions driven more by ideologies, political commitments, and economic motives than by the outcomes of analytical studies (Wachs, 1989). According to Pollack et al. (2018), the goals set for the initiation of projects and to garner support, along with the expectation of precision, can normalize deception in the atmosphere of megaprojects filled with uncertainty and unknowability. The projects' initial aims and subsequent lack of success might be used to validate this scenario.

March and Simons (1958) argue that the rationality of decision-making processes is restricted since it is impossible to analyze all possibilities. Similarly, the rationality of individuals within an organization is constrained due to their diverse motivations, desires, and capabilities. As Macharis & Nijkamp (2013) highlight, the Oosterweel Connection project serves as a clear example: when stakeholder engagement falls

short, implementing the project becomes considerably more challenging. This is because unrepresented groups may push back against its realization.

Contrary to Flyvbjerg et al. (2003b), Van Marrewijk et al. (2008) argue that the underestimation of costs, time, and risks in megaprojects is not a systematic strategy but rather a consequence of organizational characteristics and the managerial codes it brings. From this perspective, rather than accusing institutions and individuals of misconduct, intentional deceit, and political conspiracies, the challenges faced in managing projects could be viewed as the natural dynamics of professional practice. Insufficient public participation, coupled with particular interest groups seeking to gain from the project, raises the risk of these groups overtaking the project's decision-making processes (Bruzelius et al., 2002).

Megaprojects often involve political promises, agendas, and decision-making processes that the public frequently overlooks, leading to political limits and volatility throughout the project's lifespan. A significant challenge is the reliance on biased benefit estimates within the context of political sensemaking, using data to support decisions that align with the decision-maker's perspective (Clegg et al., 2017). Moreover, the normalization of misleading data in project development and decision-making can result in adverse outcomes such as cost overruns, benefit shortfalls, and schedule delays, all of which affect project feasibility (Flyvbjerg, 2017). "Dramatic" cost and time overruns are common in megaprojects, mainly driven by behavioral biases such as unwarranted optimism and deliberate deception. Additionally, challenges arise from conflicts between stakeholders and a lack of critical skills, both of which exacerbate the financial and scheduling challenges encountered by these projects (Lovallo et al., 2023).

It is expected that "good projects" will be "effective, efficient, and fair." At the evaluation stage, CBA considers effectiveness and efficiency, but ignores fairness (Van Wee & Priemus, 2017). Cost-Benefit Evaluation of projects varies depending on region and scale, resulting in a lack of comprehensive representation of effects on diverse stakeholders. Nonetheless, the decision-making approach frequently adopts a perspective focused on a single actor (te Boveldt et al., 2018).

The perception of a project's success varies among stakeholders, influenced by their individual preferences (Samset, 2013). De Bruijn and Leijten (2008b) pointed out the

dilemma of ensuring the necessary information for megaproject decision making. Using information in decision-making carries certain risks. Contributions of information from various actors may politicize the process instead of depoliticizing it, potentially causing the decision-making process itself to become a “free fight.” The differing agendas of actors may result in conflicts, or alternatively, a decision could be made directly by a government entity and then challenged by the public. Thus, how information is included and by whom in the decision-making process becomes paramount.

Decision-makers typically prefer satisficing over optimizing in decision-making processes (Leijten, 2013). Van Marrewijk et al. (2008) support this viewpoint, emphasizing that in megaprojects, rationality is always limited and flawed. They also contend that many skills engaged in megaprojects may be defined by different rationalities, resulting in decisions, acts, and opinions that do not necessarily point in the same direction.

The formulation of policies fails to keep up with the progress in planning and decision-making processes of megaprojects in the academic literature (Giezen et al., 2015). In many countries, project selection criteria, feasibility studies, and CBA govern the initial stages of a project. Nevertheless, in many cases, there are no specific regulations requiring ex-post evaluations (Greiman, 2023). Furthermore, performance data of the projects which necessary for ex-post evaluation are not published most of the times. Upon the completion of megaprojects, obtaining performance data proves to be challenging, particularly with the involvement of public entities. Yet, the presence of private capital enhances the visibility of financial achievements (Rothengatter, 2008). Megaprojects may face risks due to changes in political support. For example, the California High-Speed Rail project saw significant funding cuts under the Trump administration, along with demands for repayment of investments (Laursen, 2019). These funds were later restored by the Biden administration in 2021 (Hernández, 2021). Consequently, it is crucial to thoroughly analyze the legal and managerial challenges that can bring financial risks.

Moreover, Cantarelli and Flyvbjerg (2013) highlighted lock-in as a significant issue in megaprojects, describing it as "over-commitment of decision-makers to an ineffective course of action." It is also argued that this phenomenon limits the projects' ability to

adapt to changes, leading to a tendency to adhere rigidly to the predetermined path, even when reassessment is necessary.

2.4 Recommendations for Improving the Decision-Making Process from Literature

According to Priemus (2008), decision-making process should begin by addressing problems rather than seeking solutions. Giezen et al. (2015) emphasize that the enduring viability of megaprojects heavily relies on the adaptive capacity of planning and decision-making processes. Megaprojects represent intricate sociotechnical ventures deeply ingrained in institutional contexts, necessitating that institutional activities be prioritized ahead of technical tasks (Biesenthal et al., 2018). Moreover, the success of large-scale projects relies on articulating a strategic vision effectively, achieving total alignment, and adjusting to complexity (Shenhar & Holzmann, 2017).

Comprehending the institutional dynamics behind megaprojects is essential for their successful realization. Securing legitimacy on social, organizational, and political fronts, it facilitates the global execution of projects that are both safe and stable (Biesenthal et al., 2018). Completing projects would have been considerably straightforward if the laws and regulations had been flawless and comprehensive (Michaud & Lessard, 2000).

Megaprojects entail substantial risks, necessitating a systematic approach to management. Neglecting to implement suitable risk management strategies may result in their failure (Kardes et al., 2013). De Bruijn and Leijten (2008a) argue that one-sided evaluation strategies adapted for decision-making may not be effective because it fails to address the needs of all stakeholders, suggesting that a process-oriented approach incorporating input from various groups could be more successful. Evaluating the effectiveness, efficiency, and legitimacy of an alternative is crucial during decision-making for megaprojects, requiring thorough problem analysis. Additionally, achieving a shared understanding in problem analysis becomes vital given the diverse perspectives of different stakeholders (Priemus, 2008).

As demonstrated by Priemus (2008), after conducting a problem analysis, there might not be a singular way to handle the problem. For instance, the Dutch approach to evaluating transport projects has considered options such as utilization, pricing, and construction. Fahri et al. (2015) emphasized the importance of post-project evaluation

and underscored its critical role in organizational learning and advancement. Figure 2.5 shows a set of leading performance indicators developed by Turner and Zolin (2012) serving as a roadmap for project success, as conventional metrics of time, cost, and quality often fall short in providing a comprehensive assessment of project success. This framework enables decisions that move projects forward and toward success by aligning them with stakeholder expectations. Additionally, it allows for early identification of stakeholder commitment levels, facilitating decision-making on whether to proceed with the project or abandon it if its goals appear unattainable (Turner and Zolin, 2012).

Results Timescale	**Project Output End of Project**	**Project Outcome Plus Months**
Investor or owner	Time Cost Features Performance	Performance Profit Reputation Consumer loyalty
Project executive or project sponsor	Features Performance Time and cost	Performance Benefits Reputation Relationships Investor loyalty
Consumers	Time Price of benefit Features	Benefit Price of product Features Developments
Operators/ users	Features Performance Documentation Training	Usability Convenience Availability Reliability Maintainability
Project manager and project team	Time Cost Performance Learning Camaraderie Retention Well-being	Reputation Relationships Repeat Business
Senior Supplier (design and/or management)	Completed work Time and cost Performance Profit from work Safety record Risk record Client appreciation	Performance Reputation Relationships Repeat business
Other suppliers (goods, materials, works, or services)	Time Profit Client appreciation	Reputation Relationships Repeat Business
Public	Environmental impact	Environmental impact Social costs Social benefits

Figure 2.5 Success Measures Depending on Stakeholders (Adapted from Turner& Zolin, 2012)

According to Priemus (2010), the process from the inception to the construction of megaprojects should be seen as an knowledge-based learning period, where the public and stakeholders are actively involved, information is shared, and criticism is welcomed, with options clearly presented. This approach fosters flexibility and adaptation, facilitating adaptation to constantly changing economic, political, and technological conditions. It makes the decision-making process more democratic while also enhancing its quality.

Priemus (2010) emphasized the need of creating "process architecture" for decision-making in megaprojects and introduced a new approach to overcome pitfalls. This involves dividing the project into five decision stages: addressing problems, addressing needs, evaluating technical, functional, and economic aspects, the phase between construction and handover, and handover after completion of infrastructure. Each stage culminates in a go/no-go decision point.

The research conducted by Hansen et al. (2018) suggests a six-phase Front End Planning process, each marked a decision gateway, which is crucial for assessing project alignment with goals through quality evaluation as it can be seen in Figure 2.6.

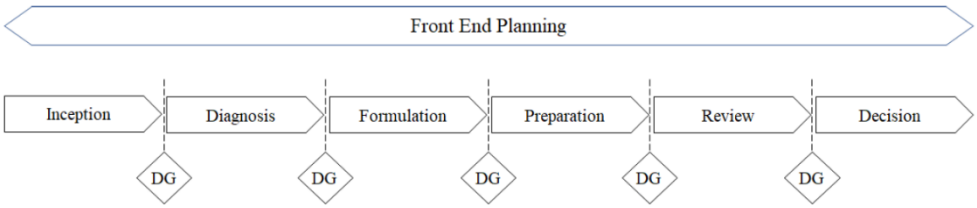


Figure 2.6 Suggested initial planning stages (Hansen et al., 2018)

Figure 2.7 clarifies the Front-End Planning procedures recommended by Hansen et al. (2018) and the questions that should be addressed. This approach enables the development of a more explicit framework for the FEP process.

FEP PHASES		FEP ACTIVITIES	QUESTIONS
Prefeasibility	Inception	Searching new possibilities and generating idea to build something	Where do we stand today?
	Diagnosis	Analyzing the current situation in construction sector and its environment and assessing needs	Do we need this project?
Feasibility	Formulation	Organizing project team, developing project charter, analyzing technology, evaluating sites, preparing conceptual scopes, analyzing alternatives	What should we do first? Which directions should we go? Which technology should we adopt?
Basic engineering	Preparation	Planning targets, identifying project risks, defining detailed project scope, developing preliminary designs, etc.	How (at what pace/ what cost/ which specific measures/ etc.) shall we get there?
	Review	Reviewing and justifying the outcomes from previous phases	Are we moving to the right direction? Is there any adjustment needed?
Decision-making	Decision	Making decision whether to proceed with/ to invest in the project or not, approving project execution plans	Are we making the right decision?

Figure 2.7 Suggested Activites and Questions in initial planning stages (Hansen et al., 2018)

Lovallo et al. (2023) pioneered a novel methodology known as Forecasting, Organizing, and Executing (FOX) as it can be seen in Figure 2.8, crafted specifically to enhance the management of megaprojects. This innovative strategy combines strategic and behavioral insights to effectively address prevalent challenges such as cognitive biases and agency problems. The FOX approach not only simplifies complex issues for policymakers but also significantly boosts the efficacy and oversight of large-scale projects, setting a new standard in project management.

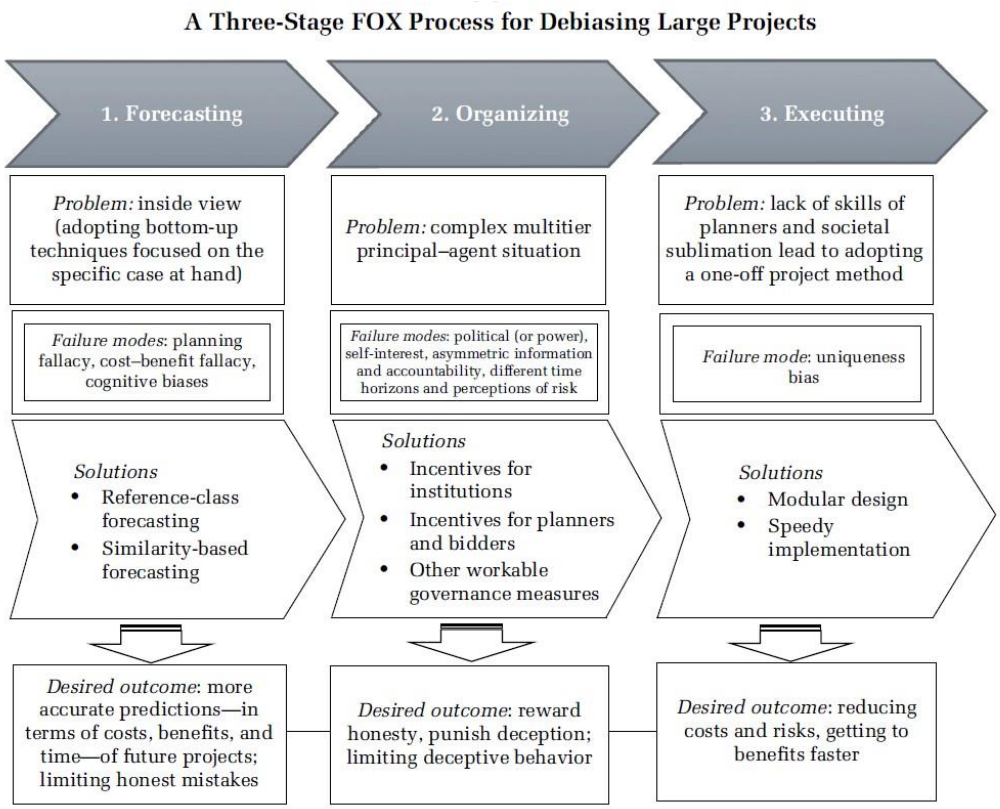


Figure 2.8 FOX Process for Megaproject Management (Lovallo et al., 2023)

This model categorizes the project into three phases: forecasting, organizing, and executing, each tailored to address unique challenges. In the forecasting phase, it employs Reference Class Forecasting or similarity-based methods to correct biases and enhance prediction accuracy. The organizing phase addresses stakeholder misalignments by proposing the creation of specific incentives and safeguards. In the executing phase, the focus shifts to overcoming technical deficiencies through modular design and lean project management techniques, ensuring the project is executed "faster, better, cheaper, and lower-risk" (Lovallo et al., 2023).

In major projects, Public-Private Partnership (PPP) is essential for achieving superior results beyond what the public or private sector could manage alone (Siemiatycki, 2013), making it a true game-changer. The establishment of temporary joint ventures might also be a preferred strategy over appointing seasoned entities to coordinate projects. This approach allows entities to come together as a special purpose entity, representing clients' positions and accessing a greater range of resources and expertise (Davies & Mackenzie, 2014).

Denicol et al. (2021) explore the organization and potential relationships of stakeholders in megaproject management using the Project System Organization (PSO) framework, underscoring the critical approach of treating megaprojects as systemic entities. This research highlights the case of UK, where HS2 Ltd was formed for the HS2 project, with a future outlook for it to transition into roles of an infrastructure manager and an initial shadow operator. A dynamic strategy has been devised to ensure the enduring success of this organization.

Different types of infrastructure projects, such as transportation, energy, and waste management, are deeply interconnected. Therefore, it is essential to approach megaprojects as parts of a broader vision and to develop comprehensive long-term, medium-term, and strategic plans. Crafting long-term strategies for sustainable development highlights the necessity of envisioning the future and respecting the concept of intergenerational equity. This approach ensures that the initiatives taken are not only advantageous for the present but also fair and sustainable for future generations (Proag, 2021).

2.5 Environmental and Social Considerations

The concept of sustainability has a critical relationship with megaprojects. Megaprojects can serve as a tool for the construction of a sustainable environment while their impact on the environment also bring about sustainability discussions. As the world faces threats from global warming and the depletion of natural resources, sustainability approaches offers an opportunity to mitigate these negative effects (Thounaojam & Laishram, 2022). Chawla et al. (2018) defined sustainability as a philosophy where natural resources are used appropriately, and today's resources are transferred to future generations by adopting financial, social, and environmental responsibilities. Sustainability is mostly associated with the environment and natural resources ,yet, it is actually a more holistic approach and it is aimed to ensure that all processes and relationships are sustainable. This comprehensive perspective is emphasized in the United Nations' Sustainable Development Goals, which have a deadline of 2030, as shown in Figure 2.9.

Figure 2.9 Sustainable development goals (United Nations Sustainable Development Goals (SDGs), n.d.)

While sustainable development goals set the standards for megaprojects today, these development plans themselves can also be considered megaprojects. By improving environmental conditions through standards and regulations and ensuring people's right to a good quality of life, the disadvantages of megaprojects can be mitigated to some extent. Rather than attempting to solve all problems with concrete constructions, governments can adopt more strategic, sustainable, and environmental approaches (Morton et al., 2017).

The concept of sustainability extends beyond the project's relationship with the natural and social environment to include sustainable project management, requiring megaproject managers in the multidisciplinary construction industry to ensure interdisciplinary coordination and cooperation (Chawla et al., 2018). Gundes et al. (2009) highlighted that while most project management approaches perceive project-related responsibilities as ending after construction is completed, sustainable project management requires project managers to maintain certain responsibilities throughout the entire life cycle of the building.

According to Yu et al. (2022), the US has pioneered innovative and radical strategies in sustainability and Net-Zero commitments, facilitated by the creation of robust policies which can provide guidance for other nations. The influence of these sustainability strategies is clearly visible in the megaprojects in the US, such as California High Speed Rail (Elam, 2022), which adhere to these principles under established standards and policies.

According to Perlaviciute et al. (2018), public support often leans towards projects perceived as beneficial. Therefore, the sustainability, energy efficiency, and carbon neutrality of a megaproject can significantly enhance its appeal and support among the community. To gain this support, projects that significantly impact the environment frequently emphasize attributes such as sustainability to justify their construction and secure societal endorsement. As a result, sustainability becomes a crucial factor in the decision-making processes of megaprojects, shaping their design and execution strategies.

Jalaei and Jrade (2015) emphasize that in contemporary megaprojects, the latest technological tools are employed in project planning and construction processes, enabling the simulation of sustainability promises even before the project is built. For example, energy simulations for buildings can be performed using Building Information Modeling (BIM) products, and technical solutions such as daylight analysis, natural ventilation strategies, and greywater transformation can be developed with the aid of these applications. Furthermore, certification systems like BIM and LEED not only incentivize green building practices but also provide clear guidelines for their implementation. Buildings with these certifications gain a privileged status and recognition in society. Overall, sustainability approaches significantly influence the decision-making processes of megaprojects, providing environmentally responsible and socially beneficial outcomes, while also enhancing the feasibility of sustainable projects.

3. LAWS, REGULATIONS, AND STANDARS: DECISION-MAKING FRAMEWORKS IN COUNTRIES

While this study offers a brief overview of global frameworks, it provides a more in-depth analysis of the laws, regulations, and standards of the UK, US, and Türkiye. This approach allows for a comprehensive understanding of global trends while enabling a detailed evaluation of the approaches in these countries from a broader perspective. Decision-making processes in the UK, the USA, and Türkiye highlight distinct evaluation dynamics, each with its own pros and cons. The primary reason for selecting these countries for comparative analysis is the presence of megaproject-specific guidelines in the UK and the US.

Chen et al. (2022) emphasize that megaprojects can serve as strategic large-scale policy tool, characterized them as follows: "not only contributes to the promotion of economic level, but also helps to regulate the national macro policy." However, the principles of megaproject management often fail to represent a global reality, as they involve the human factor, leading to approaches that may not align with the characteristics of certain countries (Ahsan & Gunawan, 2010).

The viability of megaprojects is being affected by the rise of global incentives which encourage sustainability and development. Both the US Bipartisan Infrastructure Law and the EU Recovery Plan commit significant sums to the creation of megaprojects, with the former allocating $1.2 trillion for IT and physical infrastructure projects and the latter committing €2 trillion for rehabilitation and sustainable development projects (Lovallo et al., 2023).

In conclusion, the comparative analysis of these countries highlights the necessity of adapting megaproject management practices to the unique contexts of each nation. This sets the stage for a deeper exploration of the decision-making frameworks across different nations.

3.1 Decision-Making Frameworks Across Nations

Adopting best practices and regulations from different countries can provide significant advantages in enhancing effectiveness of governance framework. However, due to the distinct characteristics of the new nation's conditions, there are also considerable risks involved (de Jong, 2008). Understanding these nuances is essential for effective decision-making and implementation of megaprojects. By examining the decision-making frameworks of various countries, valuable insights can be gained to enhance local practices while mitigating potential risks.

Certain countries have regulations and guidelines specifically designed for megaproject planning and decision-making such as the UK, and the US. While the US is setting the standard for producing megaproject research, China, Australia, and Canada are similarly prioritizing and excelling in such endeavors (Chen et al., 2022). The decision-making process for megaprojects is influenced by laws, regulations, and standards that vary in some aspects and show similarities in others across different countries. It is crucial to comprehend the decision-making processes for megaprojects specific to each country within a legal context and to consider this framework in conjunction with practical outcomes and scholarly research.

Building on this understanding, international megaprojects operate under various legistative structures, encompassing laws from their home and host countries, legal frameworks set by financing entities, regulations from regional and local authorities, and corporate governance guidelines (Levitt & Scott, 2017). Laws have evolved and adjusted in response to changes and progress in industries like construction, shipping, and insurance (Ramsey et al., 2011). To illustrate, in the construction sector, legal frameworks are striving to align with present priorities such as sustainability.

CBA is a fundamental tool in the evaluation of transport projects and aids in decision-making (de Rus et al., 2020). The European Commission has formulated a guide named "Cost-Benefit Analysis of Investment Projects," which explains the process of assessing projects and making decisions. The purpose of this guide is to provide direction to ensure compliance with the requirements that govern the evaluation process of significant projects, as mandated by the policies of the EU accession process (European Commission, 2014).

The guide highlights the adoption of CBA by European countries for assessing major projects, establishing a comprehensive framework for appraisal and decision-making processes based on CBA (European Commission, 2014). By following this guide, countries can tailor their own appraisal processes according to their specific requirements. Figure 3.1 shows the appraisal process in EU Guide. This guide is particularly important for Türkiye, given its ongoing efforts towards the European Union accession process. On October 17, 2019, a "Guide on Principles to be Followed in the Preparation of Drafts for Alignment with European Union Acquis and References to European Union Legislation" was released, laying out a roadmap for Türkiye's EU accession process (Republic of Türkiye Ministry of Foreign Affairs, 2019).

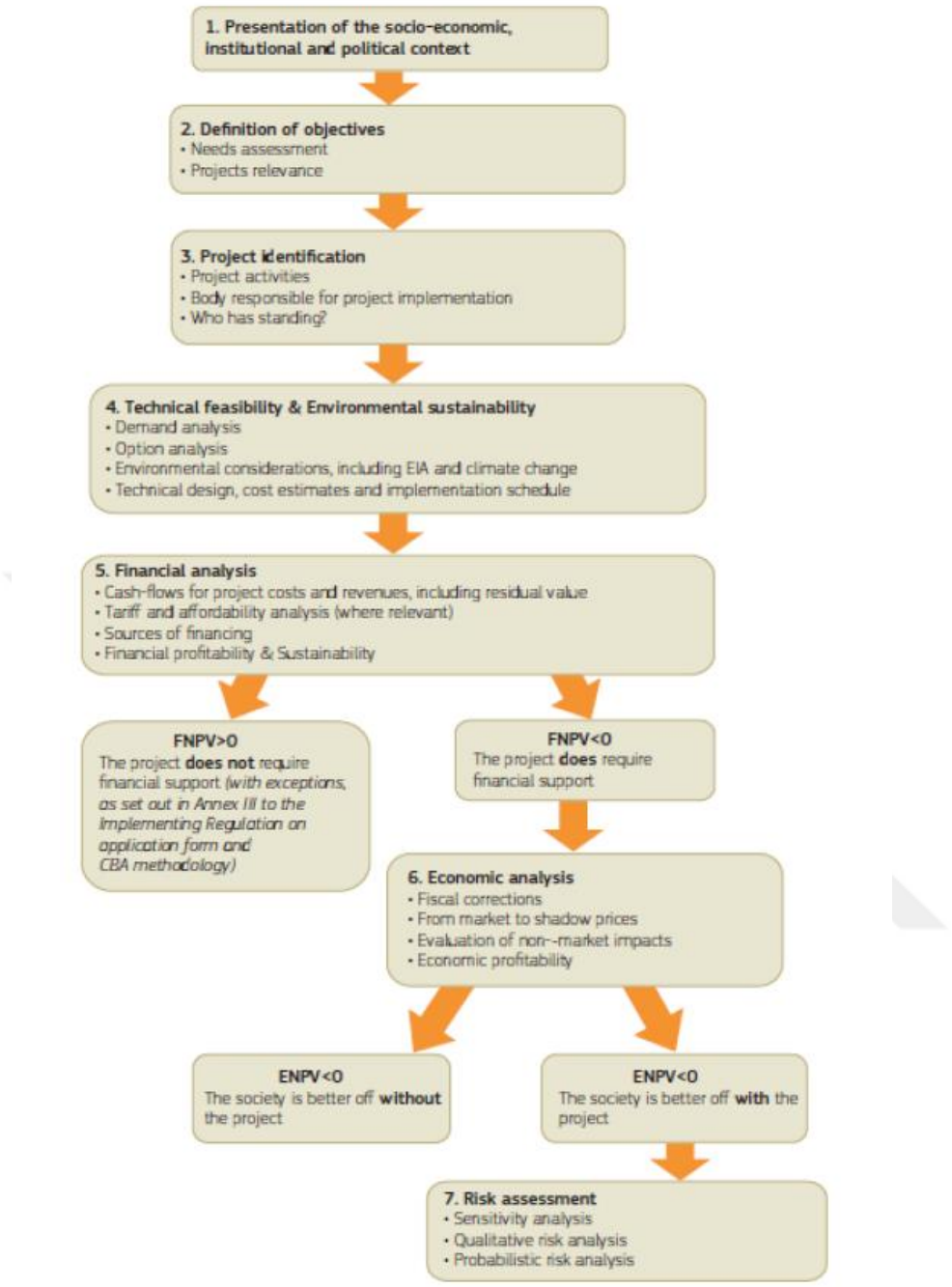


Figure 3.1 Appraisal and Decision-making process in the EU Guide (European Commission, 2014)

The OECD's study on CBA highlights that countries consider CBA as a crucial tool for evaluating investment projects. While Italy and Sweden use Cost-Benefit Analysis (CBA) solely for infrastructure projects, France, the UK, and Canada apply it to broader areas including environmental protection, technology, innovation, science, and culture. Although there are deficiencies, certain aspects like risk analysis are more advanced in countries such as the UK, Sweden, Canada, Germany, and the Netherlands. In the UK alone, information on how project impacts are distributed across different groups is available; in Canada, there is merely a qualitative assessment of stakeholders being carried out. (OECD, 2015). Figure 3.2 demonstrates the purpose and role of Cost Benefit Analysis in different countries highlighting the diverse applications and advancements in CBA practices.

		General Objective of CBA						Main Role of CBA				
	Legal foundation of CBA	Tool for prioritising investment	Justify project selection/ decision and financing	Accountability/ transparency tool	An assessment supporting project design	Tool for project monitoring	Tool for policy learning	Decision tool in allocating funding to agencies	Differs depending on actors	One among other decision making tools	Does not play a decisive in decision making	Is increasing in role and importance
Australia	●	✓						✓				
Austria	✦		✓						✓	✓		
Canada	●		✓	✓	✓			✓	✓	✓		
Chile	●		✓					✓				
Czech Republic	■			✓	✓	✓			✓	✓		
Denmark	✧	✓							✓			✓
Estonia	✧		✓	✓			✓		✓	✓		✓
France	●		✓		✓				✓	✓		✓
Germany	●		✓	✓		✓			✓			✓
Ireland	✧	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Italy	●	✓			✓	✓				✓		
Mexico	●	✓	✓	✓				✓		✓		✓
Netherlands	✦		✓						✓	✓		✓
New Zealand	✧		✓								✓	
Norway	✧	✓	✓		✓				✓	✓		✓
Slovena	✧		✓	✓	✓	✓			✓	✓	✓	
Sweden	✧	✓	✓	✓	✓	✓			✓	✓		
Switzerland	✧	✓	✓	✓					✓	✓		
Turkey	●	✓	✓	✓	✓	✓				✓		✓
United Kingdom	✦	✓	✓	✓	✓	✓	✓	✓				✓
OECD Total		**10**	**16**	**11**	**10**	**8**	**3**	**6**	**13**	**14**	**2**	**10**

● Yes, CBA is mandatory nationwide by legislation for all capital investment projects above a certain financial threshold.
■ Yes, there is a legal requirement nationwide for CBA, but only for specific category of projects.
❒ Yes, there are different legal frameworks depending on procuring /regulatory agencies at national levels.
✧ There is no nationwide legislation, but there is a legislation requiring CBA at state/regional/local government level.
❍ No.
✦ There is no legal requirement, but CBA is recommended by government and used anyway.
X Not applicable.

Figure 3.2 The role and objectives for CBA in different countries (OECD, 2015)

An analysis revealed a clear link between the initiatives proposed in the Swedish National Transport Investment Plan 2010–21 and the results obtained from CBA, emphasizing the practical applicability of CBA beyond academic circles (Eliasson & Lundberg, 2012). Transparency and stakeholder engagement are promoted and lead to positive outcomes in many OECD nations. However, there is a need for greater endeavors to enhance the accountability of permitting agencies. In the US, the Transportation Department is mandated to create a performance accountability system

for every significant project, allowing for the monitoring of environmental reviews and permit procedures (OECD, 2023).

Norway stands out with its noteworthy approach to decision-making processes for major projects. Moreover, Norway took the lead in 2000 by implementing regulations for governing major projects, Quality Assurance scheme (Volden and Samset, 2017). Norwegian Quality-at-Entry regime includes two stages, QA1 and QA2, to ensure high caliber in decision-making mechanism for major projects as shown in Figure 3.3. These two gates provide a double check for projects. The first gate (QA1) checks for consistency between political procedures and rational analysis. The second gate (QA2) involves an independent control over estimates prior to approval by parliament (Samset, 2008).

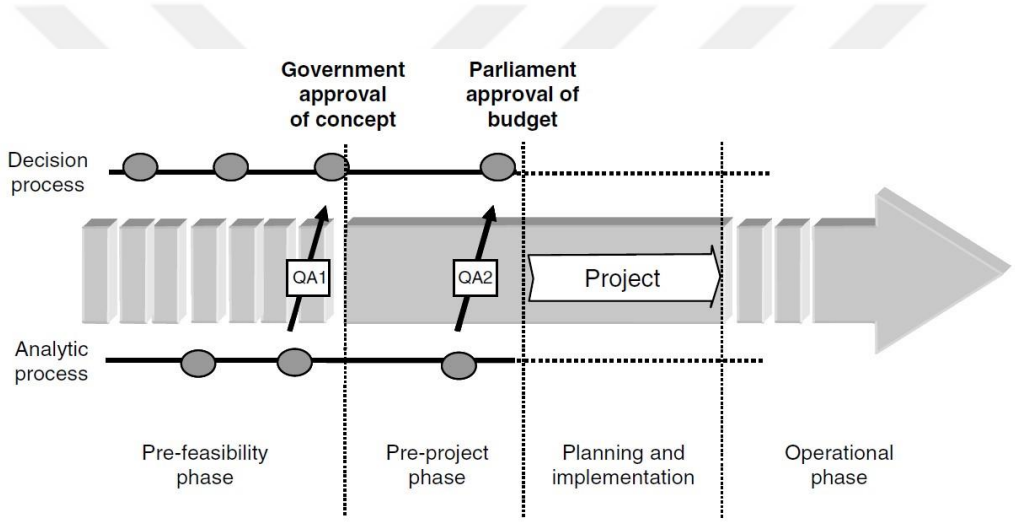


Figure 3.3 The Norwegian quality-at-entry regime (Samset, 2008)

The research conducted by Volden and Samset (2017) examines megaproject management strategies across six countries, focusing on roles, organizational structures, and decision-making processes while illustrating regulatory processes that align with established literature guidance (Figure 3.4). These countries share similarities in managing megaprojects, including a central government's governance structure, role definition, applicability to complex and costly projects, decision gates, independent quality control, assurance integration, and measures to mitigate optimism bias.

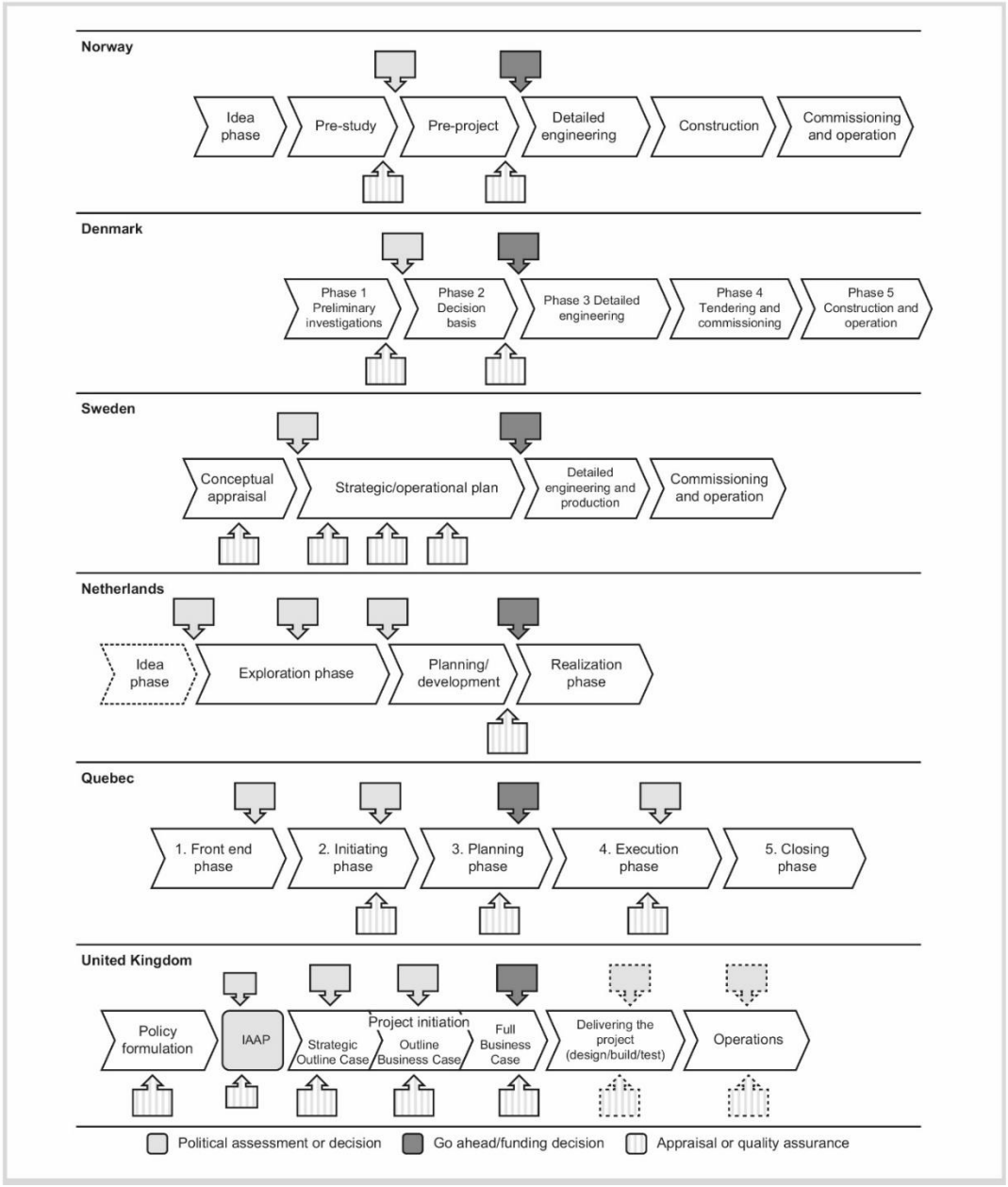


Figure 3.4 Six stage-gate models (Volden & Samset, 2017)

3.2 Regulatory Frameworks and Practices for Megaprojects in the UK, the US, and Türkiye

3.2.1 The UK: Laws, regulations, and standards

3.2.1.1 Nationally Significant Important Project (NSIP) Regime

A unique and revolutionary policy formulation, along with a specialized planning framework, differentiates the planning of megaprojects from regular projects and is crucial for their success. In the UK, the qualification of a project as either nationally significant infrastructure or another type of project determines the two distinct

procedures for planning permissions (O'Reilly, 2011). Planning Act 2008 aimed to seperate megaprojects from the local planning legislative structure, consolidate consent regimes covering megaprojects, and set timeframes for the process. These overall enhancements can lead to faster project decisions (Hickman & While, 2023).

This initiative for policy transformation not only enables the enhancement of megaprojects but also contributes to the fulfillment of the nation's strategic and futuristic objectives. The focus on advancing sustainability through planning has led to ensuring sustainable practices regarding energy, water, and transportation. Additionally, the holistic approach of incorporating policies into planning has prompted the enactment of the Planning Act 2008, aimed at streamlining procedures for major infrastructure projects (O'Reilly, 2011).

It is important to assess the motivation behind the emergence of this significant policy shift regarding major infrastructure projects. The UK government introduced "a new Development Consent Regime" for large-scale infrastructure projects in energy, transportation, water, wastewater, and waste sectors with the enactment of the Planning Act 2008. The criteria for designating projects as Nationally Significant Infrastructure that need Development Consent Order (DCO) are also outlined in this Act (Planning Act 2008, 2021). Initially, Planning Act 2008 addressed the energy, transportation, water, wastewater, and waste sectors. However, subsequent revisions expanded the scope of the policy to include major business and commercial undertakings, as well as housing developments, for evaluation within the framework of a Development Consent Order (DCO) (UK Department for Levelling Up, Housing & Communities, 2023).

The UK government prepares White Papers, which are policy documents outlining upcoming legislative proposals (UK Parliament, n.d.). In 2020, the “Planning for the Future” White Paper was published, signaling a radical transformation of the planning system. In the foreword, Prime Minister Boris Johnson described the driving force of the envisioned reform as follows:

> *As we approach the second decade of the 21st century that potential is being artificially constrained by a relic from the middle of the 20th – our outdated and ineffective planning system. (...) That is what this paper proposes. Radical reform unlike anything we have seen since the Second World War. Not more fiddling around the edges, not simply painting over the*

> *damp patches, but levelling the foundations and building, from the ground up, a whole new planning system for England (Johnson, 2020, p. 6)*

In line with “Planning for the Future" White Paper, which includes legislative proposals concerning infrastructure planning, the UK government launched the National Infrastructure Planning Reform Program in 2021 (Clifford & Morphet, 2023). This program, which advances the Planning Act 2008 and elevates megaproject planning to the next level, regulates the Nationally Significant Infrastructure Projects (NSIPs). This governance framework in the UK is designed to focus on strategic and large-scale policies. Subsequently, an action plan was established with suggested modifications to enhance this procedure even further with the claim of being "better, faster, greener, fairer, and more resilient": through the NSIP reforms (UK Department for Levelling Up, Housing & Communities, 2023).

For major infrastructure projects, various government agencies with different functions form an important part of the Nationally Significant Infrastructure regime. Planning Inspectorate (PINS) and National Infrastructure Commission (NIC) share significant responsibilities such as policy-making, reviewing, auditing, permitting, and planning ((National Infrastructure Commission, n.d.); Planning Inspectorate, n.d.a). The responsibility for managing appeals on planning schemes, applications for national infrastructure planning, investigating plans, and handling planning-associated casework rests with the Planning Inspectorate (PINS) (Planning Inspectorate, n.d.a). National Infrastructure Commission (NIC) is an executive agency designed to house experts and provide counsel regarding future obstacles that policies and large-scale infrastructure projects may face (National Infrastructure Commission, n.d.). Planned to occur once in each parliamentary term, National Infrastructure Assessment (NIA) by the National Infrastructure Commission evaluates the country's infrastructure requirements through a 30-year perspective (Clifford & Morphet, 2023).

Since the UK places importance on strategic and macro planning, the processes for developing policies for major projects are also clearly defined through National Policy Statements (NPS), which include “government’s objectives for the development of nationally significant infrastructure in a particular sector and state” (Planning Inspectorate, 2012). National Policy Statements (NPS), formulated by government and outlining goals for major projects as well as the policies for developing them, are core component of this new regime for significant projects. Once approved by Parliament,

these policies create a decision-making and investment scheme by addressing the needs and objectives of major projects, the circumstances they will operate within, their requirements, potential challenges, impacts, and considerations regarding the most suitable locations for implementation (Clifford & Morphet, 2023).

The steps of the Development Consent Order (DCO) process for major infrastructure projects in the UK are illustrated in Figure 3.5, showing the pre-application, acceptance, pre-examination, examination, recommendation and decision, and post-decision stages. Figure 3.6 presents a comprehensive process map by expanding on these stages, outlining specific timeframes, actors, actions performed, outputs, and transitions between processes (UK Department for Levelling Up, Housing & Communities (2024a).

Nationally Significant Infrastructure Projects (NSIP) are forwarded to the Planning Inspectorate (PINS), which comprises a variety of public and private bodies, for the evaluation of a Development Consent Order (DCO) application. Independent inspectors, appointed by PINS, assess this applications and advise the corresponding Secretary of State (SoS) on whether to approve the project. The decision-making process, potentially stretching up to 18 months, culminates in a final decision by the Secretary of State (SoS), who determines whether to grant or deny the DCO (Planning Inspectorate, n.d.b)

Figure 3.5 Development Consent Order process (UK Department for Levelling Up, Housing & Communities, 2024a)

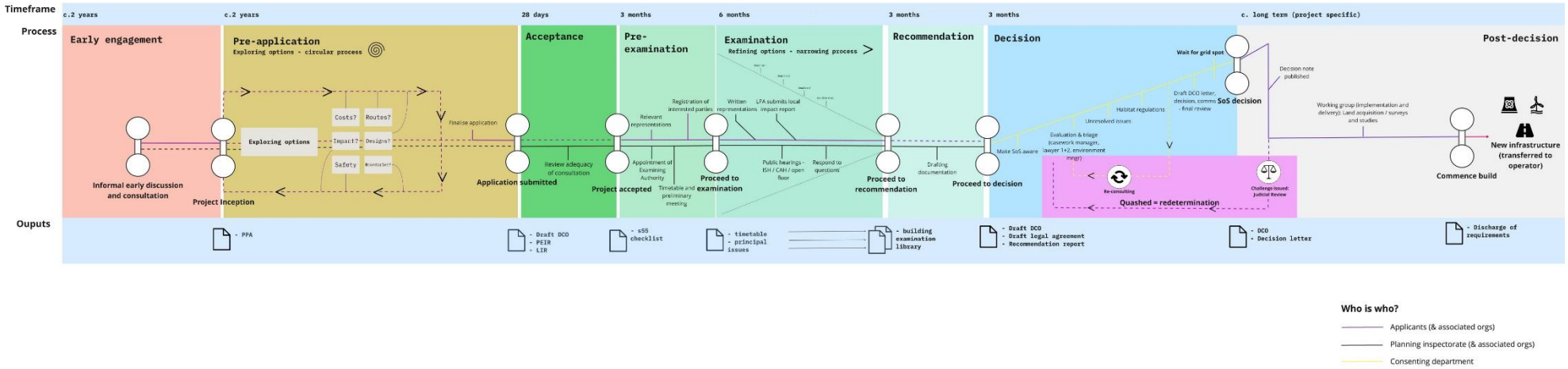
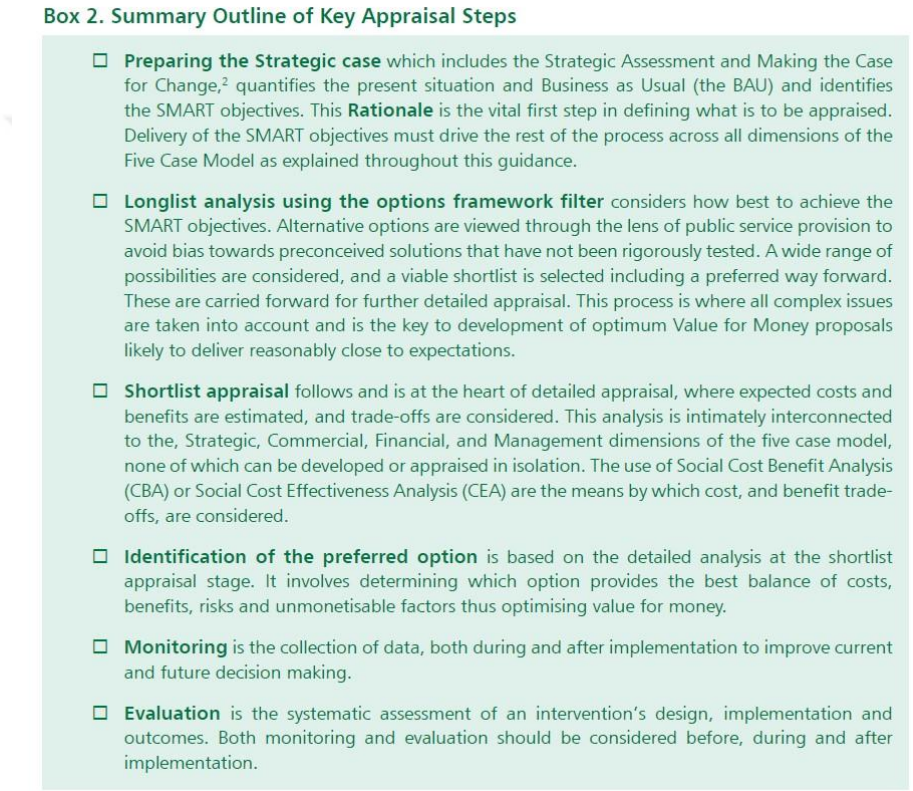


Figure 3.6 NSIP Process (UK Department for Levelling Up, Housing & Communities, 2024a)

3.2.1.2 Green Book

The Green Book released by HM Treasury, which serves as a manual for project, program, and policy evaluations in the UK, includes directives and principles regarding the use of evaluation methods. All initiatives impacting public assets and resources, and involving public spending, must comply with the Green Book. The appraisal and evaluation methods outlined in the Green Book deliver objective insights that facilitate the decision-making process (HM Treasury, 2023). Figure 3.7 outlines the main stages of the appraisal process.



Box 2. Summary Outline of Key Appraisal Steps

- **Preparing the Strategic case** which includes the Strategic Assessment and Making the Case for Change,[2] quantifies the present situation and Business as Usual (the BAU) and identifies the SMART objectives. This **Rationale** is the vital first step in defining what is to be appraised. Delivery of the SMART objectives must drive the rest of the process across all dimensions of the Five Case Model as explained throughout this guidance.
- **Longlist analysis using the options framework filter** considers how best to achieve the SMART objectives. Alternative options are viewed through the lens of public service provision to avoid bias towards preconceived solutions that have not been rigorously tested. A wide range of possibilities are considered, and a viable shortlist is selected including a preferred way forward. These are carried forward for further detailed appraisal. This process is where all complex issues are taken into account and is the key to development of optimum Value for Money proposals likely to deliver reasonably close to expectations.
- **Shortlist appraisal** follows and is at the heart of detailed appraisal, where expected costs and benefits are estimated, and trade-offs are considered. This analysis is intimately interconnected to the, Strategic, Commercial, Financial, and Management dimensions of the five case model, none of which can be developed or appraised in isolation. The use of Social Cost Benefit Analysis (CBA) or Social Cost Effectiveness Analysis (CEA) are the means by which cost, and benefit trade-offs, are considered.
- **Identification of the preferred option** is based on the detailed analysis at the shortlist appraisal stage. It involves determining which option provides the best balance of costs, benefits, risks and unmonetisable factors thus optimising value for money.
- **Monitoring** is the collection of data, both during and after implementation to improve current and future decision making.
- **Evaluation** is the systematic assessment of an intervention's design, implementation and outcomes. Both monitoring and evaluation should be considered before, during and after implementation.

Figure 3.7 Key Appraisal Steps in Green Book (HM Treasury, 2023)

The appraisal process begins with preparing a Strategic Case, encompassing the evaluation of current circumstances, assessment of its relationship with macro plans, policies, and programs, setting objectives under the SMART (Specific, Measurable, Achievable, Realistic, and Time-limited) framework, and establishing the Project Rationale to articulate the proposal's motivation. In the second stage, a broad spectrum of options is gathered and created longlist analysis filtering options to ensure the fulfillment of SMART objectives, aiming for an unbiased process, as shown in the Figure 3.8.

This approach ensures that the ideal options are identified while making it easier to handle the difficulties arising from complexity. Thirdly, the long list undergoes a filtering process to create a more detailed set of evaluations that focus on cost-benefit calculations and trade-offs through Social Cost-Benefit Analysis and Social Cost-Effectiveness Analysis.

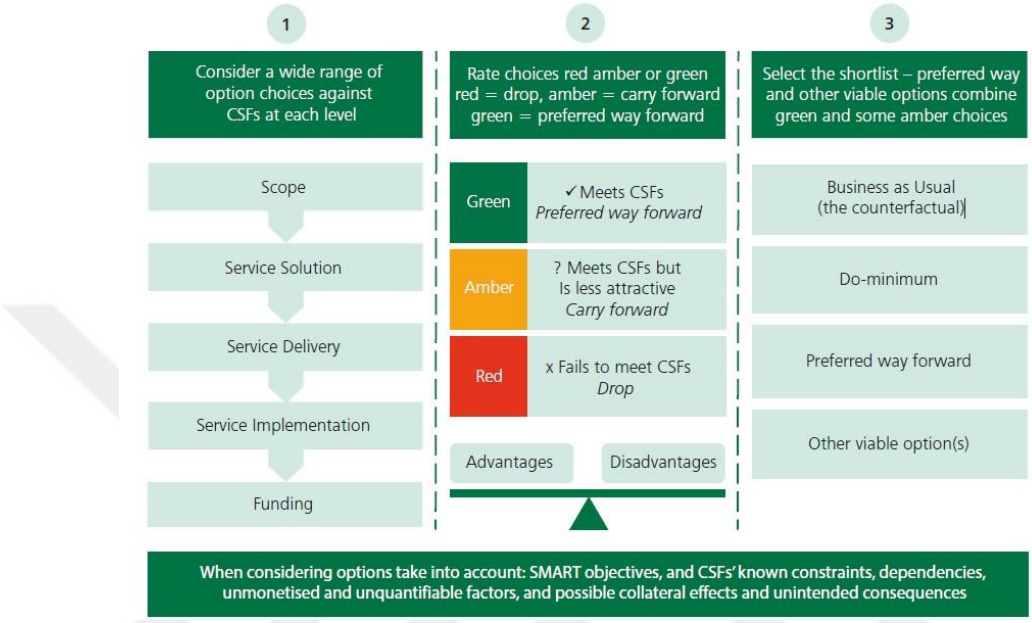


Figure 3.8 Longlisting Analysis Filtering Process (HM Treasury, 2023)

Value for Money is evaluated in the fourth stage, which involves presenting the selected option and taking into account risks, costs, benefits, and non-monetizable factors. The fifth stage involves monitoring outputs for improved decision-making, followed by the evaluation stage, which systematically assesses outputs throughout the project lifecycle. Because initiatives are multidimensional, their outcomes vary in different cases. Five Case Model is one of the most prominent approaches in UK appraisal methods. These multidimensional cases are expressed through the project's Five Case Model, which includes strategic, economic, commercial, financial, and management aspects as shown in Figure 3.9 (HM Treasury, 2023).

Strategic dimension	**What is the case for change, including the rationale for intervention?** What is the current situation? What is to be done? What outcomes are expected? How do these fit with wider government policies and objectives?
Economic dimension	**What is the net value to society (the social value) of the intervention compared to continuing with Business As Usual?** What are the risks and their costs, and how are they best managed? Which option reflects the optimal net value to society?
Commercial dimension	**Can a realistic and credible commercial deal be struck?** Who will manage which risks?
Financial dimension	**What is the impact of the proposal on the public sector budget in terms of the total cost of both capital and revenue?**
Management dimension	**Are there realistic and robust delivery plans**? How can the proposal be delivered?

Figure 3.9 Five Case Models (HM Treasury, 2023)

The Green Book highlights Distributional Analysis as a key approach, considering and individually assessing how various groups might be impacted differently by a project. Moreover, strategies have been implemented to tackle optimism bias and risks. Specifically, corrections are applied to forecasts to mitigate optimism bias, and the Sensitivity Analysis technique aims to effectively handle risks. In Sensitivity Analysis, a confidence level is determined for assessments. In the initial stages, complexities and uncertainties could complicate forecasting. Therefore, a confidence level is detailed through sensitivity analysis, ensuring that the confidence in the accuracy of the estimates is clearly communicated (HM Treasury, 2023). The overall form of the assessment is illustrated in Figure 3.10.

BAU and alternative options at least 4				
Option label	**1. Business As Usual BAU**	**2. Do Minimum Option**	**3. Preferred Option if not Do Min**	**4. More and less Ambitious Options 4-to-N → as needed**
NPSV for CBA or Net Present Unit Cost, NPUC for CEA	90% Confidence* Interval and expected value	→	→	→
Relevant present vale public sector cost	90% Confidence* Interval and expected value	→	→	→
Appropriate BCR or NPUC	90% Confidence* Interval and expected value	→	→	→
Significant Quantified but unmonetisable benefits	Brief description* Who benefits 90% Confidence range & expected.	→	→	→
Significant Unquantifiable benefits	Brief description if included	→	→	→
Residual risk and optimism bias allowances	90% Confidence Interval and expected value	→	→	→
Switching values of key variables	90% Confidence Interval and expected value	→	→	→
Life span of the option	Months and /or Years	→	→	→

Figure 3.10 Sensitivity Analysis Process (HM Treasury, 2023)

Reference class forecasting is a crucial component of project evaluations in the UK, as it helps mitigate the risk associated with optimism bias (Groom & Armendáriz, 2021). The Green Book also highlights the importance of conducting Cost-Benefit Analyses (CBA) before (ex ante), during, and after (ex post) the implementation process (HM Treasury, 2023).

In conclusion, using techniques such as the Five Case Model, Distributional Analysis, and Sensitivity Analysis, the Green Book provides a thorough foundation for UK public projects, programs, and policies. In addition to helping to develop practical solutions and improve accountability and the success of public investments, this strategy guarantees sound, impartial, and transparent decision-making (HM Treasury, 2023).

3.2.1.3 Transport Analysis Guidance (TAG)

TAG has specialized in creating a framework for transport-specific assessment processes in accordance with Green Book guidance. Compliance with Transport Analysis Guidance (TAG) is mandatory for all initiatives requiring government

permission (Department for Transport, 2014). This guide emphasizes that decision-making processes and transport appraisal processes are distinct from each other:

The transport appraisal process is about options generation, development and evaluation of intervention impacts. In contrast, the decision-making process involves a separate governance process concerned with identifying and implementing interventions that deliver the needs of the sponsoring organisation and fits best with its investment funding objectives (Department for Transport, 2014, p.1).

The chart demonstrates how the transport appraisal process is linked to decision-making activities (Figure 3.11). It emphasizes the critical role of Five Case Model, as outlined in the Green Book guidance. This approach ensures that transportation projects are analyzed from five unique perspectives, enabling a more comprehensive and effective evaluation (Department for Transport, 2014).

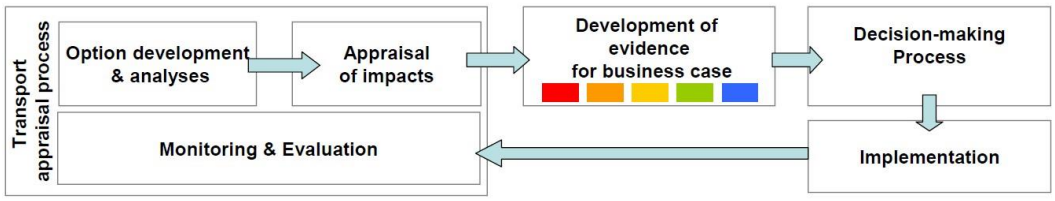


Figure 3.11 Connections between decision-making and transport appraisal (Department for Transport, 2014)

The Green Book suggests employing Cost-Benefit Analysis (CBA), but in order to align with the nature of transportation initiatives, it also advocates incorporating Option Development and Analysis alongside CBA. Transport Appraisal process is divided into three key phases: Option Development, Further Appraisal, and Monitoring (Figure 3.12). A rational structure should guide this procedure and guarantee an impartial assessment of the options. Those chosen for detailed assessment need to be supported by robust data and documentation. Furthermore, stakeholder participation in the project evaluation should be properly established, and effective stakeholder management for appraisal process is essential (Department for Transport, 2014).

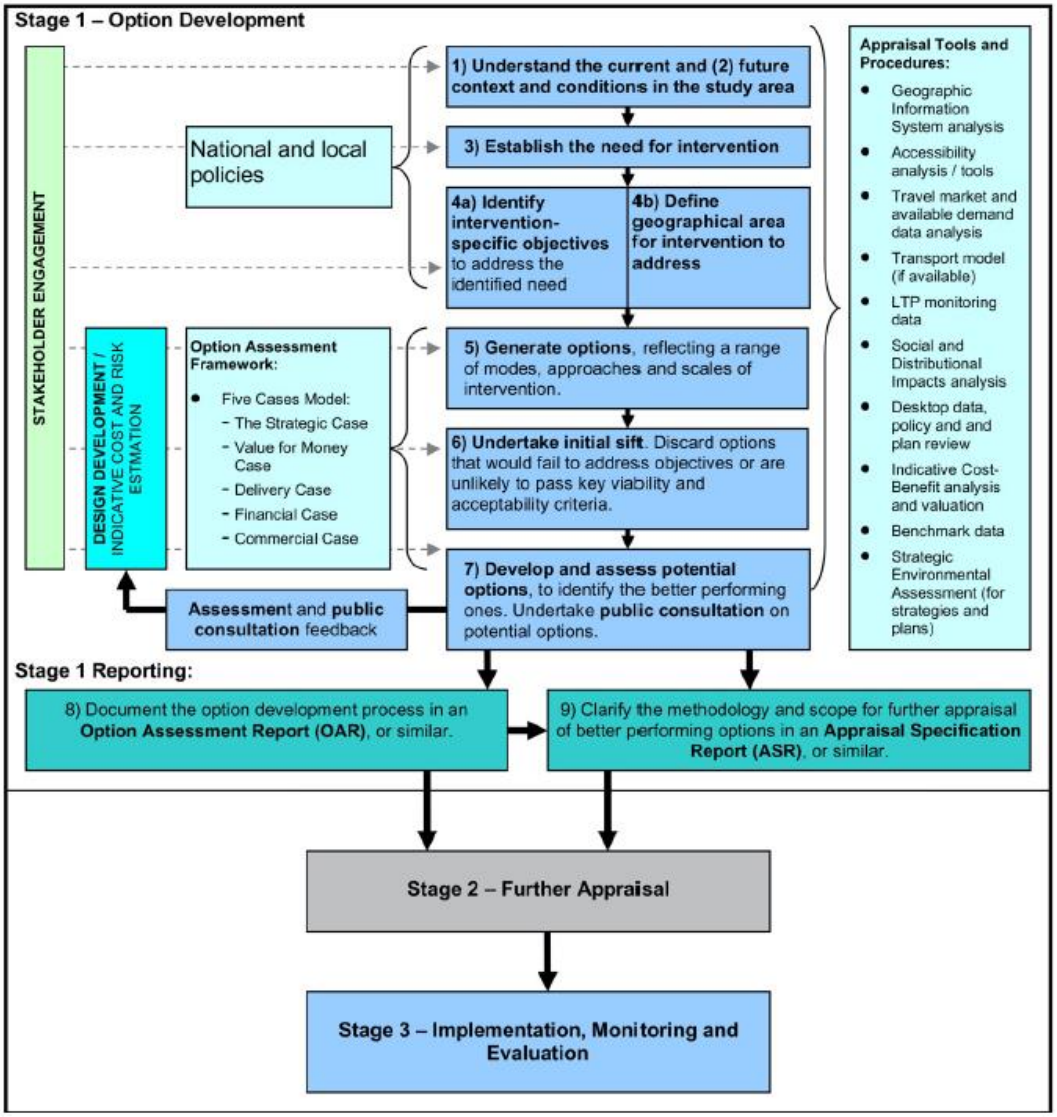


Figure 3.12 Transport Appraisal Flowchart (Department for Transport, 2018)

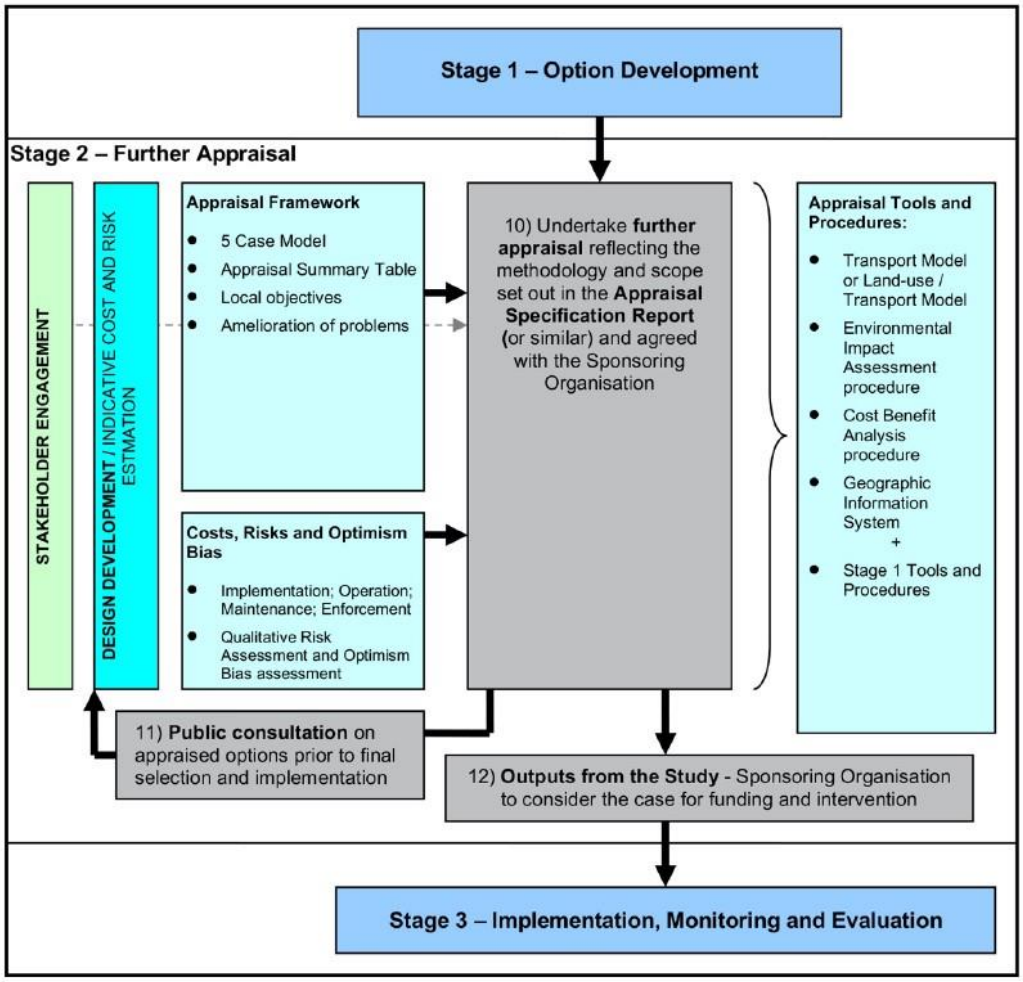


Figure 3.12 (continue) Transport Appraisal Flowchart (Department for Transport, 2018)

To conclude, the TAG framework uses a rigorous set of evaluation methods, such as Cost-Benefit Analysis (CBA) and Option Development and Analysis, to ensure transportation projects are comprehensively and fairly evaluated. By following these guidelines and encouraging active stakeholder participation, the appraisal process supports informed decision-making and the successful implementation of transport projects. This approach aligns with the strategic goals outlined in the Green Book, promoting sustainable and effective infrastructure development (Department for Transport, 2018).

3.2.1.4 Environmental impact assessment (EIA)

The Environmental Impact Assessment (EIA) procedure is regulated by Town and Country Planning (Environmental Impact Assessment) Regulations 2017, which implement the updated Environmental Impact Assessment Directive (EU Directive) of

the European Union (*Environmental Impact Assessment*, 2020). Unlike Planning Act 2008, which provides significant guidance specifically for major infrastructure projects, Environmental Impact Assessment (EIA) regulations encompass a broader spectrum of projects. The feasibility determinations for a megaproject in the UK are closely linked to the results of the Environmental Impact Assessment (EIA) and the directives outlined in the Planning Act 2008. The purpose of the EIA procedures is defined in the following manner "to protect the environment by ensuring that a local planning authority when deciding whether to grant planning permission for a project, which is likely to have significant effects on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision-making process" (*Environmental Impact Assessment*, 2020).

Projects that require an Environmental Impact Assessment (EIA) due to significant environmental impacts are subject to regulations that govern the entire process, including assessment, determination, consultation, and decision-making (*Environmental Impact Assessment*, 2020). The public can get involved in the decision-making process earlier and proactively due to EIA. Because of a successful division of responsibilities in the UK, certain projects may be transferred to local governments, depending on the viability of local environmental regulations (*Environmental Impact Assessment*, 2020). This approach enables EIA procedures to focus on projects that have serious environmental consequences, allowing for improved decision-making procedures for such projects. A flowchart illustrating the EIA stages in the UK (Figure 3.13).

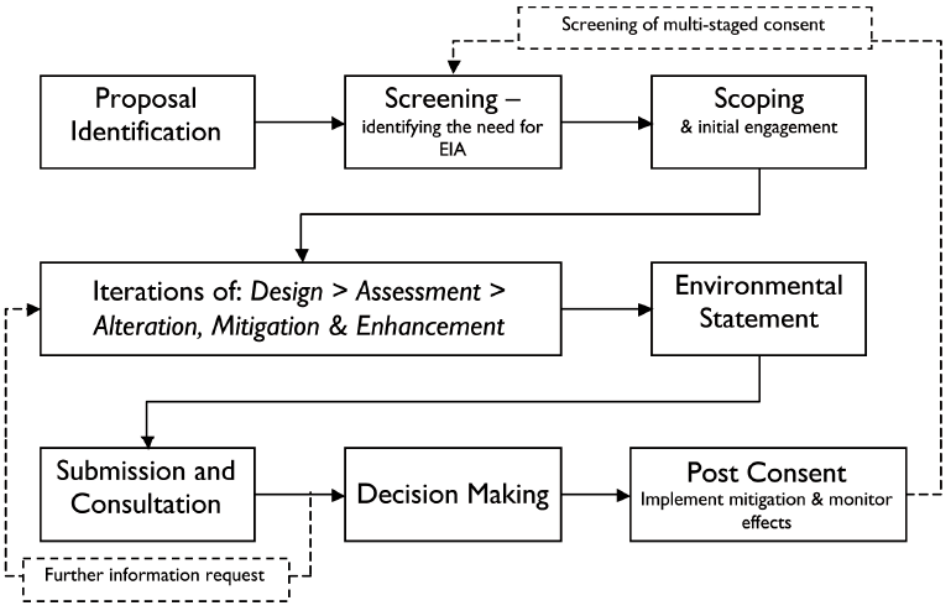


Figure 3.13 The UK EIA Stages (Institute of Environmental Management & Assessment, 2011)

EIA process typically involves five stages: "screening, scoping, preparing an Environmental Statement, making a planning application and consultation, and decision making" (*Environmental Impact Assessment*, 2020). However, the specific procedures can be tailored to the type and characteristics of the project. Comprehensive guides, like the Design Manual for Roads and Bridges (DMRB), can be created to establish detailed processes or address particular aspects of the EIA (Institute of Environmental Management & Assessment., 2011). Furthermore, different evaluation methods may be employed based on the categorization of development level, such as Schedule 1 and Schedule 2, which entails more significant and substantial effects (Planning Inspectorate, 2020).

3.2.2 The US: Laws, regulations, and standards

3.2.2.1 Major Projects Guidance

Major Projects Guidance have been prepared by the US Federal Highway Administration (FHWA) for projects costing more than $500 million that need federal assistance. Nonetheless, projects with budgets under $500 million may also be classified as major if they meet specific complexity or oversight criteria. Major projects must submit a Management Plan and a Financial Plan in accordance with the

"Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users" (SAFETEA-LU) regulations. Notably, the Financial Plan must be updated annually, while the Management Plan should be revised as necessary throughout the project's lifespan. For a comprehensive evaluation of major projects, all project-related activities are documented in the Record of Decision (ROD), Finding of No Significant Impact (FONSI), or Categorical Exclusion (CE) documents (FHWA, 2023a), which are included in decision documents within the scope of the National Environmental Policy Act (NEPA) process. This highlights that NEPA process forms the central pillar of decision-making for major projects, with all other actions evolving around this pivotal process. In other words, these records are provided upon completion of the NEPA evaluation, indicating that in the US, the NEPA process holds a central position in strategic, political, planning, and environmental procedures as it can be supported with Figure 3.14 (FHWA, 2015).

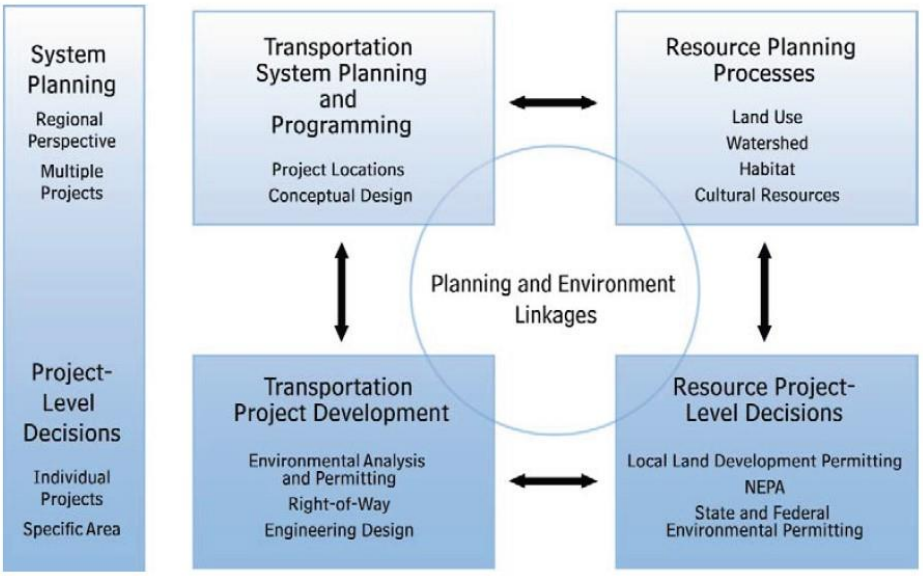


Figure 3.14 Coordination of environment, transportation, system, resource planning (Federal Highway Administration, 2015)

The pivotal role of NEPA in the assessment and decision-making processes of projects is described as follows:

> *"FHWA and FTA apply the NEPA process to transportation decisionmaking by assisting transportation officials in making project decisions that balance engineering and transportation needs with social, economic, and environmental factors. This*

process relies heavily on input from the public, interest groups, resource agencies and local governments. FHWA and FTA apply the NEPA process as an umbrella for compliance, with more than 40 Federal laws, regulations, and executive orders that provide an integrated approach to addressing impacts that transportation projects produce on the human and natural environment." (Federal Highway Administration, 2015).

To receive funding for Major Projects, FHWA requires approval of the Cost Estimate Review, Financial Plan, and Project Management Plan, all of which are evaluated during the NEPA process. Once these elements are completed, the project can progress to the final design stage. Following the NEPA process, sponsors must submit the Project Management Plan first and then obtain approval for the Initial Financial Plan before construction funds can be released. The milestones of the major projects can be seen in Figure 3.15 (FHWA, 2023b).

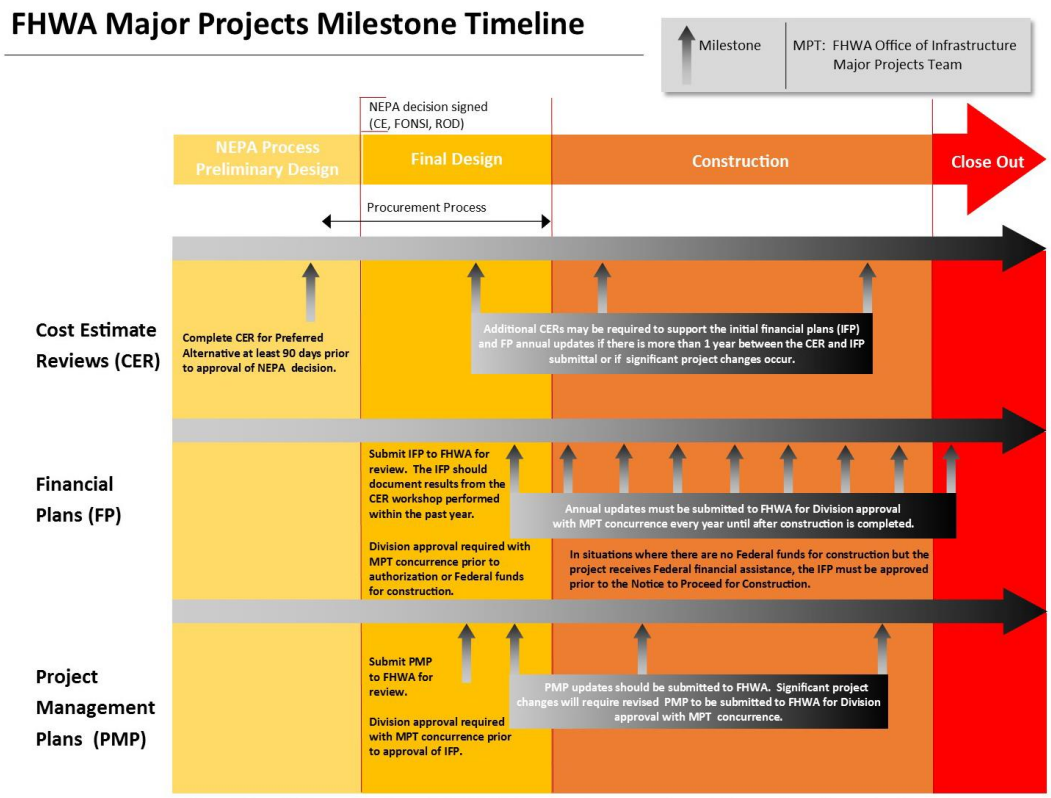


Figure 3.15 FHWA Major Projects Process (FHWA, 2023b)

The Management Plan should encompass: "Project Purpose, Goals, Objectives and Metrics, Project Description, Project Procurement, Project Organizational Management, Project Management Controls (Contract Administration, Scope, Cost, Schedule, Risks, and Quality), Project Communications Management, Project

Documentation & Reporting, Project Closeout, Project Oversight, Management of the Project Management Plan." (Federal Highway Administration, n.d.a).

According to Grant et al. (2013), the US planning system sets itself apart by embracing Performance-Based Planning and Programming (PBPP), a framework that involves formulating evaluation standards and methods tailored to specific sectors. As a result, estimation tools optimized for particular sectors become more comprehensible and effectively implemented within the planning process. In the “Performance-Based Planning and Programming Guidebook” PBPP decribed as follows:

Performance-based planning and programming (PBPP) refers to the application of performance management principles within the planning and programming processes of transportation agencies to achieve desired performance outcomes for the multimodal transportation system. PBPP attempts to ensure that transportation investment decisions are made – both in longterm planning and short-term programming of projects – based on their ability to meet established goals for improving the overall transportation system. Furthermore, it involves measuring progress toward meeting goals, and using information on past and anticipated future performance trends to inform investment decisions. (Grant et al., 2013).

The diagram shows the PBPP Framework (Figure 3.16), which is based on the concept of ongoing improvement**.**

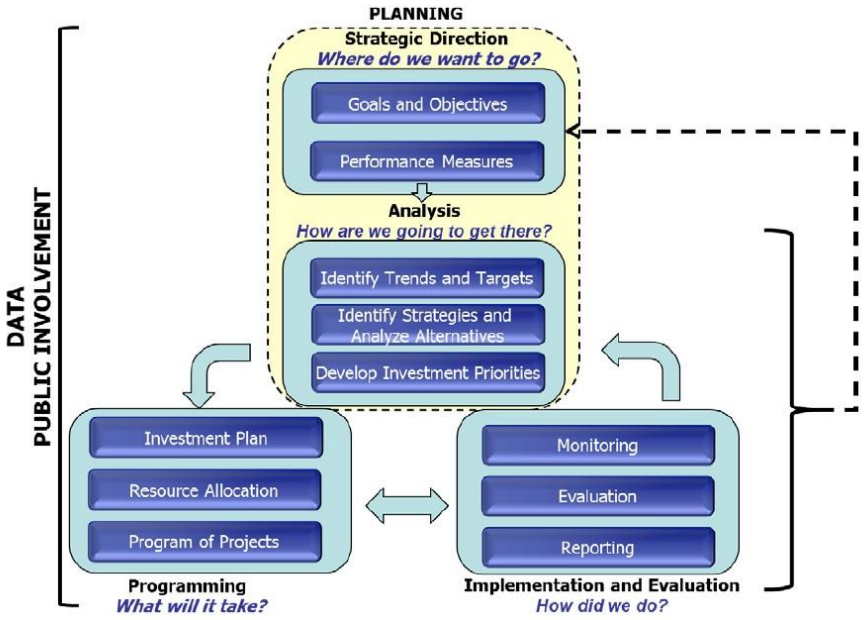


Figure 3.16 PBPP Framework (Grant et al., 2013)

The contribution of the PBPP Framework to project evaluation processes can be evidenced by a study in the US consisting of 29 transport projects that compare predicted and actual outcomes. As shown in Figure 3.17, the practice of reincorporating outputs from projects back into the process and using them to improve the process has led to significant enhancements in both cost and ridership estimations (Federal Transit Administration Office of Planning and Environment, 2020).

Measure	1990	2003	2007	2020
Number of Projects	10	19	18	27
Actual and Predicted Ridership for All Projects, Summed across Projects				
Average Actual	117,924	26,200	19,879	12,752
Average Forecast	215,756	46,316	33,601	15,398
Sum of Actual Trips	1,179,236	497,806	357,814	344,310
Sum of Forecast Trips	2,157,560	880,005	604,810	415,750
Sum Actual/Sum Forecast	55%	57%	59%	83%
Actual Divided by Predicted Costs for Each Project, Averaged across Projects				
Average	42%	67%	72%	92%
Median	41%	64%	64%	90%
Minimum	9%	5%	17%	33%
Maximum	76%	108%	217%	159%

Figure 3.17 PBPP: Comparision of ridership forecasts (FTA, 20202)

Figure 3.18 highlight the remarkable advancements in cost and ridership predictions. From 1990 to 2020, the accuracy of cost forecasts improved dramatically, with the ratio of actual costs to estimated costs increasing from 42% to 92%. Similarly, ridership forecasts saw a significant enhancement, with the ratio of actual to predicted ridership rising from 55% to 83%. These improvements emphasize the critical importance of integrating PBPP into the megaproject processes.

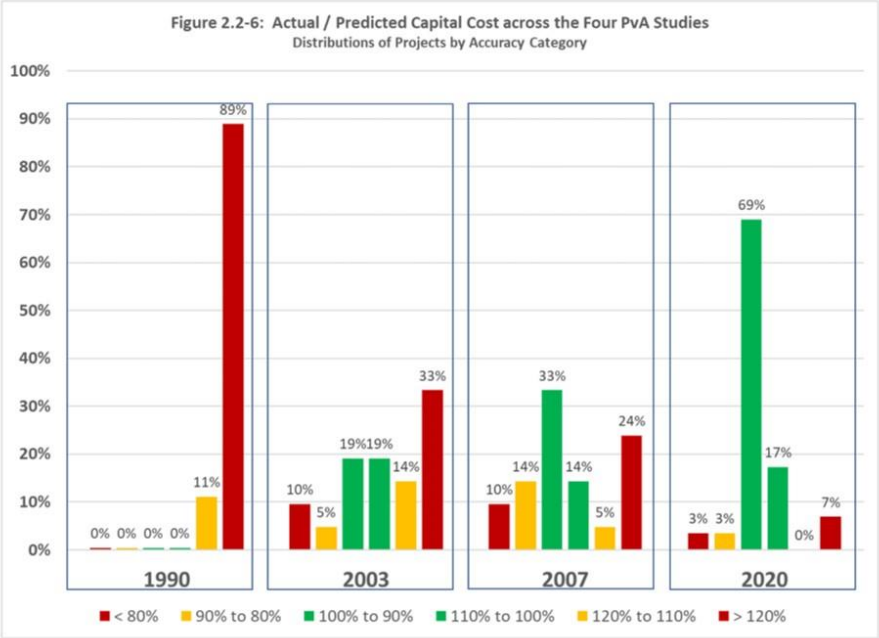


Figure 3.18 PBPP: Comparision of costs (Federal Transit Administration Office of Planning and Environment, 2020)

In Figure 2, there is a noticeable transition from red to green, indicating an improvement in the accuracy of cost estimates. By 2020, the proximity between estimated and actual costs has increased, providing significant evidence of the impact of PBPP on project success in terms of cost estimation.

For major projects, a Cost Estimating guide is available within the major project guidance framework. This guide embraces several key principles: "integrity, contents of a cost estimate, year-of-expenditure dollars, basis of a cost estimate, risk and uncertainty, project delivery phase transitions, team of experts, validation of estimates, revalidation of estimates, release of estimates, and estimating information" (FHWA, 2023c).

Furthermore, this guide recommends integrating strategies for handling risks and uncertainties into the cost estimations. California High Speed Rail (CHSR) serves as a significant example to grasp the framework outlined in this guide. As the optimism bias is pointed out by Flyvbjerg et al. (2003), the anticipated ridership projections for the project tend to be more optimistic than the actual outcomes. Hence, the forecasts for CHSR have been generated considering three distinct scenarios: low, medium, and high (California High-Speed Rail Authority, 2012). Moreover, the initial projection for the CHSR anticipated completion by 2020 with a budget of 33.7 billion dollars.

However, the latest report suggests that operations are now expected to commence in 2030 with a cost ranging between 88.5 and 127.9 billion dollars (California High-Speed Rail Authority, 2008; California High-Speed Rail Authority, 2023). Creating varied ridership prediction scenarios categorized as low, medium, and high and estimating costs within a range could be an effective approach to managing risks and uncertainties.

The 2009 Business Plan of the California High-Speed Rail Authority offered detailed insights into project estimates. Ridership and revenue forecasts were meticulously developed by Cambridge Systematics (CS), and an impartial review board scrutinized these model results. This measure was taken to prevent any manipulation of data, ensuring the integrity of the project justification (California High-Speed Rail Authority, 2009). Additionally, a Peer Review Panel was convened to enhance oversight of the project's predictions (California High-Speed Rail Authority, 2012). Moreover, efforts were made to enhance the comprehensiveness of ridership, revenue, operation, and maintenance cost analyses. The goal was to consistently seek input and support to achieve the most accurate outcomes. Support was sought from entities such as the Ridership Technical Advisory Panel (RTAP), Government Accountability Office (GAO), and Union of Railways (UIC), and predictions were refined. The application of Monte Carlo simulation was also incorporated (California High-Speed Rail Authority, 2014).

To improve the dependability of predictions in subsequent years using current data, the Year Of Expenditure model has been employed in CHSR. It is anticipated to enhance consistency in estimates by aligning cost expenditures with the respective years of expenditure (California High-Speed Rail Authority, 2008). Furthermore, a Request for Expressions of Interest (RFEI) was circulated, and subsequent responses were analyzed to assess the level of interest from the private sector. Incorporating a substantial allocation of the project to private sector, was thoroughly evaluated (California High-Speed Rail Authority, 2009).

Real Options Theory (ROT) approaches have been adopted in CHSR, and various strategies, such as the Initial Operating Section (IOS) and Staged Delivery Method have been implemented throughout the project. For instance, the Initial Operating Section (IOS) has been designated as the first operational segment, intended to serve as a model for the remainder of the project. A flexible production plan is outlined,

aligning regions and funding to generate various potential scenarios. This approach is adaptive but comes with uncertainties. Instead of navigating the challenges of a large-scale project all at once, a step-by-step progression is deemed feasible (California High-Speed Rail Authority, 2012). Moreover, value engineering has been adapted to seek more innovative financial and technical improvements without compromising quality (California High-Speed Rail Authority, 2012). Moreover, Monte Carlo analysis has been employed to enhance the precision of financial and risk forecasts (California High-Speed Rail Authority, 2014).

3.2.2.2 National environmental policy act (NEPA)

National Environmental Policy Act (NEPA) is a fundamental law that governs the decision-making processes of megaprojects in the US. NEPA was enacted on 1970, and its purpose was defined as "to ensure federal agencies consider the environmental impacts of their actions and decisions" (National Environmental Policy Act, n.d.). NEPA provides specific frameworks for project decision-making, including permit applications, federal land management, and public projects such as highways. These assessments scrutinize scrutinize the environmental, social, and economic impacts of projects, allowing the public to access information and offer feedback on these evaluations (What Is the National Environmental Policy Act? | US EPA, 2023).

Recognized as the first significant environmental legislation in the US, NEPA is commonly likened to the "Magna Carta" of federal environmental laws. Moreover, NEPA has played a pioneering role globally, inspiring other countries to develop their own environmental assessment procedures and serving as a catalyst for integrating environmental considerations into decision-making processes (NEPA | National Environmental Policy Act, n.d.). The general obligations regarding NEPA are found in 42 U.S.C. § 4321 et seq., while the regulations of the Council on Environmental Quality (CEQ), established to ensure the fulfillment of NEPA obligations by federal agencies, are outlined in 40 C.F.R. § 1500-1508 (NEPA | National Environmental Policy Act, n.d.).

As stated in Section 102 of Title 1, the law outlines the federal government's responsibilities, which include ensuring a healthy and secure atmosphere, promoting resource balance, meeting the needs of future generations, creating a livable environment, respecting culture, nature, history, and diversity, transitioning to renewable energy, promoting recycling, and fostering a shared mission between the

government and the general public (National Environmental Policy Act, 42 U.S.C. § 4331). Accordingly, NEPA, guiding many other ongoing projects in the US, plays a crucial role in the decision-making of megaprojects.

The procedures within NEPA for megaprojects include environmental evaluation, preparation of Environmental Impact Statements (EIS) and Environmental Impact Reports (EIR), formulation of project alternatives in compliance with NEPA regulations, as well as public involvement and the collection of public opinions. These elements collectively constitute essential components of the megaproject decision-making framework. The implementation of a project is depicted in the flowchart in Figure 3.19. Consequently, the decisions for megaprojects are evaluated within the framework outlined by NEPA.

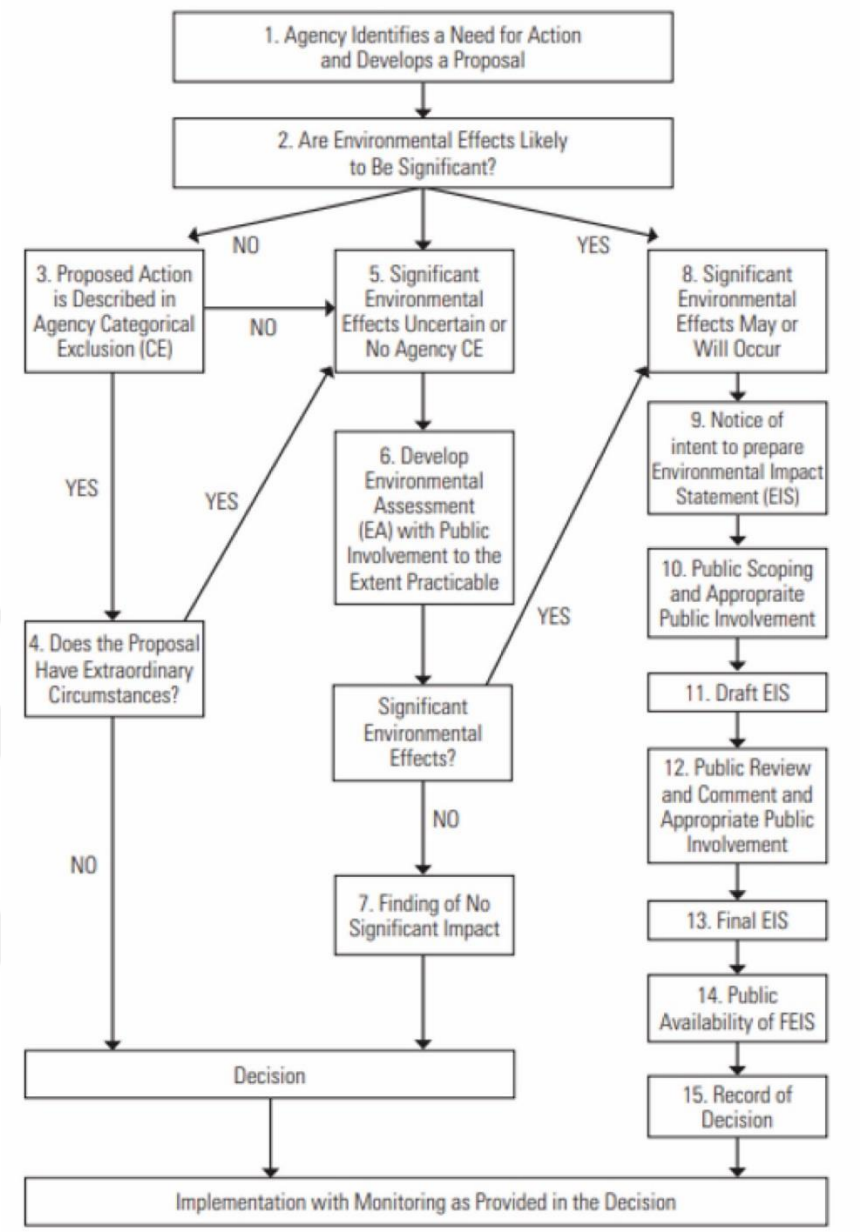


Figure 3.19: Flowchart of NEPA Procedures (Council on Environmental Quality, 2021)

This well-structured approach enables comprehensive environmental assessments, active public engagement, and adherence to NEPA regulations, thereby facilitating well-informed and equitable decision-making for megaprojects.

The initiation of the project begins with the publication of the Environmental Impact Report (EIR) and Environmental Impact Statement (EIS) (National Environmental Policy Act, n.d.). To obtain legal permits and gain social acceptance, the project needs to persuade stakeholders of its positive environmental impacts. If the project is

determined to have no significant impact, a Finding of No Significant Impact (FONSI) document is issued. Conversely, for projects identified as having significant impacts, the EIS process proceeds through public scoping, drafting, and review stages. This process culminates in the preparation of a final EIS and the issuance of a Record of Decision (ROD), which formally concludes the environmental review and allows the project to move forward (Council on Environmental Quality, 2021).

3.2.2.3 California's Distinctive Approach to Decision-Making

In a world where the sustainability approaches are prominent, interest in sustainable projects such as high-speed rail has significantly increased. California is one of the leading states in the US when it comes to sustainability (State of California, n.d.a). The state's authorities have shifted their focus to sustainable alternatives rather than highway and aviation improvements to meet the growing demand. In 2022, California officials unveiled a pioneering plan, marking the world's first initiative dedicated to achieving Net Carbon Zero Pollution goals. According to a news article, California has adopted the goal of becoming carbon neutral by 2045, with an anticipated reduction of 71% in air pollution and 85% in gas emissions (Elam, 2022).

The state of California offers a unique approach through its participatory decision-making processes and eco-rational decision-making methods, making it noteworthy. According to Cartenì (2014), eco-rational decision-making stands as an approach that elevates ecological considerations above all when making reasoned choices regarding projects. It advocates for the integration of sustainability criteria and environmental repercussions as pivotal elements within the decision-making process, rather than allowing economic viability to solely dictate project decisions. Henke et al. (2020) have significantly advanced the discussion on this topic, asserting that effective decision-making processes must integrate the eco-rational approach. They argue that this framework is essential for ensuring that economic, social, and environmental sustainability factors are decisively influential throughout the project decision-making trajectory. To illustrate, a comprehensive cost estimate was made for the entire lifecycle of CHSR, aiming to assess sustainability throughout the project's lifespan (California High-Speed Authority, 2014).

De Jong, M. (2008) considers California as one of "the strongest forms of direct democracy worldwide." California is known for its participatory and democratic decision-making, exemplified by the San Francisco Bay Area. Metropolitan Planning

Organizations (MPO) lead inclusive efforts where public and private entities collaborate to design evaluation processes tailored to the unique nature of California and its communities. Stakeholders play a crucial role in collectively determining criteria and priorities, ensuring their interests and preferences are effectively represented. Thus, the evaluation process itself is designed interactively by the individuals who will be affected by the project (De Jong, 2008). This approach not only provides an alternative to adopting the same standard tools applied uniformly across the world but also underscores the significance of democratic approaches in decision-making processes. Direct involvement of those who are affected makes the process more responsive and inclusive, improving the process's alignment with community needs and preferences. This collaborative approach improves openness, promotes trust, and eventually leads to more sustainable and well-received project results. Moreover, engaging stakeholders directly in the decision-making processes of megaprojects creates a framework to overcome challenges, making these processes more transparent and concrete (Macharis & Nijkamp, 2013).

The decision-making process in California can be illustrated through an examination of the California High Speed Rail (CHSR) project. CHSR is a mega transportation aimed at reducing travel time between San Francisco and Los Angeles to 2 hours and 40 minutes. It is expected to be the fastest train in the US, reaching speeds of 220 mph The project aims to create a new sustainable transportation alternative in the state to achieve the state's environmental goals (California High-Speed Rail Authority, 2009).

CHSR project was initiated following a democratic process. In 2008, the step towards bringing the project to life through community approval was achieved with the approval of “Safe, Reliable High-Speed Passenger Train Bond Act” which is also called Proposition 1A. The people of California voted on the decision to proceed with the high-speed rail project, and it was endorsed with a 52.62% "yes" vote. This indicates that 6,680,485 individuals expressed their confidence in the project (California Secretary of State Debra Bowen, 2008).

This approval established a legal foundation, embraced a vision, secured funding, and obtained community support for the project. Through a public vote is an indicator of community involvement in the decision-making process for a project of this scale. The community has expressed confidence in this high-speed train project by voting in favor. With the law, the authority to issue bonds for financing the project has been

granted (California High Speed Rail, 2008). Moreover, the opportunity for enhanced federal collaboration and financial support has arisen with the implementation of the "Bipartisan Infrastructure Law" in 2021. This may play a pivotal role in funding the Project (California High-Speed Rail Authority, 2022).

According to the Business Plan published in 2014, the California High-Speed Authority has committed to achieving zero greenhouse gas emissions, fully recycling steel and concrete waste, and using renewable energy to support sustainable practices (California High-Speed Rail Authority, 2014). The aggressive standards adopted by California in sustainability are evident in the state's project development approaches.

California High Speed Rail seeks to implement a sustainable initiative and simultaneously enhance social benefits by creating job opportunities and programs. It is expected that the number of jobs created in 2023 will exceed 10,000. Moreover, due to a shortage of qualified experts in High-Speed Rail in the US, a training program has been initiated with the aim of educating and integrating skilled professionals into the project (California High-Speed Rail, 2023). The Community Benefits Agreement (CBA) by the Authority ensures the commitment to the advantages the project will bring to the community. To illustrate, alongside the Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grant Award, a $24 million grant is created to improve the disadvantaged Wasco region environmentally, economically, and socially. Local solutions have also been generated in the feasibility study of the project to address social concerns. Context Sensitive Solutions (CSS) has been identified as the decision-making mechanism in the Bay Area's Peninsula. Along with this mechanism, stakeholders have assumed a more active role, expressing their concerns and suggestions about the project, and seeking solutions. In this way, stakeholders have contributed to improving the project in terms of aesthetics, safety, and environmental factors in their own regions (California High-Speed Rail Authority, 2009).

3.2.3 Türkiye: Laws, Regulations, and Standards

3.2.3.1 Environmental Impact Assessment (EIA)

NEPA approach in the US has served as the foundation for global environmental assessment practices, spreading to other countries. However, countries have revised these procedures to align with their unique characteristics. To assess the environmental impacts of development initiatives, Environmental Impact Assessment (EIA) Regulation [Çevresel Etki Değerlendirmesi Yönetmeliği (ÇED)] was enacted in 1993, drawing principles from the European Environmental Impact Assessment Directive (Ministry of Agriculture and Forestry, 2009). This regulation has seen several amendments in response to evolving global trends and advancements.

EIA Regulation sets forth the procedures and principles for assessing environmental impacts. It details the methods used, specifies which projects require evaluation, defines the scope of the assessments, establishes guidelines for evaluations, and explains the pre- and post-construction phases of projects under review. Additionally, the regulation outlines training procedures for personnel, aiming to strengthen the institutional EIA process (EIA Regulation, 2022). In Türkiye, the EIA process and the project process are considered two concurrent processes that operate in parallel as illustrated in Figure (Ministry of Agriculture and Forestry, 2009).

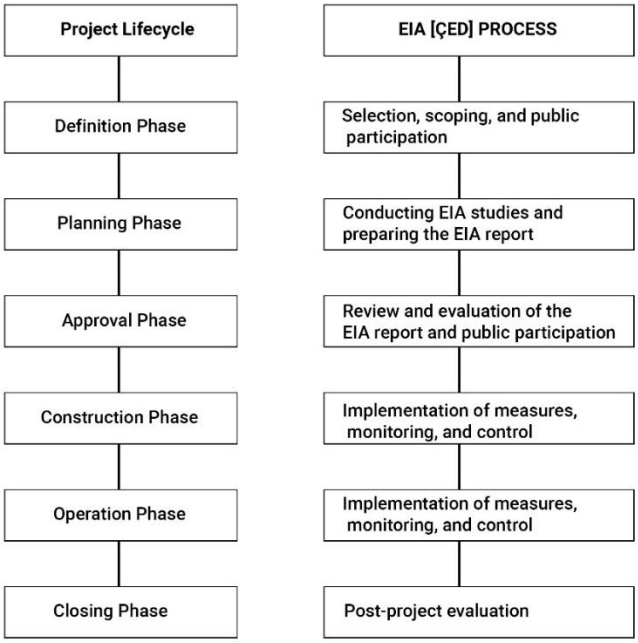


Figure 3.20 Project Lifecycle and Environmental Impact Assessment Process (Adapted from Ministry of Agriculture and Forestry, 2009)

3.2.3.2 Investment Preperation Guides

Investment decisions in Türkiye are guided by the Investment Preparation Guidelines, which are published biennially. These guidelines establish a framework for conducting feasibility studies. Due to their publication cycle, the framework and evaluation criteria may change every two years. The influence of these guidelines on Türkiye's project development process is thoroughly analyzed in Chapter 4.

3.3 Comparisons of the Laws, Regulations and Standards

Despite the variations in their regulations, the UK, the US, and Türkiye all prioritize an Environmental Impact Assessment (EIA) process at the initial stages of megaprojects, which involves evaluating and disclosing the environmental impacts to the public. Environmental decisions for projects are formulated through National Environmental Policy Act (NEPA) in the US, the Environmental Impact Assessment (EIA) in the UK, and the Environmental Impact Assessment (EIA) in Türkiye.

Regarding the scores for federalism and democracy as indicators for transport infrastructure investment, the UK scores lower, whereas the US ranks significantly higher. It is noteworthy that while the US, especially California, includes elements of direct democracy in its practices, the UK's methodology focuses on a hierarchical decision-making structure and extensive involvement of the private sector. (de Jong, 2008). This contrast in their foundational structures results in each country developing unique decision-making processes through their distinct approaches. OECD proposes the adoption of certain principles for the governance of infrastructure projects as shown in Figure 3.21.

Figure 3.21 OECD Reccommendation for Infrastructure Governance (Rivadeneira et al., 2023)

OECD has also established a set of infrastructure indicators to assess various countries and has evaluated them accordingly as indicated in Figure 3.22 (OECD, n.d.a,b,c & Rivadeneira et al., 2023).This thesis focuses on the UK, the US, and Türkiye, with the relevant evaluations compiled and adapted by the author. More detailed comparisons are available in Appendix A.

According to the findings, Türkiye exceeds the OECD average in long-term strategic vision and efficient and effective procurement. Additionally, Türkiye outperforms the UK in long-term strategic vision, although the UK demonstrates remarkable performance in efficient and effective procurement. No data is available for the US.

The UK excels in evidence-based decision-making, while Türkiye not only fails to meet these performance standards but also shows significantly lower performance compared to the average. In terms of fiscal sustainability, affordability, and value for money, both the UK and the US display high performance, whereas Türkiye performs below the OECD average. In the regulatory framework indicator, Türkiye's performance is also lower than both the OECD average and that of the UK and the US. The US shows a high level of performance in sustainability, followed by the UK. Regarding threat management, the US ranks highly, while the UK is below the OECD average (OECD, n.d.a,b,c).

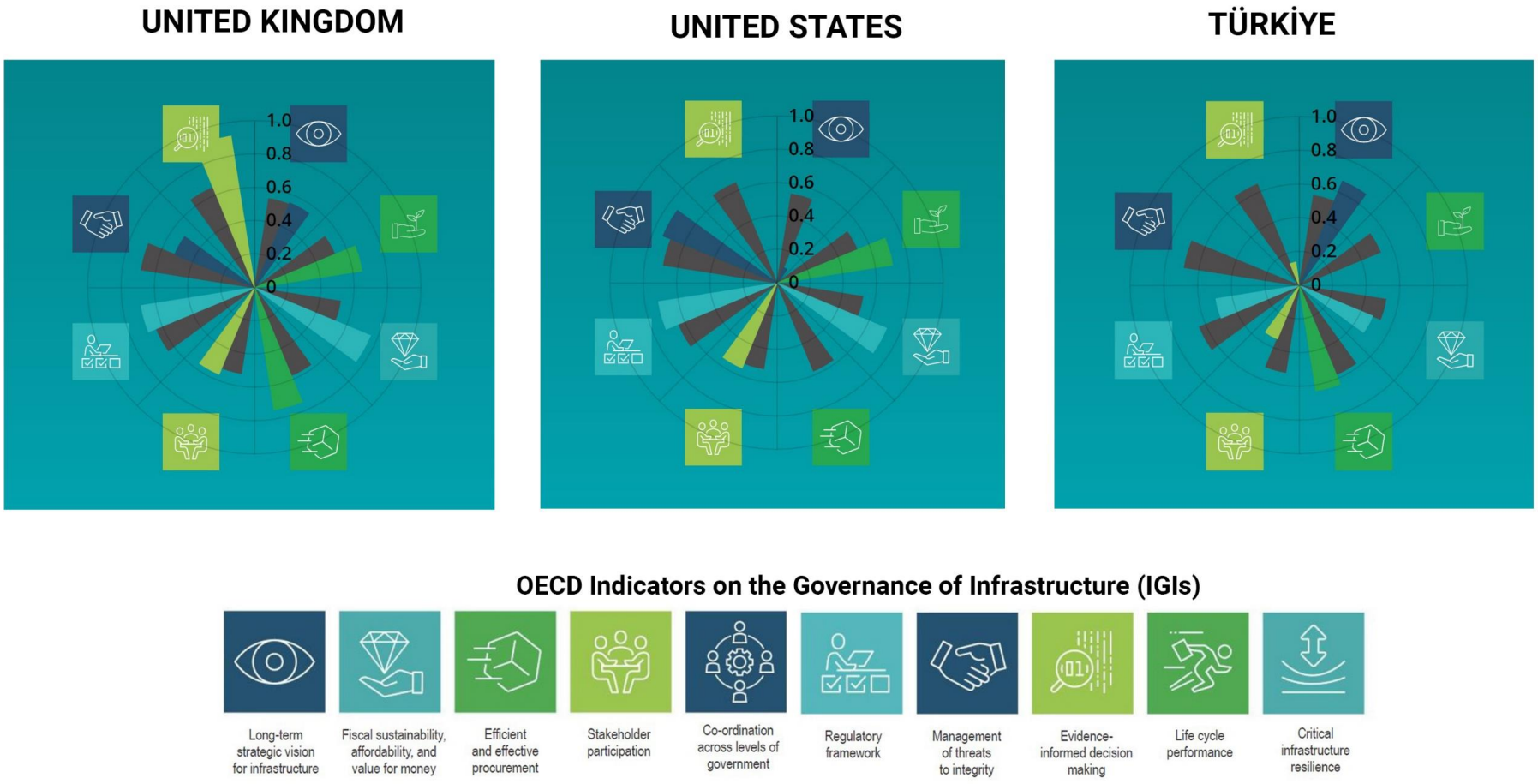


Figure 3.22 Comparision of Countries according to OECD Indicators on the Governance of Infrastructure (IGIs) (Adapted from OECD, n.d.a,b,c & Rivadeneira et al., 2023)

Moreover Figure 3.23 compiled and adapted from OECD survey data, provides a comparative analysis of infrastructure planning and management approaches between Türkiye, the UK, and the US. It illustrates key differences in their strategies, policies, and institutional frameworks. These variances encompass the presence of national cross-sectoral infrastructure plans, the duration and scope of sectoral plans, the institutions responsible for long-term infrastructure assessments, and the mechanisms for stakeholder participation and project prioritization. This visual aids in understanding the diverse approaches employed by these countries in addressing their infrastructure needs and challenges.

	Türkiye (TUR)	United Kingdom (GBR)	United States (USA)
A national cross-sectoral infrastructure plan	No	Yes	No
National sectoral infrastructure plans?	Yes	Yes	Yes
Sectoral infrastructure plans cover more than 10 years	Shorter than 10 years	Longer than 10 years	Shorter than 10 years
Primary institution responsible for assessing the country's long-term infrastructure needs	Yes, a committee at centre of government / cabinet	National Infrastructure Commission	No, each line ministry or agency carries their own assessments
National long-term vision or other national document setting strategic priorities	Yes	Yes	
Any mechanisms in place to update/revise the infrastructure vision	The vision can be revised based on political demand/economic or social need	There is a regular review process	
A short list of priority projects at the national level	Yes, within and across sectors	Yes, within and across sectors	Yes, within and across sectors
Primary institution responsible for setting the criteria to prioritise infrastructure projects	No specific entity in charge, each entity has their own prioritisation criteria	Ministry of Finance or equivalent	Ministry of Finance or equivalent
Level of participation of stakeholders during the formulation of the long-term national infrastructure plan	Platforms for open debate and consultation are enabled for citizens' participation throughout the process	Platforms for open debate and consultation are enabled for citizens' participation throughout the process	Other
Any national infrastructure commission	There is no infrastructure commission	Yes, established and operational	There is no infrastructure commission
Any national infrastructure bank	Yes, established and operational	No, but there are plans to establish a National Infrastructure Bank	No, but there are other entities with a broad scope of action that includes supporting investment in infrastructure
How is capital expenditure included in the budget preparation	Submission and consideration integrated between current and capital expenditure	Separate submission and decision process for current and capital expenditure budgets	Submission and consideration integrated between current and capital expenditure

Figure 3.23 Comparision of the Countries (Adapted from OECD Survey on the Governance of Infrastructure, 2020; OECD Survey on the Governance of Infrastructure, 2022)

How is capital expenditure included in the budget preparation	Submission and consideration integrated between current and capital expenditure	Separate submission and decision process for current and capital expenditure budgets	Submission and consideration integrated between current and capital expenditure
How are multi-year infrastructure projects bud geted for?	The budget requests funding incrementally each year until the project is completed	The budget requests funding incrementally each year until the project is completed	The budget requests funding for the entire cost of multi-year project up-front
Is there a formal process to evaluate value for money in infrastructure projects?	All PPP projects and the other projects above a certain threshold	For all projects	
Infrastructure projects subject to an independent and impartial expert assessment	Projects are not subject to an independent and impartial expert assessment	Projects above a certain threshold	Projects are not subject to an independent and impartial expert assessment
Methodologies used to assess PPP infrastructure projects	CBA, MCA, Cash Flow Analysis, Business Case methodology, Public sector comparators	CBA, MCA, Business Case methodology, Central Guideleness, Cost effectiveness Analysis	CBA, MCA, Cash Flow Analysis Business Case methodology, Central Guideleness, Public sector comparators, Public Interesr Tests, Cost effectiveness Analysis
Methodologies used to assess other infrastructure projects	CBA, Cash Flow Estimates, Cost Effectiveness	CBA, MCA, Business Case Methodology, Central Guidelines, Cost Effectiveness	CBA, MCA, Cash Flow Analysis Business Case methodology, Central Guideleness, Public sector comparators, Public Interest Tests, Cost effectiveness Analysis
Is it mandatory to undertake risk management of risks associated to the public procurement of infrastructure projects?	No	Yes	Yes

Figure 3.23 (continue) Comparision of the Countries (Adapted from OECD Survey on the Governance of Infrastructure, 2020; OECD Survey on the Governance of Infrastructure, 2022)

Are risk management activities covering the entire infrastructure procurement life cycle?	No	Yes	Yes
Is there national guidance on stakeholder participation? Is the guidance specific to infrastructure?	General guidance on stakeholder participation, but it is not specific to infrastructure	General guidance on stakeholder participation, but it is not specific to infrastructure	General guidance on stakeholder participation, but it is not specific to infrastructure
Is the implementation of the stakeholder participation guidance mandatory?	Yes, in certain sectors or for certain projects	Yes, in certain sectors or for certain projects	Yes, in certain sectors or for certain projects
Is there monitoring, evaluation and regular public reporting on the implementation of the stakeholder participation guidance?	Implementation is monitored and evaluated, but there is no public reporting	No	No
Are there guidelines, policies or tools to support the implementation of the stakeholder participation guidance?	No	Yes	Yes
Is stakeholder participation open to individual citizens and does it implement participation models that enable individual citizens to meaningfully engage?	Stakeholder participation is not open to individual citizens	Stakeholder participation is always open to individual citizens	Stakeholder participation is always open to individual citizens
Is there a government-wide digital platform to provide information on infrastructure projects?	No	Yes	Yes
Are stakeholders informed on how and why their input has been considered in the permitting procedure?	No	Yes	Yes

Figure 3. 23 (continue) Comparision of the Countries (Adapted from OECD Survey on the Governance of Infrastructure, 2020; OECD Survey on the Governance of Infrastructure, 2022)

4. A DECISION-MAKING APPROACH PROPOSAL FOR TÜRKİYE

4.1 Current Model

Regulations governing decision-making procedures for large-scale projects in Türkiye lack precision, and there is an absence of defined procedures for evaluating megaprojects within Turkish laws, rules, and guidelines. As a result, the decision-making approaches used for large-scale projects in Türkiye differ from one another. It might be more difficult to adjust to the unique challenges encountered by megaprojects if the assessment procedures are the same as for small-scale initiatives.

Türkiye is actively formulating both national macro-level policies and strategies as well as delineating specific objectives and approaches on a global scale, thereby shaping a defined vision for future projects. To illustrate, World Bank Group's Country Climate and Development Report (2022) highlights Türkiye's dedication to combating climate change. This commitment was underscored by its ratification of the Paris Agreement in 2021, where Türkiye promised to achieve net zero emissions by the year 2053. Additionally, efforts are being made to incorporate the global vision into Türkiye's development plans. Up to $146 billion in economic benefits are anticipated from meeting climate objectives between 2022 and 2040, but realizing objectives will demand significant expenditures from the public and private sectors (World Bank Group, 2022).

Turkey distinguishes itself through its proactive identification of strategic priorities and formulation of macro policies. Various national plans, including Development Plan, Medium-Term Program, Presidential Annual Program, as well as sectoral and regional strategies, all contribute to outlining Türkiye's vision and future objectives. These broad policies provide a snapshot of Türkiye's strategy, of which major projects are integral components.

Development Plan outlines the nation's five-year strategic direction and overarching vision. The formulation of the 12th Development Plan 2024-2028 was a collaborative effort with the coordination of Presidency of Strategy and Budget, engaging ministries, governmental agencies, and public representatives via a series of meetings, workshops, and questionnaires. Following this participatory process, Development Plan received approval from the Grand National Assembly of Türkiye and has been officially published. Future macro-level strategies will build upon the foundation laid by this plan. Additionally, the 12th Development Plan outlines the Strategies for Long-Term Development covering the years 2024-2053 (Presidency of Strategy and Budget, 2024). Furthermore, the Ministry of Treasury and Finance, in conjunction with the Presidency of Strategy and Budget, annually prepares the Medium-Term Program with a three-year outlook, formalized by the President's Decision (Presidency of Strategy and Budget, 2023a).

In Türkiye, significant guidelines govern the development of macroeconomic policies and the execution of public investments. According to Durdag (2021), Türkiye has the capacity and legislation to carry out a sound public investment program, but its implementation, particularly in PPP megaprojects, is debatable. Both short- and long-term objectives are set by macroeconomic policies such as development plan and medium-term plans.

Strategic Environmental Assessment (SEA) is integrated into these policies, plans and programs in Türkiye. According to Strategic Environmental Assessment (SEA) Regulation, SEA defines an environmental evaluation process aimed at integrating environmental principles into plans, programs, and policies from the early stages to reduce negative outcomes and enhance positive benefits. It emphasizes a participatory approach and assists decision-makers. Moreover, a project in the Environmental Impact Assessment (EIA) process considers the Strategic Environmental Assessment (SEA) report if available. (Republic of Türkiye Ministry of Environment, Urbanization and Climate Change, 2017).

Additionally, the regulation includes the procedural steps of the SEA process. This involves the formulation of a public participation strategy, engagement of various institutions, organizations, and professionals through consultation meetings, preparation of a draft report, solicitation of feedback on the decision, and ultimately the preparation of a final report. The report is evaluated by the Ministry in terms of

adequacy for decision-making. Once quality control is completed by the Ministry, the report is published as final.

Guidelines for preparing investment programs serve as a roadmap for assessing and incorporating projects into the investment plan. These guidelines detail aspects such as the criteria for evaluation, the methodologies for analysis, the steps necessary for a project's admission into the investment schedule, the stakeholders involved, and the documents required. Figure 4.1 displays the fundamental policies in Türkiye that impact the investment development process.

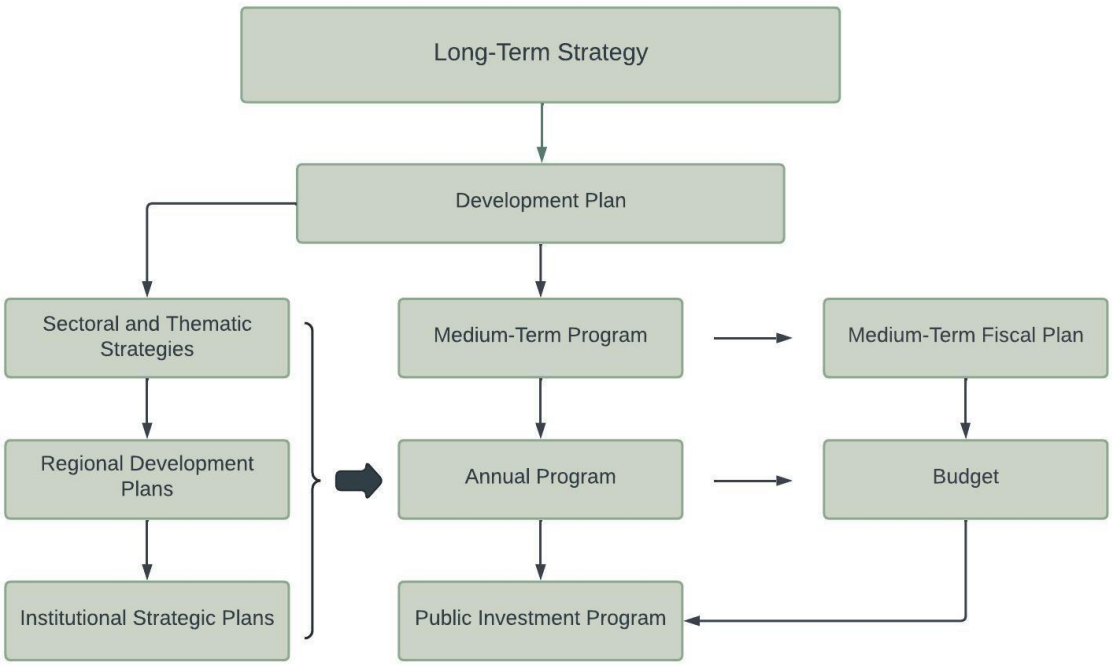


Figure 4.1: Flowchart of the basic policies in Türkiye (Adapted from Republic of Türkiye Ministry of Development, 2018)

According to 2024-2026 Investment Program Preparation Guide, projects that do not fall under the category of information and communication technology and have a budget exceeding 50 million Turkish Liras must undergo a feasibility study. This study should include a Cost-Benefit Analysis (CBA) or Cost-Effectiveness Analysis (CEA) to assess the project’s priority, its commercial, financial, economic, and social feasibility, as well as its environmental impact, and must be uploaded to the KaYa Public Investment Information System (Presidency of Strategy and Budget, 2023b). Due to the lack of open access, KaYa information system falls short in providing transparency, which prevents general public from accessing project feasibility reports.

The criteria for assessing and choosing projects for investment and inclusion in the investment program are then outlined in the Investment Program Preparation Guide, the most recent version of which is 2024–2026. According to Circular on the Implementation and Monitoring of In-Year Transactions of the 2024 Investment Program, projects within the investment program will be managed in a coordinated manner, aligning them with macroeconomic policies, industry strategies and programs, as well as corporate strategic plans (Presidency of Strategy and Budget, 2024a).

As outlined in the 2024-2026 Investment Program Preparation Guide, proposals and decisions regarding public investments will rely on analyzing needs, problems, and solutions through sectoral and regional strategies, incorporating action plans and validated feasibility studies (Presidency of Strategy and Budget, 2023b). The project development process begins with the establishment of macro-policies and strategic directions, followed by the formulation of an investment manual that aligns with development agendas, medium-term plans, and annual objectives and strategies. Subsequently, the project concept is refined for inclusion in the investment manual.

After the project concept is established, an initial feasibility study is undertaken to assess its compatibility with overarching macro-policies. Pre-feasibility process is followed by a comprehensive feasibility analysis, the outcomes of which are uploaded into the KaYa information system. Concurrently, the project's design and planning stages are detailed, incorporating an evaluation of EIA process. According to EIA Regulation, EIA is a process that analyzes the environmental effects of proposed projects, examines mitigation methods, assesses alternatives in terms of location and technology, and monitors and controls project implementation (Republic of Türkiye Ministry of Environment, Urbanization and Climate Change, 2022).

EIA is a collaborative procedure aimed at identifying the environmental consequences of ititiatives. Instead of functioning as an independent decision-making mechanism, it acts as a supportive tool, progressing in parallel with the decision-making process (CED nedir?, n.d.). The regulation on Environmental Impact Assessment outlines the setting under which projects may be included in the investment program. Accordingly, for a project to acquire incentives, approvals, permits, and licenses, as well as for investment to begin and the project to be bid, a decision of "No Environmental Impact Assessment (EIA) required" or "Positive EIA" must be obtained. However,

applications for these processes can still be submitted (Republic of Türkiye Ministry of Environment, Urbanization and Climate Change, 2022).

If the EIA yields a positive result, the project is then added to the investment program. Decisions regarding the inclusion, modification, or removal of projects from the Investment Program are presented for the President's approval by the Presidency of Strategy and Budget, following the consultation with the Ministry of Treasury and Finance (Presidency of Strategy and Budget, 2024a). Presidency of the Republic of Türkiye Investment Office published a report in 2023 titled "Investing in Infrastructure & PPP Projects in Türkiye," which includes a diagram illustrating the selection process for bankable projects (Figure 4.2).

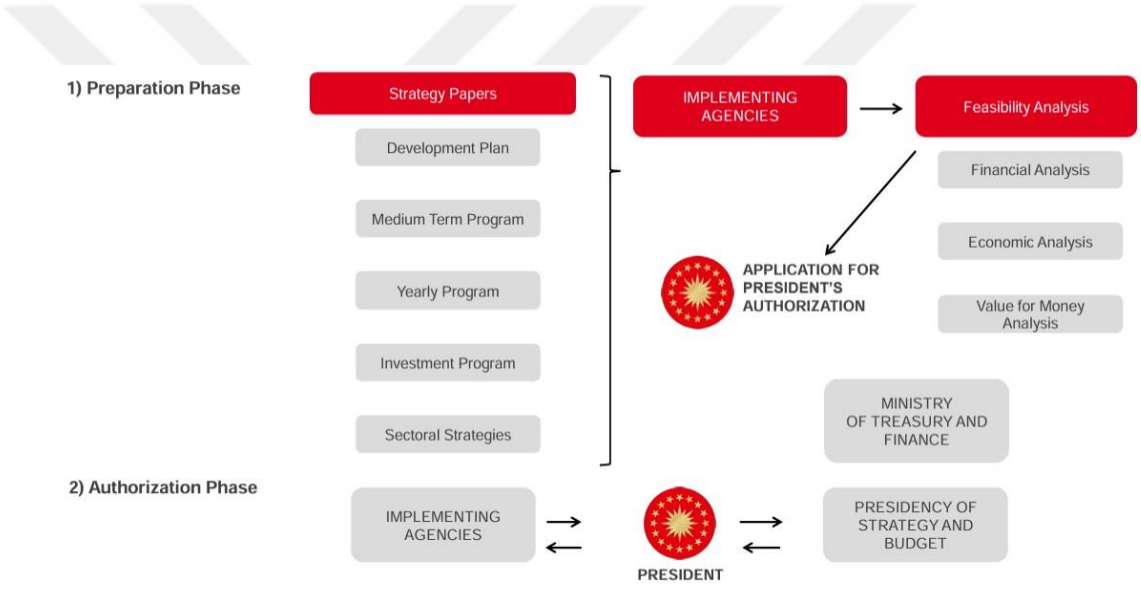


Figure 4.2 Selection process for bankable projects (Presidency of the Republic of Türkiye Investment Office, 2023)

Proposed projects for the investment program need to be uploaded, together with a written rationale, to the "KaYa" Public Investments Information System. A feasibility study that incorporates CBA or CEA must be completed before submitting a project proposal. While CBA is the most desirable, CEA may be used when costs and benefits are not monetized or quantified. Additionally, a Multi-Criteria Analysis may be considered optionally. Furthermore, either no Environmental Impact Assessment (EIA) is required or a positive EIA conclusion is necessary. The investment program includes projects that meet these requirements (Presidency of Strategy and Budget, 2023b).

This entire process is managed using the KaYa online information system; however, this system is not accessible to the public. If the feasibility studies become outdated or are deemed insufficient for inclusion in the investment program, they must be updated. According to the Circular on Implementation and Monitoring of In-Year Transactions of the 2024 Investment Program, a project must be listed in the investment schedule and meet the specified criteria in order to be put out to tender and for expenditures to be authorized (Presidency of Strategy and Budget, 2024a).

The Environmental Impact Assessment (EIA) process, while not a direct component of the feasibility process, runs parallel to it (Ministry of Agriculture and Forestry, 2009), which can lead to significant challenges during the assessment phase. In this context, the advancement of some projects before the completion of EIA process may lead to oppositions about the role of EIA in decision-making processes. Ulusoy (2019) suggests that EIA typically commences following the feasibility phase, leading to prolonged project execution timelines. Therefore, it is advocated that starting these assessments early on, during the initial, pre-feasibility, and feasibility phases, a practice embraced by global institutions, is essential for achieving a harmonious blend of environmental and economic concerns while also mitigating delays.

Projects may bypass the standard route, starting from macro policies to the inclusion in investment programs and feasibility assessments, emerging instead independently. It is possible to propose megaprojects without regard to macro and strategic planning, even if they have significant effects and demand significant funding. To illustrate, Istanbul Planning Agency (2021) argues that Canal Istanbul Project shows deficiencies in terms of compliance with higher policy documents and fails to meet the basic principles of need, problem, and solution, which are essential for public investment projects. Furthermore, it is considered not to have economic feasibility and does not meet the conditions for inclusion in the investment program. Despite this, there is a persistent emphasis on the project, even at the level of discourse (Istanbul Planning Agency, 2021).

The government's hands-on management and decision-making processes for the Istanbul’s Grand Airport project have effectively reduced uncertainties, risks, and complexity. But this shift has also reduced the power of important players, including the Istanbul Metropolitan Municipality, created a lack of transparency, and weakened public participation (Eren, 2019). In other words, limited public involvement in mega

project processes can lower risks but weaken public acceptance; extensive public involvement might lengthen processes, complicate legal matters, and raise uncertainties. Thus, balancing public participation with a structured approach in decision-making is crucial. The International Monetary Fund (IMF) report evaluates Türkiye's fiscal transparency, and according to the IMF's Fiscal Transparency Code (FTC) standards, the reliability of Türkiye's annual financial reports evaluated by independent organizations is found to be at a "basic" level. Additionally, it is noted that standards related to public participation in budget processes and the independent evaluation of these processes are "not met." The report further reveals that although CBA are conducted on all major projects and contracts are awarded through competitive, transparent bids, these analyses are not publicly disclosed (International Monetary Fund, 2017). As a result, there is a notable lack of transparency in Türkiye's megaproject feasibility assessments and their outcomes.

The flowchart shown in Figure 4.3 shows the decision-making process for megaprojects in Türkiye. Due to the lack of a specific guide or precise decision framework for megaprojects or major investment projects, this diagram was created by the author in accordance with the megaproject decision-making practices as described in public institution regulations, directives, and media reports.

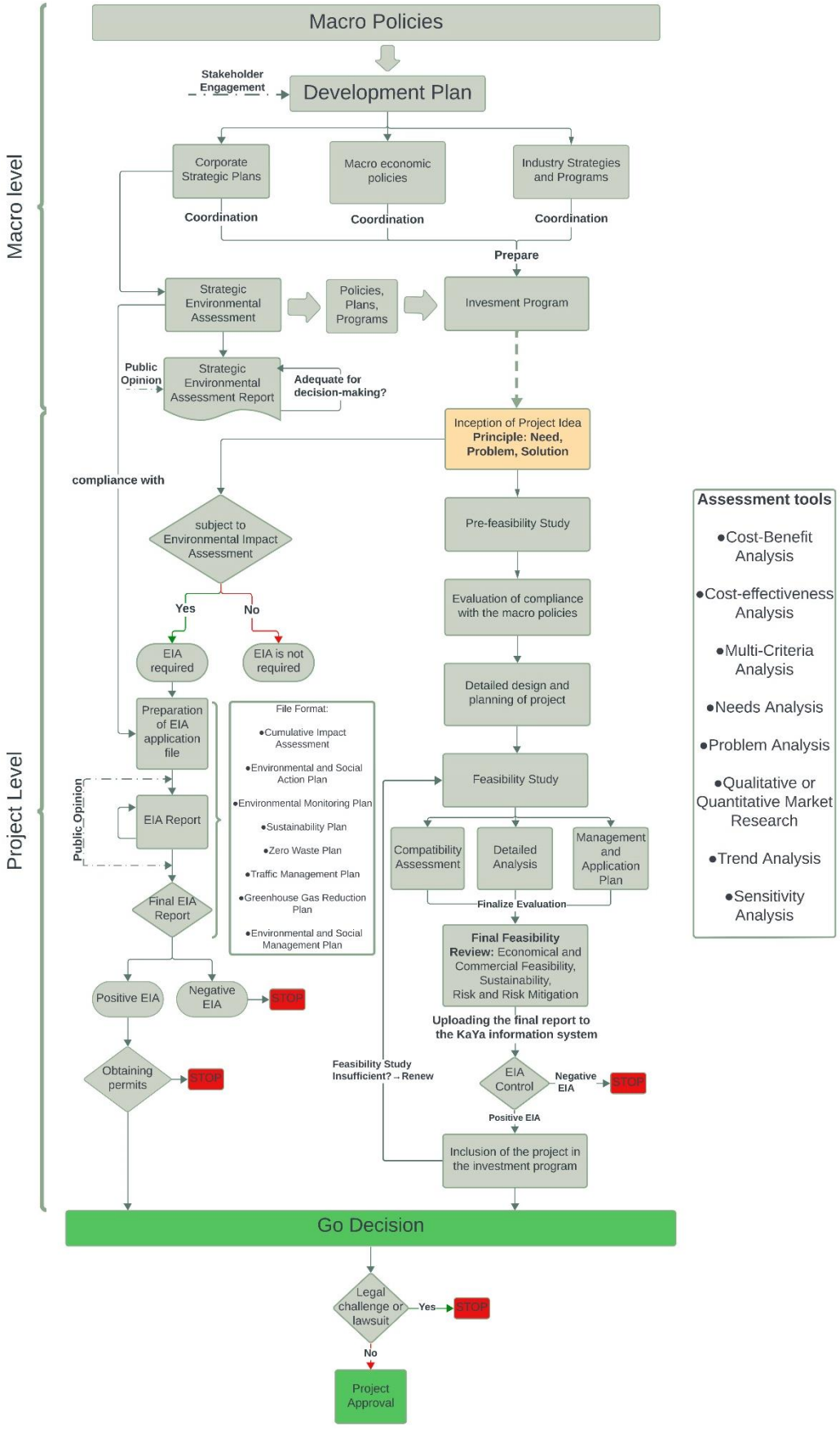


Figure 4.3 Decision-Making Process of Megaproject for Türkiye

According to the 2024-2026 Investment Program Preparation Guide, the elements of the project's feasibility study is shown in the diagram created by the author (Figure 4.4).

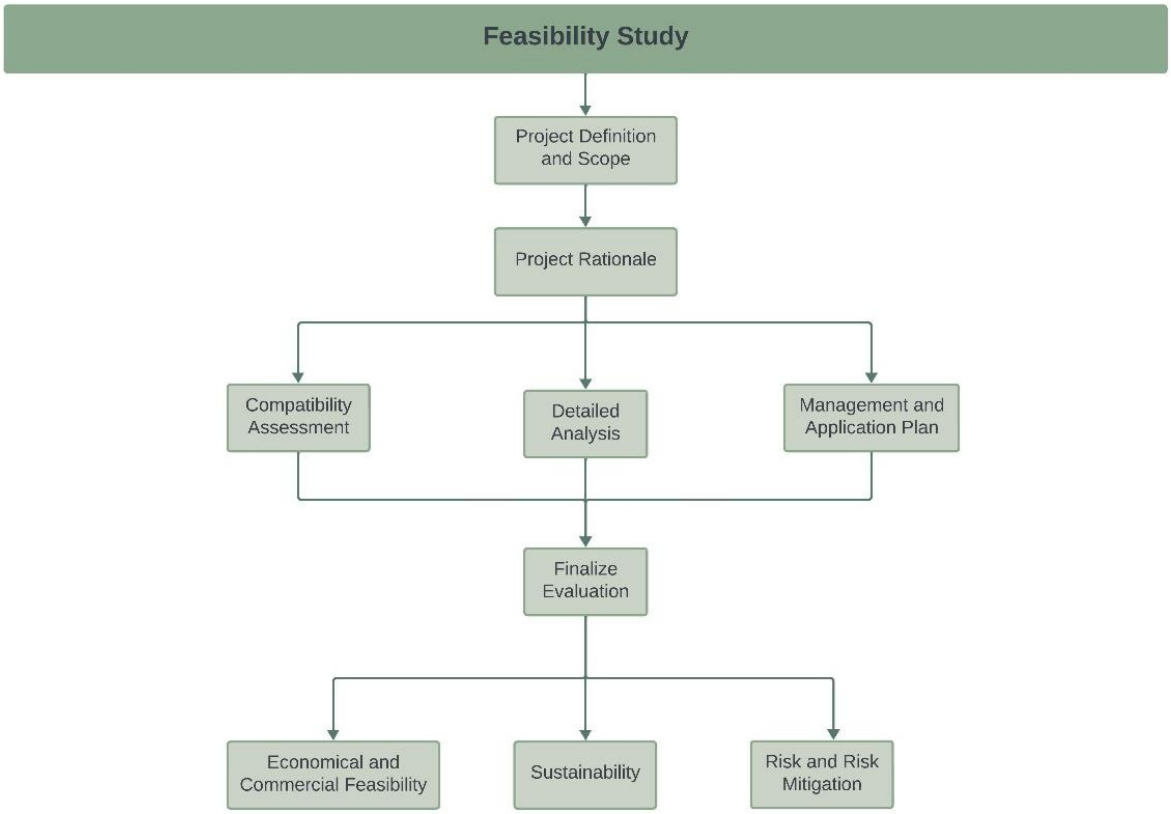


Figure 4.4 Flowchart of Feasibility Study in Türkiye

The steps involved in the feasibility studies can be outlined as follows: establishing the project identity card with project's definition and scope, presenting the rationale behind the project, evaluating its alignment with macro policies and legal procedures, conducting thorough analysis studies, and devising a management and implementation strategy. The Management and Application plan process involves evaluating the technical capabilities of implementing organizations, establishing a project management and organizational plan, defining project timelines and identifying critical activities, and outlining the project implementation strategy (Presidency of Strategy and Budget, 2023b).

The detailed analysis phase of the feasibility study encompasses assessments of alternatives, site selection, and evaluations of technical, financial, economic, environmental, and social feasibility, as well as demand and risk analysis. During the

evaluation of alternatives, at least four options are appraised. The base alternative, representing the no-project scenario, along with minimal intervention and two project alternatives, will be considered, and the most favorable alternative will be selected. The preferred alternative needs to demonstrate benefits in terms of financial, economic, and social aspects. Proposals for public need to align with strategic plans and be economically viable. The economic analysis determines whether the project contributes to national welfare. Additionally, projects funded by EU sources are required to have a feasibility report prepared in accordance with EU standards (Presidency of Strategy and Budget, 2023b).

Moreover, this guide also specifies that project evaluations will employ CBA. In cases where data cannot be quantified or valued in monetary terms, CEA will be applied. For assessing qualitative impacts, the use of MCA is optional but beneficial. During the environmental assessment, mitigation strategies will be determined and any monetizable data regarding environmental effects and mitigation actions will be assessed in CBA. Figure 5.5 presents a flowchart created by the author, detailing the required elements of a feasibility study for proposing a project to the investment program, as outlined in the 2024-2026 Investment Program Preparation Guide.

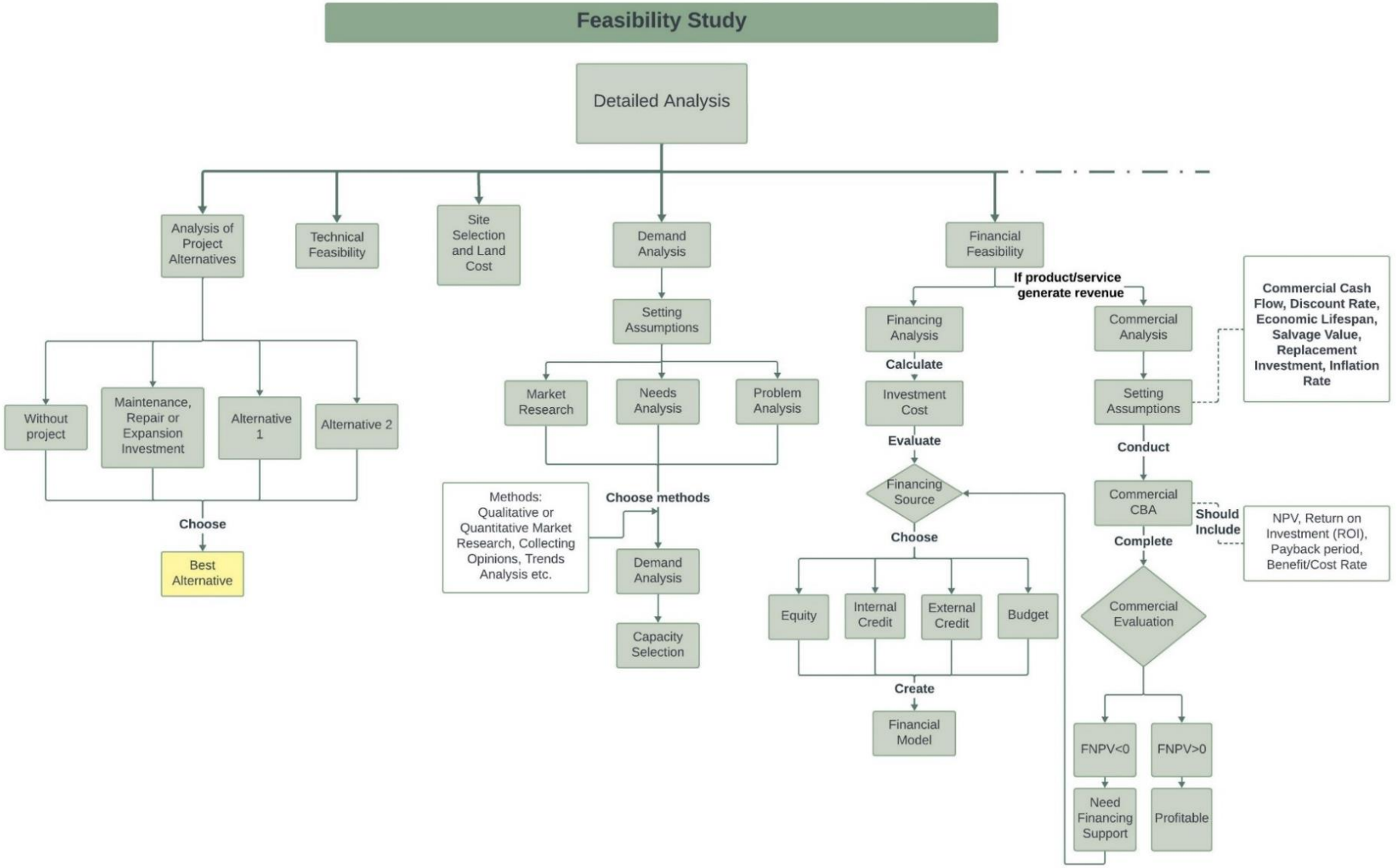


Figure 5.5 Detail Flowchart of Feasibility Study in Türkiye

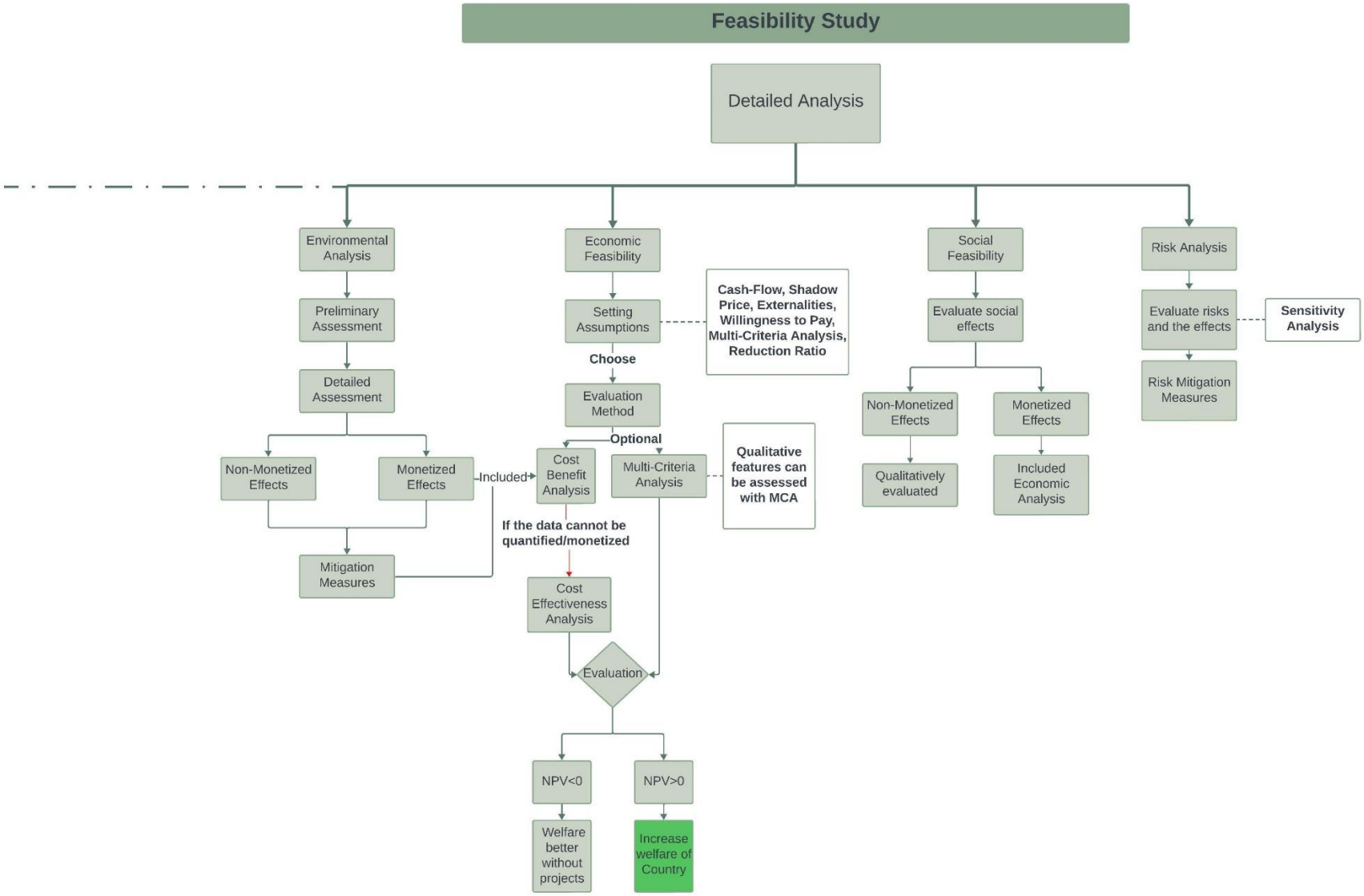


Figure 5.5 (Continue) Detail Flowchart of Feasibility Study in Türkiye

5.2 Deficiencies in Decision-making Process

After reviewing various guides, regulations, and literature, the author has identified several deficiencies and areas for improvement within the current framework for managing megaprojects in Türkiye. In summary, the decision-making processes for managing and executing large-scale projects exhibit significant shortcomings that undermine their effectiveness and efficiency. These deficiencies not only impact the overall success of the projects but also affect the alignment with broader strategic objectives, potentially leading to suboptimal outcomes.

The primary issues include the absence of a precise definition for megaprojects and a lack of a suitable decision-making framework that accommodates their unique, complex, and challenging nature. Moreover, lack of transparency in decision-making and feasibility assessments poses a significant challenge. This lack of transparency hinders public access to project information, posing a significant challenge. Despite the presence of robust macro policies and strategic plans, projects often bypass these frameworks through alternative approaches, compromising the integrity of the process.

Additionally, there are issues with project prioritization within the decision-making process. The absence of "control gates" permits projects that are not well-aligned with strategic policies or that are deemed inadequate in preliminary feasibility studies to advance to the planning phase. Furthermore, projects are not subject to limited time constraints, leading to prolonged periods between their initiation and completion.

Furthermore, there is a lack of a systematic and holistic stakeholder participation and management system. This deficiency in stakeholder engagement and public inclusion highlights the failure to implement participatory processes effectively. The practice of bypassing the determination of the necessity for Environmental Impact Assessments (EIA), given the expected significant environmental impacts of large-scale projects, is flawed. Limited involvement of independent entities can reduce the effectiveness of project scrutiny and governance. The strategic policies employed at the outset of are criticized for their discontinuity and lack of comprehensive evaluation throughout the project development process.

Although there are guidelines for integrating projects into investment programs, their application is insufficient. Risk assessments during the feasibility stage lack a strategic

perspective throughout the project's lifecycle, highlighting the absence of a comprehensive Risk Management Strategy. The involvement of the private sector, necessitating the protection of trade secrets, limits public access to project details. Furthermore, the absence of independent bodies to review feasibility studies or the EIA process is an important issue. The centralized nature of the process introduces a risk of irrational evaluation due to political motives and the overlap of roles between decision-makers and project developers. Table 5.1 outlines the key deficiencies in the decision-making processes for megaprojects.

Table 5.1 Key Deficiencies of Megaproject Decision-Making in Türkiye

Deficiencies
Lack of Megaproject Definition and Guide
Lack of Transparency
Problems regarding the prioritization of project
Absence of Stop and Control Gate
Lack of Time Limits for Pre-development Phase
Lack of a Systematic Stakeholder Management System
Bypass of EIA and Lack of Independent Organization of Controlling EIA Process
The need for Independent control and audit entities
Deficiencies in Strategic Evaluation of Projects
Deficiencies in an Integrated Risk Management

4.3 A model Proposal for Decision-Making Process of Megaprojects in Türkiye

Megaprojects play a critical role in achieving Türkiye's development goals and strengthening its position in the global economy. However, Türkiye lacks a well-established decision-making procedure suited to the complex nature of these projects. In this context, this section proposes an innovative model aimed at improving the decision-making processes for megaprojects in Türkiye. It addresses the strengths and weaknesses of the existing system, thoroughly examines theoretical frameworks, and analyzes the legislation and practices of other countries to offer a roadmap for developing an effective, sustainable, and participatory decision-making mechanism tailored to Türkiye.

This proposal is built upon an extensive literature review and the analysis of international examples. With this model proposal, the decision-making processes for megaprojects in Türkiye are structured to embody systematic, sustainable, participatory, reliable, and transparent characteristics, thereby establishing a comprehensive framework. The model aims to systematically improve the planning and implementation processes of large-scale projects in Türkiye by providing a comprehensive and multi-layered review throughout the entire lifecycle of megaprojects. Each step builds upon the solid foundations of the previous one, creating an integrated framework essential for the successful execution of projects. The objective is to methodically identify and address existing shortcomings, ensuring a more robust and effective framework for managing and executing megaprojects.

The primary focus should be on implementing Megaproject Reform, which involves defining megaprojects, establishing criteria, and creating a guide for decision-making processes. Legislation should ensure that megaprojects align with macro policies, and a clear planning guide should be enforced to prevent projects from proceeding independently. During the macro policy development phase, the country's priorities should guide mega project selection.

Unlike the current model, early financial assessments could be integrated into macro policies using methods like the Reference Class Forecasting method employed in the UK. Additionally, it is critical to create institutional frameworks and develop specialists in guiding megaprojects, similar to the UK's Planning Inspectorates. Segmenting these procedures into key phases and establishing time limitations, akin to the UK's NSIP Process, is recommended to abbreviate lengthy decision-making processes.

These stages include Policy Formulation and Statement, Strategic Planning and Pre-Feasibility, Detailed Design and Feasibility, Project Pipeline, Parliament Approval, Legal Challenges, and Post-Decision Process; which have been adapted from megaproject approaches in various global contexts, particularly from the NSIP process in the UK. The duration of these stages should be determined by experts during the National Policy Statement process. The timeframe of each stage should be determined during the National Policy Statement process by experts. Additionally, stakeholder engagement and risk management should be comprehensively addressed, and management strategies specific to the project should be determined.

Through this comprehensive approach, laying the foundations for societal acceptance by ensuring public involvement in projects from the policy stage onwards can be achieved. Stakeholder engagement and risk management must be carefully planned from the outset and seamlessly integrated across all project phases to ensure transparency. Furthermore, there should be an openly accessible information system, enabling public to easily retrieve project-related information. In this framework, "go/no-go" decision points are crucial. These critical junctures determine whether projects proceed, undergo revisions, or are terminated. This approach enhances Türkiye's performance and sustainability in megaprojects by effectively addressing their strategic, economic, and environmental impacts.

Furthermore, enacting incentive laws and securing financing tailored to infrastructure project requirements, similar to the Bipartisan Infrastructure Law in the US, is essential to improve the quality of infrastructure investments in Türkiye. Integrating feasibility studies into macro policies allows for assessing policy feasibility and budget allocation before project inception. The implementation of incentive laws can facilitate the development of more sustainable megaprojects. Furthermore, independent experts should be involved in monitoring and overseeing the project, enhancing the reliability of the process. Figure 4.6 shows the proposed decision-making approach for megaprojects in Türkiye. The proposal outlines a systematic and rational approach to decision-making for complex megaprojects, equipping decision-makers with the necessary analytical tools and conceptual frameworks to enable well-informed choices.

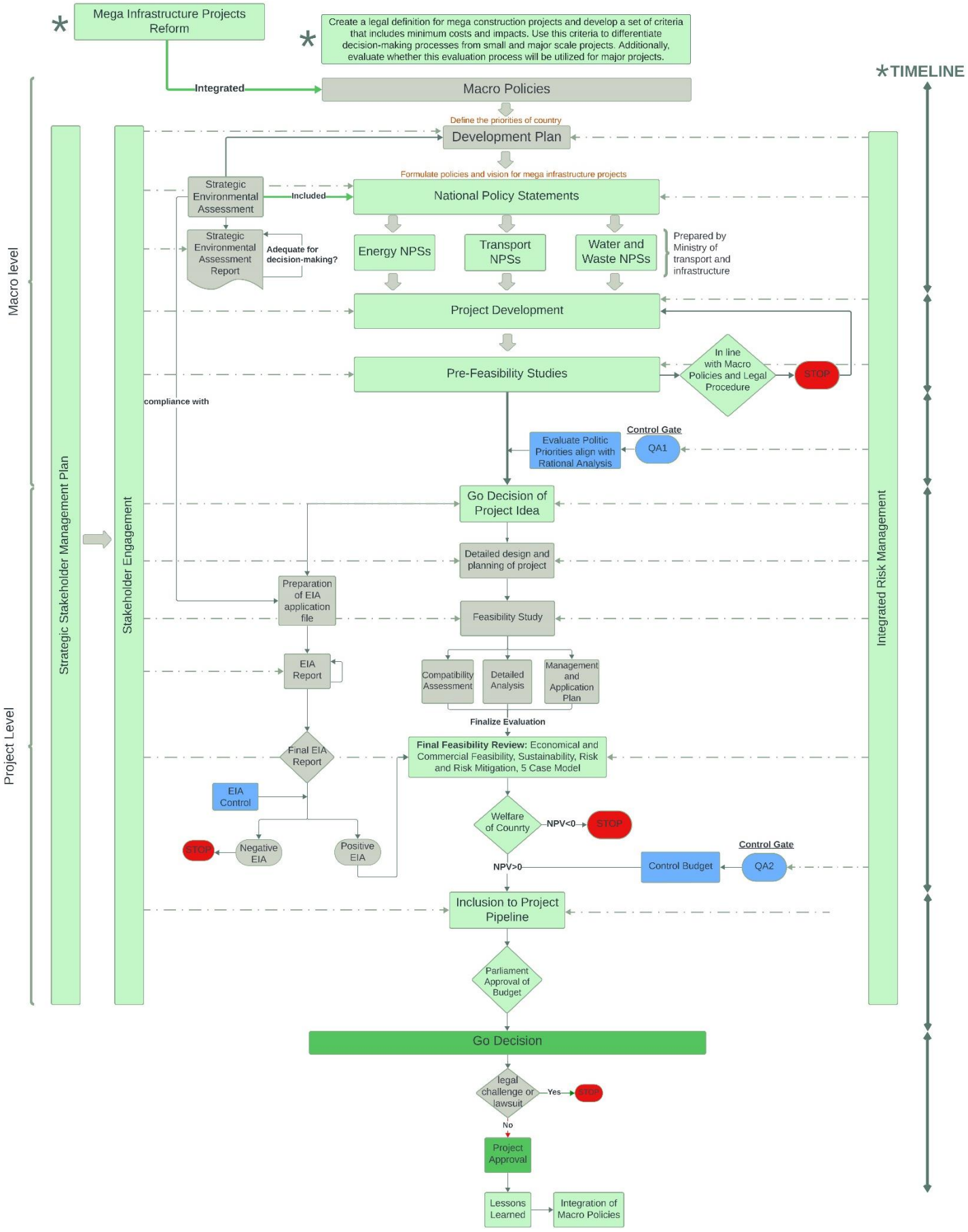


Figure 4.6 A Model Proposal for Türkiye

Policy formulation and statement

This phase begins with reforms aimed at establishing a clear definition and set of criteria for megaprojects, fundamentally transforming how decisions are made regarding these projects. This reform is integrated with macro policies within the framework of a broad vision. The decision-making process starts with the formulation of macro policies designed to shape a comprehensive vision, which then guides the development of Development Plans, as is currently practiced, and identifies the priorities of the nation.

In Türkiye, overarching macro policies provide a framework that spanning economic, political, technological, and social realms, crafting a broad strategic outlook. However, when it comes to the specific realm of developing and evaluating megaprojects, t these policies often fall short. This proposal suggests that Türkiye could benefit from adopting certain aspects of the "National Significant Infrastructure Projects (NSIP) Reform" practiced in the UK. National Policy Statements in the UK are policy declarations produced by the government, containing specific government objectives and guidelines for nationally significant infrastructure projects, and establish a framework for sector-specific project development and decision-making processes (Nationally Significant Infrastructure Projects, n.d.). Reflecting these priorities, national policies in transportation, energy, water, and waste management are developed by the Ministry of Transportation and Infrastructure, culminating in the issuance of National Policy Statements.

National Policy Statements provide a framework for evaluating the viability and benefits of projects while determining their direction and scope of infrastructure projects, and these statements are enriched through public participation. Alongside the National Policy Statements process, Türkiye's megaproject priorities will be clearly defined, and specific targets, guidelines, and sector-based decision-making and evaluation mechanisms for megaprojects will be developed. Additionally, this policy statement will incorporate a strategic environmental assessment process to comprehensively examine the potential environmental impacts of megaprojects.

Strategic planning and pre-feasibility

Aligned with macro policy developments, Megaproject Reform establishes specific objectives, guidelines, and decision-making frameworks customized for each sector. This framework streamlines the assessment of potential environmental impacts through a strategic evaluation process, fostering a more strategic approach to planning. Following the release of National Policy Statements, the project development process begins, and projects are subjected to a pre-feasibility assessment. At this stage, projects are subjected to a compatibility check with macro policies to filter out those that do not align, allowing the remaining projects to advance for a comprehensive evaluation.

This stage serves as a critical point in the decision-making process; for approved projects, a go decision is issued. This "go decision" then controlled through a control gate based on Norway's "Quality At Entry" principles, evaluating projects in terms of their alignment with the country's political priorities and the rationality of their analyses. This is a first control gate, and independent professionals evaluate whether the project assessments reflect the realities, ensuring the political and analytical consistency of the projects.

Detailed design and feasibility

Following approval, the project advances to the detailed design and planning stage, concurrently initiating the Environmental Impact Assessment (EIA) process. The evaluation of whether a project is subject to EIA should be eliminated; instead, EIA should be mandatory for mega infrastructure projects. For example, the Ministry of Environment and Forestry determined during the planning process in 2007 that an EIA was not required for the Eurasia Tunnel project, even though it falls under the category of projects subject to environmental impact assessment under the directives of the European Union and credit institutions (Sahin, 2015).

After the completion of detailed design and planning, the project's feasibility is evaluated, integrating economic, environmental, and social considerations to scrutinize the project's strategic fit. Adopting evaluation principles from the US and the UK models for feasibility assessments ensures comprehensive planning throughout the project stages. For instance, embracing the UK's "5 Cases Models" allows for a thorough analysis of the project, strengthening its strategic base. Feasibility studies

should broaden their approach by incorporating the UK's featured Reference Class Forecasting approach, alongside established tools such as CBA, MCA, and CEA.

Furthermore, this model integrates the cost estimating principles outlined in the US Federal Highway Administration's Major Project Program Cost Estimating Guidance (2007), which include: "Year of Expenditure Dollars, Project Delivery Phase Transitions, Risk and Uncertainty, Validation of Estimates, Revalidation of Estimates, Release of Estimates and Estimating Information, and Quality Assurance/Quality Control". Based on the principles described, cost estimates are determined for the year of expenditure, and it is necessary to specify clearly the project phase in which these estimates are made. Thus, considering that the cost estimation in the initial phase and in the more advanced phase are at different levels of accuracy, this situation helps improve the reliability of estimates when basing decisions on the estimations.

Additionally, there should be continuous monitoring of these estimates throughout the project's duration. It's vital to manage the risks and uncertainties inherent in cost estimation, perform a secondary evaluation of the estimates, and update them as necessary in response to any changes. The accuracy and reliability of the cost estimates need to be verified prior to their dissemination, and they should only be used as a decision-making basis if they accurately reflect the intended scope.

Establishing a quality assurance team is essential to consistently verify the precision of cost analysis throughout the project. Similar to practices in US, strategies such as providing a range for costs to reduce risks in cost estimation and creating demand forecasts using low, medium, and high scenarios can be adapted. Consequently, the uncertainties associated with the project are effectively managed, enabling a comprehensive analysis of its viability in differing scenarios.

Moreover, by adopting practices from the US, such as implementing the Request for Expressions of Interest (RFEI) process early in the feasibility stage, the effectiveness of market research efforts can be enhanced, showcasing private sector engagement. This strategy allows for the integration of insights from potential investors and suppliers into the feasibility analysis, thereby identifying private sector interests. To illustrate, a Request for Expressions of Interest (RFEI) was issued for the California High Speed Rail (CHSR), and the level of interest from the private sector was determined by by analyzing the responses received. This analysis was key in

determining whether private sector entities were willing to participate in the project (California High-Speed Rail Authority, 2009).

Utilizing Monte Carlo simulations, as practiced in the US, can improve forecasts by enhancing technical knowledge. Additionally, alongside the existing mitigation strategies, supporting actions strategies employed in US can also be adopted. This means taking a holistic approach to societal interests, similar to the Community Benefit Agreement signing in the California High Speed Rail (CHSR) project. To illustrate, California High-Speed Rail Authority's Community Benefits Agreement outlines the benefits to the community, including job opportunities, educational programs, and support for small businesses. This agreement ensures communities can protect their rights and interests, while also aiming to increase positive social impacts and mitigate negative effects through various efforts (California High-Speed Rail Authority, 2009).

The feasibility phase concludes with the final feasibility review. The feasibility study incorporates Five Case Model from the UK into the existing review of Economic and Commercial Feasibility, Sustainability, and Risk and Risk Mitigation, revealing the project's significance from multiple perspectives. However, Five Case Model alone is not adopted because it is important to preserve the specific perspective of Türkiye on sustainability and risk management cases in project evaluation. The final review involves reporting on the project's alignment with strategic goals, evaluating sustainability and risk, and assessing its impact on welfare.

Instead of locking the project into a single approach (Cantarelli and Flyvbjerg, 2013), it's essential to consider Real Options Theory (ROT) during decision-making for megaprojects in Türkiye. ROT suggests evaluating methods that better adapt to the process, such as phased implementation, adjusting the project's scale, and postponement (Martins et al., 2015).

Project pipeline

Megaprojects deemed viable through the assessment of feasibility study outputs are selected and subjected to an additional control point. The second control gate, which is adapted from the Norwegian Quality at Entry regime, examines the economic viability of megaprojects by reviewing project estimates through independent experts. Suitable projects are filtered and included in the Project Pipeline, which is formed by

consolidating planned strategic projects. Megaproject Pipeline aligned with macro policies and strategic objectives is established, determining future megaprojects. Feedbacks from the public and professionals for this pipeline are gathered. Moreover, surveys and meetings can be utilized as tools for feedback collection during this process.

Parliament approval

After being included in the Project Pipeline, megaprojects need to receive parliamentary approval to proceed. Projects undergo assessment in parliament to secure budgetary consent. In order to move forward, a positive EIA report is also required. Presenting the EIA results to parliament for economic approval ensures public trust and addresses environmental concerns. Projects evaluated by parliament as financially viable receive budgetary approval. This process enhances transparency and empowers the public's role in the project. Parliamentary approval confirms the project's feasibility, reducing conflicts among political actors and project termination risks.

Legal challenges

In order to avoid drawn-out litigation and appeals procedures, the legal objection method used for Nationally Significant Infrastructure Projects (NSIP) in the UK will be implemented. This approach sets a restricted time constraint for filing legal objections.

Post-decision process

Lessons learned during the decision-making phase of the project are seen as ongoing opportunities for improvement in future projects. The process and analytical methods are assessed through ex-post analysis. To enhance transparency, project information is made accessible via public information system. Performance-Based Planning and Programming approach, which has led to significant performance improvements in the US (FTA, 2020), are adopted. This practice establishes a continuous improvement process to enhance both project-specific procedures and overall processes, contributing to achieving large-scale performance goals and strategies across the country (Grant et al., 2013).

5. CONCLUSION AND RECOMMENDATIONS

Megaprojects represent significant investments charcterized by high costs, notable risks, extensive planning horizons, advanced technical requirements, and diverse stakeholder engagement. These projects are unique endeavors with iconic value and serious environmental and social impacts, often shaping political agendas (Davies et al., 2017; Li et al.,2018; Flyvbjerg, 2017; Kardes et al., 2013; Van Wee & Priemus, 2017; Vickerman, 2017). Each megaproject is singular, occuring once in a specific context, which poses challenges in uncovering the essence of effective planning (Brockmann, 2020). During the planning process, megaprojects are influenced by these characteristics and strive to develop their own language.

Given the complexity and consequences of these projects, comprehensive and inclusive decision-making processes are crucial. Despite advancements in project management methodologies, modern projects are still plagued by significant challenges such as cost overruns, schedule delays and benefit shortfalls (Flyvbjerg & Gardner, 2023a).

In this thesis, the focus was initially on examining research on megaproject management and decision-making approaches. The management and decision-making processes of megaprojects are comprehensive subjects that are approached in diverse ways across literature and practice. This study evaluates the decision-making processes of megaprojects from three perspectives: literature, practical applications, and regulatory frameworks. Each evaluation offers unique perspectives. This research reveals the distinctive features of megaprojects and their management compared to conventional projects. However, there is no consensus on established frameworks, approaches, and standards for managing megaprojects. Effective guidelines are essential for ensuring their success and avoiding persistent roadblocks. As mentioned by Michaud and Lessard (2000), if rules and regulations for managing large-scale projects were accurately formulated, it would enable flawless management. These guidelines should be flexible and adaptable to the dynamic nature of megaprojects,

adapting seamlessly to each project's unique characteristics instead of rigid rules that do not fit.

Numerous research highlight that megaproject failure is often attributed to inadequate decision-making during the planning phases of the project (Davies et al., 2017). This underscores the importance of Front-End planning, with Flyvbjerg and Gardner (2023b) advocating for a "think slow, act fast" principle to overcome the break-fix cycle. Therefore, it is crucial to allocate sufficient time and importance to the planning and decision-making processes, especially during the initial phase of megaprojects.

The unique nature of megaprojects makes their management particularly challenging. Thus, it is important to explore new and innovative approaches instead of relying solely on conventional methods based on past experiences (Brockmann, 2020). In the literature, several approaches stand out as promising for megaproject management; including adaptive capacity, Project System Organization (PSO), integrated risk management, systematic stakeholder management, Real Options theory (ROT), organizational learning, process architecture. While some countries have adopted these approaches, many remain theoretical and are not widely implemented.

In this thesis, laws, regulations, and standards in the UK, the US and Türkiye are compared to evaluate different regulatory environments and decision-making approaches. Firstly, a general overview of different approaches applied by the countries for megaproject decision-making is provided. Then, the laws, regulations, and standards in the UK, the US, and Türkiye are compared. These regulations play a crucial role in determining the feasibility of megaprojects, which are complex and challenging due to their multi-layered nature. In the decision-making processes of megaprojects, the USA, the UK, and Türkiye have adopted different approaches.

Regulations in these countries constitute crucial factors in the feasibility decisions of megaprojects. In other words, laws, regulations, and standards set the limits for projects. Achieving success in megaprojects can be realized by incorporating best practices from different countries and developing more effective regulations and standards. The UK and the US have developed guidelines and approaches for managing large-scale projects, and they stand out for establishing evaluation standards. Nationally Significant Infrastructure Projects (NSIP) regime in the UK provides a roadmap for major projects, while the Major Projects Guidance in the US

offers guidance. These two approaches also serve as examples for Türkiye in certain aspects. This thesis also explores practical approaches to assess the applicability of regulations across different countries. It aims to highlight real-world experiences and methodologies that diverge from theoretical frameworks and regulatory standards. Furthermore, the emphasis on sustainability in megaproject planning serves as a significant example.

Finally, the current decision-making model in Türkiye has been analyzed in this thesis, and a novel approach is proposed for Türkiye. hile some countries have established comprehensive frameworks for planning major projects, Türkiye lacks a regulatory guide specifically for megaprojects, despite significant investments. This results in the absence of a clear definition and specific framework addressing the complexities and unique demands of megaprojects in Türkiye.

Additionally, the planning and decision-making processes for megaprojects in Türkiye suffer from a lack of transparency, hindering access to critical information about evaluation and planning. Another significant challenge is the issue of prioritization, as the lack of clear priorities can impede effective project execution. The absence of time limits in the pre-development phase often causes delays. Moreover, the absence of a structured approach to managing stakeholders results in ineffective communication, while inadequate integrated risk management hampers thorough risk handling efforts.

Another major issue is the absence of control gates or decision points, making it unclear when to continue or stop a project. While Environmental Impact Assessments (EIA) holds great importance for large-scale projects, there is a risk that such evaluations may not always be mandated. Additionally, there is a lack of independent experts to oversee both the general project estimations and Environmental Impact Assessment (EIA). Currently, Türkiye has not adopted an assessment method that effectively enhances the strategic layers of the decision-making process for megaprojects such as Five Case Model in the UK.

The author propose a novel model to address the identified deficiencies in the management and decision-making processes of megaprojects in Türkiye. This model presents a new approach that can be implemented in Türkiye’s megaproject management practices by taking into account literature reviews, regulatory frameworks, and practical applications. The proposed model aims to provide a clear

definition of megaprojects and establish a framework to develop criteria for them. This process may help in identifying and evaluating megaprojects effectively, ensuring a more systematic and transparent approach to their management.

The proposed model includes key steps that begin with defining megaprojects and establishing a framework. The stages outlined, ranging from Policy Formulation to Post-Decision Process, are adapted from megaproject methodologies worldwide, with a specific emphasis on the NSIP process in the UK. After establishing a framework for megaprojects, the next step is Policy Formulation and Statement phase. Türkiye is one of the leading countries when it comes to determining its strategic goals and vision. Policies specifically for megaprojects should be developed to reflect this vision and goals. To develop these policies and acquire the necessary expertise and experience, it is proposed to establish an Infrastructure Commission. This stage would help determine the country's priorities regarding megaprojects. As a result, this process will pave the way for more successful and effective megaprojects in the future.

Strategic Planning and Pre-feasibility phase follows the policy formulation phase. In this phase, project concepts that align with the country's megaproject priorities are refined and evaluated for their feasibility. Compatibility of the evolving project with the overarching strategies and policies is assessed to ensure that it aligns with macro policies. Projects found to be incongruent are revisited in the project development stage. The purpose of this process is to prevent the advancement of projects that are not aligned with macro policies.

Detailed Design and Feasibility phase involves conducting more comprehensive analyses and designs for the project. In this phase, alongside the current approach, the adoption of the "Five Case Model" approach from the UK is aimed at evaluating the project from strategic, economic, commercial, financial, and managerial perspectives. Additionally, the EIA positive report is incorporated into this stage, merging the two processes. Subsequently, if the project is deemed strategically viable, contributes to the nation's welfare, and yields a positive EIA, it proceeds. This "go" decision is evaluated at a control point. Projects that are determined to progress based on this evaluation by independent experts are added to the project pipeline.

Project Pipeline is a comprehensive list of megaprojects that have been approved for implementation in the country. These projects are significant in scale and impact, and

as such, require parliamentary approval before they can proceed. This important step helps to ensure that the decision-making process is inclusive and transparent, and that all stakeholders have a say in the matter. By carefully evaluating each project and seeking parliamentary approval, Project Pipeline helps to build public confidence and ensure that the projects are executed efficiently and effectively.

Following parliamentary approval, a project can advance unless it encounters legal challenges. In such instances, a designated timeframe is set for addressing legal matters. This strategy aims to prevent prolonged legal disputes that might impede project progress. Furthermore, the model incorporates lessons learned from the project post-approval to enhance its efficiency. The overarching structure of this model includes integrated risk management and systematic stakeholder engagement, facilitating comprehensive and methodical planning across all project phases.

The successful implementation of this model is contingent upon the collaborative efforts of diverse stakeholders, ranging from governmental bodies to industry experts, and the public at large. The first step is to establish a definition and framework for megaprojects by government institutions, followed by the creation of an Infrastructure Commission. This commission should develop policies, programs, and projects that align with macro policies. Experts should then be informed and their input sought to further develop the model. Comprehensive briefings and training sessions for stakeholders should be organized to enhance awareness and understanding. Training sessions with experts from different countries should also be conducted to gain a detailed understanding of evaluation methods.

Moreover, monitoring and control process should be initiated from the outset, and it should be open to improvements. Finally, the viability of the model for Türkiye should be assessed by piloting it on a specific project. Pilot projects based on the proposed model can provide valuable insights and opportunities for iterative improvement. The knowledge gained from this experience can be used to optimize the process and ensure its sustainability in the long run. This involve analyzing each stage of the project, identifying areas that require improvement, and implementing measures to address any issues that may arise.

Although there is no standardized definition or robust decision-making model for megaprojects, Türkiye’s efforts in macro-policy development and strategic planning

are noteworthy. Integrating these efforts into megaproject management could create significant opportunities for future projects. The research indicates a need for substantial improvements in transparency, stakeholder participation, and risk management. The proposed model aims to remedy these deficiencies, striving to establish a more systematic, sustainable, participatory, reliable, and transparent decision-making process for Türkiye's large-scale projects. Implementing these changes could enhance Türkiye's position in the global economy and contribute to achieving sustainable development goals.

When introducing the proposed model, it is important to consider various country-specific factors that are distinct to Türkiye. These factors may include Türkiye's cultural nuances, regulatory frameworks, and institutional capabilities, all of which can have a significant impact on the success or failure of the implementation process. While this model provides a broad strategic framework, it should not overlook local priorities, needs, and challenges. It is crucial to implement transparent and robust evaluation methods. Additionally, garnering support from stakeholders and reaching consensus on the viability of this model is essential.

This model proposal should be seen as a potential to ensure that megaprojects unfold in the best possible way, rather than as strict regulations that would slow down or hinder megaproject processes. With the implementation of this model, Türkiye establish a more systematic approach to megaproject planning, encouraging stakeholder involvement, effectively managing risks, and promoting transparent planning processes. Additionally, the proposed model addresses project priorities, introduces strategic project development methods, and fosters public acceptance through more democratic processes. Implementing time constraints aims to shorten the lengthy planning phase of projects, potentially expediting their realization. Furthermore, this model distinguishes megaproject management from standard projects, fostering expertise in this specialized field. The thesis emphasizes the need for continuous improvement in the decision-making processes of megaprojects to ensure their success. By embracing this innovative and forward-thinking approach, Türkiye can navigate the complexities of megaprojects and become a pioneer in strategic project management.

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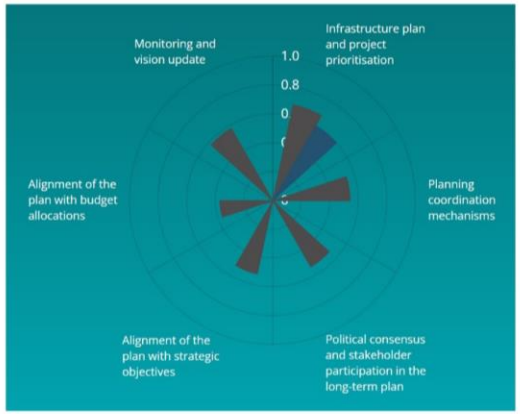
APPENDICES

APPENDIX A: Comparision of the Countries (Adapted from OECD Survey on the Governance of Infrastructure, 2020; OECD Survey on the Governance of Infrastructure, 2022)

APPENDIX A

UNITED KINGDOM



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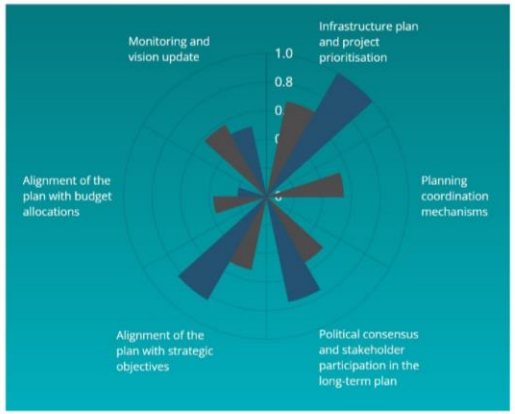

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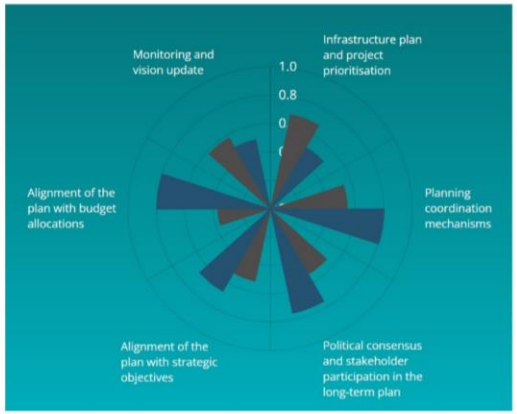

OECD Indicators on the Governance of Infrastructure (IGIs)

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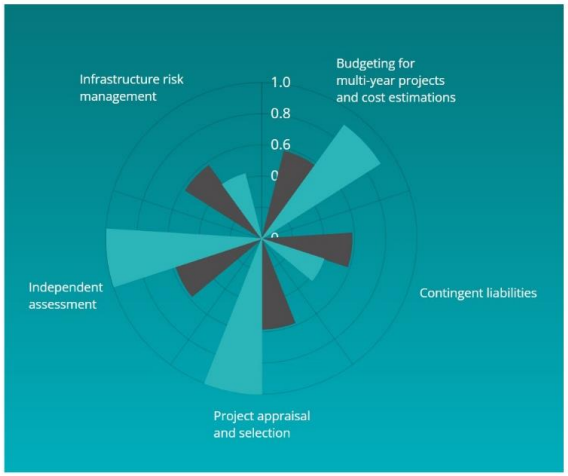

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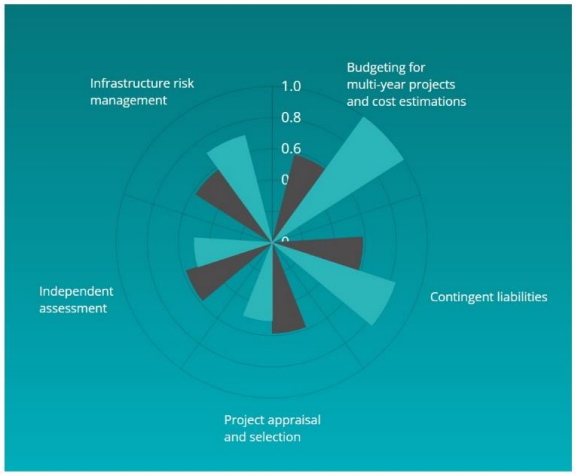

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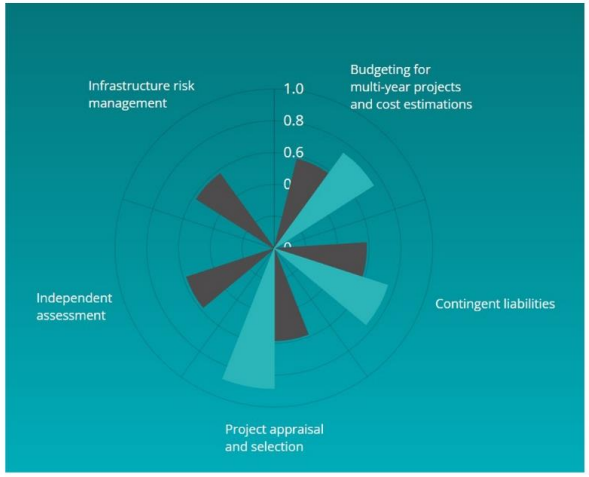

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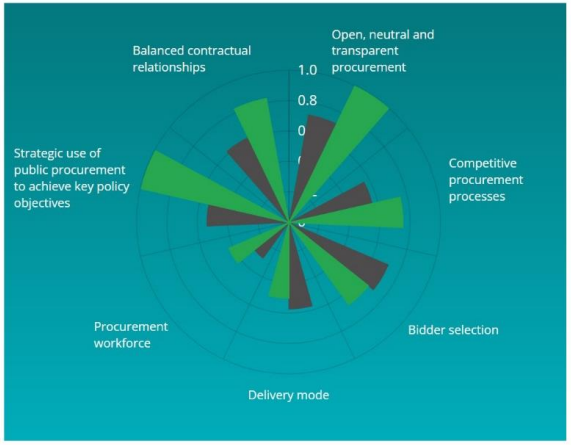

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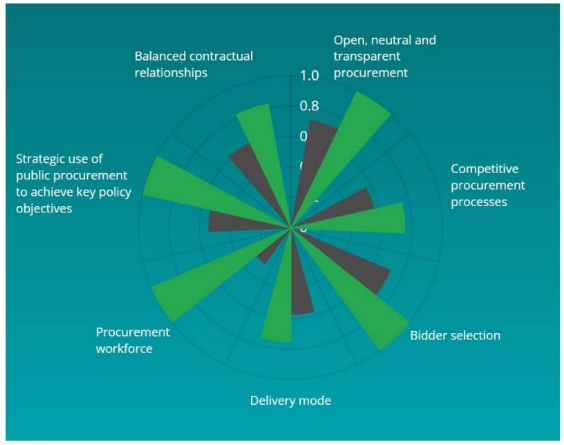

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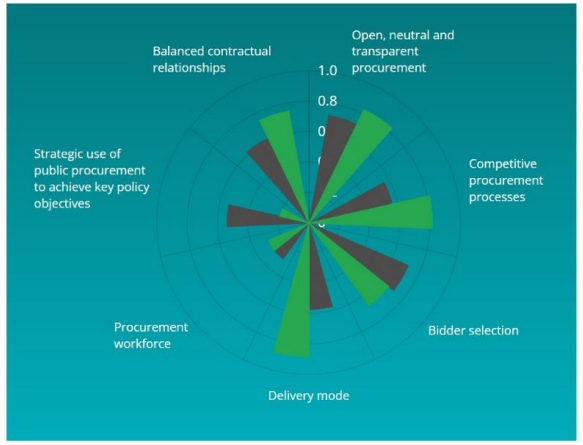

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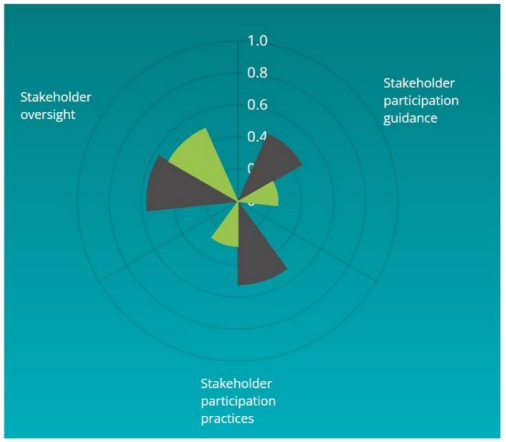

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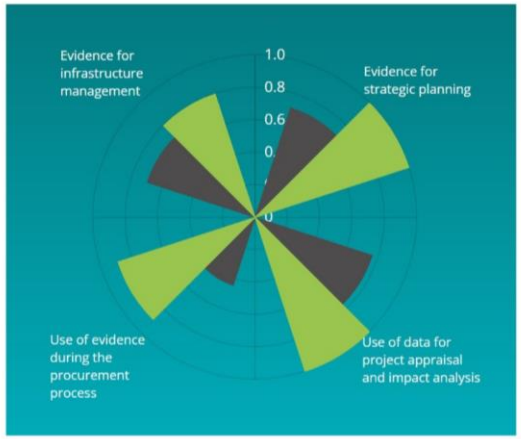

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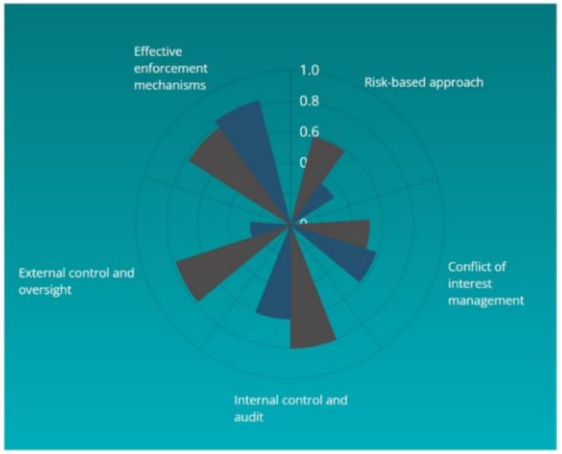

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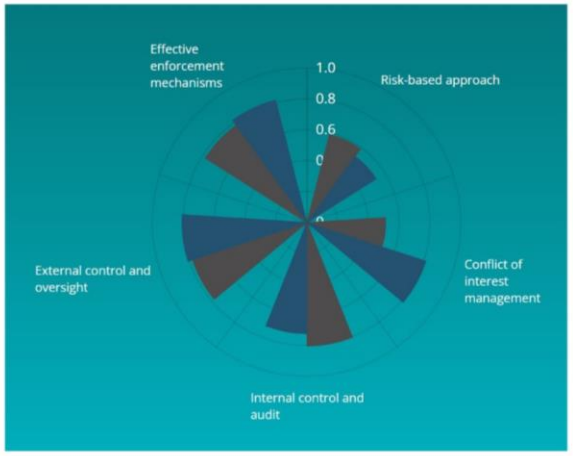

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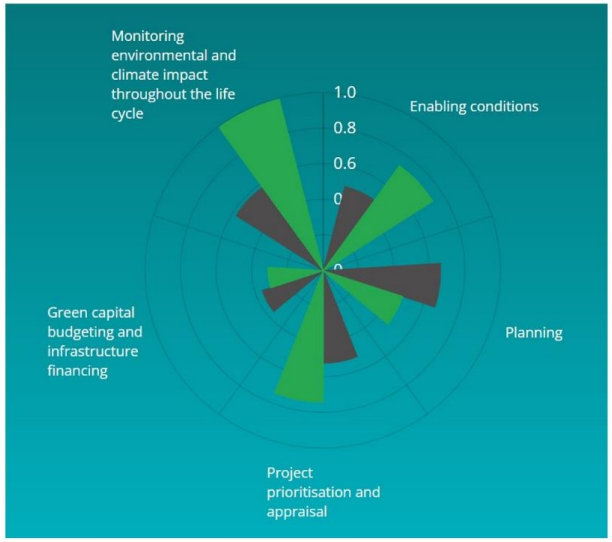

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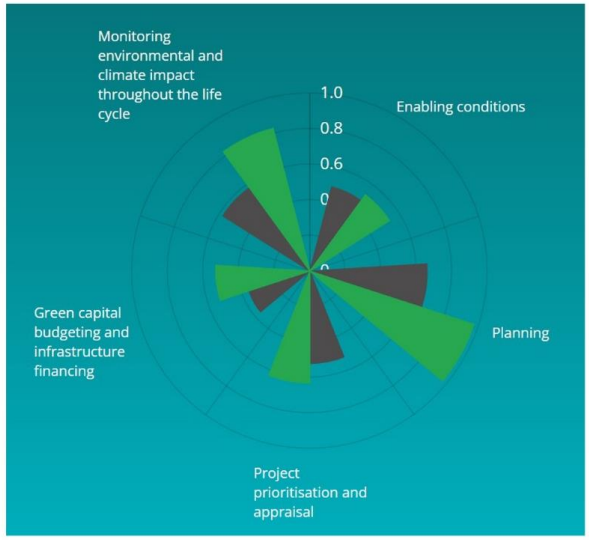

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