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EUROPEAN MEGAPROJECTS: MANAGING CONTEXTUAL UNCERTAINTY THROUGH THE STAKEHOLDER MANAGEMENT

Relatore: Prof. Mancini Mauro

Tesi di laurea di:

Francesca Romeo Matr. 837604

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SINTESI

Oggi, grazie alle scoperte tecnologiche d'avanguardia, alla crisi finanziaria di natura globale, alle instabilità ambientali e a un'aggressiva e feroce globalizzazione, stiamo vivendo un rapido cambiamento nel contesto che ci circonda, ad un passo sempre crescente. Questa è la ragione per cui, la consapevolezza di un contesto complesso e la sua relativa incertezza è indispensabile e fondamentale per gestire con successo un mega-progetto.

Con questa breve introduzione, la mia Tesi intende studiare l'incertezza derivante dal contesto dei mega-progetti Europei, nel settore delle infrastrutture, con l'obiettivo di accrescere la conoscenza riguardo a questo tema e porre le basi per un futuro framework volto a ridurre l'incertezza del contesto attraverso una gestione efficace degli stakeholders di progetto.

La ragione principale del mio focus risiede nel fatto che i progetti di infrastruttura non solo impattano sull'economia e sulla società del paese in cui vengono sviluppati, ma anche sull'ambiente urbano, perché includono ferrovie, strade, ponti, sistema di fornitura d'acqua, etc. Tali progetti, inoltre, richiedono ingenti investimenti di denaro (miliardi di euro) e trasformano quindi l'economia di un paese. Considerando l'importanza di tali progetti in questo determinato settore, ho deciso di focalizzare la mia attenzione su questo specifico tema cercando di capire come l'incertezza derivante dal contesto può impattare sullo sviluppo di un mega-progetto di infrastruttura.

I contenuti di questa Tesi sono presentati seguendo questo schema.

Nel primo capitolo viene descritto il problema di partenza e le relative domande di ricerca articolate in una domanda principale e altre domande secondarie che servono a definire meglio il focus e i confini del mio studio. Seguono poi gli obiettivi da raggiungere e i contributi che derivano da questo lavoro.

Il secondo capitolo espone l'analisi della letteratura. Vi è una suddivisione in sotto-capitoli, ciascuno dei quali descrive lo stato dell'arte di un tema specifico. Il primo tema presenta i mega-progetti a caratteri generali, per poi concentrarsi sul settore di infrastrutture e mega-eventi; il secondo tema, altrettanto importante, è relativo all'incertezza e alle sue relazioni con la complessità e gli stakeholders di progetto; infine, il terzo tema è quello della gestione degli

stakeholders, con un focus dell'influenza degli stakeholders nei mega-progetti di infrastruttura.

Nel terzo capitolo viene spiegata la metodologia di ricerca utilizzata in questa Tesi. Vengono presentati: l'approccio razionale e sequenziale seguito per affrontare di volta in volta lo studio dei temi in oggetto, i metodi e gli strumenti usati per raccogliere dati empirici ed infine, la pianificazione temporale. L'ultima sezione descrive la mia collaborazione con un Professore del dipartimento di Ingegneria Civile e con una studentessa dottoranda dell'Insituto Superior Técnico, università di Lisbona, Portogallo, dove ho svolto parte della mia attività di ricerca.

Il quarto capitolo descrive i tre casi studio selezionati e li analizza attraverso un framework appositamente costruito per ricavare tutte le informazioni necessarie. Il framework, essendo comune a tutti i tre progetti, garantisce uniformità e rende più facile la comparazione dei casi di studio. Ogni analisi è seguita da un commento relativo alle conclusioni e ai principali argomenti chiave.

Nel quinto capitolo viene spiegato nel dettaglio lo sviluppo del nuovo approccio che propongo, principale output della mia ricerca. Segue poi l'applicazione dell'approccio ai tre casi di studio precedentemente analizzati.

La discussione relativa alle considerazioni finali dell'approccio proposto è presente nel sesto capitolo, dove si possono trovare anche dei suggerimenti, idee e alcune linee guida per lo sviluppo futuro di un framework che integri il nuovo approccio e che serva per gestire in modo più efficace gli stakeholders di progetto. I suggerimenti e le linee guida descritti in questo capitolo sono il frutto di un'interpretazione ed elaborazione delle informazioni ottenute tramite interviste ai project managers dei progetti e quindi ereditano quel carattere di praticità e realtà tipici di un'esperienza personale conquistata "sul campo".

Infine, l'ultimo capitolo, il settimo, presenta le conclusioni e suggerimenti per future aree di ricerca sullo stesso tema

EXECUTIVE SUMMARY

Today due to the technological improvements, the global financial crisis, the environmental instabilities and the aggressive globalisation, we are facing a rapid change of the context around us. This is the reason why the awareness of the complexity of the context and the related high uncertainty is fundamental today for successfully managing mega-projects.

With this background, this thesis wants to study the contextual uncertainty in European mega-projects infrastructure sector, with the aim to increase the understanding about the theme and put the basis for a future framework in order to reduce the uncertainty stemming from the context through an effective stakeholder management.

The reason to focus the research on the infrastructure sector is the fact that infrastructure mega-projects have an impact, not only on the economy and society of the country where the project is performed, but also on the future development of urban environments because they include railway systems, roads, bridges, water-supply systems, etc. These big infrastructure projects require big amount of investments (billions) and, therefore, they transform the economy. Because of this importance, I decided to focus my study on this sector, trying to understand how the contextual uncertainty can impact on the development of infrastructure mega-projects.

The content of the thesis is presented following this structure.

In the first chapter, the problem statement and the relative research questions are addressed. After a brief introduction on the background, the problem of the research is identified and the main research question is designed with the involvement of secondary research questions aimed at defining better the focus and the border of the research. Then the objectives and the contribution to the scientific knowledge is expressed.

In the second chapter the literature review is presented. The chapter is divided into three subchapters and each one reveals the current state-of-the-art about different topics. The first section presents the literature review of mega-projects, in particular infrastructure mega-projects and mega-events; the second section is about the literature review of the uncertainty

and it relations with the complexity and the stakeholders; finally, the third sections addresses the stakeholder management focusing more on the external stakeholders' influence in infrastructure mega-projects development.

The third chapter explains the research methodology applied for the thesis. This chapter discusses the rational approach followed to the topics addressed, together with the methods and tool for gathering empirical data and the timeframe followed for the research. There is also a subchapter concerning the collaboration with the Insituto Superior Técnico of Lisboa, Portugal, where part of the research work was conducted in order to study more in depth a Portuguese case study.

The chapter four describes the three case studies selected using a framework specifically created to find and gather the necessary information for the analysis. This framework is also common to all the case studies in order to make the comparison easier. After each case study analysis, there is the section regarding the conclusions and findings.

In the fifth chapter is described and explained in details the development of the new approach proposed as the main outcome of the research work, and the application of the approach to the case studies analysed previously.

The discussion about the considerations of the new approach is showed in the chapter six, where also some suggestions and guidelines for the future framework for an effective stakeholder management are presented. The suggestions and guidelines are the result of the interpretation of the interviews conducted through the case studies analysis in order to get insights from the real experience of project managers of infrastructures mega-projects.

Finally, the last chapter concerns the conclusion and suggests some research stream for further research works on the same topic.

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CHAPTER 1
INTRODUCTION

1.1 Problem statement & Research questions

Nowadays when managing infrastructure mega-projects, especially the cross-countries ones, or mega-events, the problem is that the context in which the project is placed is undertaken or not properly addressed. For these projects, the external stakeholders are those ones that mostly affect and are affected by the context and its changes, which is the reason why they are considered one of the most important source of uncertainty in the planning phase. The context is changing at an ever-increasing pace, thus the uncertainty related is even higher because changes in the political scenario, or economical or environmental one, represented by the correspondent external stakeholder, lead to new risks or opportunities for the project development. It follows that the challenge for the project manager is to foresee these changes, and implement and plan the project in question trying to use the stakeholder management as a tool to manage the uncertainty, reducing the risks of possible failures, such as delays, cost overruns, lost opportunities, ... To accomplish and guarantee the success of the planning phase, where we know the uncertainty level is higher and so is needed more attention and accuracy because of the possible protracted consequences all along the future phases of the project, there is the need to understand in depth the influence of external stakeholders in order to maximize the efficiency of the external stakeholder management process.

The project manager should also acquire more information as much as possible about the country(s) where the project is placed in terms of political, economic, social and environmental situation in order to be able to foresee on time possible changes or uncertainties, and to act promptly being flexible and capable to adapt to a new scenario. These changes in question are brought by the external stakeholders like political party, economic institutions, environmental activists and so on... Thus, an external stakeholder management process should be, if conducted properly and effectively, first, the tool to manage the uncertainty, and then, an opportunity to improve the project development leading to its success.

The main research question, therefore, seems to be

"How does the contextual uncertainty impact on the development of mega-projects?"

This involves questions such as:

- Which external stakeholders are more influential in the planning phase of the project?

- Which are the impacts of the external stakeholders' actions and attitudes toward the project in the planning phase?

- Which are the contextual factors that influence the complexity of the project?

- Which are the major uncertainty issues related to external stakeholders?

According to the existing external stakeholders' analysis we need to understand which is the best approach that is more integrated with the uncertainty analysis. There is a lack of knowledge, indeed, of how the contextual uncertainty impact on the mega-projects' development and how it is integrated with the stakeholder management.

1.2 Contribution & Objectives of the research

The main contribution of this thesis is to increase the knowledge of how to manage external stakeholders to reduce the uncertainty related, and therefore, to reduce its impact on the project development.

To fill the gap in the literature and make knowledge contribution, the aim of the research described here is to study the relation between the contextual uncertainty and the project external stakeholders, and to propose an integration of the two perspectives to be able to maximise the efficiency in managing the uncertainty through the stakeholder management. To make possible this integration, this research presents a structured way (quantitative and qualitative) for the analysis of the external stakeholders to be integrated with the analysis of the context and generate, thus, different scenarios with different level of uncertainty.

Therefore, the outcome of this research is the development of a new integrated approach for the external stakeholders and uncertainty analysis, some guidelines for the possible strategies to adopt in the different scenarios of uncertainty, and some ideas and suggestions for the future framework for an effective stakeholder management. The aim is to help and support the project manager in the planning phase to better manage the external stakeholders' network that can be subjected to changes due to the modifications of the context and due to the high level of uncertainty.

This approach will be the basis for a future framework to improve decision-making process in the planning phase for the reduction of the risks and uncertainties that impact the project

development, to improve the project performances of being on time and within budget, thus guaranteeing the project success.

The specific objectives of the research are to:

- Understand the concept of contextual uncertainty for mega-projects in general and for infrastructure mega-projects and mega-events in particular.

- Increase the understanding of the importance of the context in which the project is placed to enhance the achievement of the project outcomes.

- Develop a structured process to analyse external stakeholders' impact and to integrate it with the complexity of the context to identify different levels of uncertainty.

- Develop guidelines for strategies to cope with uncertainty through an effective external stakeholders' management.

1.3 Structure of the thesis

The structure of this Thesis is as follows.

Chapter 1: Introduction. This part covers the background of the research, the problem statement and the relative research questions, the objectives to be achieved and the contribution of the work.

Chapter 2: Literature Review. This section introduces and reveals the current state-of-the art about mega-projects, infrastructure sector, and mega-events; uncertainty and risk management; external stakeholders and their influence in large infrastructure projects.

Chapter 3: Research Methodology. This section discusses the rational approach followed in this research work to address the topic, together with the methods and tools for gathering empirical data and the timeframe followed for the research.

Chapter 4: Case studies. In this chapter are presented and analysed the case studies chosen, showing the conclusions and findings to get information.

Chapter 5: Development of the new approach. This section presents the new approach for the stakeholders and the uncertainty analysis, and the application of the approach to the case studies analysed. The aim is to ensure more efficacy in handling the project, improving its development and thus guaranteeing the success of the project.

Chapter 6: Discussion. This chapter discusses the new approach showing some considerations and suggestions for a future framework and presenting the limitations.

Chapter 7: Conclusions.

CHAPTER 2
LITTERATURE REVIEW

2.1 Mega-projects literature review

2.1.1 Mega-projects

Mega-projects are large-scale investments projects typically costing USD/EUR 1 billion or more, characterized by complexity both in technical and human terms, taking several years of development and involving multiple public and private stakeholders.

As mentioned in the literature, there are basically three important features related to mega-projects: large amount of resources; high human, social and environmental impact; and extreme complexity (Capka, 2004; Flyvbjerg, Bruzelius, and Rothengatter 2003).

Large amount of resources: megaprojects require high amounts of costs, labour, physical and financial resources; *High human, social and environmental impact*: mega-projects affect various communities differently and impact the economy, civil society and the natural environment and, in addition, these projects are often an issue of public interest because public entities and public spending is involved in the process; *Complexity*: technically speaking these large projects are complex and the complexity emerges as a major challenge for the project managers (Kardes et al. 2013).

Mega-projects can be seen also as a combination of different smaller projects with different contents, but coordinated together to achieve a goal and a common result. Each of these sub-projects is also characterized by complexity, uncertainty, integration of different skills in the organization, coordination of construction activities etc., all typical elements of a mega-project (van Marrewijk et al. 2008)

There are different definitions in the literature but they do not clearly define and differentiate a mega-project from a project, thus the following figure (Fig.1), taken from a research conducted by Zidane et al. (2013) shows how a mega-project is positioned among projects

considering three important axis: needs (number of stakeholders and complexity & uncertainty); size; and time frame.
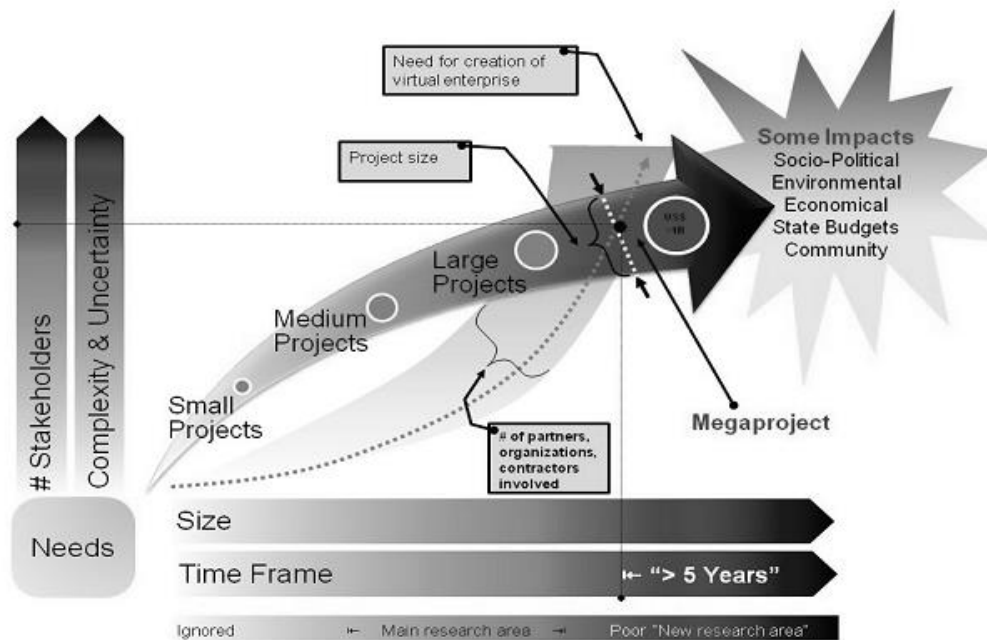
Fig. 1 Position of a mega-project among projects(Zidane, Johansen, and Ekambaram 2013)

Despite an increasing number of large infrastructure developments are being undertaken around the world, the record of performance of these projects is poor (Flyvbjerg 2003).

Gellert et al. (2003) categorize mega-projects into four types: infrastructure (e.g. damns, ports, and railroads); extraction (e.g. minerals, oil and gas); production (e.g. massive military hardware such as fighter aircraft, chemical plants, and manufacturing parks); and consumption (e.g. tourist installation, malls and theme parks).

In recent findings of a research conducted by the OMEGA Centre (OMEGA Centre 2012) it has been recognized that mega-projects, and especially mega transport projects, can be considered 'agents of change' because they have multiple spatial, economic, environmental, political and other implications, and what is considerably important to underline is their potential to change the context into which they are placed, that often is under-appreciated by decision-makers. This can result in unexpected consequences that could be either beneficial or problematic. For this reason, there are some considerations to do, especially when addressing the planning phase of such projects, like what sort of territorial, sectoral or other types of change it is expected to achieve; the timeframe over which such change might be expected to take place given forecast/scenario contextual conditions; the financial, institutional, personnel, legal, environmental resources and policy frameworks that are likely to be needed and over what period.

Another important feature of this mega projects is their 'openness' as the result of their continuous interaction and interdependency with the changing context they serve and impact upon (including environmental, social, economic, physical, institutional and political context).

Since we are mentioning the importance of the context when dealing with mega-projects projects, it is needed to understand deeper what we mean with context and which is its power.

The term context is used meaning cultural/social beliefs-values, time and space concerns, economic circumstances, institutional and planning frameworks and the political situation. The importance given to the context today is even high because, due to the technological improvements, the global financial and environmental instabilities and forces of globalisation, the context is changing so fast at an ever-increasing pace. To face with this complex reality, we need to acknowledge the importance of some considerations: the contextual changes will surely and inevitably drive pivotal decisions that are going to affect outcomes, therefore it is better to undertake periodic sensitivity analyses of the context(s) of such projects all along the project lifecycle; there must be awareness of context in successful decision-making to address the risks, uncertainties and complexities also because some events like political changes may turn positively or negatively for the success of the project and this is the reason why the political influence/support must be considered a critical contextual factor over the whole project lifecycle (OMEGA Centre 2012).

Therefore, due to the complexity of the context, it is easy to believe how one of the key aspects of such large (in size and in budget) projects is the significant under management of risks in practically all stages of the value chain and throughout the lifecycle of the project (Beckers et al. 2013). The long-term character of these projects requires a strategy that reflects the uncertainty and huge variety of risks they are exposed to over their lifecycle. Moreover, today due to the technological improvements, the global financial and environmental instabilities and forces of globalisation, the context is changing so fast at an ever-increasing pace. This is the reason why the awareness of the complexity of the context and the related high uncertainty is a fundamental factor especially in the planning phase, because it has significant impact on the success of the project.

Mega-projects' European Context

This research work studies mega-projects in the European Context, focusing especially on infrastructure mega-projects, with the example of two important transportation mega-projects (HSR Portuguese project and the CTRL in London), and on a case of a mega-event, the EXPO 2015 in Italy, due to its characteristic of high uncertainty.

Therefore, it is needed an excursus about the European context to present some data and findings driven by the Megaproject COST Action research "Delivering European Megaprojects" (Brookes 2015).

First, we need to highlight some limitations talking about the European context since the overall geographic area is not homogenously defined under a political, economic and environmental profile. For instance, the power of external stakeholders can play a strong and important role in influencing the mega-project's performances in Western democracies, but when dealing with more autocratic political systems that power can be much greatly diminished.

The performance of mega-projects has been considered problematic in terms of overall on-time and too-budget delivery and in terms of the utility of the project once in operation, and it affects both the stakeholders and the society where it is performed. The MEGAPROJECT's Cost Action identified three key drivers to improve delivery performance in Europe: engaging external stakeholders, designing good governance and learning across mega-projects. Through an in-depth analysis it was found out that there are some categories of external stakeholders more likely to have a positive influence on mega-projects such as national government, client/owner, financiers and project team; others with a negative influence such as local residents, environmentalists (the engagement of which is fundamental to ensure good mega-projects delivery performance), regulatory agencies and suppliers. The local government, instead, could have positive or negative influence depending on the specific case. The findings reveal that to ensure good delivery performance in Europe, the external stakeholders management must be done in the early stages of the project life cycle with a major focus on the possible environmentalists, monitoring their attitudes to the project and engaging them as soon as possible with structured frameworks.

Important driver in European mega-projects' performances is the good governance, commonly through SPE, Special Purpose Entities (50% of mega-projects in Europe are delivered involving the use of an SPE). A SPE is a project-company completely aligned with the mega-projects design, delivery and operation and it follows rules highly contextualised in the national legal framework in which it operates. We will see in fact in the two cases of transport mega-projects further analysed the creation of an SPE to manage the project.

2.1.2 Infrastructure mega-projects

Infrastructure mega-projects are defined as major projects, large-scale systems characterized by being physical or dimensionally large, with many subsystems and components, and complex relations among them (Yeo 1995). Besides the dimension and the composition, the main characteristics are long life-time, multiple uncertainties associated such as cost overruns, schedule delays and some external factors as changes in the context. These projects are usually commissioned by governments and delivered by private contractors with the aim to develop and manage public utility infrastructures (e.g. airports, highways, railways, wastewater systems, power plants).

Infrastructure mega-projects are always at the centre of public attention because their impacts are especially on communities, environment and local and national government budgets and they can be considered an important component in the economy of a country because they affect in large way the environment and the social life of where they are placed.

There are many classifications about the Infrastructure sector.

Grimsey & Lewis (2002) defined five major categories: Energy (power generation and supply), Transport (toll roads, light rail system, bridges and tunnels); Water (sewage, waste water treatment, and water supply); Telecommunications; Social Infrastructure.

El-Gohary et al. (2006) proposed a scheme for Infrastructure projects defining five different domains: Transportation (highway construction, bridges – aesthetical and structural types-, transit planning, transportation planning), Water (water resource, water supply, water treatment), Mining, (solid waste management, hazardous waste disposal).

There is not a clear and agreed definition about Infrastructure mega-project and Gibson et al. (2010) in their work proposed the following one:

> *"A capital project that provides transportation, transmission, distribution, collection or other capabilities supporting commerce or interaction of goods, service, or people. Infrastructure projects generally impact multiple jurisdictions, stakeholder groups and/or a wide area. They are characterized as projects with a primary purpose that is integral to the effective operation of a system. These collective capabilities provide a service and are made up of nodes and vectors into a grid or system (e.g., pipelines (vectors) connected with a water treatment plant (node))."*

Where Vectors examples are: Electrical Distribution/Transmission systems; Pipelines; Highways; Canals; Railway systems; Tunnels; Telecommunication lines; Wide Area Networks. Nodes/Centralized facilities examples are: Dams; Power Generation Facilities; Steam or chilled water production; Marine, Rail or Air Terminals; Water/Waste Water/ Solid Waste Processing. According to this definition, the Infrastructure project provides the needed services and connections to enable industrial facilities and buildings to function effectively.

Another classification of infrastructure mega-projects proposed by Bertolini (Bertolini and Salet 2008) must be mentioned because it is based on two dimensions: the first one concerns the different functions of the projects, single-purpose infrastructure or multi-functional infrastructure; the second dimension concerns the degree of spatial concentration, where all relevant stakeholders are focused on one particular space, or diffusion where the decision-making is diffused over many places. Bringing the two dimensions together a topology including four types of infrastructure mega-projects is constructed.

	Mono-functional	Multi-functional
Spatially concentrated	Single objects (e.g. bridges, tunnels, interchanges)	Central Nodes (e.g. integrated urban centres, mixed out of town centres, airport or port complexes)
Spatially diffused	Routes (e.g highways, railways, canals, cables, electricity networks)	Metropolitan network spaces (e.g. integrated places)

Tab. 1 Typology of infrastructure mega-projects (Bertolini and Salet 2008)

Differentiation of infrastructure mega-projects in four general settings is useful in order to analyse different types of challenges because each of these categories brings different sources and levels of complexity and uncertainty

To remind the most important phases of an Infrastructure project below a schematic view:

Fig. 2 Project's phases

However, achieving success in infrastructure development is not an easy task, delivery performances are poor as stated by Flyvbjerg (2003) and this is also due to the presence of optimism bias particularly in infrastructure mega-projects.

Optimism bias is the inclination for people to be overly positive when making predictions about the outcomes of future planned actions.

Evidence from the past century suggests that costs and delivery times are consistently underestimated and benefits overestimated in the development of new transport, water, waste, energy, schools and hospital facilities (Matti 2010). In his work S. Matti (2010) studied international examples from North America, Europe and Asia finding out that the production and dissemination of greater information through benchmarking does not lead to reductions in the prevalence of optimism biases but, it was recognised that when combined with incentives built formally into government procurement processes, benchmarking then can support improvements in the quality of projects outputs.

On the other side, Flyvbjerg (2004) suggests to minimize optimism biases in project delivery by creating institutional cultures that normalize and reward accurate forecasting and construction management, while de-legitimizing the practice of being overly optimistic. Recently, various strategies have been adopted to create institutional cultures that redress the tendency towards systematically overoptimistic forecasting.

2.1.3 Mega-Events

In academic literature there are several definitions of mega-events and all of them agree on large scale global cultural events with global significance due to the impacts in three main domains including environmental, economic and sustainable development (Chalip 2006).

Mega-events enhance and boost the existing economy because they accelerate the development of new or improvement of infrastructure such as transportation system, stadia, airport capacity and upgrades in water and sewage services (Chalip 2006; Jones 2001).

Another important factor to consider about mega-events is the great mobilization of resources that are of course a reflection of the political decisions and the priorities over which many can not agree and the complexity makes this even more dramatic.

These projects are the most strategic and require a huge financial effort that implies a strong engagement from public institutions in the project financing phase. For mega-events, such as World Exposition/Fairs (EXPOs) the complexity of the context is even increased by the mixture of social interest continuously changing in the short and long term that lead to modification in the perception of the performance of the project. Therefore, the clear picture of the project is available only after decades, thus, it is strongly recommended a rigorous approach to project uncertainties in order to take opportunities that could be lost without a precise balance of positive and negative impacts (Locatelli and Mancini 2010). Locatelli and Mancini in their paper (Locatelli and Mancini 2010) proposed a risk-management approach focused on stakeholder, SHAMPU framework, to analyse the EXPO 2015 to propose practical actions to achieve the best results.

2.2 Uncertainty Management literature review

2.2.1 Uncertainty: definitions and characteristics

As stated at the beginning of this thesis, mega-projects are large-scale projects characterized by complexity, uncertainty, dynamic interfaces and political, economic or legal influences. Nowadays, due to the fast changings in the context with new political or economic scenarios, the level of uncertainty related to mega-projects is increasing so rapidly that the project management is shifting from the traditional risk management techniques and tools, towards a more complete and comprehensive approach called uncertainty management.

Before to go deeper in addressing how to manage the uncertainty we need first to truly understand what uncertainty is, how is defined and which are its sources.

Uncertainty is defined by the Oxford Dictionary of Current English of 2005 as "the state of being uncertain; something you cannot be sure about". This definition clearly states that uncertainty is related to the lack of certainty, but in project management theory of course this term assumes a more holistic and complete interpretation.

What often happens is to ambiguously overlap the term uncertainty with the term risk making confusion on the real difference between the two concepts. The Oxford Dictionary describes risk as "the possibility of something bad happening at some time in the future; the situation that could be dangerous or have a bad result". From this definition, the term risk is not only associated to a probability of occurrence (a quantification of the possibility of something) but it is also associated to negative consequences and impacts.

The difference between uncertainty and risk is ambiguous and depends not only on the disciplines in which we are dealing, but also on the author's approach and purpose. In the Table 2, adapted from the paper work of O. Perminova *et al.* (Perminova, Gustafsson, and Wikström 2008), there is a clear overview of the definitions of the two terms according to different disciplines.

Disciplines	Risk	Uncertainty
Economics	Risk refers to events subject to know or knowable probability distribution[1]	Uncertainty is unknowable and unpredictable, a situation for which it is not possible to specify numerical probabilities[2]
	Risks as opposed to uncertainty is assumed calculable within the premises of probability theory, thus is controllable (Keynes, 1921)	Uncertainty is a state in which individual actors find it impossible to attribute a reasonably definite probability to the expected outcome of their choice (Keynes, 1937)
Psychology	Risk is the fact that the decision is made under condition of known probabilities[3]	Uncertainty is a state of mind characterized by a conscious lack of knowledge about the outcomes of an event[4]
Philosophy Org. Theory		Uncertainty emanates from a set of objective but largely unmeasured environmental characteristics[5]

Table 2 Risk and Uncertainty as defined in different disciplines

[1] (Knight 1921)
[2] (Knight 1921)
[3] Stanford Encyclopedia of Philosophy: http //plato.standford.edu/
[4] (Head GL. 1967)
[5] (Jauch LR; Kraft KL 1986)

In this thesis, the term uncertainty wants to replace the term risk because in the era of rapid change in which we live nowadays, uncertainty is a rule, not an exception anymore, thus is not enough to speak about risks, but it is more appropriate to speak about uncertainties. Recently, an alternative approach in project management is "prepare-and-commit" in which uncertainty is accepted as a given and the project management is organized in a manner that it can respond to unexpected developments (Koppenjan et al. 2011)

Among all the disciplines before mentioned, there is still missing the Project Management one but it will be addressed soon in order to give more space to discussion, since there are different opinions and beliefs on this topic in the literature.

Not only in different disciplines the two terms assume different interpretations but also in the project management discipline different authors had defined risk and uncertainty in different ways. A clear overview on the definitions of risk and uncertainty in the Project Management discipline is proposed in Table 3, adapted from different sources (Burcar Dunović 2015; Johansen 2015) and from all the papers read during my research.

Source	Risk	Uncertainty
Wideman (1992)	Decision-making in a state of risk is when there is sufficient information to determine an estimate of the likelihood of the identified consequences of a decision	Decision-making in a state of uncertainty is when there is no or insufficient information available to determine all alternative consequences or solutions or to determine their likelihood
Galbraith (1997)[6]		The difference between the amounts of information required to perform the task and the amount of information already possessed by the organization.
Lichtenberg (2000)[7]	Possible event that would have a reasonably major negative or positive impact and that may or may not occur	Lack of knowledge/ variability
Jaafari (2001)	The exposure to loss/gain The probability of occurrence of loss/gain multiplied by its respective magnitude	The probability that the objective function will not reach its planned target value The unknown probability of occurrence

[6] Galbraith, J.R (1977) Organization design, Reading, Mass: Addison-Wesley
[7] Lichtenberg, S. (2000). *Proactive management of uncertainty using the successive principle: a practical way to manage opportunities and risks*: Polyteknisk Press.

Source	Risk	Uncertainty
Smith and Merritt (2002)[8]	The possibility that unwanted outcomes or failures will disrupt a project	Uncertainty is, along with loss and the time component, an aspect of risk that cannot be eliminated or separated from risk
Chapman Chris and Ward Stephen (2003)	Risk is an implication (consequence) of uncertainty of the level of achievable performance, presented as an unwanted variability in relation to the expected outcomes, which is estimated for each feature of execution using a comparative cumulative probability distribution when measurement is suitable	Uncertainty is the lack of certainty. From the definition of risk the following can be concluded: Uncertainty is a source of risk in relation to the level of execution
Hillson (2007)[9]	Risk is any uncertainty that, if it happens, will have an effect on one or more objectives	Risk arises from uncertainty. From the definition of risk the following cab ne concluded: uncertainty can be a risk if, where it occurs, it has an impact on project objectives
Perminova, Gustafsson, and Wikström(2008)		Uncertainty as a context for risks as events having a negative impact on the project's outcome, or opportunities, as events that have beneficial impact on project performance
Kerzner (2009)[10]	Risk is a measure of the probability and consequences of failure to achieve the defined objectives of a project	The definition does not include the concept of uncertainty
ISO standard (ISO31000:2009)	Risk is the effect of uncertainty on objectives	Uncertainty is a natural need to weigh up the project results and measure their risks and benefits, mainly when the decisions have unpredictable outcomes

[8] Smith, P. G. and Merritt, G. M. (2002) *Proactive Risk Management: Controlling Uncertainty in Product Development* Productivity Press

[9] Hillson, D. and Simon, P. (2007) *Practical Project Risk Management: The Atom Methodology*, Management Concepts, Incorporated

[10] Kerzner, H. (2009) *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, John Wiley & Sons

Source	Risk	Uncertainty
Rolstadas, et al. (2011)[11]	Risk is defined as the probability that an event will occur multiplied by consequence involved if it occurs	Uncertainty is connected to the outcome of an event and can be expressed with a probability.
Johansen, Ekambaram, Krane, & Steiro (2012)[12]		Project uncertainty is defined as controllable and non-controllable factors that may occur, and variation foreseeable events that occur during a project execution, and that have a significant impact on the project objective
PMBOK (5th ed. 2013)	Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, or quality.	Form the definition of risk can be concluded: uncertainty is a characteristic of risk. An uncertain event or condition, if it occurs, will have a positive or negative effect on a project objective

Tab. 2 Definitions of Risk and Uncertainty in Project Management discipline

From this table, we can draw some conclusions. Different authors in different years had tried to give a definition of these two terms and basically all of them agree on the fact that the risk is related to a neutral or negative event of which we can calculate the probability of occurrence, while the uncertainty is related to an unknow event which could turn into positive outcome, becoming an opportunity, or negative outcome, becoming a threat.

Literature debates also on the perspective about the relation between risk and uncertainty: one perspective sees the two terms completely different concepts, the other one sees them as part of a continuum from subjective to probabilistic.

In my Thesis, I support the first perspective but with a contribution: starting from the assumption that the two terms are different, I suggest the total substitution of the term uncertainty with the term risk and I am going to explain further the reason why.

The uncertainty here is defined as a condition where there is lack of information needed to understand and define which could be the event that may occur if a change happens due to

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[11] Krane, H. P., Rolstadas, A., & Olsson, N. O. (2011). An empirical analysis of project risk in a time
perspective. *International Journal of Project Organisation and Management, 3*(1), 36-56.
[12] Johansen, A., Ekambaram, A., Krane, H.P., & Steiro, T. (2012). *Exploring uncertainty and flexibility in projects: towards a more dynamic framework?* Paper presented at the EGOS Colloquium, Helsinki, Finland

internal or external factors. The event, thus, is considered unexpected because not even planned and expected to occur in the execution phase of the project. Being the nature of the event uncertain, then, if the event occurs, it could have positive or negative impact on the project development.

The major issue of the project manager in the planning phase becomes the one to foresee the uncertainties in order to figure out soon, or to be able to be prepared in the future, which events can occur during the project execution and start planning a strategy to deal with them.

In the literature, it was also discussed the theme about the different types of uncertainty can be found in a project or the different areas to which it is related. To give a synthesis on the opinions and findings I can mention the major authors that researched the topic and gave their contribution to the actual knowledge.

Ward and Chapman (S Ward and Chapman 2003) divide project uncertainty into five areas: variability associated with estimates; uncertainty about the basis of estimates; uncertainty about design and logistics; uncertainty about objectives and priorities; uncertainty about fundamental relationship between project parties. Atkinson *et al.* (Atkinson, Crawford, and Ward 2006) restrict the areas from five to three: uncertainty associated with estimating, uncertainty associated with project parties and uncertainty associated with stages of PLC (Project Life Cycle). The last source I mention is De Meyer *et al.* (De Meyer, A., Loch, C.H. and Pich 2006) because they classifies uncertainty into three categories, according to the impacts they have, on the basis of a series of in-depth case studies. The three categories are: variation, known unknows and unknown unknows, or unk-unk's.

"[...]

- Uncertainty type Variation: Their impact is small, so we only need to worry about some variation around our targets.

- Uncertainty type Foreseeable Influences: We know what the influences are, but we do not know whether they will occur or not and we do not know the precise impact (probability of occurrence and impact). This is the notion of risk used in established project risk management.

- Uncertainty type Unforeseeable Influences: We do not know what the influences are. They are not within our horizon, they are outside of our knowledge, and therefore, we cannot plan for them. The decision theory and economics disciplines call this "unawareness" or "incomplete state space", and technology management scholars (cf. Schrader *et al.* 1993) call it "ambiguity".

[...]"

The classification of uncertainty, supported also in this thesis, is the one proposed by Rolstadås & Johansen (2008) where uncertainty is divided into three types according to the sources from which is coming, that could be internal or external. Internal uncertainty can be either

operational if related to the choice of concepts in the planning phase and technical uncertainties in the implementation phase; or strategic if related to the project owner's changing strategic considerations of the project. The external uncertainty, instead, is the contextual one related to the external environment where the project is placed. In this thesis, the external environment is influenced by political, economic and legal & regulatory factors.

In Figure 3 it is clear how the external uncertainty is higher in the planning phase and how the overall level of uncertainty increases/decreases due to the external uncertainties.
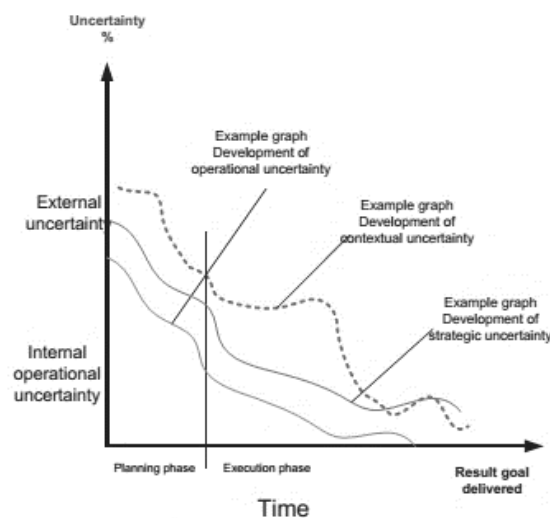
Fig. 3 "Uncertainty during the course of the project – Internal and External Uncertainty (A. Johansen, Krane, Ekambaram, Steiro, 2012)"

The literature doesn't address so much the topic of contextual uncertainty, focusing more on the internal factors the lead to uncertainties in the organization, related to the stages of the project or to estimates, costs, etc.

In this thesis, I want to focus mainly on the contextual uncertainty to understand how the context, in which the project is placed, plays a fundamental role in the project development and how the changes in the context can impact and be managed.

This is the reason why I strongly suggest the need to shift from the risk management concept to the uncertainty management one because when dealing with mega-projects nowadays the sources of uncertainty are wide ranging and include lack of information, ambiguity, characteristics and attitudes of the project stakeholders, trade-offs between trust and control mechanisms in different stages of the project life cycle, rapid changings in the context, etc. All these sources can not be addressed and managed effectively with the traditional risk management practices, particularly in the early stages of the project as the planning phase.

Ward and Chapman (S Ward and Chapman 2003) were one of the first authors to suggest a shift from the risk management into uncertainty management because of the weakness and

limits of the risk management tools and techniques to address some events defined as uncertainties. Therefore, an uncertainty management approach facilitates to address some issues of the project that are outside the boundary of the project itself, like the context, and facilitates also the integration with project management practices earlier in the project life cycle. Moreover, the uncertainty management is defined as necessary condition for effective project management because only with this kind of approach the project manager can address all the different sources of uncertainty (Atkinson, Crawford, and Ward 2006).

One of the major contribution of the work of De Meyer *et al.* (2006) was to combine the types of uncertainty with the dimension of the complexity, related to the *number of interactions among influence variables*. The result of this combination is a matrix where it is clearly stated how in presence of unforeseeable influences and high complexity, the traditional project management techniques and tools are not sufficient to deal with them.
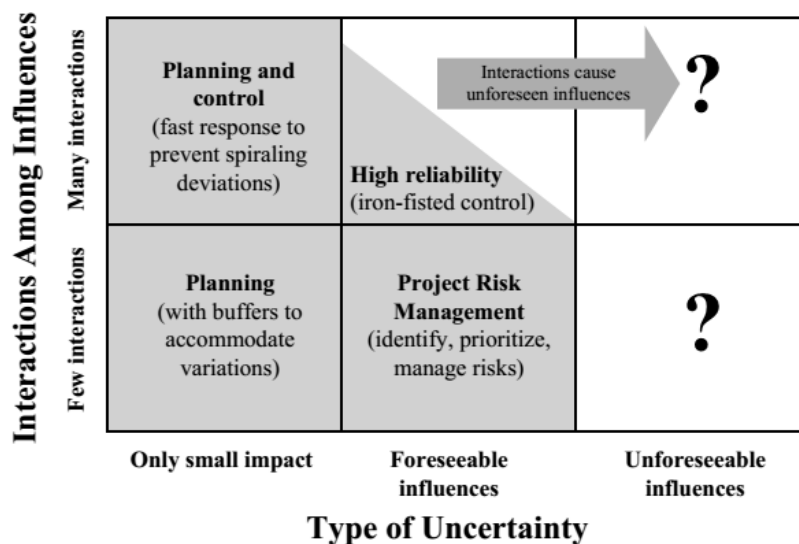
Fig.4 "the limits of established project risk management methods"

In fact, according to the classification of uncertainty given by the authors, the classical project risk management can manage only the variation and the foreseeable uncertainty in project with low complexity because the team does not have the right level of flexibility required to respond to surprises, so to events that cannot be foreseen on time. The more we move on the right side of the matrix, the more is required a new approach more flexible and ready to adapt to new scenarios.

To conclude I will use the term uncertainty with this definition *"a condition where there is lack of information needed to understand and define which could be the event that may occur if a change happens due to internal or external factors. The event, thus, is considered unexpected because not even planned and expected to occur in the execution phase of the*

*project. Being the nature of the event uncertain, then, if the event occurs, it could have positive or negative impact on the project development "*and I will use uncertainty always at the place of risk.

The focus here is on the contextual uncertainty related to the environment where the project is placed and on the major source of the contextual uncertainty which is the external stakeholders' network.

2.2.2 Uncertainty & Complexity

In this section I examine the interrelation between uncertainty and complexity in the Project Management. Padalkar *et al.*, based on a semantic analysis of project management literature, argue that the two term are terminologically confounded.

The complexity, along with the level of uncertainty, is a in intrinsic characteristic of mega-projects and this concept comes from the systematic approach, the application of which is the basis of project management. Before to address the relationship between complexity and uncertainty, I will introduce a synthesis of the literature on the definitions and characteristics of project complexity.

The definition of complexity given by the Collins English Dictionary (2015) is "the state or quality of being intricate or complex" where complex is defined as "made up of various interconnected parts".

In the project management literature, the term complexity has been defined by many authors but none of them agree upon a common definition because every definition is based on the perceived characteristics of complexity. Baccarini (Baccarini 1996) formulated the first important concept arguing that complexity is "consisting of many varied interrelated parts" which can be described in terms of their degree of differentiation and interdependency. The APM (Association of Project Management, 2008) describe a complex project as one which will typically involve interaction between several organisations and or different units in the same organisation, requiring the coordination of the work of several disciplines and involve a wide range of project management methods, tools and techniques.

Besides the different definitions of project complexity, the authors have also tried to identify the possible dimensions of the complexity with the aim to propose or suggest frameworks to cope and deal with it.

From examination of the literature there is no consensus on what the dimensions of project complexity are. Remington and Pollack (Remington and Pollack 2007) differentiate between four dimensions of complexity: structural, technical, directional and temporal. Geraldi *et al.*

(Geraldi, Maylor, and Williams 2011) divide project complexity into five dimensions: structural, uncertainty, dynamics, pace, and socio-political complexity. Bosch-Rekveldt *et al.* (Bosch-Rekveldt et al. 2011) suggest three dimensions of complexity relevant in large engineering projects: technical, organizational and environmental complexity. Kerdes *et al.* (2013) suggest to examine complexity of mega-projects under two dimensions: technical complexity related to the size of the project, and social complexity related to the interactions among the people involved in the project. More recently, Chapman (2016), based on a review of all the existing frameworks for coping with complexity described in his work, adopts six common dimensions of complexity pertinent to rail construction: finance, context, management, site investigation works, task and delivery.

Based on the literature review, in line with the division proposed by Bosh-Rekveldt et al. I consider complexity in mega-projects divided into three dimensions: the first one concerns the technical issues (size of the project, technologies, etc.), the second one concerns organizational issues (internal project parties, tasks, etc.) and the third one is related to the context issues (external stakeholders; political, economic, legal and regulatory changes in the context: etc).

Complexity and Uncertainty are two concepts strongly related to each other. If we consider complexity, in a broader view, as the number and type of components and the number and type of relationships between them, then an increase in complexity means an increase of the difficulty of understanding and comprehending the effect of influencing one element, thus the result is an increase in uncertainty (Salet, Bertolini, and Giezen 2013). Therefore, the relation between complexity and uncertainty could be described by a function of direct proportionality where, of course, the increase is not really proportional but, to the increase of one factor, corresponds the increase of the other one. In the literature we can find different types of relationships between complexity and uncertainty that can be categorized in three groups: uncertainty and complexity are independent characteristics (van Marrewijk et al. 2008); complexity is compounded by uncertainty (Williams 2002)[13]; project complexity is the source of uncertainty in projects (Danilovic and Browning 2007).

More recently, another type of relationship between complexity and uncertainty raised: project complexity stems from uncertainty (Chapman 2016).

Chapman, assuming that complexity arises from what is uncertain and unpredictable, defines thus project complexity as follows "a complex project is one which exhibits a high degree of uncertainty and unpredictability, emanating from both the project itself and its context". He gives also an explanation of the two factors. Aspects of project uncertainty emanating from within the project itself are: uncertain goals and scope, the adoption of novel technology with the choice of organisational structure, project management method and contracting strategy;

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[13] Williams, T. (2002) *Modelling Complex Projects*. West Succex: John Wiley & Sons.

while aspects of uncertainty emanating from the context are: the external stakeholder's evolving expectations, definitions of project success and the relationship between them.

Since in this thesis the focus is on the contextual uncertainty I will refer always to the dimension of the complexity related to the context.

The context dimension refers to all of the external factors that have an impact on the project and it includes stakeholders, environmental issues, legal and legislative requirements, local issues, and project-specific factors (Shane, Gransberg, and Strong 2014). Stakeholders are the parties that directly affect and are affected by the project and the factors under stakeholders include the public, politicians, the owner, and jurisdictions. The public is directly affected by and has the potential to affect the project from initial conception all the way through completion and well after turnover and it can express its voice also helped by the media tools and channels. The impact of the environment is an external source of complexity, which places it in the context dimension. This category contains two factors: sustainability and limitations. Legal and Legislative Requirements are another category for the context dimension. Procedural law refers to the legal channels and limitations, such as permitting, zoning, and land acquisition, that constrain implementation of a transportation project. Global and National Events may also increase the complexity of managing a project. Economics and incidents are the factors identified for this category. Therefore, Shane *et al.* (2012) define complex projects as involving an unusual degree of uncertainty and unpredictability (emanating from dynamic environment) in which many of the critical factors are outside the project team's direct control. The same perspective on complexity, that arises from a dynamic environment expressed as "frequently changing context", is found in Giezen's work (Giezen 2012). Also other authors concur that complex projects are characterised by unpredictability and that elements " can change in ways that are not totally predictable and which can then have unpredictable impacts on other elements that are themselves capable of change (Cooke-Davies 2011).

Today due to the technological improvements, the global financial and environmental instabilities and forces of globalisation, the context is changing so fast at an ever-increasing pace. Therefore, the awareness of the complexity of the context and the related high uncertainty is a fundamental factor especially in the planning phase, because it has significant impact on the project's development and then on its success.

2.2.3 Uncertainty & External Stakeholders

It is widely acknowledged that one of the characteristics of mega-projects is the involvement of multiple stakeholders whose interests and concerns can influence the project's shape and development to a greater or lesser extent. This is especially the case of infrastructure mega-projects where stakeholders are considered a major source of uncertainty.

Before to address the review of the eventual existing frameworks and approaches used to manage stakeholders in context of high uncertainty, an introduction of how stakeholders and uncertainty are related each other is required.

For this specific topic, the literature is not well updated because the integration and relationship between stakeholders and uncertainty has not been so addressed and researched by scholars, therefore there is a gap. The aim of this thesis is to give a contribution to the knowledge by studying the relation and integration between contextual uncertainty and external stakeholder management and in this section I am going to present an overview of the related literature review.

In the previous section, speaking about complexity dimensions, emerged that external stakeholders are one of the categories of the context dimension, in fact complexity may stem from the number of stakeholders, the variety of stakeholders' perspectives, conflicting stakeholder agendas, the ever-changing dynamic of stakeholder relationships, etc.

Therefore, we can argue that an increase in the diversity ad number of the external stakeholders related to the project, has as a direct consequence an increase in the level of complexity. Aaltonen *et al.* (Aaltonen and Kujala 2016) adapt the division proposed by Ramasesh and Browing (2014), who divide complexity dimension into element complexity (determined by the number, variety, internal complexity and lack of robustness of project elements), and relationship complexity (determined by the number, variety, criticality, patterns, internal complexity and externality of relationships among project elements) to propose a division of complexity into stakeholder element complexity and stakeholder relationship complexity. The stakeholder element complexity includes the number of project stakeholders, variety of projects stakeholders and their goals and stakeholders' internal complexity. The variety of project stakeholders is related to the differences in stakeholders' attributes, backgrounds and goals. The stakeholder relationship complexity, instead, include the number, variety, patterns and internal complexity of stakeholder relationships. Moreover, the authors distinguish the complexity related only to external stakeholder relationships because it is more crucial and important considering the impacts on the project. In fact, mega-projects are subject to the effects of a wider socio-political environment and the demands and pressure stemming from external stakeholders such as community groups, local residents, landowners, environmentalists, regulatory agencies, and local and national governments (Aaltonen, Jaakko, and Tuomas 2008; Bent Flyvbjerg 2014)

Based on the previous literature review, external stakeholders on one side influence the level of complexity impacting on the context dimension and, on the other side, are considered source of uncertainty due to their unpredictability and dynamicity. Therefore, we can conclude that the relationship between external stakeholders and uncertainty is strong, even if a further investigation on how to manage effectively the external stakeholders in order to reduce complexity and thus the contextual uncertainty (uncertainty emanating from environmental

factors such as political, economic, legal and regulatory factors) is needed and it will be the aim of this thesis.

Even though the literature doesn't address so much the study of this relationship (external stakeholders & contextual uncertainty), some authors proposed some frameworks/approaches to combine risk management practices and stakeholder management ones.

Ward & Chapman (Stephen Ward and Chapman 2008) emphasized the importance of the link between stakeholders and uncertainty arguing for an active approach to stakeholder management, based on an analysis of the project. They suggest a process framework called SHAMPU (Shape, Harness, and Manage Project Uncertainty), which represents a synthesis of earlier project risk management process frameworks, to provide a structure for a review of approaches to analysing stakeholders and related uncertainty management issues. They recognized the importance of the awareness of the context, including a simple framework for consolidating information about the project context for uncertainty management purposes consisting in six basic questions (Chapman Chris and Ward Stephen 2003), and argued that the most important uncertainty management issues are usually related to objectives and relationships between the key stakeholders. The SHAMPU "identify" phase involves identifying sources of uncertainty, associated responses and secondary sources, as "issues". Stakeholders are considered a major source of uncertainty in all the stages of the PLC. Ward (S. Ward 1999) argues that the involvement of multiple stakeholders in a project introduces uncertainty associated with: objectives, expectations and associated priorities of different stakeholder; specification of responsibilities; perceptions of roles and responsibilities; communication across interfaces; the capabilities of various stakeholders; formal contractual conditions and their effects; informal understandings on top of, or instead of, formal contracts; arrangements and mechanisms for coordination and control. Of course, since 1999 many things changed and more and diverse uncertainty issues related to stakeholders can be identified.

This framework was also adopted to analyse the case EXPO 2015 by Locatelli and Mancini (Locatelli and Mancini 2010) because stakeholders were considered the major sources of uncertainty and thus this framework process makes stakeholder issues central to the seven phases and it is more detailed than most other project risk management process framework.

Although the SHAMPU seems to be appropriate in managing stakeholders when they are the major sources of uncertainty, no other authors or scholars investigated more on this topic to improve its effectiveness and its adaptability to all the stages of the PLC. Moreover, there is no a clear focus on the uncertainty stemming from the context and the perspective adopted to address the overall management of a project is the one of the project owner.

2.3 Stakeholder Management literature review

2.3.1 Project Stakeholders: definition & classification

The management of project stakeholders is an essential part of the project management process and the Project Management Institute (PMI) has recently added project stakeholder management as a "10th Knowledge area" due to the importance attached to appropriate engagement of stakeholders in key project decisions and activities (PMI 2013). Project managers must consider all the stakeholders' needs, requirements and expectations in order to guarantee the project success (Olander 2006).

Stakeholder theory has its origins in 1984 when Freeman defined stakeholders as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984) [14] . Cleland in the 1986 introduced stakeholders and stakeholder management process to the project management, highlighting the importance of stakeholder identification, classification, analysis and management approach formulation (Cleland 1986)[15].

Project stakeholders have been defined in numerous ways, starting from Freeman whose definition, later adopted also by the PMI, has been criticised because too broad, giving space to other authors to define more precisely who can be considered a stakeholder. Mitchell *et al.* (Mitchell, Wood, and Agle 1997) address the problem identifying three main stakeholder attributes (power, legitimacy and urgency) with the aim to define a "stake". A stakeholder, thus, is someone who possess one or more attributes. McElroy and Mills (2000) suggest in alternative to Mitchell *et al.* (1997) a definition of project stakeholders stating that they are a person or a group of people who have a vested interest in the success of a project and the environment, within which the project operates. Based on the literature review I define here project stakeholders broadly as any person or group of persons who can affect or is affected by the project and has an interest in it.

Besides the different definitions given to the project stakeholders, various researchers have identified different classifications to classify them in several categories with the aim to address each category in the best way possible.

Clarkson (Clarkson 1995) introduced the notion of primary and secondary stakeholders, accepted also by McElroy and Mills (2000), and Lester (2007) [16] the notion of direct and indirect stakeholders. To some extent, the two divisions essentially categorize project

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[14] Freeman, R.E. (1984) *Strategic Management – A Stakeholder Approach,* Pitman Publishing Inc.

[15] Cleland, D.I. (1986) "*Project stakeholder management*". Project Management Journal, 17(4), 36–45.

[16] Lester, A. (2007) "*Project Management - Planning and Control*". 5th ed, Elsevier Ltd.

stakeholders in a similar way. According to Cleland and Ireland (2007, 153) [17], primary stakeholders include those who have legal relationships with the project and a responsibility in the project management processes, such as cost, time, quality management. Similarly, direct stakeholders are people who directly engage in the planning, executing and administration processes of a project (Lester 2007). Both Cleland and Ireland (2007) and Lester (2007) agree that secondary and indirect stakeholders do not participate directly in the project. Included in this category are environmental, social and economic groups, media, and families.

The most common division, adopted also in this thesis, is into internal and external stakeholders (Harris 2010; Leung 2010; Winch 2010). Typically, internal stakeholders are described as formally members of the project with a legal contract (e.g. owners, customers, and employees), whereas external stakeholders are those ones not formally members of the project but with an interest in the project and thus, they may affect or be affected by the project (Leung 2010). Olander (Olander 2006), adapting the work of Cleland (1999)[18], present in his doctoral dissertation a figure (Fig. 5) which shows clearly the categories of internal and external stakeholders for construction projects.

Fig. 5 Potential stakeholders for construction projects (Olander 2006)

There is a broad array of literature related to the stakeholder management process (Olander, 2006). Among many, Littau *et al.* (Littau, Jujagiri, and Adlbrecht 2010) cite Cleland (1986) and highlights the steps of the process where identification, classification, analysis, and lastly management of stakeholders are particularized. Bourne (2009)[19] has a slightly different

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[17] Cleland, D.I. and Ireland L.R. (2007) "*Project Management: Strategic Design and Implementation*". 5th ed. New York: McGraw-Hill.
[18] Cleland, D.I. (1999) "*Project Management – Strategic Design and Implementation*".3rd edn, McGraw-Hill
[19] Bourne, L. (2009). *"Stakeholder Relationship Management: a Maturity Model for Organisational Implementation"*. Farnham, Surrey, UK, Gower.

process, which is more commercialized: identify, prioritize, visualize, engage, and monitor. Mitchell *et al.* (1997) reflect on classification and analysis by examining the stakeholder salience, which is "the degree to which managers give priority to competing stakeholder claims". An important feature in stakeholder management is managing stakeholders' expectations (Newcombe 2003; Bourne and Walker 2005; Atkin and Skitmore 2008). The entire stakeholder management process is much based on project managers' combination of consciousness and intuitiveness in order to understand stakeholders' expectations and thereby increase their positive input and maximize the project value (Bourne and Walker 2005; Bourne 2006[20]).

The present research is concerned primarily with external stakeholders because, as mentioned in the previous sections, the aim is to understand how the external stakeholders are related to uncertainty and thus, how they affect the project development.

Freeman (1984) argued that the more difficult task is to understand external changes originating from the environment of a corporation because they affect its ability to cope with internal changes. External changes bring uncertainty, which needs a specific management approach because it cannot be readily assimilated into the relatively more comfortable relationship with internal stakeholders. Olander in his doctoral dissertation investigate deeply the external stakeholders theme addressing the importance of the focus on external changes, and, in my thesis, I will refer often to Olander's findings.

From the literature review the external stakeholder analysis process is described by Olander as consisting of the following five steps: stakeholder identification, stakeholder needs and concerns, stakeholder impact analysis, evaluation of alternative solutions, level of acceptance.

The whole process is dynamic and iterative, where the different steps interact across the PLC because they need an adaptation, and where every part of the analysis will have to be conducted several times over as the project progress in order to provide more and sufficient information about the effect.

2.3.2 Stakeholders' influence in infrastructure mega-projects

Infrastructure mega-projects typically involve a high number of different stakeholders entering the project lifecycle at different stages with different roles. Therefore, effective engagement and management of the stakeholders is a critical factor with high priority, especially in the planning phase (Chinyio and Akintoye 2008).

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[20] Bourne, L. (2006). *"Visualizing Stakeholder Influence - Two Australian Examples"*. Project Management Journal, 37, pp. 5.

Importance and relevance of external stakeholders' involvement in Infrastructure mega-projects

Among the project stakeholders a major focus for infrastructure mega-projects is on external stakeholders because they are those one who can bring external changes usually difficult to control and manage. Bourne and Walker (Bourne and Walker 2005) suggest to successfully identify external stakeholders and effectively collaborate with them to thoroughly understand their expectations and potential impact upon project success, with the aim to maximise external stakeholder positive inputs and minimise any potential detrimental impacts.

Public opposition, for instance, represented by media or local communities, due to various factors, has been reported as the main reason for failure in several cases, and together to the local/national government they represent the major focus for project managers because of their great influence and power over the project.

There are some key project stakeholders that must be engaged as soon as possible through the establishment of trust, credibility, transparency (Flyvbjerg at al. 2003; Hardin 2006 [21]; Currall and Inkpen 2008 [22]) in order to create consensus in decision-making, which is fundamental in turbulent and uncertain contexts. The consensus built in the early stages is essential because can often contribute to important cost savings through the reduction of delays caused by public opposition and challenges that could otherwise occur in the post-planning stages. The most important opportunities that come from the engagement of stakeholders are basically the identification of those concerns that, when properly addressed, can lead to improvements in the project concept; the reduction of conflicts, which otherwise could jeopardize legitimate project plans and programmes; and fast, transparent and robust decisions (OMEGA Centre 2012).

Therefore, should be present a Stakeholder Involvement Program in the early stages of the project, as integral part of the project management process, and in order to make it true and successful, the public should be aware about the fact that their involvement and participation will influence the decision-making process. Transparency and trust should be ensured as fundamental prerequisite of the programme to avoid that Stakeholders become sceptical about the programme if they have the perception that decisions are taken before-hand. (El-Gohary, 2006).

Many authors have undertaken studies about stakeholder engagement and relationships in construction and infrastructure mega-projects (Genus 1997; Patel, Kok, and Rothman 2007;

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[21] Hardin, R. (2006), "*Trust*". Polity Press, Cambridge.
[22] Currall, S. C. and A.C. Inkpen (2008) "*On the Complexity of Organizational Trust: A multilevel co-evolutionary perspective and guidelines for future research*". Section 2.8 in Working Paper 2, The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines, OMEGA Centre, University College London, pp. 119-151

Pinto, Slevin, and English 2009). Stakeholder engagement in infrastructure and construction mega-projects aims at involving all project stakeholders especially in the planning phase to reduce conflicts and establish clear project priorities. In fact, even if the external stakeholders are not formally and legal members of the project, they can adversely affect the project or even stop it with their conflicts or resistance.

Stakeholder Impact analysis

Stakeholder analysis in infrastructure mega-projects is a fundamental process that should be done carefully by project managers to analyse the project stakeholders environment, where for stakeholder environment is intended a project setting including " all organizations, and relationships between them, that can affect or be affected by the project" (Aaltonen 2011). In the literature, there are various stakeholder analysis methods concerning their identification, classification, assessment and impact on the project.

I synthetize all the classification methods present in literature in Table 4, where all the different methods classify stakeholders based on different elements, such as attributes, positions towards the project, indices or matrix/format to map the stakeholders.

Mitchell et al. (Mitchell *et al.* 1997) classify stakeholders based on the possession of one or more attributes, that are power, legitimacy, and urgency, defying a salience framework to assess the salience of the stakeholder in the project. The power may arise from the stakeholders' ability to mobilise social and political forces or from their ability to withdraw resources from the project organisation. Legitimacy is defined in terms of stakeholders who bear some sort of risk in relation to the organisation, beneficial or harmful. The urgency attribute gives the dynamicity to the stakeholder influence and it is defined as the degree to which claims (or stakes) call for immediate attention. Based on the possession of one or more attributes, Mitchell *et al.* (1997) label then the stakeholders with some specific names in order to identify seven class and suggest a specific management strategy for each of them. The classes are: dormant, discretionary, demanding, dominant, dangerous, dependent, definitive. In the figure below (Fig.6) there is the schematic representation of the different classes.
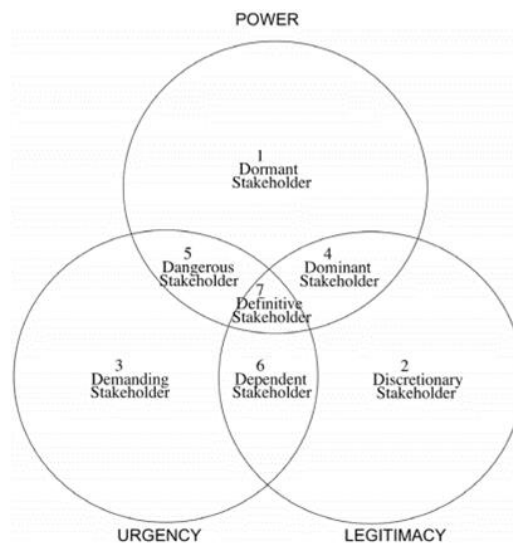
Fig. 6 Stakeholder classes (Mitchell *et al.* 1997)

McElroy and Mills (McElroy and Mills 2007)[23] consider the position occupied by the stakeholders towards the project and identify five levels of stakeholder position: active opposition, passive opposition, not committed, passive support, active support. Johnson *et al.* (2005)[24] propose a matrix to map the stakeholders according to two dimensions: the power to influence the project (high or low) and the level of interest in impressing their expectations on the organization's purpose and choice of strategies (high or low). Combining the two dimensions and their levels (high or low), it follows four different cases where to map the stakeholders, and to each of the cases corresponds a management strategy: keep satisfied, key subjects, minimal effort, keep informed.
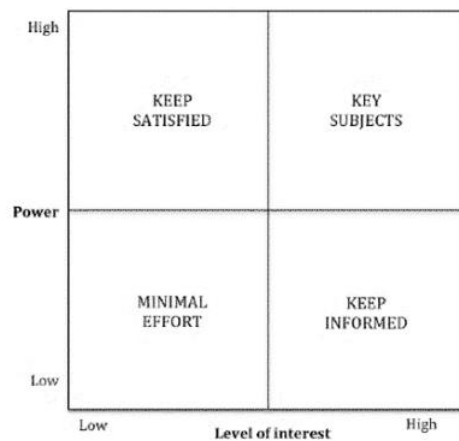
Fig.7 Power/Interest matrix (Johnson *et al.* 2005)

[23] McElroy, B. and Mills, C. (2007). "*Managing Stakeholders*" in: Turner, J.R. (ed.) Gower Handbook of Project Management
[24] Johnson, G., Scholes, K. And Whittington, R. (2005). "*Exploring Corporate strategy: Text and Cases*". 7th edn, Prentice Hall, London.

Newcombe (Newcombe 2003) propose a different matrix where the two dimensions taken into account are the predictability of the stakeholders (how likely the stakeholder is to try to enforce its expectations on a project) and the power possessed (as the means to do so). From the combination of the dimensions and their levels (high or low) it follows four different categories of stakeholders that should be managed in a different way: stakeholders with few problems, unpredictable but manageable stakeholders, powerful but predictable stakeholders, greatest dangers or opportunities.

Predictability

	High	Low
Low	**A** Few problems	**B** Unpredictable but manageable
High	**C** Powerful but predictable	**D** Greatest danger or opportunities

Power

Fig.8 Power/Predictability matrix (Newcombe 2003)

The vested interest-impact index (Viii) is proposed by Bourne and Walker (Bourne and Walker 2005) as an index to quantify the influence of the stakeholder in the project. The "vested interest" level (V) and the "influence impact" level (i) are qualitatively assessed on a five-point scale between "very high" (=5) and "very low" (=1). The vested interest-impact index for a given stakeholder is then calculated as $Viiii = \sqrt{(v * i/25)}$.

Olander (Olander 2007) proposes first an adaptation of the power/interest matrix of Johnson *et al.* (2005) developing a impact/probability matrix (Fig.) where the project stakeholders are categorized depending on their level of impact and probability of impact on the project. The matrix indicates the relationship that project management might typically establish with stakeholders mapped in the different quadrants.

Level of impact	Keep satisfied	Key players
	Minimal effort	Keep informed

Probability of impact

Fig.9 Impact/Probability matrix (Olander 2007)

Studying the impact of the external stakeholders then, he proposes also an index to assess the stakeholder impact by developing a quantitative method as the result of the integration of (1) Mitchell et al.'s (1997) stakeholder attributes; (2) Bourne and Walker's (2005) stakeholder vested interest-impact index; (3) McElroy and Mills's (2003) stakeholder position toward the project. This methodology is described by Olander as comprehensive because it assesses stakeholder impact attitudes. The external stakeholder impact index is calculated as the result of the multiplication of the three factors.

Nguyen et al. (Nguyen, Skitmore, and Wong 2009), based on the index of Olander, propose a similar quantitative approach to evaluate stakeholder influence but incorporating one more variable, stakeholder knowledge, emphasizing its importance in large projects because stakeholders are more influential if they gain concrete project information instead of relying on rumours and anecdotes.

The stakeholder analysis topic has been researched and addressed by many scholars and researchers in these years, contributing to the creation and identification of so many strategies, frameworks, approaches, methods to assess the influence/impact of the stakeholders in the project with the aim to manage them effectively and guarantee the project success. Despite the numerous papers, works, researches, etc. about this topic, none of them, or very few, addresses the topic of stakeholder analysis to be integrated with the uncertainty analysis and propose an combined approach. Therefore, since this gap, the aim of my thesis is to develop a new method of stakeholder impact analysis, based on the current knowledge and literature, in order to be able to integrate it with the analysis of the context and related contextual uncertainty.

2.3.3 Stakeholder management models in Infrastructure mega-projects

Today current construction and infrastructure mega-projects are implemented in highly complex and uncertain environments where multiple stakeholders with divergent interests, objectives, and socio-cultural backgrounds create conflicts and difficulties for the project management. The complex and volatile nature of these projects require systematic approaches and appropriate skills of project managers to accommodate stakeholder interests and to achieve the best value of project outcome (Mok, Shen, and Yang 2015).

Therefore, stakeholder management process is seen as an effective approach to bring to the attention of the project manager the stakeholder concerns and to develop robust stakeholder relationship in complex project environments (Bourne and Walker 2005). The main purpose of the project stakeholder management is to manage the relationship between the project and its stakeholders (PMBOK 2013) but the uncertainty and complexity are increasing the

difficulty for the project management to balance competing claims on resources between the project and the project stakeholders (Aapaoja and Haapasalo 2014). The ability to understand and manage the roles and requirements of various stakeholders is a critical task for a project manager (Bourne and Walker 2005), thus more attention and focus is required.

In literature, there are no systematic processes for the stakeholder identification and management in construction and infrastructure mega-projects, even if the stakeholder analysis and identification have been recognised as important processes to facilitate the understanding of how to manage stakeholders in invariably changing and unpredictable environments (Aaltonen, Jaakko, and Tuomas 2008). Several scholars have proposed different stakeholder management process models summarized in table 4 (adapted from Yang *et al.* (Yang et al. 2011)), however, there is no consensus on the best model.

Scholars	Stakeholder management processes
Karlsen (2002)	Identification of stakeholders; analysing the characteristics of stakeholders; communicating and sharing information with stakeholders; developing strategies; following up.
Elias et al. (2002)	Developing a stakeholder map of the project; preparing a chart of specific stakeholders; identifying the stakes of stakeholders; preparing a power/stake grid; conducting a process level stakeholder analysis; conducting a transactional level stakeholder analysis; determining the stakeholder management capability.
Yang(2006)	Identifying stakeholders; gathering information about stakeholders; Analysing the influence of stakeholders.
Bourne and Walker (2006)	Identifying stakeholders; prioritizing stakeholders; developing a stakeholder engagement strategy.
Olander(2006) adopted Cleland (1999)	Identification of stakeholders; gathering information on stakeholders; identifying stakeholder mission; determining stakeholder strengths and weaknesses; identifying stakeholder strategy; predicting stakeholder behaviour; implementing stakeholder management strategy.
Wlaker et al (2008)	Identifying stakeholders; prioritizing stakeholders; Visualizing stakeholders; Engaging stakeholders; monitoring effectiveness of communication.
Jepsen and Eskerod(2009)	Identification of the (important) stakeholders; characterization of stakeholders pointing out their: (a) needed contribution (b) expectations concerning rewards for contributions (c) power in relation to the project; decision about which strategy to use to influence each stakeholder.
Aapaoja and Haapasalo (2013)	New framework for stakeholder identification, classification and requirement engineering in order to merge project stakeholder management, salience and classification.

Table 4 Stakeholder management process models in construction and infrastructure projects (adapted from J. Yang *et al.* 2010)

Aapaoja and Haapasalo (Aapaoja and Haapasalo 2014) have focused on the development of a framework that identify, classify and manage project stakeholders in construction and infrastructure mega-projects. The constructed framework (Fig.10) includes four main phases: defining the project purposes and customer constraints; identifying project stakeholders according to their functional role; assessing the stakeholder salience and the probability of their impact/ability to contribute; classifying and prioritizing stakeholders according to four groups. Moreover, the framework includes the requirements engineering process (Aapaoja and Haapasalo 2014).
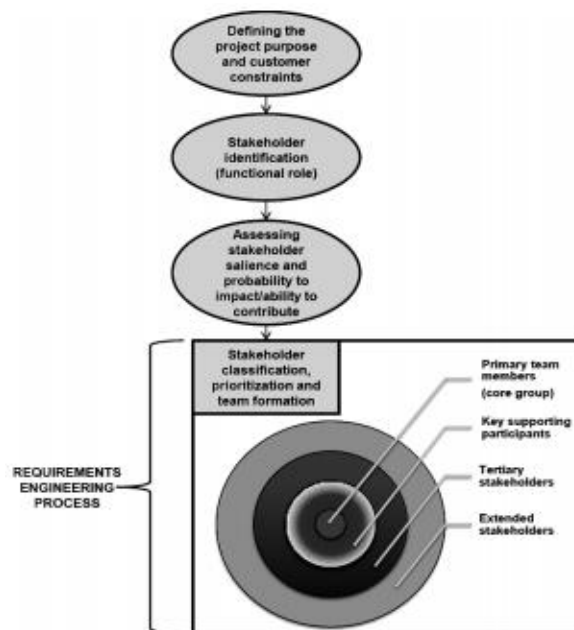
Fig.10 Framework for stakeholder identification and classification (Aapaoja and Haapasalo 2014)

This framework focuses especially in the early stages of the project, when it is crucial to identify both certain and uncertain stakeholders. It has the objective to define a better and systematic way to identify, classify and manage project stakeholders in order to facilitate the value creation and project outcome by identifying and consolidating different roles and responsibilities of stakeholders. The framework, however, presents the following limits explicated by the authors, that reduce the efficacy of its implementation: it does not consider potential changes in the stakeholder network, hence, to analyse changes among stakeholders and their salience, it should be applied in all the phases of the project; it does not take into account stakeholders' attitude (e.g. proponent or an opponent). Moreover, I consider another limit, that is of extreme importance in turbulent and uncertain context, which is the missing integration of the stakeholder analysis process with the uncertainty and complexity analysis processes.

All the previous models and approaches reviewed in this section suggest a sequence of steps where stakeholders are identified, classified, analysed and then managed through different strategies in construction and infrastructure mega-projects, but none of them integrate the uncertainty analysis process.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research process

The research process used in this thesis (see Fig.11) aimed at providing an understanding of the influence of the contextual uncertainty on the project development. A systems approach was adopted and three case studies have been employed as the main method of research in combination with literature reviews. The three case studies were selected because the qualitative nature of this research in order to give more practical examples and derive from the reality the major findings.

Problem definition
- Definition of the research area and the possible problem to address

Literature review
- Mega-projects: infrastructure sector
- Uncertainty management
- Stakeholder management in Infrastructure mega-projects

Case studies
- Data collection: primary and secondary sources
- Analysis of the data
- Discussion of the findings

```
┌─────────────┐  ┌──────────────────────────────────────┐
│ Framework   │  │ ▪ Stakeholder impact analysis        │
│ development  │  │ ▪ Integration between stakeholder's  │
│             │  │   dynamism and context complexity    │
│             │  │ ▪ Development of guidelines for       │
│             │  │   strategies to manage uncertainty    │
│             │  │ ▪ Application on the case studies     │
└─────────────┘  └──────────────────────────────────────┘

┌─────────────┐  ┌──────────────────────────────────────┐
│ Discussion  │  │ ▪ Discussion of the results of the    │
│             │  │   application of the framework        │
│             │  │ ▪ Final discussion                    │
└─────────────┘  └──────────────────────────────────────┘

┌─────────────┐  ┌──────────────────────────────────────┐
│ Conclusion  │  │ ▪ Answer to the research questions     │
│             │  │ ▪ Problem addressed                    │
│             │  │ ▪ Conclusion of the thesis            │
└─────────────┘  └──────────────────────────────────────┘
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Fig.11 The research process

3.1.1 Co-operation with Civil department of Instituto Superior Técnico of Lisboa

The research reported here is focused on project management issues in European context. When I defined the research area, I focused my attention on the Infrastructure sector for two main reasons: the importance and actuality of the sector itself and the opportunity to conduct a part of my research abroad in another country, where there was addressing a research stream in the same sector.

Therefore, I took the chance to study a real transport mega-project in a different country from Italy, where I could experience a different culture, a different point of view and reality of facts. Thanks to my Supervisor, I started a collaboration in the Civil department of the Instituto Superior Técnico of Lisboa, Portugal, where a research stream on risk management in transportation mega-projects was carrying on. I worked in collaboration with a PhD student who had already worked on the Portuguese project of the High Speed Rail so I could benefit of her knowledge not only about the project, but also about all the theoretical models and framework used for risk management in these kind of mega-projects. The collaboration was

very good and important for me, either from an academic point of view, because I could study in depth the case and contact also the managers of the projects to conduct some interviews and gather thus real data based on experience, and from a personal point of view, being the experience of self-development.

3.2 Timeframe for research

The research work has been performed based on a plan agreed upon the possible period I could have spent in Lisbon, in the hosting university Instituto Superior Técnico. The original topic of the research has been chosen together with the Portuguese Professor and, after a preliminary study in Milan, Italy, I continued the work in Lisbon, Portugal.

The methods choice relies on state of art approaches and methodologies for uncertainty analysis and stakeholders' analysis on project management in the European context presented in the literature review.

In the Figure (Fig.12) is proposed the plan of my research work that I follow through these months.

Literature review is the longest activity (activity 1) in terms of duration, starting from the beginning of the work, and ending with the data collection. The analysis of the case studies is divided in data collection through primary and secondary sources (activity 2) and the analysis and interpretation of the data collected (activity 3). Next, the development of the new approach (activity 4) is followed by the interpretation and discussion of the new approach applied to the case studies (activity 5). Finally, the work ends with the conclusions and future research suggestions.

Activity	April	May	June	July	August	September	October	November	Dicember	January	February	March	April
			2016								2017		
Literature review													
Data collection													
Analysis and interpretation of the data													
Development of the new approach													
Discussion													
Conclusions													
Milestones	Literature review conducted at Politecnico of Milan					Research conducted at Insituto Superior Técnico, Lisbon (PT)					Discussion of the approach and suggestions		Intend to submit a paper

Fig. 12 Timeframe for the research work

In addition, a scientific paper was already produced in partnership with Instituto Superior Técnico – Lisbon University, and it will be submitted to an international Journal: the Journal of Management in Engineering, ASCE JME, Special Collection: Organizational Behaviour and Governance of Megaprojects:

ROMEO, Francesca; PEDRO, Marisa J.G.; ABREU e SILVA, João; and MANCINI, Mauro. (under submission for ASCE JME). *MANAGING CONTEXTUAL UNCERTAINTY THROUGH THE STALEHOLDERS MANAGEMENT IN EU MEGAPROJECTS*

Thus, it is possible to present the progressing research on risk and uncertainty management issues, providing new ideas and understandings about also the integration with the external stakeholders management. It also demonstrates some of the research developed during the Lisbon' visiting.

3.3 Problem definition

The definition of the research and the relative problem to address has its origin in the recognized importance of the context where the geo-political and economic assets are changing so fast bringing a high level of uncertainty and complexity. Therefore, the management of the infrastructure mega-projects, those projects which impact the society and the economic more than others, become a difficult and crucial task for project managers.

Once defined the research area, the next step was to identify more specifically the problem to address in order to formulate the research questions that would have led to the starting of the study. The problem identified was concerning the difficulty of the project manager today to cope with the contextual uncertainty, emanating from the contextual factors (political, economic and legal & regulatory factors), and with the high complexity, intrinsic characteristic of mega-projects. The main issue of the project manager is that risk management techniques and tool are not sufficient to manage this uncertainty because the major source is represented by the external stakeholders. Therefore, the missing study and understanding of the contextual uncertainty's impact on the project, together with the inadequacy of the existing tools and techniques of risk management, lead to the formulation of the main research question which drove the whole research:

"How does the contextual uncertainty impact on the development of mega-projects?"

Research question involving the sub-questions: *Which external stakeholders are more influencer in the planning phase of the project? Which are the impacts of the external stakeholders' actions and attitudes toward the project in the planning phase? Which are the contextual factors that influence the complexity of the project? Which are the major uncertainty issues related to external stakeholders?*

The problem, according to the research questions, was addressed following the scheme in Fig.13.

```
┌─────────────────────┐          ┌─────────────────────┐
│  External stakeholder│          │   Context analysis   │
│      analysis        │          │                      │
└─────────────────────┘          └─────────────────────┘
           │                                 │
           ▼                                 ▼
┌─────────────────────┐          ┌─────────────────────┐
│ Analysis of the impact│         │Analysis of the changes│
│    and influence     │          │  and of the complexity│
└─────────────────────┘          └─────────────────────┘
           │                                 │
           └────────────┬────────────────────┘
                        ▼
              ┌─────────────────────┐
              │  Evaluation of the   │
              │ uncertainties related│
              └─────────────────────┘
```
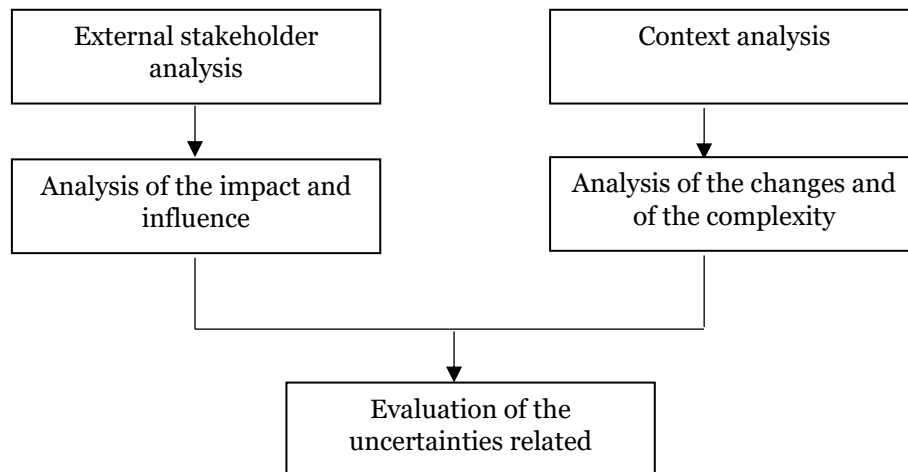
Fig.13 the approach used for analysing the uncertainties in the project

3.4 Literature review

The literature review was conducted for the purpose of establishing the state-of-the-art concerning the relation between contextual uncertainty and external stakeholders in infrastructure mega-projects. The review can be divided in three main blocks:

- Mega-projects: infrastructure mega-projects and mega-events.
  The definition of the concept of mega-projects introduces the borders of the research area, then the focus is on infrastructure mega-projects to clearly define the concept, the scope and the characteristics, and on mega-events to give a more complete overview on the possible typologies of projects where the high contextual uncertainty has an impact.
- Uncertainty management.
  This section has the aim to define the concept of the uncertainty in mega-projects and to explore its relationship with the complexity and the stakeholders in order to understand how uncertainty is considered and managed today.
- Stakeholder Management.
  The review addresses, first, the stakeholder concept in terms of definition and classification models; second, the importance and influence of external stakeholders in infrastructure mega-projects; finally the existing stakeholder management models and frameworks are presented and discussed.

The literature review has the main objective to give a complete and comprehensive overview on the current knowledge about these three main topics and it consists in papers, reports and books. In the search for literature the following databases were used:

- Researchgate
- Sciencedirect
- Scopus
- Elsewhere
- Catalog of my home university Politecnico di Milano
- Catalog of Instituto Superior Tecnico of Lisboa, Portugal

3.5 Case studies

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries of the between phenomenon and context are not clearly evident (Yin 1994). In this thesis, I chose to use a qualitative approach for the analysis if the case studies to focus on matter of insights, discovery and interpretation rather than testing an hypothesis.

Qualitative research and case studies are more oriented towards the process and the relationship between factors and are based on information gathering from interviews, observations, and other documents (Merriam 1998). In the present thesis, the information was collected primarily through secondary data, such as reports, documents, papers available on internet, and then some interviews to project managers were conducted.

The case study methodology has the advantage to study the problem on a real case giving more robustness to the hypothesis that you formulate based on the findings and conclusion of the situation examined, but the limit is that the information collected and the relative interpretation for the final analysis depend on the researcher's preference and point of view. Therefore, the analysis of a case study can have a bit of subjective when the data need to be interpreted to draw the conclusion of the results.

3.5.1 Description of the case studies

The purpose of this case study was to examine the influence of the changes in the context and the impact of the external stakeholders' attitudes on the project in the planning phase, and how the project managers has handled this issues. Three projects were examined. The reasons behind the choice of the projects were their technical characteristics such as country of performance, type (transport mega-projects or mega-event), life time; and the final status of the project (suspension, success or delay).

Case 1: The High Speed Rail in Portugal

The High-Speed Rail Project in Portugal is a Transport Megaproject of a value of about 15.2 billion € with the purpose to build the high speed rail network for Portugal consisting of 5 links: : Lisbon/Madrid, Lisbon/Oporto, Aveiro/Salamanca, Oporto/Vigo, Evora/Faro-Huelva.

The scope was to be integrated with Trans-European Transport Network (TEN-T) and it would link the most important Portuguese cities as well as providing international connections with Spain. One of the major benefits would have been the time saving travelling from Lisbon to Oporto in max 1,15 hours, competitive time compared to flight time of about 51 minutes.

Case 2: The Channel Tunnel Rail Link between UK and France

The Channel Tunnel Rail Link (CTRL) is a UK high-speed rail link between the Channel Tunnel and London St Pancras international with 3 intermediate stations at Ashford, Ebbsfleet and Stratford. The scope of the project was the one to be integrated in Trans-European Transport Network (TEN-T), a trans-national priority project within the high-speed rail axis between Paris, Brussels, Cologne, Amsterdam and London. The purpose of the Regional High Speed Rail (HSR) in UK was to increase rail capacity, to reduce journey times between London and the Channel Tunnel and to link London with Paris and Bruxelles. CTRL carries up to 8 Eurostars per hour and (from 2009) up to 8 Domestic Services per hour as well as the possibility of 2 other 'open access' paths. The relevant physical dimensions of the project are 113 Km of length, 152 bridges, 9.63 billion (in 2010 USD) of total value.

Case 3: The EXPO in Milan, Italy

Expo 2015 is the universal exposition, a unique global event that took place in Italy, exactly in Rho – Pero in the north-west of Milan, next to the "Fiera Milano" the Milan large-scale exhibition centre, from 1 May to 31 October 2015. The Theme of the Exposition is "Feeding the Planet, Energy for Life", and centres on nutrition and the sustainable use of resources, the right to a healthy, safe and sufficient nutrition for the whole planet and on the research into and sharing of more sustainable models of production and consumption.

The EXPO area (1.38 Km2) is divided into Pavilions, accounting for 50% of the space, an external area for the 35% and a green belt for the last 15%. EXPO 2015 represents a perfect project to understand the strength of a rigorous methodological approach to uncertainty and the need for a mature consciousness at managerial level on these topics. The total cost of the project was estimated around 2.254,6 € billion.

The three case studies have in common high level of complexity and uncertainty of the context and great importance and influence of the external stakeholders. The Portuguese project is a clear example of how the influence of external stakeholders can lead to the suspension of the project, the Channel Tunnel Rail Link project is an example of good management of the external stakeholders with the achievement of the project success, whereas the Italian case of

the EXPO projects is an example of high uncertainty of the context that lead to difficulties of stakeholder management, cost overruns and delays/postponements.

3.5.2 Data collection

The case study started by reviewing all the reports, documents and papers of the selected projects that were public and available because other scholars or researches had already studied them.

Another source of information gathering was internet and the articles published on newspapers at the time of the project development, useful to catch also the public opinion. The purpose of studying these documents was to obtain a relevant background information about the projects in order to plan and structure the forthcoming interviews with the project managers. Unfortunately, the people interviewed were not that much due to the difficulty in contacting them.

The first purpose of the interviews was to clear some doubts or fill some gaps in the previous round of data collection if, for instance, not all the information was easily traceable and understandable; the second purpose was to collect some precious insights or suggestions for future guidelines and strategies based on the real experience of the managers, who faced directly all the difficulties and problems I identified. The interviews were conducted by SkypeCall or by phone call and they were semi-structured with a set of open questions, which allowed flexibility in addressing some new issues could emerge during the conversation that were not planned before. Therefore, the managers first clarified some technical information about the project helping me in understanding the influence of the external stakeholders and how they were manged in situation of high uncertainty and complexity, and then they suggested some improvements and advice of strategies to use in managing the external stakeholders with the aim to reduce or manage more efficiently the uncertainty associated.

3.5.3 Data analysis

After the collection of all the information needed to address the problem identified at the beginning, I started the analysis and interpretation of the data.

The analysis consists in identifying the changes occurred in the political, economic and legal & regulatory context, identifying the impact of these changes with the relative consequences on the project development, identifying the external stakeholders' attitudes toward the projects and their influence according to the eventual change in the context (e.g. government's attitude toward the project when the elections with the change of the political party occurs), identifying the possible uncertainties related to each stakeholder and draw the conclusions. The projects were then compared to analyse how in presence of different strategies of

stakeholder management the related uncertainties were managed and how the project development was affected by different situations of the context.

3.6 Development of the new approach

In this thesis is presented a new approach which is the basis for the future framework. The new approach proposed consists of three parts: the first one for evaluating the importance and influence of the external stakeholders, the second one for identifying the level of uncertainty associated to each category of stakeholders according to the level of complexity of the context, and the third one for suggesting guidelines for strategies to manage the external stakeholders according to the different scenarios of uncertainty.

The aim of this approach is to integrate the analysis of the external stakeholders and the analysis of the complexity of the context in order to identify a level of uncertainty to assign to each stakeholder category.

3.6.1 Description of the approach and literature used

The final objective of the approach is to assign to each stakeholder category a level of uncertainty to make the project manager be able, in the planning phase to foresee to which stakeholder give more attention in order to reduce the uncertainty related. The steps required are three:

- 1st step: Evaluation of the external stakeholders influence through a quantitative index and evaluation of their importance through the stakeholder mapping in a matrix based on two new dimensions.
- 2nd step: Integration of the stakeholder analysis and the context analysis through a matrix where the combination of two dimensions, one related to the external stakeholders, and one related to the context, will lead to the creation of four different scenarios, each of them characterized by a specific level of uncertainty.
- 3rd step: Implementation of guidelines for strategies to adapt to each of the different scenarios.

The development of this approach is based on the existing methods and tools in the literature that I used to adapt my analysis. For each of the steps I used different sources:

- 1st step: the quantitative index used for the evaluation of the external stakeholders influence is the one proposed by Olander (Olander and Landin 2005), while the new matrix is an adaptation of the one proposed by Newcombe (Newcombe 2003).
- 2nd step: the integration of the two analysis is made by combining two dimensions in a matrix where the result is four different levels of uncertainty. The matrix is based on

the uncertainty matrix used for describing the influence of environmental uncertainty in the organization (Daft 2008).

- 3rd step: the guidelines suggested for the strategies to implement in each different scenario are based on the experience of the project manager interviewed and on the experience of previous project managed in the same situation of uncertainty.

3.6.2 Application of the new approach to the case studies

The new approach has been then applied to the case studies in order to confirm its accuracy and validity. Unfortunately, it was not possible to apply the approach to the CTRL case because the information gathered on internet, papers, reports were not enough to complete successfully the external stakeholders' analysis, in fact some information for the calculation of the stakeholder impact index were missing. Therefore, the application of the approach can me mentioned for the Italian and the Portuguese case studies.

3.6.3 Discussion of the application

The result was good and the relative analysis were approved by the project managers interviewed because this approach gives the correct importance to the stakeholder influence analysis and, moreover, it helps the project manager to identify a level of uncertainty to assign to each stakeholder category and to plan a proactive strategy. While in the Portuguese case study the driver for the level of uncertainty was the stakeholders' attitude dynamism, in the Expo case the driver was the complexity of the context. This is the reason why the combination of the two dimension is fundamental and essential to understand and assign the level of uncertainty, otherwise the risk is to lose some information and do not choose the best strategy.

For what concern the application of the new approach, a word should be spent about the limitations of the approach. The reason why the approach could not be applied to the CTRL case lies in the lack of information related to external stakeholders' attitudes. Therefore it was not possible to do all the calculations for the analysis of the external stakeholder, neither to do the following steps because each step takes as inputs the output of the previous step.

3.7 Conclusions

The reliability of qualitative research is sometimes questioned because of the lack of opportunity for other researchers to reproduce the same study with similar results. It is important then, to have transparency and clearness of the method used to conduct the study and of the choices taken. The thesis here presented has addressed these concerns in three ways.

First, different data gathering sources have been used. Public documents, reports and newspaper articles have been analysed. Project managers of the Portuguese case study and another Italian project manager have been interviewed about the case study and the suggestions for a future framework. second, the data gathering has been conducted in collaboration with a PhD student from the Civil department of the Insituto Superior Técnico, the university of Lisbon, in Portugal, where I conducted part of my research. This has a real value in guaranteeing the interpretation and discussion of the data from different perspectives. Finally, the development of the new approach has given to me the opportunity to combine the data and information gathered with a specific purpose.

CHAPTER 4
CASE STUDIES

4.1 Description of the selected case studies

In this chapter I introduce the case studies selected for this research, using a general framework for the description, common to all the three projects in order to facilitate the comparison and analysis. The framework is an adaptation of the template created by the MEGAPROJECT COST Action used to describe and analyse the case studies. The focus of the framework used in this thesis is on the external stakeholders and on the context, where for context I refer to political, economic and legal and regulatory environments.

The general framework consists in the following steps:

- Description of the technical features: the scope, the purpose, the value and technical details
- Description of the context divided in political, economic and legal & regulatory environments
- Timeline with the important milestones and changes in the context (the changes are referred to the correspondent environment)
- Overview of the consequences and impacts of the changes in the context
- External stakeholders analysis:
    - External stakeholders identification: classification in private/public and map of the relationships
    - External stakeholders attitude analysis: attitude to the project and influence on the project
- Conclusions and key findings: conclusion of the analysis if the case highlighting the critical factors and the issues of the projects.

4.1.1 HSR (High Speed Rail) in Portugal

Description and technical features

The High-Speed Rail Project in Portugal is a Transport Megaproject of a value of about 15.2 billion € with the purpose to build the high speed rail network for Portugal consisting of 5 links:

- Lisbon/Madrid: to strengthen the connection between the two capitals and increase multimodality in the international connections
- Lisbon/Oporto: to create a new rail connection between the two main cities of Portugal, and serve the intermediate region (+/- 70% of GDP and +/-61% population)
- Aveiro/Salamanca: to link Aveiro, Viseu and Mangualde by rail to Guarda and Spain. They are included in Priority Project no.3 ("Southwest European High-speed Railway Line")
- Oporto/Vigo: to strengthen the connections and multimodality between Oporto and Galiza (Spanish) Included in Priority Project no.19 ("High-speed Railway Interoperability in the Iberian Peninsula").
- Évora/Faro-Huelva: the latter depending on subsequent studies to be carried out

The scope was to be integrated with Trans-European Transport Network (TEN-T) and it would link the most important Portuguese cities as well as providing international connections with Spain. One of the major benefits would have been the time saving travelling from Lisbon to Oporto in max 1,15 hours, competitive time compared to flight time of about 51 minutes.
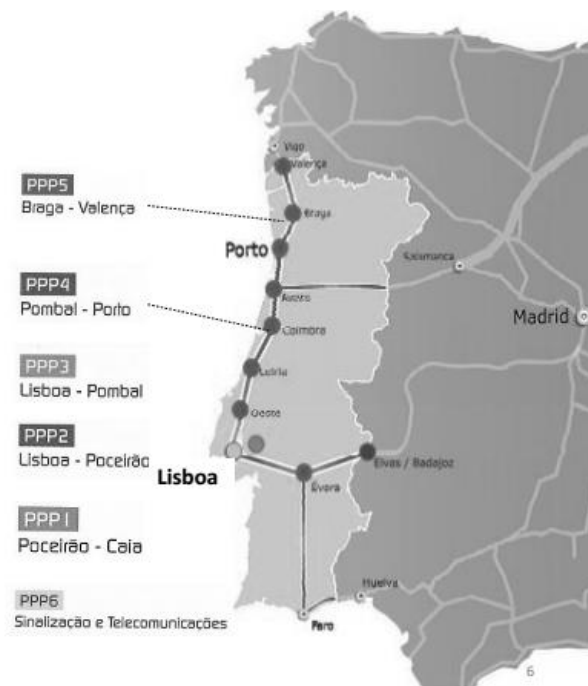
Fig.14 Overview of the HSR route

Description of the context:

Political environment

When the project started (2000) there was the Socialist party at the power and since 2007/2008 the main opposition party opposed strongly to the project. The only awarded PPP was reframed.

- 1999-2002: Government Socialist (PM A. Gueterres)
- 2002 Parliamentary elections: Government Centre-Right (PM José Barroso)
- 2005 Parliamentary elections: Government Socialist (PM J.Sòcrates)
- 2009 Parliamentary elections: Government Socialist (PM J.Sòcrates)
- 2011 Parliamentary elections: Government Centre-Right (PM Coelho)

In the period 2000-2007 Portugal had four different and usually instable governments

Economic environment

In 2000 the economy situation of Portugal was in trouble well before being hit by the financial crisis and in 2003 with the recession it began a fiscal policy.

- 2007: the project final business model is defined
- 2008: Availability of the Portuguese banks and EU Grants
- 2009: the TEN-T approved new financial support for TTT Oriente Station (5.4 ml €)
- 2010/2011: Crisis and Troika

Fig.15 Economic Growth

Fig.16 External Deficit (% of GDP)

Fig.17 Budget Deficit (% of GDP)

The bust followed a boom (Fig.15). Earlier, low interest rates, made possible by being part of the Euro zone, fueled an economic expansion that was supported by high expectations regarding future productivity growth and was financed by debt (Fig.16 and Fig.17).

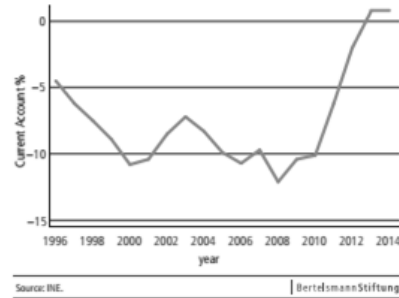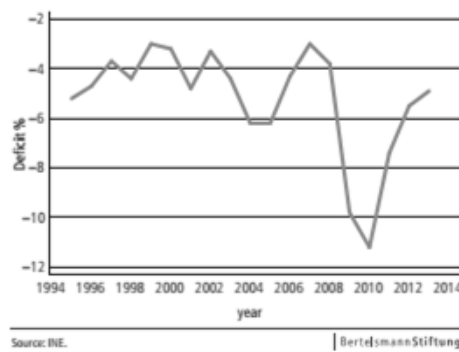Portugal's problems with its public finances are linked with the level of external debt and lack of competitiveness of the economy. The past structural mismanagement of the public finances had then a negative impact on the economic situation of the country in the early 2000. From the beginning of the decade, Governments became more and more involved in PPPs projects. Initially most PPPs had an immediate positive impact on the budget balance but later on, it turned into a negative impact when the infrastructure has been built and the government starts paying for its availability, in particular when it's provided free of charge to users. The excessive use of PPPs let to an over-capacity especially for highways and put a burden on the budget.

Legal & regulatory environment

- 2003: the company RAVE was created to develop the design of the HSRailway that should have linked Portugal and Spain.
- 2001: AVEP (Alta velocidade Espanha-Portugal), a European Economic Interest Group was created by Spain and Portugal to study the «linking of Spain and Portugal by a High-speed Rail Network». AVEP was owned by RAVE and ADIF. AVEP is responsible for co-ordinating market research studies and defining routes and other technical aspects of the trans-crossing sections of this railway system, and co-ordinates applications and procedures for obtaining EU funding for the project.

Timeline: Milestones and changes in the environments

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
2000				
2001	Creation of the EEIG-AVEP		(2001-2006) European funding associated with the priority projects within the TEN-T created by the European Commission and co-financed by DG TREN (EC	
2002				
2003	Creation of RAVE	The Iberian summit defines the 4 cross-border HSR connection		(2003-2010) Different laws applied to PPPs
2004		The links Lisbon/Oporto, Lisbon/Madrid, Aveiro/Salamanca e Oporto/Vigo were included in the 30 priority projects of TEN-T		

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
2005		YEAR OF ELECTION: Socialist	Directorate-General for Energy and Transport) trough the MIP (Multi Annual Indicative Programme)	
2006		The strategic Guidelines for the Railway Sector were presented		
2007		Change of location for the new Lisbon Airport	A regulation was published regarding the community supported to be granted to the TEN-T project with an overall value of appr. 5.3 billion €	(2007-2010) Several pieces of legislation where put forward to implement preventive measures (reservation of corridors from incompatible land uses) – only for Lisbon/Madrid; Oporto/Vigo; Lisbon/Oporto
2008			Crisis	Public Contract Code: Decrete-Law No. 18/2008 of 29 January
2009		YEAR OF ELECTION: Socialist		
2010			Sovereign debt credit crisis	
2011	End of RAVE	ELECTION: Center-Right (change of government)		

Tab.3 Timeline of the HSR Portuguese project[25]

Consequences and impacts of the changes in the context

Changes in the Political Environment

In the period 2000-2007 Portugal had 4 different and usually instable governments. The first implication of the political instability, given in major part by the rotation from a centre left-wing government to a right-wing government (2002) and viceversa (2005), is that government always like to present their inherited fiscal position in the worst light they can to provide a rational austerity measures. The main issue identified was the total absence of a social agreement between political parties for long term infrastructure projects that could ensure continuity to the project.

Changes in the Economic Environment

The consolidated impact, economy and business, of all the mega-transport projects and other Public Private Partnerships, increased the debt, and made the model of economic and financial global consolidation impracticable, making it a high risk to taxpayers and to the financial sustainability of the Portuguese State. The two milestones in the changes of the opinions were the crisis in 2008 and the sovereign debt crisis in 2010 and the government had two objectives in responding to these events: to maintain the stability of the Portuguese financial sector and to buffer the domestic impact of the crisis. These arguments were used in the political campaign for the government election.

Changes in the Legal & Regulatory environment

In the period 2003-2010 different laws were applied to PPPs and in the period 2007-2010 several pieces of legislation where put forward to implement preventive measures (reservation of corridors from incompatible land uses). All these changes caused some delays in the project, but overall the impacts were not important.

External stakeholder analysis

External stakeholders' identification: classification and map

- Public Stakeholders:
- Regulatory agencies
- Local Government
- National Government
- Other internal supply-side categories (APA, APL, IGF, etc)

Private Stakeholders:
- Local residents
- Local Landowners
- Environmentalists
- Conservationists
- Archaeologists

▪ Other external private stakeholders (ADFER, OE, CIP, AEP, Press&Media, Political

opinion, Opinion Makers)
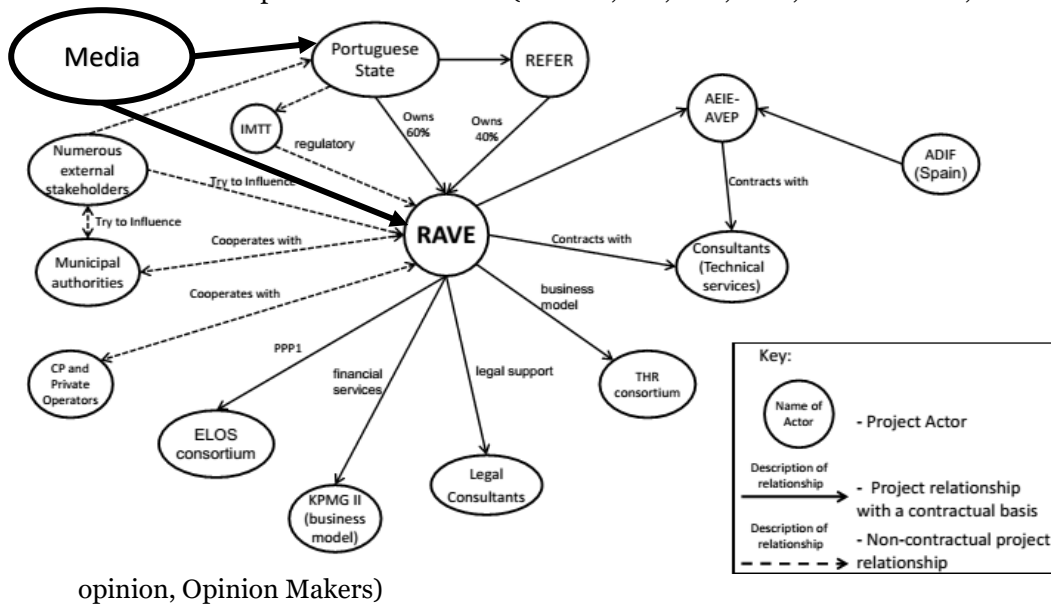
Fig.18 External Stakeholders Map [26]

In the figure above (Fig.18) the External Stakeholders relationships are described in this map where more emphasis is given to the stakeholder group "Media". This is mainly because in a previous analysis of the case of some years ago, the "media" was not considered properly as a stakeholder category, while in this thesis I decided to highlight this stakeholder showing in the map the relationships with the other stakeholders since it was found that it had the major influence on the project.

To give a more comprehensive overview of the companies involved in the project and which ones were created on purpose, I propose the following scheme taken from various reports and documents read about the case.

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[26] Adapted from João de Abreu e Silva and Marisa Pedro. 2003 *"The High-Speed Project in Portugal" case study.* in "The Megaproject Portfolio", 2nd ed.
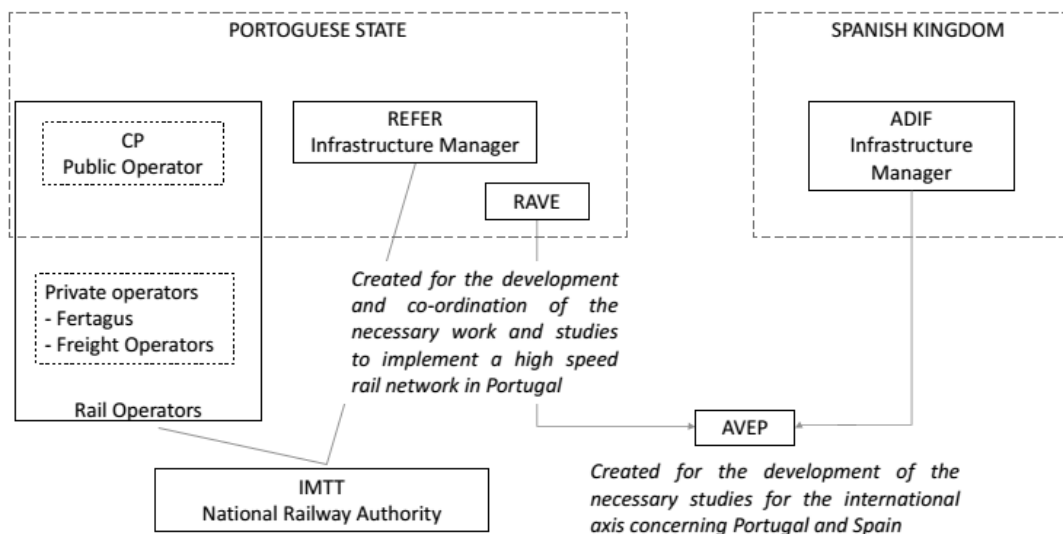
Fig.19 Institutional Framework

External Stakeholders' attitude analysis

External Stakeholder	External Stakeholder's attitude to the project	External Stakeholder's influence on the project
ADFER (Portuguese Association for the Development of Railway Transport)	In general there are positive opinions, even if in some cases the opinions are negative - related with project viability and corridor delimitation	When unfavorably opinion, may cause delays in issuing the studies
Environmental organizations (ex. LPN and Quercus)	Highly unfavourable: For example: with the road component, the Tagus river bridge will have more cars entering into the city and it will increase environmental impacts. However, there are a few positive opinions about the project, once it may bring development.	Can limit the development of the process (when presenting successive complaints about negative impacts that the project brings)
CIP (business Confederation)	See this as a commercial opportunity to provide industrial, technical and logistical support. Can provide the grow up of the commercial/economic areas, but on other hand there isn't the same development for the freight. They were important public stakeholders in the decision processes leading to the location for the new airport and TTT bridge.	Has provided support to advocates of different project configurations. They presented an alternative proposal to replace the Iberian gauge by a European gauge on the conventional rail network to provide better interoperability for freight. They had influenced the alternatives of the corridor delimitation.

External Stakeholder	External stakeholder's attitude to the project	External Stakeholder's influence to the project
OE (board of engineers)	A little controversy among board members	It is extremely appropriate to hold a debate on this project.
APA (Portuguese Environmental Agency)	Positive opinion, in general. In some cases the opinion is no-positive (related to corridor delimitation).	Influence of the corridor delimitation and the configuration of the alternative routes. Possible delays.
Municipal authorities	Some municipalities: favourable opinion and interested in the project. Others: unfavourable opinion regarding the corridor definition, which can produce physic constrains within the territory	Important to support the development of the process
Media	Since 2008 negative media appearances; defined as a stakeholder group with strong effect on the project outcome	If really negative can influence the local communities and the political opinion
Government	First it supports the project because it could stimulate the Portuguese economy, increase competitiveness and develop its cities into a network but with the change of the party at the government the opinion turned in strongly negative with the introduction of austerity measures	The support of the government currently working during the project development is fundamentally to let the project go on. If the government is strongly unfavourable then the implications are delays or cut off
Local communities	Rail Sparks protest: Protests over the threat to the Lisbon-Madrid line have erupted in the rural impoverished western region of Extremadura, which has the most to gain from the link.	If the communities are against the project they can significantly influenced the project causing delays and serious obstacles to the normal development

Tab.4 External Stakeholders' attitude analysis [27]

The previous table describes the external stakeholders' attitudes and influences toward the project giving a short description of both the positions occupied (attitude) and the influence that can be exercised on the project. In my analysis, I added the last three stakeholders, "media", "government", and "local communities" since in the previous report, made by the

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[27] Adapted from João de Abreu e Silva and Marisa Pedro. 2003 *"The High-Speed Project in Portugal" case study.* in "The Megaproject Portfolio", 2nd ed.

MEGAPROJECT COST Action these stakeholders were only treated as the main important that stopped the project but without a specific and dedicated space in the attitudes analysis.

Conclusion and key findings

As a conclusion of the analysis, it has been observed that the context changed a lot in all its environments (political, economic and legal & regulatory). The main critical change was the one represented by the political party who was continuing changing through the project development resulting in a fragmented support to the project. The instability in the political environment lead to big uncertainties in the future of the project. Moreover, the economic environment was also influenced a lot by the changes such as the crisis in the 2008. Besides the contextual changes that brought uncertainty, the other element which characterized the project in terms of criticality, uncertainty and difficulty was the influence expressed by external stakeholders based on their opinions. Some of them were associated with the perceived ability of the HSR project to provide benefits such as industrial, technical and logistical support to stimulate economic growth, while others were created by the perceived relationship of the project to environmental impacts along the corridor. The first Portuguese Government, in an official communication, reported "*in an economic development context, the future will be a permanent increase of travel*". This sentence was the main justification to support the project since it would had had positive economic results. The external stakeholders opposed to the project highlighted the negative influence on the levels of public debt and possible crowding-out effects of the project by creating a constraint in funds available for private investment. Therefore, the HSR project is a clear example of how the external stakeholders' attitude can have a strong impact on the project, especially if they are characterized by a high level of dynamicity, so they change a lot through the project development (supporting first, opposing then).

If we want to take two big events which can be considered driver for the changes in their position, then we have to look at the crisis of 2008 and the ensuing sovereign debt crisis (2010). Since 2008 there was a growth in the number of negative media appearances. In 2010, the project was reframed and a new schedule was defined. The then main opposition party, (currently in Government), strongly opposed the project and when in power, postponed the project. To have success in its action of opposing the project, the party took advantage of the strong power of media, using them to make aware the population of the risk for the Portuguese economy with the implementation of the project.

This project has suffered from media attention and attack. This is a case where media, even if is not considered a stakeholder group from literature, here can be due to the strong effect on the project outcome. The stakeholders that had greater prominence in social communication were the Government, contractors, opinion makers and opposition parties.

Overall, the contextual changes and the stakeholders' high dynamicity are the two main factors that influenced the suspension of the project.

Findings from the Interviews

After the analysis of the case study through the material I could find on internet such as reports, newspapers' articles, and I could get access to thanks to the collaboration with the PhD student who had already worked on the case, I conducted some interview to get more information. The interview was structured in semi-opened questions where the answer could be free but in the text of the questions there were some examples as guidelines. The first part of the interview was related to the stakeholders' analysis.

Stakeholders' analysis

The interview concerning the stakeholders' part was aimed at identifying the most influential stakeholders or stakeholder groups in the project development, the kind of impacts responsible of the importance given to those stakeholders, the frequency of changing of their attitude toward the project and some free considerations about the stakeholders' management they adopted during the project with some suggestions for a better approach.

From the interview emerged that the most influential stakeholder in the project's development was the Government, as it was emerged also from the analysis of the case study. In fact, the instability of the political context, mirror of the dynamism of the Government, was recognized as the major cause of the problems of the project. The Governments had influence on main constant changes in the scope of the project, in fact, some political decisions such as the location of the main stations, the variation on the type of traffic, etc. had as effects delays in the development phase and some postponement in the stages where to take decisions for the technical evaluation. Therefore, the main impacts related to the most influential stakeholders are delays, postponement and suspension.

Another important element, recognized by the Project Managers, was the frequency with which the Government changed its attitude toward the project in accordance with some local and municipal community's wishes. This led to a higher instability characterized by high uncertainty.

The main concerns identified by the interviewed, lies on these points:

- Lack of knowledge regarding the whole project and its needs and requirements
- The Governments was not really aware and conscious of the influence of the High Speed Rail (HSR) project in the transportation system in the European Union. In fact, the HSR project was included in a major project called Trans-European Transport Network (TEN-T)

Therefore, it is extremely hard to manage these kinds of project, especially in turbulent context and conditions like in this case. The main ideas emerged as suggestions are:

- The Political parties have to assume long term commitments in order to not compromise these kind of big infrastructure investments
- Big political campaigns should be promoted and not focusing only on the inherited fails, but in a certain way to better sell the project and to influence in a positive way the public opinion

Uncertainty analysis

The interview concerning the Uncertainty analysis was aimed at identifying the main uncertainties related to the project, the phase/moments when they occurred, the impacts, the ways in which they were managed during the project and some lessons learned from the project.

The main uncertainties that emerged during the conversation with the Project Managers were of three types: financial, political and cost-benefit studies. The financial uncertainties are related to the economic problems of funds and investments needed for this big project, the political uncertainties are related to the constant changes in the political decisions, parties and opinions, and the cost-benefit studies are related to the technical evaluations of costs and benefits of the project. The major benefits were to increase the number of trains, to speed up the transportation across the country and to connect Portugal with Spain.

The phase in which these kinds of uncertainty showed up was the feasibility study and then continued through the preliminary study. The impact of these uncertainties was defined as high because several changes of scope and several changes in alignments/corridors occurred. Normally political decisions were made for the events that were going to occur, therefore, the uncertainty was managed at a technical level through engineering studies. There was an approach to identify the uncertainty *a priori* and implement a strategy *ad hoc*. From the interview, some lessons learned emerged as conclusion:

- Support technically and economically all the decisions through proper and appropriate preliminary studies
- Choose projects with viable and sustainable financing
- Ensure social agreements for long term structuring projects
- Ensure an appropriate communication plan for the public opinion to influence the decision makers
- Ensure internal and external competences to manage these proejcts

4.1.2 CTRL (Channel Tunnel Rail Link) in UK

Description and technical features

The Channel Tunnel Rail Link (CTRL) is a UK high-speed rail link between the Channel Tunnel and London St Pancras international with 3 intermediate stations at Ashford, Ebbsfleet and Stratford. The scope of the project was the one to be integrated in Trans-European Transport Network (TEN-T), a trans-national priority project within the high-speed rail axis between Paris, Brussels, Cologne, Amsterdam and London. The purpose of the Regional High Speed Rail (HSR) in UK was to increase rail capacity, to reduce journey times between London and the Channel Tunnel and to link London with Paris and Bruxelles. CTRL carries up to 8 Eurostars per hour and (from 2009) up to 8 Domestic Services per hour as well as the possibility of 2 other 'open access' paths. The relevant physical dimensions of the project are 113 Km of length, 152 bridges, 9.63 billion (in 2010 USD) of total value. The main sources consulted for this case study were: "The Megaproject Portfolio" by MEGAPOJECT COST Action and "Chunnel Tunnel Rail Link" by OMEGA CENTRE (Brookes and Elmahrough 2015; OMEGA Centre 2008).
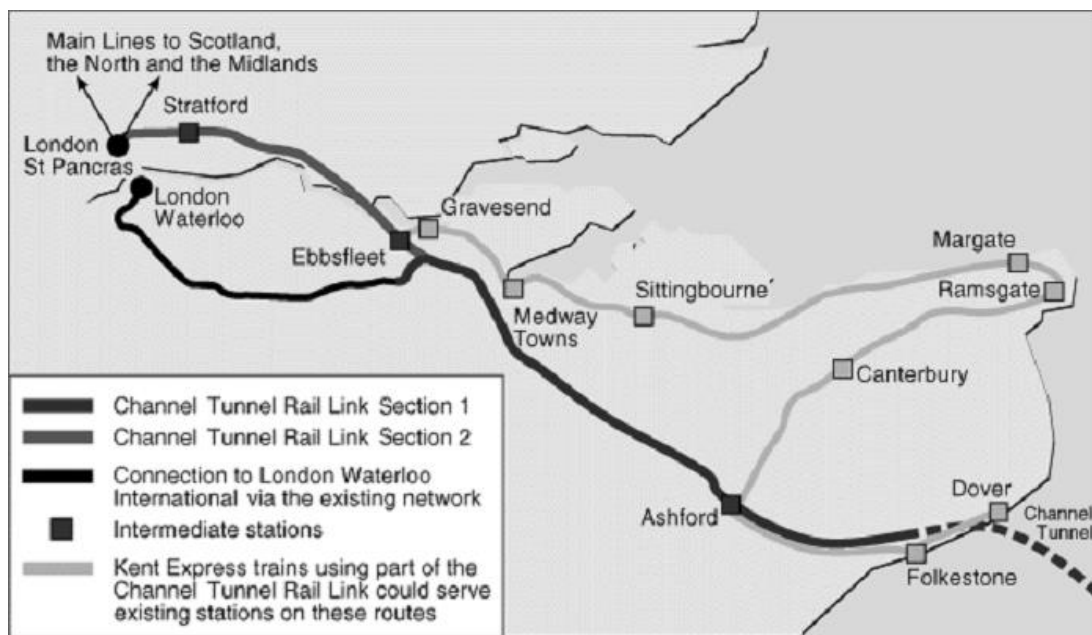

Fig.20 Overview of the CTRL route [28]

Description of the context:

Political environment

The planning phase started in 1974 and the political scenario was a bit turbulent at that time. Both Conservative and Labour Governments attempted a variety of experiments to boost

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Britain's underlying growth rate and competitiveness. The route selection for the project was a lengthy process influenced by political considerations, the emergence of strategic development potential and competing agendas. In the years 1964-75 the party in power in the UK changed three times and there were six different ministers of transport.

- 1964: Douglas-Home's Conservative government
- 1964-1970: Harold Wilson's Labour government
- 1970-1974: Edward Heath's Conservative government
- 1974-1979: Labour party
- 1979-1997: Conservative party

Economic Environment

The economic situation of the time was presenting several constraints, above all in terms of funds to be assigned to infrastructure projects. The reliance of the CTRL project on private sector funding dates from its conception and was at the insistence of the Prime Minister of the time (Margaret Thatcher 1979-1990). This situation (at least in its rhetoric) continued beyond 1997, despite the change in government. LCR (the SPE created on purpose for the project, the company aimed by the British Government for developing former railway land in the UK) was responsible for financing its construction and operation, but the government agreed to provide GBP 1.7 billion funding and development rights around Kings Cross and Stratford stations, and guaranteed LCR's debt. However, LCR was unable to raise the GBP 0.8 billion equity and GBP 3-4bn debt finance needed to build the Link. Escalating costs and reduced passenger forecasts were cited as reasons. The government refused to provide more grant funding, but agreed a financial restructuring with LCR, involving the sale and leaseback of trains, in 1998.

Legal & Regulatory environment

An environmental impact assessment in 1996 established Minimum Requirements specifying protection measures to be taken along the route, but the public opposition that had been provoked by BR's 1974 proposals was revived. LCR appointed the consortium of SNCF (the National Railway of France), SNCB (The National Railway of Belgium), British Airways and National Express to operate the Eurostar service. The Eurostar operation will return to Government ownership in 2086. The original concession awarded to LCR had been for 999 years. It is now reduced to less than 90 years.

Timeline and Changes in the environments

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
1964	British and French Governments	Change of the government: Labour party		

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
	agreed that a bored rail tunnel under the Channel would be a good investment.			
1966	An agreement was signed for the private sector to build and finance a tunnel – Government guaranteed loans would cover most of the cosT			
1970		Change of the government: Conservative party		
1971	British Railways (BR) & French Railways (SNCF) work on combined rail scheme between 2 capital cities			
1972	The UK and French governments, SNCF, BR and the British and French tunnel companies signed contracts, which later resulted in a Treaty (1986)			
1974	Major public opposition resulted, in light of fears about the impact of faster and more frequent trains	Change of the government: Labour party		
1975	The Government abandoned the Channel Tunnel idea and decided to concentrate (with France) which was an easier political option.			
1979		Change of the government: Conservative party		

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
1981	BR and SNCF reached agreement to build a tunnel.			
1984	Secretary of State for Transport of both countries announce willing to give the necessary political guarantees to facilitate fixed link (however without public financial support).			
1986	UK and France sign Channel Tunnel Treaty. The Channel Tunnel concession was awarded to Trans Manche Link (later Eurotunnel).			The enabling legislation, in the form of the Channel Tunnel Act was prepared. The Channel Tunnel Treaty is signed by Margaret Thatcher and Francis Mitterand.
1987	Channel Tunnel act rules out public funding for international services		The Channel Tunnel Act specifically said that no Government support would be forthcoming for the construction of a new rail link. The fixed link was to be privately financed, owned and operated – no public subsidy could be given	The Channel Tunnel Act receives Royal Assent
1988	Government established the principle of private sector involvement			
1989	BR invites tenders for joint venture			

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
	partner. Eurorail selected			
1990	**DELAY:** BR"s joint venture with Eurorail disbanded			
1991	Evaluation of route options Government announces construction will be joint venture under private finance initiative		The BR & Eurorail joint venture had originally required £1,900 million of public sector money to be either committed or placed at risk during the early stages of construction. The Government felt that some of the risks could be better managed by the private sector and therefore decided that the project should proceed as part of the Private Finance Initiative (PFI).	
1992	BR"s Rail Link Project Group is reorganized to refine the east London route. Arup joined the project team.			
1993		UK Government announces that CTRL is to constructed as a public/private joint venture		
1994	Public consultation on preferred route. Channel Tunnel	The CTRL Bill is introduced to the House of Commons.		

| Year | Events/Activities | | | |
	Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
	Rail Link bill in parliament			
1995	Thames gateway planning framework published			
1996	CTRL bill gains royal assent. Environmental impact study. LCR Appointed as concessionaire (LCR acquiring ownership of Union Railways Ltd and European Passenger Services Ltd)	London and Continental Railways (LCR) appointed to build, manage and operate CTRL following tender process.		Royal Assent is granted for the Channel Tunnel Rail Link Bill.
1997	**DELAY:** LCR unable to raise sufficient finance. Financial restructuring agreed	Change of the government: Labour party. (1997/98) Government announces that LCR are unable to raise the necessary funds to construct CTRL. LCR work on a restructuring of the financial deal for the project	LCR approached the Department of Transport to obtain a relaxation of the contract – this effectively asked the Department to increase its financial risk in the project by £230 million. After LCR's announcement that second stage financing could not be reached, the Department of Transport considered its options and instructed its advisers to scrutinise the demand forecasts for Eurostar UK	
1998		The Government accepts LCR's restructuring proposals for the construction, operation and	The Deputy Prime Minister announced the failure of LCR to raise funds to build the	

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
		financing of the CTRL.	CTRL without a further sum of £1.2 billion from the Government. LCR would have to find the money some other way.	
1999			Re-financing completed with a successful bond issue (£2.65bn).	
2001	The Deputy Prime Minister signs agreement to secure completion of the CTRL.			
2007		Change of the government: Labour party		
2008			Crisis	
2010	Concession sold to Canadian pension plan	Change of the government: Conservative party		

Tab.5 Timeline of the CTRL project [29]

Consequences and impacts of the changes in the context

Changes in the Political Environment

In the years 1964-75 the party in power in the UK changed three times and there were six different ministers of transport. The project itself was not party-political. Douglas-Home's Conservative government started it, Wilson's (first) Labour government signed an agreement 'in principle', and Heath's Conservative government signed legal contracts and the Treaty. Finally, Wilson's (second) Labour government cancelled the first high quality rail link to London, then the Tunnel itself. In the early 1980s Mrs Thatcher expressed interest in a fixed link between England and France, which she had supported as a member of the Heath government. The governments in those years had to face external economic constraints, rising public expectations as to living standards and public welfare and their own claims that the economy was in principle manageable by the state to a high degree of precision. Each

government of the period thus found itself victim of a high level of public disillusionment, with large 'mid-term' swings and by-election losses entering the political equation for the first time since the war. Governments of both major parties had come to similar conclusions about the need to join.

Changes in the Economic Environment

The Channel Tunnel Act specifically said that no Government support would be forthcoming for the construction of a new rail link. Therefore, the fixed link was privately financed, owned and operated – no public subsidy could be given. But, under the Channel Tunnel Act the public sector was legally obliged to:

- procure, at its own expense, substantial (connecting) new and upgraded infrastructure works plus rolling stock for international passenger and freight services;

- set (jointly with SNCF- French railway company)) fixed tolls (subject to a guaranteed minimum) revenue to Eurotunnel for a given period in return for half the operating capacity (necessary for Eurotunnel to raise finance).

Changes in the Legal & Regulatory Environment

The changes in the legal & regulatory environment didn't have impacts on the project.

External Stakeholder analysis

External stakeholders' identification: classification and map

Public Stakeholders:

- Regulatory agencies (department of the Environment, Transport and the Regions)
- Local Government (local authorities)
- UK Parliament
- Department of Transport (DfT)
- Other internal supply-side categories (Pressure groups, Forums & meeting)

Private Stakeholders:

- Local residents
- Local Landowners
- Environmentalists
- Conservationists
- Archaeologists
- Other external private stakeholders (King's Cross Railway Lands Community Development Group)
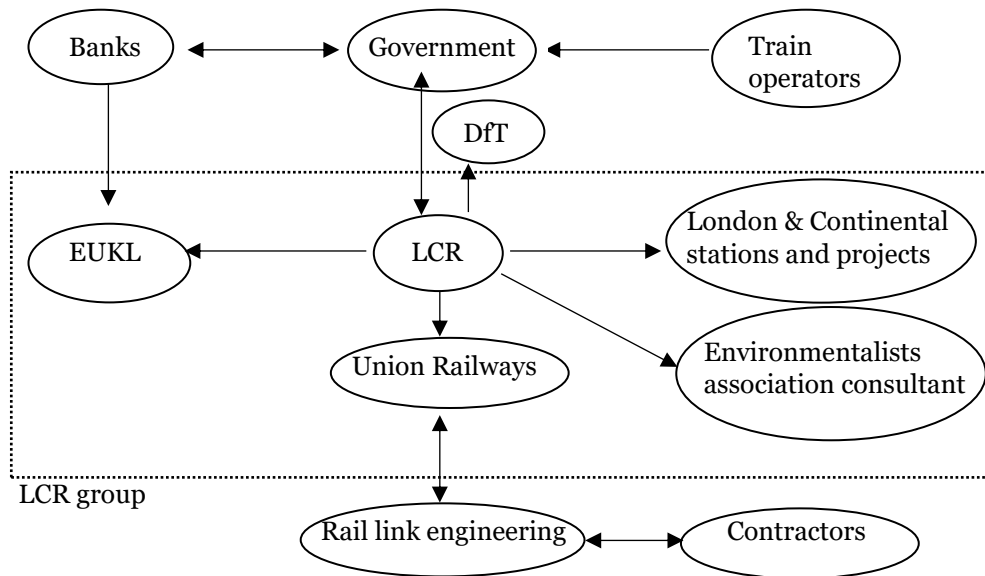
Fig.21 External Stakeholders' Relationships Map [30]

To give more explanation of some acronyms used in Fig.21 LCR is a property development company owned by the British Government for developing former railway land in UK. LCR was established in 1994 during the privatization of British rail. LCR bid and won the contract from the UK government in 1996 and operate the Channel Tunnel Rail Link under the terms of the Channel Tunnel Rail Link Act 1996. This is an act of parliament of UK that provides for construction, maintenance and operation of the Channel Tunnel Rail Link. As a part of this deal, European passenger service (EPS) and Union railways, companied owned by British Rail, were transferred to LCR ownership. EPS was the British arm of the joint Eurostar operation and LCR renamed EPS as EUROSTAR (UK) Ltd, so EUKL.

External Stakeholders' attitude analysis

External Stakeholder	External Stakeholder's attitude to the project	External Stakeholder's influence on the project
National media interest, protest groups formed, Local residents	In 1988/89, public reaction was wholly adverse. Demonstrations by S. London & Kent communities which culminated in a major demonstration in Trafalgar Square. The east London route was extensively supported by lobby groups such as the Stratford Promoter Group.	82 petitions lodged in Parliament against Private Bill authorising construction of CTRL Terminal at King's Cross

[30] Sources: (i)Adapted from Marisa Pedro and Miljan Mikic. 2003 *"High Speed 1 (HS1) – Channel Tunnel Rail Link (CTRL)" case study*. in "The Megaproject Portfolio", 2nd ed.
(ii) Adapted from OMEGA CENTRE. 2008 "Channel Tunnel Rail Link". UCL project profile.

External Stakeholder	External Stakeholder's attitude to the project	External Stakeholder's influence on the project
London Borough of Newham (local residents near London)	Became a serious opponent of the King's Cross Bill, and in November 1989 organized a conference as part of its efforts to promote an easterly approach with a station rather than a terminus at Stratford – an idea supported by John Prescott, the Labour shadow Secretary of State for Transport.	It lobbied successfully for an international station at Stratford as part of a wider urban regeneration project.
DfT (department for transport)	It was the main sponsor of the CTRL project	The department of transport has an important influence because it is responsible for overseeing all the aspects of the preparatory work undertaken by British Rail (BR) including negotiations with the private consortium appointed to deliver the project.
Local Government	Local authorities affected by the CTRL route and stations options development process were supportive toward the project	

Tab.6 External Stakeholders' attitude analysis [31]

Conclusion and key findings

OMEGA Centre in 2008 analysed the CTRL case study (Dimitriou et al. 2014) and from the analysis it emerged that this projects is a clear example of how decision-making for the project repeatedly responded to changing contextual influences exerted through a variety of stakeholders and champions. In the OMEGA's analysis, another important finding was that the changing premises, scope and nature of decision-making for the CTRL was characterised by a necessarily "adaptive process" adopted by its key stakeholders to better cope with the changing risks, uncertainties, complexities and contextual influences it encountered throughout its development. In the work of Dimitriou *et al.* (2014), that contains also the OMEGA's analysis, the case study was analysed also from a political influence point of view and they suggest that political influence/support for the CTRL represents the most critical contextual factor in all aspects of the project's development. Therefore, political support is

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considered a clear prerequisite to the successful launch of the project and the sustained efforts by the UK government to ensure the project was implemented.

Since the transport mega-projects are considered agent of changes due to their impact and influence on the environment around where the project is placed, also the CTRL can be seen as an agent of change in relation to urban regeneration and sub-regional growth.

Besides the importance of the political support of the national and local government, from this case study the other important element is the stakeholder engagement, trust and transparency. The major lesson learned from this project is the essentiality and importance of a good and effective communication between countries and stakeholders as a priority in order to include understanding of different cultures of each stakeholder given the fact that they are in different part of Europe. Projects communications management is often one of the most important aspects of the project planning and execution phases.

Therefore, the success of the project was also due to the right strategy of keeping stakeholders fully informed throughout the project development to identify/anticipate potential issues going forward that could otherwise jeopardise planning and delivery.

4.1.3 EXPO 2015 in Milan

Description and technical features

Expo 2015 is the universal exposition, a unique global event that took place in Italy, exactly in Rho – Pero in the north-west of Milan, next to the "Fiera Milano" the Milan large-scale exhibition centre, from 1 May to 31 October 2015. The Theme of the Exposition is "Feeding the Planet, Energy for Life", and centres on nutrition and the sustainable use of resources, the right to a healthy, safe and sufficient nutrition for the whole planet and on the research into and sharing of more sustainable models of production and consumption.

The objective of Expo Milano 2015 is also that of providing the Visitor with a unique, memorable experience in terms of culture, education and entertainment, presenting itself as a traditional and innovative Exposition at the same time: traditional because it will follow the guiding principle of the BIE regarding the educational value of Expositions, and innovative because it will lay down a new concept of Universal Exposition – thematic, sustainable, technological and centred on the Visitor Experience (Expo 2015 SpA 2014)

The EXPO area (1.38 Km2) is divided into Pavilions, accounting for 50% of the space, an external area for the 35% and a green belt for the last 15% (Locatelli and Mancini 2010). The toal cost of the project was estimated around 2.254,7 € billion.

In 2008 two groups of works were envisaged for the realisation of Expo Milano 2015:

- the Essential Works (urbanisation interventions, architectural structures irrigation and water supply intervention, construction of the Italian Pavillon and interventions to connect the site), for which Expo 2015 and other bodies are responsible, and whose total value amounts to € 2,129.1 million;
- the Related Works (infrastructures such as streets, roads, railway, underground lines), which are the responsibility of other bodies.

Fig.22 Expo Milano 2015 site (Expo 2015 SpA 2014)

In the figure (Fig.22) above is represented the picture of the Expo site. The Master Plan submitted to the BIE is based on two axes at right angles, recalling the layout of ancient Roman cities

- The "Decumanus", or World Avenue, an axis approximately 1.5 km long and 35 m wide which crosses the whole Site from east to west. Along this axis are the pavilions of the various Participants, thus offering every Country a prominent position and great visibility;
- the "Cardo", a perpendicular axis 350 m long with a north-south orientation, along which rise the structures built for the participation of the Italian Communities and territories.

At the intersection of these two main avenues there is "Piazza Italia", a symbolic meeting point between Italy and the world (Expo 2015 SpA 2014).

Description of the context:

Political environment

The political situation in Italy was not stable in the years before the opening of the Expo universal exposition (May 2015). The project started in the 2008 with the creation of the Expo

SpA company in charge of the management of the project. Therefore, to analyse and understand which were the political changes/events that influenced the project we need to refer to the period 2008-2015. At the beginning the project had organizational problems and this was the reflection of the instability of the political environment due to the parties' issues. Not only the problems were at the national level with the change of the government (from left-centre to right-centre) but also at the local level with the change of the Mayor of the Municipality of Milan, where the exposition took place. The political scenario at the national level was the following one:

- 2006-2008: centre-left party (prime minister R. Prodi)
- 2008-20011: centre-right party (prime minister S. Berlusconi)
- 11/2012-04/2013: technical government (prime minister M. Monti)
- 2013-2014: democratic party (prime minister G. Letta)
- 2014-2016: centre-left party (prime minister M. Renzi)

Besides the changes in the government, we have also instabilities at a local level for the municipality of Milan:

- 2006-2011: L. Moratti, Mayor of the municipality of Milan
- 2011-2016: G. Pisapia, Mayor of the municipality of Milan

For the municipality of Milan, the change in the power was only one but the two Mayors had different ideas and opinion toward the project.

Economic environment

The economic scenario in Italy was not stable. In the 2007 the financial crisis with the bankruptcy of Lehman Brothers impacted the Italian economic environment, leading to a more strict and rigid system. After the crisis of 2008, the Italian economy knew a period of stagnation and recession, with a reduction of the PIL by 1,2 %. Moreover, around the 2011, the sovereign debt crisis occurred with the raising of the spread and the distrust and credit crunch for the banks. The Italian banks in fact could not be able anymore to give private loans to the private sector at a fair rate, therefore, this contributed to make more difficult the possibility for companies to get access to the credit and the structural crisis continued to impoverish the country. In this economic environment, the choice to believe in Milan and, in Italy, was a hazardous choice, seen by the majority, but also the chance to release the country.

Legal & Regulatory environment

The realisation of the EXPO 2015 required the definition and application of a specific regulatory framework in order to regulate the organization and management of the global event and the participation in it. Therefore, all the changes in the legal a& regulatory environment will be addressed only for the universal exposition. The reference text taken for initialising the regulatory framework is the 1928 Convention Relating to International

Expositions, along with various regulations by the BIE aimed at disciplining the competences of the Country hosting the event and the participation of the Countries in the event. Since the event took place in Italy, it remained under the exclusive jurisdiction of the Italian State and, consequently, the applicable rules are those in force in Italy. All the legislative measures defined must be adopted by the Countries involved with the aim of facilitating the organisation of the Exposition. In July 2012, the Italian Government and the BIE stipulated an Exposition Site Agreement, ratified by Law 3/2013. It is an agreement which already used in universal exposition with great success with measure aimed at simplifying procedures for entry visas, temporary residence permits, for exempting from tax paying the Participating Countries for the import of goods and materials and so on. Regarding the safety and legality issues, the relevant regulatory sources for work site safety and for the regularity of public contrasts are, respectively, Legislative Decree 81/2008 and subsequent amendments and additions, and Legislative Decree 163/2006. The site's yards were also subject to anti-mafia regulations updated with the coming into force of the new "anti-mafia" code: Legislative Decree 159/2011.

Timeline and Changes in the environments

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
2006	The Italian Government send the application to the BIE for Milan as city hosting of the Expo	Centre-left party at the government and L. Moratti at the Municipality head of Milan		Legislative Decree 163/2006: regulates all awarding public procurement regarding works, services and supplies implementing Directives 2004/17/EC and 2004/18/EC
2008	BIE assigned the organisation of Expo 2015 to the city if Milan and Expo Spa is created	Election: change of government, centre-right party. New president of the Infrastructure department	Crisis with reduction of the PIL – 1,2%	Legislative Decree 81/2008: regulates work site safety issues
2009	New nomination for the manager of Expo Spa		The Italian Government allocated an amount of money to modernise the courthouse	

Year	Events/Activities Project stakeholders	Changes Political env.	Changes Economic env.	Changes Legal&Reg. env.
2010	The "registration" dossier of the Exposition is given to the BIE and approved			
2011	Cmc, a new company, won the contract for the works in the site and start of the work on site	Election: change of the Mayor of the municipality of Milan	Raising of the spread and distrust and credit crunch for the banks	Legislative Decree 159/2011: regulates the new anti-mafia code
2012	The works related to the exhibition area started	Change of government: technical government	The Italian Prime Ministerial Decree has authorized the allocation of € 1.305.60 million to implement the works and activities connected to the Event	Exposition Site Agreement: stipulated with BIE for simplifying some procedures
2013		Change of government, democratic party		
2014	Several arrests: general director of Expo Spa and others for some incorrect actions and corruption	Change of government: centre-left party		
2015	Opening of the Expo 2015			

Tab.7 Timeline for the EXPO 2015 case [32]

Consequences and impacts of the changes in the context

Changes in the Political Environment

As it is showed in the table of the timeline, the political environment was very in ferment during the period 2008-2015. There were changes in the parties at the national government and one change in the Municipality of Milan, and all these changes influenced the project and

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[32] Adapted from the "Sustainability report" by Expo Spa (Expo 2015 SpA 2014)

the context around. Moreover, a factor that made the political scenario even more turbulent and instable, was the fact the in more than two occasions the change of the government was not consequent to a regular election. The first time happened with the government of R.Prodi (2006-2008) at the head of the centre-left party, which was excluded from the power by an event of political distrust, therefore the election were anticipated and the centre-right party with S. Berlusconi won. The second time happened with the technical government of M. Monti, who was in charge to make order in the Italian political situation after the previous government. The third time was with the democratic party led by G. Letta who received the power from the President of the Italian Republic G. Napolitano since the centre-left party could not govern because of a lack of majority in the consensus. And the last case could be considered the same because the prime minister M. Renzi was not elected democratically with regular election but was "put" at the head of the centre-left party that won the elections. It is clear how in this turbulent environment, the opinions and attitudes toward the project were not the same at all. The mayor of the municipality in 2006/2007 L. Moratti started to supporting actively the project contributing to the creation of the theme. With the prime minister R. Prodi, all the documents for the presentation of the dossier to the BIE were ready. When the centre-right party went at the government, the minister of economy changed as well and he showed a passive support toward the project. Even the new mayor of the municipality did not show a great enthusiasm for the initiative. In the case of the Italian political scenarios, the big risk and uncertainties were due to the turbulent context with all the instability at the government. There was not a stable and predictable situation because all the changes happened rapidly. During the preparation if the case and of the documents there was the worry about the possible suspension of the project or the possible postponements or even the possible incapacity of managing and organizing for the expected date of opening (31 October 2015)

Changes in the Economic Environment

The period 2007/2008 was very difficult for the Italian economy, characterized by instability, crisis and recession, where the organization of a Mega-event like the Universal exposition in Milan was not considered a good idea and opportunity for the country. Some politicians were not enthusiastic of the choice to nominate Milan as the hosting city because it would have meant huge investments and efforts to be able to open the event on time and respecting all the requirements and constraints. It was seen more as a challenge rather than an opportunity to growth and support the economy. In fact, all this argument became the central thesis supported by Local activist groups and committees against the project because it was considered a disaster from all the point of view. The impacts of this economic changes can be categorised as delays and postponements in the project development because there was the problem of finding other funds, of trying to stabilise the situation and, especially, of containing and opposing the protests of the activist groups against the project.

Changes in the Legal & Regulatory environment

All the laws and the legislative decrees did not influence the project development raising issues or causing delays/postponements. In case of Mega-events, like an Universal Exposition, the Legal & regulatory environment is often supporting the realization and organization of the event trying to simplify some procedures or allowing particular requests, since the participating countries are coming from all over the world and there is the need of standardization and more control from the regulatory authorities.

External Stakeholder analysis

External stakeholders' identification: classification and map

Public External Stakeholders:

- Government Authorities
- Regulator & local Authorities
- Civil Societies
- National Government
- Municipality
- Partners & Sponsor

Private External Stakeholders

- Visitors & Global community
- Local activist group
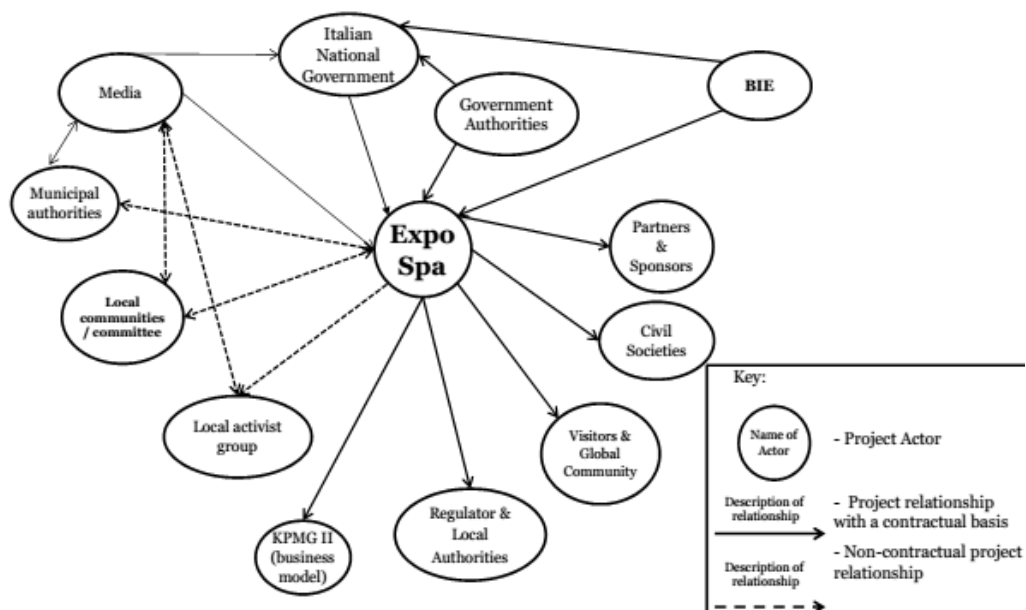- Local community & committee
- Media

Fig.23 External Stakeholder Map

External Stakeholders' attitude analysis

External Stakeholder	External Stakeholder's attitude to the project	External Stakeholder's influence on the project
Bureau International des Exposition (BIE)	The BIE supported the project supervising and monitoring the organisation. It registered high level of satisfaction	It is the main stakeholder who determines the g/ no go of the project because it approve the application to be the hosting city
Partners: Event & Project Sponsors	The sponsors supported the project and let to the success in terms of high quality of the content guaranteed, high level of participation.	If the sponsor stop to support the project because of some negative events due to the behaviour of the company organiser (problems related with the environment or with the social responsibility) then there is the problem of loss of funds.
Visitors and the Global community	They supported the project participating and sharing the content through social networks and creating a community	If the visitors and the global community don't support the project, then the participation and the awareness of innovations from all over the world is missing and it could play a negative impact on the project. The visitor experience and life experience in these events is fundamental because it can overcome all the issues and problems in terms of organization because the user like the outcome.
Government Authorities and Emergency services: Police, Fire service, Ambulance	They supported the project as Official bodies in charge of planning, managing certain operational aspects and intervening in emergencies during the event	If the Official bodies are against the project doing some manifestations or strike due to many reasons, the impact on the project development is enormous because it requires more time (so delays for the opening date) to negotiate an agreement or solve the situation with compromises
Regulator and Local Authorities: ARPA, National Industrial Accident Insurance (INAIL), Lombardy Region's Expo Environmental observatory	These organizations gave a contribute and a support to define rules and external controls for specific environmental and social issues	Their involvement as players in all the stages of organisation and management, each in its own specific area, is essential for the success of the project. The benefits are indirect (improvement in facilitating the achievement of targets) and direct as opportunities for career and skills development
Local activist groups: Black Block	They were strongly opponents to the project with	Their position against the project influence the project

External Stakeholder	External Stakeholder's attitude to the project	External Stakeholder's influence on the project
	some violent actions in the city of Milan.	development because they caused lot of disasters and problems that required the intervention of the emergency services and in addition the spending of extra money to make order in the city and contain the protest
Local community: NO-Expo Committee	This committee was opponent to the project because of the big corruption and dishonesty in the assignment of the contracts, in the payment of the employee and in all the organization. They started in 2007 with an active protest and some actions	The danger of the opposition of local communities or committee is a priority because it can impact a lot on the project causing delays and postponements
Civil Societies: Charitable foundations, Universities, Research institutions, non-profit organisations	They supported the project through creation of a network and alliances, discussing about social issues including legal compliance and preventing Mafia infiltration in the management of contract connected to the event	Their work and help contributed in a positive way in the project development thanks to their involvement in environmental aspect connected with the use of resources, changes in land use and landscapes. Their research activities guaranteed a high-quality level for the Event content
National Government	It was not always active support of the project due to the frequent changes in the political party at the power. There was not a total opposition but sometimes a low involvement and enthusiasm that did not speed the works.	The political support is the most important and essential one because it determines the go/ no-go of the project
Municipality	The Municipality of Milan changes its Mayor two times during the project life cycle. The first mayor was strongly supportive, while the second one was not so enthusiastic but he did his forma support	In the specific case of Mega-Events, the support of the municipality of the city hosting the event is the prerequisite in order to let the project start. Moreover, it facilitates the correct development on time trying to solve some issues
The Media	All the organisations or individuals providing the public with news and information about the event, including the social media were both supportive and opponent the project because	Media has a role to generate new stories and images about the current relevant issues such as progress in construction, state of payments, current list of participating countries and influenced positively the project

External Stakeholder	External Stakeholder's attitude to the project	External Stakeholder's influence on the project
	the activist groups used also the media to spread the information.	because tried to provide the public with transparent information about the social/environmental/economic issues related to the event

Tab.8 External Stakeholders' attitude analysis (adapted from the Sustainability Report 2014, Expo Milano 2015)

Conclusion and key findings

The Expo 2015 is a mega-event characterized by a huge complexity from all the point of views, from the organisation, to the stakeholders' management, from the economic framework to the involvement of all the different countries from all over the world. Expo 2015 represents a typical project to understand the strength of a rigorous methodological approach to uncertainty and the need for a mature consciousness at managerial level on these topics (Locatelli and Mancini 2010). From the analysis of the Expo case, the uncertainty stemming from the context had an impact on the timing of the project, causing delays and postponement of the opening date. The event should have been officially started in the 2014 and the delay was about 1 year and still, at the opening ceremony, some buildings were under construction. The political and economic environments played here an important role, influencing most of the decisions taken to face some problems that occurred. Therefore, a good stakeholders' management and a correct engagement plan is fundamental and essential for the successful realisation of this kind of mega-events. All the news and information about the bad management of the project, the corruption, the arrests of general directors, and the negative impacts on the Italian economy, could have caused the suspension of the project or a major postponement because without control. Therefore, the support of the public institutions, such as the government, the municipality, the government authorities, the civil society and so on, is the *condicio sine qua no*n of a good success of the project because these stakeholders have the power to direct some public opinions toward a positive view.

CHAPTER 5
DEVELOPMENT OF THE NEW APPROACH

5.1 Introduction to the new approach

In this section I present the new approach which is the basis for the future framework. The new approach consists of three main parts: external stakeholders' analysis, uncertainty analysis, guidelines for strategies. The aim of this approach is to integrate the stakeholder and uncertainty management processes in order to make the project manager able to understand to which stakeholder he has to give more attention starting from the planning phase. This integration is made possible through the consideration of the influence of the context over the project development.

This new approach stems from the awareness of the necessity of an integration between stakeholders' analysis and uncertainty analysis because, as clearly stated in the real projects analysed in the previous chapter, what is still missing in the project management process is a good cooperation and collaboration. In the Portuguese case for instance, the changes in the context led to big uncertainties which could not be addressed in time due to bad management of external stakeholders. The problem of do not foresee on time the uncertainties can result in a difficulty in managing the relationships and the attitudes of the stakeholders that can turn against the project, above all if the communication is not enhanced and ensured by the project manager. The result could be a disaster for the future of the project that can be suspended, as for the case of the HSR in Portugal.

The new approach is the sum of existing or adapted tools and approaches of the literature and in the following sub-chapters I will explain in details all the single parts of the approach.

5.2 Description of the new approach

We can consider the three main parts of the approach as steps of a whole process of analysis:

- 1st step. External Stakeholders' analysis: evaluation of the external stakeholders' influence through a quantitative index and evaluation of their importance through the stakeholder mapping in a matrix based on two new dimensions.

- 2nd step. Uncertainty analysis: conjoint analysis of stakeholders and the context through a matrix where the combination of two dimensions, one related to the external stakeholders, and one related to the context, will lead to the creation of four different scenarios, each of them characterized by a specific level of uncertainty.

- 3rd step. Guidelines for strategies: development of guidelines for strategies to adapt to each of the different scenarios.

5.2.1 External Stakeholders' analysis (1st step)

The first step in this new approach is the analysis of external stakeholders in order to understand their position in the network in terms of salience and influence's level. When the project manager has to take some decisions for the strategy to implement in managing the stakeholders, he needs first to know which one asks for more attention based on the possible related risk.

The analysis is divided in two parts: first I evaluate the impact of each external stakeholders using a quantitative index and then I evaluate the importance and influence by mapping the stakeholders in a matrix.

External Stakeholders' impact: quantitative index

For the analysis of the impact of stakeholders I decided to use a quantitative index for its objectivity and clearness in assessing the salience over the project. Reviewing the literature, the best tool the fits with my analysis is the one proposed by Olander (Olander and Landin 2005), the stakeholder impact index, which in turn is the result of the combination and integration of other tools and indexes in the literature proposed by other authors. The choice of this index was made for the completeness and comprehensiveness of all the essential factors needed for the correct evaluation of the impact of the stakeholder.

To explain the index in all its parts and how to calculate it, I will refer to the work of Olander.

Starting from the final formula of the stakeholder impact index SII I will go backward to explain how it is calculated.

$$SII = ViII * A * Pos$$

The formula is composed of three main elements: (i) the vested-impact index "ViII" (Bourne and Walker 2005); (ii) the stakeholder attribute value "A", which is the sum of all the

attributes possessed by the stakeholder (Mitchell *et al.* 1997); (iii) the position value toward the project "Pos" (McElroy and Mills 2000).

(i) The vested-impact index "ViII"

The vested-impact index is a concept developed by Bourne and Walker (2005) and it consists of the parameter vested interest levels (probability of impact), and influence impact levels (level of impact). The final formula of the index is:

$$ViII = \sqrt{(v * i/25)}$$

The vested interest levels "v" and the influence impact levels "i" are qualitatively assessed in a 1 to 5 scale: 5 (very high), 4 (high), 3 (moderate), 2 (low), 1 (very low).

- For the vested interest "v" the levels are assigned based on the involvement of the stakeholder in the project which determines its interest.
- The assessment of the impact "i" is slightly more complicated to define in an objective way; therefore, I suggest always a qualitative scale from 1 to 5 but with this level's description:
  - 5 (very high): the changes to the project have an impact on the status of the project (serious postponement/ suspension) and the chance to implement strategies for containing the problem or mitigating the risk is not so big
  - 4 (high): the changes/actions have a visible and quantifiable impact on the budget/time/quality but still there is space for recovering actions or mitigation strategies
  - 3 (moderate): the actions have an impact on the project with small changes about delays in the studies of the case or in the decisions
  - 2 (low): the impacts are considered on the support/non-support of the project but in an indirect way
  - 1 (very low): the impact is not quantifiable in terms of budget/time/quality but there is only a slight change

Once you have assigned the level of the vested interest and the level of the impact for each stakeholder, then you can calculate the vested-impact index through the formula.

(ii) The stakeholder attribute value "A"

The stakeholder attribute values "A" is assessed by summing all the weighs assigned to each attribute (power, legitimacy or urgency). To each attribute is given a weigh between 0 and 1, where the sum of all the three weighs-attributes for each stakeholder has to be 1. The stakeholder attribute value will depend on the distribution of the three attributes (power (p), legitimacy (l), and urgency (u)) that each stakeholder possesses, showing the relative strength and importance with respect to the specific case. In fact, the distribution can vary from project to project according to the priority of the attribute. In the infrastructure mega-projects, it was

chosen a distribution where more importance is given to the attribute of power because in these projects the stakeholders are more important and influencer if they have more power. In this thesis, I will adopt the same distribution proposed by Olander in his work: p= 0.4, l= 0.3 and u= 0.3.

Before to sum the weighs of the attributes possessed by the stakeholder, we need first to define which attributes the stakeholder possess. Therefore, in order to make easier and clear the assignment of the attributes I suggest to assign the attributes based on the strategy the stakeholder is more likely to adopt through the following scheme:

Strategy		Attributes		
Name	Description	Power	Legitimacy	Urgency
Direct withholding strategy	Stakeholder restrict project's access to critical resources which are controlled by him/her	√		
Indirect withholding strategy	Stakeholder influence project's access to resources that are not directly controlled by the specific stakeholder	√		
Resource Building strategy	Stakeholder acquire and recruit critical and capable resources to their group	√		
Coalition building strategy	Stakeholder build alliances with other project stakeholders to increase their perceived power or legitimacy		√	
Conflicts escalation strategy	Stakeholder attempt to escalate the conflict beyond initial project related causes		√	
Credibility building strategy	Stakeholder increase their perceived legitimacy by acquiring credible and capable resource (capable individuals with good network)		√	
Communication strategy	Stakeholder use different types of media to communicate and increase urgency of claims			√
Direct action	Stakeholders organize protests			√

Tab.9 Assignment of the attributes based on the strategy

This is a way to help managers in assessing the attributes of the stakeholders because often is easier to understand how the stakeholders can behave adopting some strategy rather than look at the definition of the attribute and give personal interpretations.

(iii) The position value toward the projects "Pos"

The position value is given by assign a numerical value to each of the stakeholder's position toward to projects defined by McElroy and Mills (2000):

- Active opposition: Pos = -1
- Passive opposition: Pos = -0.5
- Not committed: Pos = 0
- Passive support: Pos = +0.5
- Active support: Pos = +1

With the assessment of all the three elements is possible to calculate the stakeholder impact index by multiplying each value, which in turn has to be calculated as I explained in the previous parts.

Once having calculated the index for each single stakeholder, then is needed to calculate the total stakeholder impact index for evaluating the overall impact of external stakeholders to the project. The formula for the total stakeholder impact index is:

$$SII_{project} = \sum SII_k \qquad \text{Where k =1 to n number of stakeholder.}$$

If $SII_{project}$ is positive the project has a favourable stakeholder impact, but if it is negative the stakeholder impact is unfavourable. Olander also suggest that a sufficient stakeholder management process should ensure an increasing $SII_{project}$ during the project's life cycle, or at least not one that decrease.

External Stakeholders' influence: Salience/Predictability matrix

At this point the stakeholder impact has been calculated through an index, which is a relative number where the sign is indicative of the favourability/unfavorability toward the project.

The only impact index is not sufficient to have a clear overview of the position and importance of all the stakeholders in the network, therefore a matrix is needed in order to map the stakeholders and give a visual understanding of the real situation.

In the literature there are several matrixes developed to assess the influence/importance of stakeholders and the one used in this tis approach is an adaptation of the Power/Predictability matrix of Newcombe (2003).

The matrix adapted is the Salience/Predictability matrix.

Salience/Predictability matrix

In this matrix one dimension is referred to salience of the stakeholders, the other one to the predictability of their attitude toward the project. I suggest to use the salience instead of the power, as in the matrix of Newcombe (2003) because the power is not always the most important attribute, as I already explained in the previous section. In order to consider the global importance of the stakeholder it should be take into account its salience, which in turn considers all the attributes (power, legitimacy and urgency).

Salience dimension

To assess the salience of the stakeholder I suggest to use the stakeholder classes defined based on the attributes possessed, therefore, if a stakeholder possesses just one attribute, it will have lower level of salience compared to one who possesses more than one attribute. Once defined the stakeholder classes, to each class is given a numerical value in order to create a scale according to which is possible to map the stakeholder in the matrix for the "salience dimension"

The stakeholder's classes are defined by Mitchell *et al*. (1997) dependent on the distribution of stakeholder attributes and in the following figure (Fig.25)is clear how the classes are assigned.

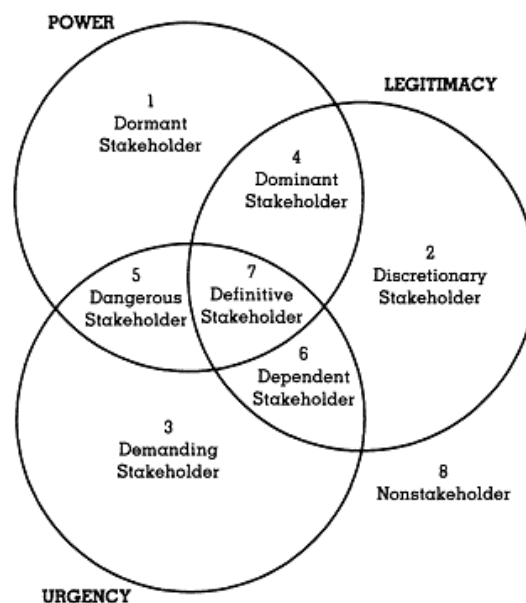Fig.24 Stakeholder classes (Mitchell *et al*. 1997)

The description of each classes is here proposed:

- ▪ Dormant Stakeholder: they possess the power of imposing their will on the projcts, but their power remains unused since they do not have legitimate relationships or urgent claim. They have the potential to acquire a second attribute, so the project manager should be aware of their potential impact.

- Discretionary stakeholders: they possess the legitimacy but no power to influence the project and no urgency in claims. The key point of these stakeholder is that, in absence of power and urgent claims, there is no pressure on mangers to engage them in active relationships.
- Demanding Stakeholders: they have urgent claims but no power or legitimacy, so they are labelled as latent stakeholders (Mitchell et al. definition) where salience is low
- Dominant Stakeholders: they have power and legitimacy so the expectations of any stakeholders perceived by managers as being powerful and legitimate appear to clearly matter. They expect and receive much of the managers' attention.
- Dangerous Stakeholders: they possess urgency and power, so they can be coercive, and possibly violent making them dangerous to the project. The actions of these stakeholders can be dangerous to the stakeholder-manager relationship and to the individuals and entities involved.
- Dependent Stakeholders: they lack power but have urgent and legitimate claims and they are labelled dependent because of their depending on other stakeholders for the power necessary to carry out their will.
- Definitive Stakeholders: the salience here is very high because these stakeholders possess all the attributes. When a stakeholder who possesses both power and legitimacy has an urgent claim, then managers have a clear and immediate mandate to attend to, and give priority to, that's stakeholder's claim.

Once you have identified the class the stakeholder belongs to, the next step is to assess to each class a numerical value to define the "value of the salience" in the matrix. The value has been assessed in the following way, giving priority to the attribute "power" which for these projects focus of this thesis has been considered the most important among the others.

- 1: Discretionary/ Dormant/ Demanding Stakeholders
- 2: Dependent Stakeholders
- 3: Dangerous Stakeholders
- 4: Dominant Stakeholders
- 5: Definitive Stakeholders

Predictability dimension

The predictability is here referred to the ability to predict the attitude of the stakeholders toward the project. In this case the value of the predictability is strictly linked to the dynamicity of the stakeholder: the more the stakeholder is dynamic changing his/her position and attitude toward the projects, the more his behaviour is unpredictable.

To assign the value of the predictability I suggest to use a qualitative scale 1 to 5 based on the dynamism of the attitudes of the stakeholder: 5 (very high), 4 (high), 3 (moderate), 2(low), 1 (very low)

Mapping in the Matrix

Each stakeholder will be collocated in the matrix in a position that correspond to the level of salience previously defined and to the level of predictability as well. the visual representation in the matrix will be a balloon, the diameter of which is given by the absolute value of the correspondent stakeholder impact index calculated in the previous step. In this way the stakeholder will be classified not only on the basis of the possession of one or more attributes, but also on the basis of the quantitative impact he/she can have on the project. The comprehension of the stakeholders' network is made easier by looking at the matrix.

5		
4	Greatest danger/ opportunity	Important stakeholder but predictable so it is easy to manage
SALIENCE **3**		
2	Unpredictable but manageable	Few problems
1		

1	**2**	**3**	**4**	**5**
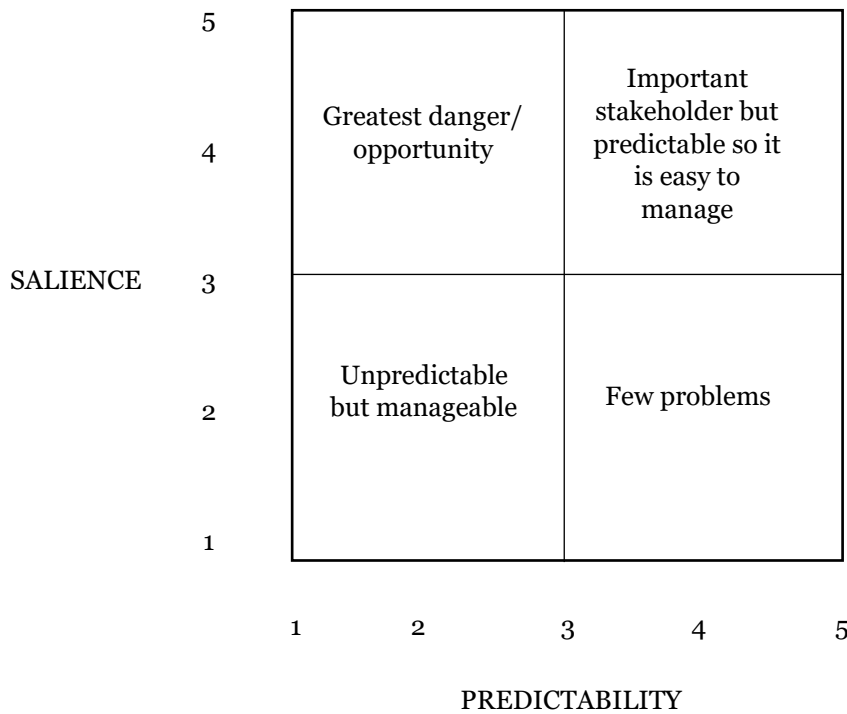
PREDICTABILITY

Fig.25 Salience/Predictability matrix (adapted from Newcombe 2003)

5.2.2 Uncertainty analysis (2nd step)

Once the external stakeholders' analysis is completed, the next step is the uncertainty analysis. For the analysis of the uncertainty in this thesis I suggest an integration between the stakeholders' analysis and the context analysis since it was found, in the case study analysis, that the influence of the context in mega-projects is very important and that the uncertainty, stemming from the context, is often undertaken, thus the project manager has difficulties in managing external stakeholders.

The objective of this analysis is to assign to each stakeholder's category a level of uncertainty in the planning phase, to facilitate the job of the project manager in foreseeing the possible

uncertainty stakeholder-related, so thus to focus more attention and effort in managing those stakeholders, with the final aim of reducing or mitigating the uncertainty through the right strategy.

In fact, the context is a fundamental element to consider when taking decisions in the strategies to manage stakeholders, because sometimes the changes in the context lead to uncertainties, which are impossible to manage if seen with delays.

Therefore, I suggest to use a matrix with two dimensions, the dynamism of the attitudes of external stakeholders, and the complexity of the specific environment related to the stakeholder I am considering (if the stakeholder is "local government" then I have to look at the complexity of the political environment as "context". In this way, each stakeholder is classified according to the specific context he/she belong to.)

	LOW	HIGH
HIGH	**HIGH/MEDIUM UNCERTAINTY** - Small n° external elements and they are similar -Stakeholders' attitude change frequently and unpredictably	**HIGH UNCERTAINTY** - Large n° external elements and they are dissimilar -Stakeholders' attitude change frequently and unpredictably
LOW	**LOW UNCERTAINTY** - Small n° external elements and they are similar -Stakeholders' attitude remain the same or change slowly	**LOW/MEDIUM UNCERTAINTY** - Large n° external elements and they are dissimilar -Stakeholders' attitude remain the same or change slowly

DYNAMISM (vertical axis, HIGH top to LOW bottom)

COMPLEXITY (horizontal axis, LOW to HIGH)

Fig.26 Dynamism/Complexity matrix for Uncertainty assessment (adaptation from the uncertainty matrix in complex environments in the organizations (Daft 2008))

This matrix is adapted from the one proposed in a book "The environment of Management" (Daft 2008) where, in a chapter regarding the organization-environment relationship, there is a discussion about the environmental uncertainty the organizations have to deal with. In the book the dimensions of the matrix are both related to the environment, the rate of change in factors in environment (first dimension), and the number of factors in organization

environment (second dimension). In this way, the levels of uncertainty are assessed only on the basis of the characteristics and complexity of the environment around. In presence of high frequency of changes and high complexity, then the strategy suggested in the book is the adaptation to the new environment.

To adapt this matrix to my specific case, I change one dimension to create the integration between the stakeholders' analysis and the context analysis with the aim to identify the level of uncertainty to each combination.

Dynamism dimension

The first dimension is the dynamism of the attitude of stakeholders, referred to the frequency of changes in their positions and attitudes toward the project. The value of this dimension is assessed qualitatively in high or low since is not easy to quantify the dynamicity. Therefore, we consider "high dynamism" when the stakeholders' attitudes change frequently, because for some reason or events they pass from supportive to opponents easily. If the dynamism is high, then the predictability is low and thus the stakeholders are considered unpredictable because the project manager cannot predict their behaviour. While the "low dynamism" is the opposite situation, when the stakeholders' attitudes remain the same or change slowly, once in the whole project development.

Complexity dimension

The second dimension is the complexity of the context. Here a note should be done because the context is a too general term and it has to be understood correctly in order to be able to map the stakeholders in the matrix. Since in the beginning of the thesis I define the context as made by different environments, such as political, economic and legal & regulatory environments, then we need to distinguish every time which environment we are referring to. So, if we are considering a specific stakeholder, then we need to refer to the specific environment he/she belongs to, in order to analyse the complexity of the context. For instance, if I want to consider the stakeholder "local government", then I have to look at the complexity of the political environment. To assess the level of complexity I have to consider every time different factors such as the stability of the government, the timing of the elections (if they can be anticipated), the position of some strong parties if at the power, etc. Once I defined the level (high/low) of the specific environment (political in this case), then I can put the stakeholder, also according to the level (high/low) of its attitudes' dynamism, in one of the quadrant of the matrix, assigning thus a specific level of uncertainty.

The Dynamism/Complexity matrix in fact, by combining the two dimensions, creates four different scenarios and each of them is characterized by a specific level of uncertainty, as it showed clearly in the Fig.27.

To consider the two steps (external stakeholders' analysis and uncertainty analysis) as a continuum, then the previous classification of stakeholders in the Salience/Predictability matrix should be reported in this matrix, with the same visual representation of balloons. In this way, the integration is made very easy and we can classify each stakeholder in a different quadrant of the uncertainty matrix.

The aim should be to give to the project manger a tool to visualize the stakeholders' network clearly and to focus more attention to those stakeholders in the quadrant of High/Medium Uncertainty level. The priority of attention should be assessed in this way:

- First the priority is given to the stakeholder with the highest level of uncertainty
- Then, among the stakeholders with the same level of uncertainty, the priority is given to the stakeholder with the highest value of the stakeholder impact index

5.2.3 Guidelines for strategies (3rd step)

The third step of the approach is to give guidelines for strategies to implement in each of the scenarios of uncertainty. The final aim of this approach, in fact, is to support the project manager in the planning phase to better manage the stakeholders' network that can be subjected to changes due to the modifications in the context and due to the high level of uncertainty. The guidelines of this last steps should be then investigated more in depth in order to formalise new effective strategies in the stakeholder management. The whole approach here described ha the objective to improve decision-making process in the planning phase for the reduction of the risks and uncertainties that impact on the project development and to improve the project outcomes of being on time and within budget, thus guaranteeing the project success.

These guidelines, that I will describe in details in this section, are the result of, from one side, the analysis conducted through the case studies, the literature review and the reading of other past projects in the same conditions and situations, from the other side, the interviews I conducted to the project managers of the cases. In some extent, these guidelines could be considered as suggestions for adapting the strategy that better fits with the conditions of the scenario (level of uncertainty, level of complexity level of dynamism). Therefore, the future work will be in the direction of formalization of these suggestions in real strategies and of implementation in the planning phase, verifying how much the uncertainty level can be reduced/mitigated.

After the project manage has completed the first two steps of the approach and has assigned to each stakeholder a level of uncertainty, he has to take decisions on how manage the stakeholders, taking into account the priority rules.

From the uncertainty matrix four scenarios are proposed:

High uncertainty: High complexity of the context and High dynamism.

The suggestion strategy is the flexibility, and in some cases, even the resilience, due to the high need of ability of adaptation to the changes of the context and of the stakeholders' positions toward the project. Today addressing uncertainties is a condition to build resilience. The nature, size, impact, occurrence in time of an event are not known often, therefore, building resilience goes with the need to anticipate within uncertainty, within the system, or across scale. The suggested strategy to adopt in this scenario is thus the resilience for the ability to adapt to the changes, but also the anticipation and the possibility to have more resources to use when some changes occurs. The adaptive strategy is the only solution in rapid changing context where sometimes you are not able to anticipate of foresee the event, but you can get ready to it.

High/medium uncertainty: Low complexity and High dynamism.

In this scenario, the complexity of the context is low, it means that the environment is stable and not affected by critical changes which modify the environment itself. Therefore, the uncertainty is more related to the stakeholders' influences over the project because the dynamism is high, thus the stakeholder changes frequently his position and attitude, giving difficulties to the project managers in predicting the stakeholder's behaviour. Here the suggested strategy is the one of reducing the dynamism, thus make the stakeholders' attitude more predictable. The tools could be a strong engagement of the stakeholders in local activities with the aim to gather information about their attitudes and the positions toward the project, a strong communication plan to inform them about the project and try to guide their opinions toward a positive direction of supporting the project.

Low/medium uncertainty: High complexity and Low dynamism.

This scenario is the opposite situation of the previous one, where now the dynamism is low, thus the stakeholders' attitudes are pretty much stable so predictable and manageable, while the complexity of the context is high. In this case the uncertainty is more referred to the changes in the environment because there so many external elements the increase the complexity. The suggested strategy is to reduce the complexity of the context

Low uncertainty: Low complexity and Low dynamism.

This scenario is the best one because stakeholders are easy to manage thanks to the low dynamism of their attitudes and, in turn, high predictability, and the context is not complex, so there are not so many external elements that can bring big changes and modify thus the environment. Here the suggested strategy is to strengthen the relation with the active supportive stakeholders in order to ensure always a big support and, on the other side, to maintain stable the relationship with passive supportive/opponents because they are not

acting directly, and to weaken the relationship with the active opponents trying to make them change direction.

5.3 Application of the approach to the case studies

In this section I apply the new approach to the case studies to confirm its validity and coherency with application posteriori (the aim of course is to apply it in the early steps of the planning phase). The results of the application have been approved by the project managers interviewed because it is a good approach that gives the correct importance to the stakeholder influence analysis and help the project manager to identify a level of uncertainty to assign to each stakeholder category and to plan a proactive strategy.

The application of the approach consists in the first two steps because the third step regarding the guidelines for the strategies is something that can be applied only to future projects, since for these projects the strategies were already taken in the past.

5.3.1 HSR Portuguese project: application of the approach

External stakeholders' analysis (1st step)

For this step, it can be useful utilize a table, proposed by Olander in his work, in order to clearly visualize all the necessary information for calculating the stakeholder impact index.

Stakeholders			A				ViII	Pos	SII
	P	L	U		v	i			
APA	0.4	0.3	-	0.7	2	3	0.49	+0.5	+0.18
Municipality	0.4	0.3	-	0.7	2	2	0.40	+0.5	+0.14
Media	0.4	-	0.3	0.7	4	5	0.90	-1	-0.63
Government	0.4	0.3	-	0.7	5	5	1	-1	-0.70
L. C.	-	0.3	0.3	0.6	3	4	0.70	-1	-0.42
E.O	-	0.3	0.3	0.6	4	4	0.80	-0.5	-0.24
TOT									-1.67

Tab.10 External Stakeholders' impact index calculation for the HSR project

Stakeholders	Class
APA	Dominant
Municipality	Dominant
Media	Dangerous
Government	Dominant
Local communities	Dependent
Environmental Organizations	Dependent

Tab.11 External Stakeholders' classes for the HSR project

From the Tab.10 it is clear how the Stakeholder impact index of the total project is negative (-1.67), therefore the stakeholders' influence is unfavourable. The application's results of the first part of the analysis is coherent with the reality because if we consider the stakeholders "government" and "media" we find the highest values for the attribute value (A = 0.7), the highest values for the vested-impact index, which means that these stakeholders not only had a great interest in the project but also the impact was high with important changes and consequences on the project development, and the position value is -1 in both cases. Therefore, the stakeholder impact index is -0.70 for the "Government" and -0.63 for the "Media", we can do two considerations. The first consideration is about the sign, since it is minus, it corresponds to the opposition of the stakeholder toward the project. The second consideration is about the absolute value, which is higher compared to the one of all the other stakeholders. The index then, gives an objective description of the influence of the stakeholder adding more information respect to some other analysis tools and it is strong for classifying the stakeholders' categories to whom give more attention.

After the calculation of the stakeholder impact index, the next step is to map the stakeholders in the Salience/Predictability matrix as follows:
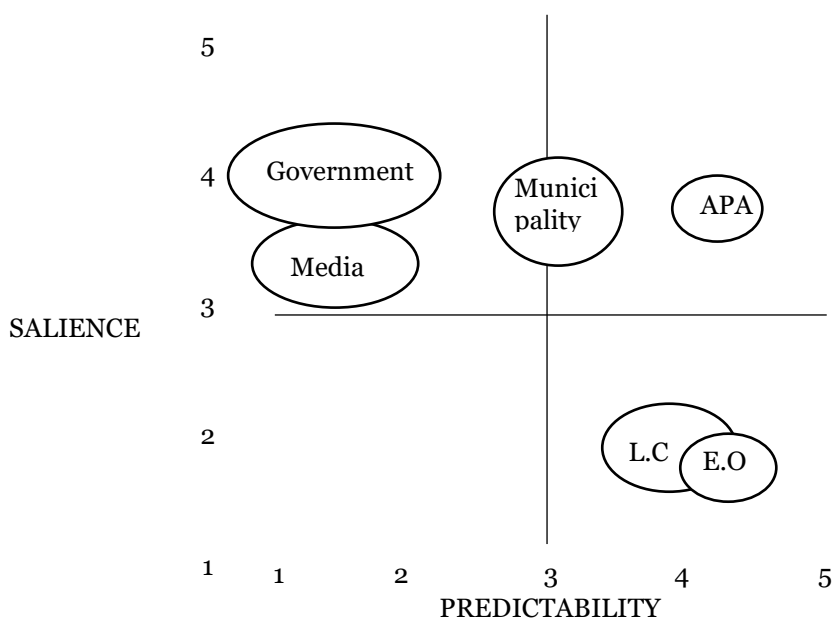

Fig.27 Salience/Predictability matrix

In this matrix, it is showed the position of the main external stakeholders according to their salience and their predictability. The dimensions of the balloons, used to represent graphically the stakeholders, are determined by the absolute value of the stakeholder impact index calculated before. From the analysis, it appears clearly how the Government and the Media stakeholders were not only the most important in terms of impact, looking at their dimensions, but also the most dangerous actors. In fact, as explained in the chapter about the description of the case studies, these two external stakeholders determined the sort of the status of the project, ending with its suspension. A major factor that make them even more dangerous was the low predictability of their attitudes toward the project. The Government changed his attitude several times, in fact the party at the power (socialist or conservative) in turn was supporting/opposing the project based on some country-related issues like the impact on the economy, the environment, etc. Therefore, it was a very dynamic stakeholder that creates problems to the project manager who had always to put in doubts all the work done till at that moment waiting for the next election. In addition, the Media contributed in raising issues and uncertainty because since 2008 was strongly opponent helping also the party in the opposition to spread a message to the community about negative aspects and impacts of the project. The municipality is positioned with a moderate predictability due to the fact that some municipalities had favourable opinion and interested in the project, while others had unfavourable opinion regarding the corridor definition, which can produce physic constrains within the territory. The salience of the municipality was set at a "high" level because they are considered dominant stakeholders with power and legitimacy, the predictability is set at level 3. They are moderately predictable since some municipalities had favourable opinion and interested in the project, while others had unfavourable opinion regarding the corridor definition, which can produce physic constrains within the territory. For the local communities and environmental organizations, the situation is totally the same, they are almost predictable in their attitudes because they did not change opinions and they are considered dependent stakeholders.

Uncertainty analysis (2ⁿᵈ step)

Now the further step is to combine the information taken from this matrix, the predictability of the stakeholders' attitude, with the complexity of the context. The predictability of the salience/predictability matrix is renamed as "dynamism" in the uncertainty matrix, because, even if the two terms are addressing the same concept, in this case the focus is more on the frequency of the change of their opinion. The uncertainty matrix applied to the case is the following one:
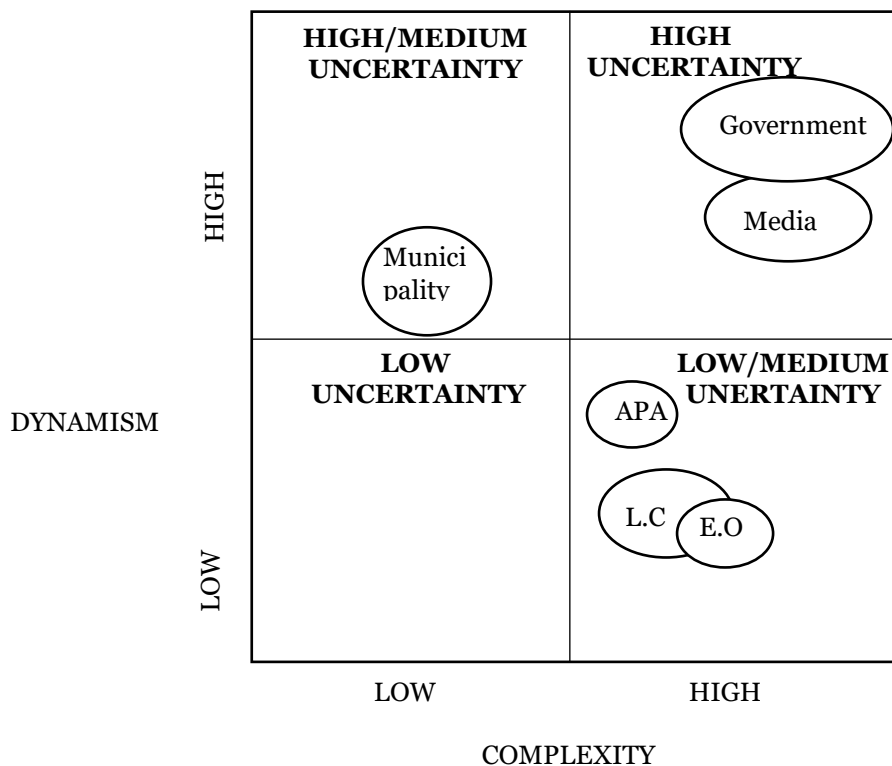
Fig.28 Uncertainty matrix

From the uncertainty analysis, it emerged that, as clearly stated in the previous analysis, the two most important and influence stakeholders are Government and Media and they are in the quadrant characterized by high level of uncertainty, so they require the attention of the project manager with high priority. The Municipality is positioned in the High/Medium uncertainty level because, even if the relative environment is not complex, then, compared to the other stakeholders such as APA, Local Communities and Environmental organizations, it changed attitude at least once, or it was not completely unified in the supporting or opposing position toward the project, but anyway at a lower extent compared to Government and Media.

Looking at the dynamism dimension, we should find the exactly situation we had in the salience/predictability analysis because we derive the dynamism from the previous matrix, while for the complexity dimension we have to analyse the relative context considering all the influential factors and then map the stakeholder in the right quadrant.

This approach helps, first, to visualise the importance of the stakeholders in the network, so in this case it was clear that government and media had the priority in the attention of the project manager. And then, thanks to the uncertainty matrix, the project manager can classify the stakeholders based on the complexity of the context and the dynamism of their attitudes placing them at least in an uncertainty level. Doing this pre-analysis, the project manager can have some guidelines in where direct more effort and attention because it works as an alert system. When the uncertainty is high, then the alert is high and consequently the next action is the implementation of specific strategies, that should be the 3rd step of the new approach.

5.3.2 CTRL UK project: application of the approach

For this case study, I could not be able to apply my approach because the information I could gather about the external stakeholders were not enough and exhaustive in order to calculate the stakeholder impact index. Unfortunately, this can be considered a limitation because where there is lack of information there is a situation of uncertainty. Moreover, this case study was chosen as an example of a good communication strategy in the stakeholder management, that led to a project management process not of bad performances, in terms of contextual uncertainty and related issues. This case was chosen to give an example of a project in which the good communication plan and the effective engagement of the external stakeholders (which are the strategies suggested in high uncertainty scenarios) can help in reducing the uncertainty. All the conclusions related to this case cannot rely on empirical and valid data because I could not have the chance to interview some project managers of the case, or consult several sources. It was just an example to compare the Portuguese transportation mega-project with another European transportation mega-project.

5.3.3 EXPO 2015 project: application of the approach

External stakeholders' analysis (1st step)

For this step, it can be useful utilize a table, proposed by Olander in his work, in order to clearly visualize all the necessary information for calculating the stakeholder impact index

Stakeholders			A				ViII	Pos	SII
	P	L	U		v	i			
Government Authorities	0.4	-	-	0.4	3	2	0.5	+0.5	+0.10
Municipality	0.4	0.3	-	0.7	4	5	0.9	+1	+0.63
Media	0.4	-	0.3	0.7	4	5	0.9	+1	+0.63
Government	0.4	0.3	-	0.7	5	5	1	+1	+0.70

Stakeholders				A			ViII	Pos	SII
	P	L	U		v	i			
Local Communities	-	0.3	0.3	0.6	3	3	0.6	-1	-0.36
Regulator & Local Authorities	-	0.3	-	0.3	2	2	0.4	+0.5	+0.06
Local activist group	-	0.3	-	0.3	3	3	0.6	-1	-0.18
Civil society	-	0.3	-	0.3	2	2	0.4	+0.5	+0.06
TOT									+1.64

Tab.12 External Stakeholders' impact index calculation for the Expo event

Stakeholders	Class
Gov. Authorities	Dormant
Municipality	Dominant
Media	Dangerous
Government	Dominant
Local communities	Dependent
Regulator and Local communities	Discretionary
Local activist group	Dependent
Civil society	Discretionary

Tab.13 External Stakeholders' classes for the Expo event

The External Stakeholders' impact index is a positive value of +1.64 and different considerations can be made. First, a positive value means that the stakeholders' influence over the project is positive, therefore the project was supported almost from all the stakeholders, with active actions from some of them, and with a passive support from others. The most important stakeholders, again, are the "Government" and the "media" because they have a

stakeholder impact index of +0.63 both. The difference between these two actors is in the attributes possessed and in the vested interest impact index, higher for the Government. In this specific case of a mega-event, the considerations are slightly different respect to the ones done for a transportation mega-project. In fact, for a mega-event like a Universal Exposition, the Government decide the go/no-go of the project because it has to support the application and request for being the hosting country of the event, since it impacts the economic, social and political environment of the country. Looking at the table, also the Municipality in this project covered an important role having the stakeholder impact index of +0.63. The Municipality is considered a Dominant stakeholder together with the Government, differently from the Media, a dangerous stakeholder. Expo 2015 was not impacted by the Media with a strong campaign against its operations. Of course the public opinion got access to some information about corruption, a bad management, waste of resources and other negative implications, but it was not enough to stop the project. The position of the Media is +1 because it supported the project, through especially the social networks, the social contests, etc. in an active way. The Media cannot be passive. In the Expo case, two stakeholders played the role of the antagonist, strongly opposing the project with several actions such as violent protests. The Local activist group of Black Blocks destroyed the city during the opening ceremony in order to try to create problems for the organization. The calculation of the total stakeholder impact index is important because it gives an overall view of the stakeholders network's attitudes and influence over the whole project.

After the calculation of the index for each stakeholder and the definition of the classes, it is possible to map the stakeholders in the salience/predictability matrix
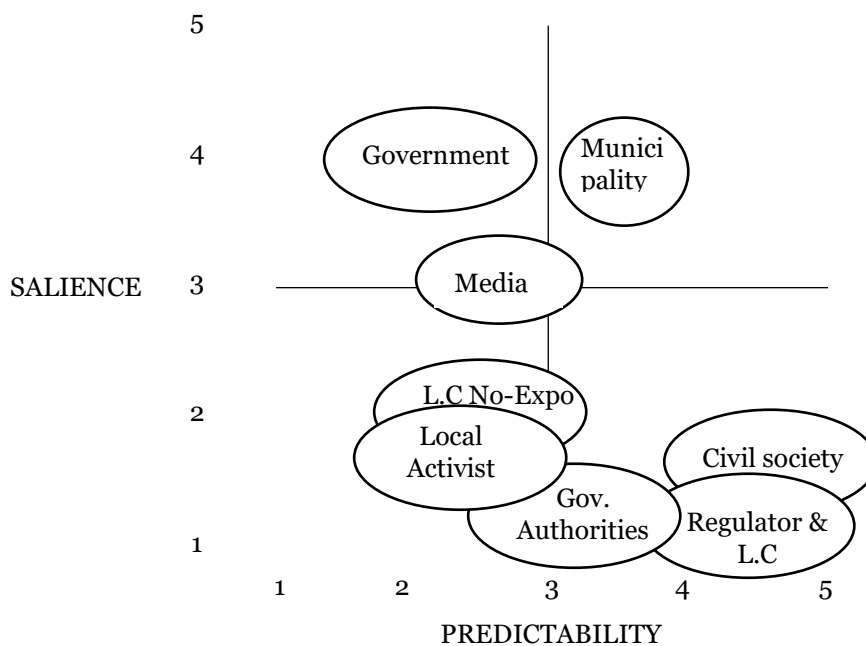

Fig.29 Salience/Predictability matric for Expo project

From this matrix, we can draw other considerations. First it is more clear here, rather than in the previous step of the calculation of the index, who is the stakeholder to whom give more importance and attention in order to prevent some negative actions. From a first sight, the project manager can have a picture of the external stakeholders' network and he can direct his attention to those stakeholders that have high salience and low predictability. In the figure above (Fig.30), unfortunately it was not possible to give the right dimensions to the balloons representing the stakeholders due to format-related reasons, but if we consider the values of the indexes we can recognize which stakeholder has more influence than the others. From a rapid view, the stakeholders positioned more in the left side of the matrix are those ones who need more attention from the project manager because the more the predictability of the attitude is low, the more the stakeholder can represent a problem due to his/her dynamism toward the project. It is also true that for the Expo case the real problems were not due to the lower predictability of the stakeholders' attitude as it could be for the HSR Portuguese project, but more due to the complexity of the huge organisation to manage. It is reasonable that stakeholder category such as Government Authorities, Civil society and Regulators are not considered a threat or risk for the project because their position were clear since the beginning of the preparation of the project.

Uncertainty analysis (2nd step)

Now the further step is to combine the information taken from this matrix, the predictability of the stakeholders' attitude, with the complexity of the context.
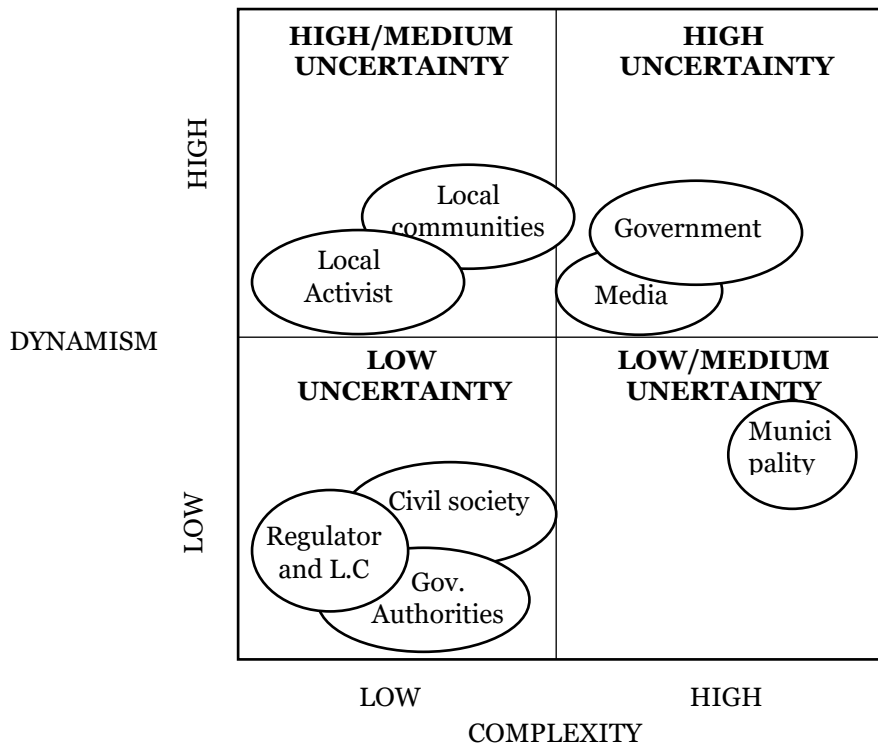

Fig.30 Uncertainty matrix for the Expo project

The uncertainty matrix applied to the Expo case gives a clear overview of the levels of uncertainty that can be assigned to each stakeholder. If with the previous matrix we were only displacing the stakeholders to understand their importance and influence on the project, here we also add another important information, which is the complexity of the context. For instance, if we take the stakeholders "government" now it is clear why it needs attention, even if, in the salience/predictability matrix, its predictability was low because all the different political parties at the power supported the project. The project manager should give more attention to the government because the complexity of the political environment is extremely high. In fact, in the description of the case, it was clearly shown the instability and ferment of the political context characterised by several elections and not all of them were conducted regularly and democratically. Therefore, the highest value of uncertainty can be assigned to this stakeholder. The media is in the same quadrant of the government because the complexity of the environment around, socially and politically speaking, was very complex that could lead the media to become against the project. The activist groups, local communities & committee and the local activist group Black Blocks, have a "high/medium" level of uncertainty because the complexity is low. They could be dangerous stakeholders if not under control, due to the violence in their protest that can lead to physical damages, besides the indirect implications. In the low side of the matrix we find all the other stakeholders that are considered not a threat because they have a low level of uncertainty, so easy to manage and easy to predict. The municipality has a "low/medium" level of uncertainty because the complexity of the political environment was so complex in Italy at that time, therefore, it represents a stakeholder to monitor. For the Expo case, the application of the approach shows how the complexity of the context can determine the level of uncertainty and not only the dynamism of the stakeholders' attitude. This is a more reason why there is the need to combine the stakeholders' analysis with the complexity dimension of the context, otherwise the risk is to lose some important information.

This tool of the uncertainty matrix gives a real power to the project manager who can, not only classify stakeholders according to their level of uncertainty, but also build a strategy to monitor the situations and prevent negative implications and events.

CHAPTER 6
DISCUSSION & FINDINGS

6.1 Discussion of the approach & Suggestions

In this chapter I present first, a general overview of the ideas and considerations about the theme of uncertainty related to mega-projects that emerged from the analysis of the case studies and the interviews conducted; then I introduce a section where I discuss about the findings and the suggestions to improve the new approach in order to create a framework.

6.1.2 Considerations about the new approach

Infrastructure mega-projects and mega-events are considered *mega* because the size is *mega*, the total cost is *mega*, and the scope is *mega*. Mega is just defined as unit of measurement that reminds to something more than big. There are no easy ways to manage perfectly and successfully these kinds of project, because uncertainty and complexity are two intrinsic characteristics that require more attention, effort, accuracy and all the other elements that make the outcome of a project a success. This thesis focused, on purpose, on this theme of the uncertainty and complexity, due to the centrality and the importance of the theme in an era in rapid change as the current one. The analysis of the case studies and the interviews I could conduct to get insights from the real experience "on the field", led to some important considerations.

The attention to the context in which the project is performed has been undertaken in these years, focusing more on new tools and techniques for a better risk management or stakeholder management. The biggest mistake was the one to consider all these processes as independent and not integrated as a unique system that manage the whole project. If the stakeholder management is not integrated with the risk management, then a correct implementation of the mitigation actions or strategies cannot be completely successful, because there is missing the link between the stakeholder, source of some risks, and the risk itself. In my thesis, I moved

the focus from the risk to the uncertainty because now it is more important and efficient to be able to foresee the uncertainties rather than the risks. *Which is the reason why of this shift?* The reason why lies in the fact that a mega-project starts already with a level of uncertainty. Therefore, the project manager needs to anticipate the future risks by addressing the uncertainties. An uncertain event, being uncertain, can be transformed into a risk or into an opportunity, or it can never occur during the project. This is the reason why there is the need to anticipate the events, identifying as soon as possible the uncertainties related to the project. Also with an opportunity there is the need in fact to be prepared, because otherwise there could be the risk to lose the opportunity, due to incapacity of managing the opportunity or, even worse, due to incapacity to identifying on time the opportunity.

In this thesis, I define uncertainty as *"a condition where there is lack of information needed to understand and define which could be the event that may occur if a change happens due to internal or external factors. The event, thus, is considered unexpected because not even planned and expected to occur in the execution phase of the project. Being the nature of the event uncertain, then, if the event occurs, it could have positive or negative impact on the project development "*

With these assumptions concerning the importance of the uncertainty and the integration with the stakeholder management process in a unique system, the importance of the context in which the project is performed is clear. The context is becoming more and more important due to the changes and the frequency of these changes that occurred in the last years and are going to occur. Therefore, the uncertainty stemming from the context must be addressed by the project manager as a prerequisite to obtain the success of the project. This analysis should be done then in the early stages of the project, in the planning phase, because, if the uncertainties are correctly identified in this phase, then it is more easy and there is more time to implement actions and preventive strategies. The ability of a project manager is the one to prevent negative actions, when it is possible, or to face them in a success way. Therefore, the uncertainty analysis should help him in achieving this objective.

The context is divided here into three main environments: the political, the economic and the legal & regulatory one. Each of these environments has different characteristics and it is represented by different external stakeholders' categories. There is the need, then, to address the analysis of the context divided into three different analysis to be able to get all the information more focused on the specific environment. The actions and strategies in fact should be tailored and customised for the specific stakeholder.

In mega-projects, being always risky, the political environment plays an important role. The main consideration should be done on the biggest risk in the planning phase, which is always represented by the Government. The political party at the government is responsible of all the decisions concerning the project. In the infrastructure mega-projects, politicians define the process that must be adhered to when an agency plans construction projects. The political

process and obtaining approvals from the stakeholders are in fact a major cause of delay and overruns (Booz Allen Hamilton 2005)[33]. Controlling the political process and satisfying the needs of the politicians have impacts and effects on the project success. Politicians are known form their pressure to minimize traffic disruption and accelerate the project (Crichton and Llewellyn-Thomas 2003) [34]. The political environment, therefore, is the most important one and should be taken in consideration and under continuous control from the project manager since the planning phase. From the analysis of the case studies and the interviews, what emerged as important elements characterising the uncertainty, are the dynamism of the stakeholders' attitude toward the project and the complexity of the relative context. In fact, the external stakeholders are considered source of uncertainty due to their attitudes' dynamism, if they change frequently the position and attitude toward the project, then is more uncertain for the project manager to understand and foresee their behaviour in order to keep them under control. But only the external stakeholders' dynamism is not enough to address the uncertainty, there is the need to consider the complexity of the context. If a stakeholder is almost predictable since he does not change so often the position and attitude toward the project, but the complexity of the relative context is high, then an unexpected change can influence the position of the stakeholder or create some obstacles. In fact, in the Portuguese case study the main factor was the dynamism of the attitude of the external stakeholders that changed frequently their positon, in addition to the complexity of the environment; whereas in the Italian case study the main element determining the high uncertainty was more the high complexity of the context. These findings helped me in proposing an approach that could gather this information and proceed with an almost structured way divided in three steps with the final aim to define a level of uncertainty for each stakeholder's category in order to understand the correct strategy to adopt.

6.1.2 Suggestions for a future framwork

The new approach I described in the chapter 5 has the final aim to set the basis for a future framework. The steps to follow are three and the fourth one should be the choice of the correct strategy to implement for each level of uncertainty. In the interviews I conducted I also gathered some suggestions and ideas for a better management of these mega-projects, based on personal experiences of the project managers that I want to share in this section.

The first suggestion concern the relation with the political party, since the political context is considered extremely important and influential for the project development. in the planning

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[33] Booz Allen Hamilton. 2005. TCRP Web Document 31: "*Managing Capital Costs of Major Federally Funded Public Transportation Projects".* Transportation Research Board of the National Academies, Washington, D.C.

[34] Crichton, D., and K. Llewellyn-Thomas. 2003. "*F. G. Gardiner Express- way Dismantling Project from the Don Roadway to Leslie Street*". Presented at 2003 Annual Conference of the Transportation Association of Canada, St. John's, Newfoundland and Labrador.

phase in fact, the bigger risk is represented by the decisions taken from the political party. Since all the most important decisions are taken from the political party at that time at the government, there is the need to establish a good communication with it. The more the relationship with the government is good, the more the project manager has good chances to avoid some obstacles and problems. If the project life time is higher than the execution time of the political party, we can imagine that during the project development there will be different parties at the power because the probability of a change is very high. Therefore, what is extremely important and essential in this case, it to make the political party understand that the project will have a real impact on the country, and the continuous changing of the attitude toward the project, supporting or opposing the project, can have serious impact and damages to the country itself. Therefore, it should be signed a *social agreement* in which should be clear that the purpose of the project and that it must go on even if there will changes in the government. Without this social agreement, the political party, in turn at the government, believes to have the power of stopping the project if it does not consider it a good opportunity or a need for the country. In this way, at each change of government, all the works done previously are destroyed with a loss of money. This social agreement could be seen as a protocol, signed by everyone and that cannot be put in discussion for the whole duration of the project. The aim is to guarantee the continuity in the works, avoiding also the risk to destroy what has been done previously. This protocol ha also the good effect of lowering the dynamism of the stakeholders' attitude increasing their predictability because they sign at the beginning of the project that they are going to agree on the project implementation. Therefore, this could also limit the power to the political party. The country should always put at the first place, and not subordinated at the personal interest of someone.

Besides the social agreement between parties (all the external stakeholders involved), there is the need to choose feasible and sustainable projects accompanied with the right economic and technical support. Having in mind big project that are not feasible to implement for several reasons, represent an obstacle to the good organisation and management of the project. That is the reason why, in the planning phase, there is the need to prepare a lot of *preliminary studies*: feasible, economic and technical studies with relative reports and documents, to have all the necessary information to make the right decisions. These preliminary studies help in avoiding wrong estimations of the total budget, the total resource, the time and so on. The two main situations in which the estimations can be wrong are when the budget is declared lower to have more chances to be accepted, and when the information to estimate correctly the budget is not enough.

Another important suggestion is concerning the *communication*. Since the beginning it is extremely important a strong and effective communication plan and information system. Every stakeholder involved in the project must know what it is going on, and all along the project life cycle, these communication plan and information system should be always updated and shared between all the parties. The trust and transparency must be ensured and

guaranteed to establish a good relationship with all the stakeholders. The secret for the success of the project is to have a proper and fantastic communication plan to increase also the awareness of the stakeholders on the project activities. If the project manager can foresee to have a problem in a couple of months, for instance, he should not wait till the problem occurs, but he should try to manage it properly, engaging every one with the aim to minimise it. One of the reasons to implement a communication strategy is to avoid the possibility to manage the project for personal interests. In fact, if all the stakeholders involved know the facts, the project activities, the figures and all the element related to the project, then the project manager does not leave spaces for someone to manage the project in a "special way" because everyone knows the risks. The transparency in the communication avoid the problem of a bad management based on personal interests. The other important reason why there is the need of a good communication plan is to educate the public opinion on the benefit/losses of the projects, through a clear and transparent explanation of the impacts on the country, the long-term effects etc… Sometimes the project encounter the opposition of the public opinion just because the information spread about its impact is wrong or not complete. This represents a serious obstacle for the project manager, who can see the project stopped only due to lack of the right information.

How to manage the major risks? Through a strong risk management should be the answer. The risk management serves to identify the risks, define the methodology to manage them, define the responsible in charge of the management. All of this needs to have a trace and a proof of how is the current situation in an objective way. This risk management process must be accompanied by a clear documentation and information about the risks and who oversees them. Sometimes in fact, the project manager can have a subjective evaluation of the situation.

Another consideration and suggestion should be done considering these mega-projects in the European context. It is known that in the European Union, these kinds of projects, that have an impact on the infrastructures of the country/countries involved, are partly financed by the European funds. Therefore, in this view, the money belongs to Europe, and the spending should be under control to avoid waste of resources and a bad management that can bring the project to a disaster with serious consequences for the economy of the country/countries where the project is performed. The suggestion is to implement some more controls on how the European funds are spent by the companies, including some extra documentation aimed at demonstrate the capability to manage this money. The company in charge of the project implementation, usually the S.P.E, that company created on purpose, should show clearly to have the skills, the organization, the resources, the teams with the right competences to be successful in the implementation of the project. So, EU should finance only those projects for which it is presented a clear and good risk analysis, where could be see all the possible risks identified, all the kind of measures should be taken and all the competences and resources needed to implement the right measures. The purpose if this risk program is also to avoid to

give free interpretations of the current guidelines about the European funds. The fact is that without a real control, the risk is to receive money from EU and waste them.

These suggestions should be integrated together to create a valid framework for an effective stakeholder management. The ideas collected from the interviews and from the whole analysis in this thesis, led me to propose these guidelines for a possible framework.

- Strong Preliminary analysis
    - Analysis of the context: political, economic, legal & regulatory environment identifying all the factors that could create instability or uncertainty
    - *Analysis of the external stakeholders to identify the importance and influence through the calculation of the stakeholder impact index and the through the mapping in the salience/predictability matrix*
    - *Analysis if the uncertainty through the uncertainty matrix considering the stakeholders' dynamism and the context's complexity*
    - *Definition of the strategies to implement for each stakeholder's category*

    New Approach

- Strong Communication Strategy
    - Communication plan to educate the public opinion on benefit/losses of the project
    - Communication plan to inform with transparency all the stakeholders about the fact, the project activities, the figures, and all the other important elements related to the project development

- Strong Engagement Strategy
    - Engagement plan to involve all the stakeholders since the early stages of the project, to ensure always an alignment of objectives
    - Engagement plan to make the team work more easy
    - Team building plan to ensure cohesion and membership

- Strong Monitoring Activities
    - Monitor & Control plan through all the stages of the project
    - Connection with the central system in order to have the situation always under control and foresee on time eventual risks or events, that, if not identified properly and on time, could lead to negative consequences

- Strong Competences & Skills
    - Acquisition of specific knowledge and competences, especially if the project is cross-countries, in order to align all the different practices, methodologies, tools that can be different from country to country

- o Acquisition of specific local competencies fundamental to overcome some problems between countries or parties
- o Creation of a team with diversity selecting members with different cultures, backgrounds, methodologies... in order to have a strong capacity in better addressing problems and implementing the project

- Preparation of risk provisions
  - o Economic risk provisions: increase the initial budget of a certain amount of money to use in case of some events occur. This increase the capability to respond quickly and effective to the change obtaining short-term results
  - o Competencies risk provisions: acquire knowledge, competencies, skills, talents that would be able to deal with risks/uncertainties identified and to implement solutions with a long-term perspective.

6.2 Limitations

The limitations of this approach could be find in the tools used and in the information needed to make all the analysis.

For what concern the tools used, the limitations are related to the qualitative nature of the scales used to perform some analysis of the external stakeholders, and to the practicality of the uncertainty matrix to identify the level of uncertainty. The reality is always different from the theory, because more complex and complicated to understand, therefore, it is difficult to represent it in a simple way by simply mapping the stakeholders in a matrix. This tool in fact, wants to be a valid helper for the project manager to direct his/her attention to some stakeholder groups/categories without the arrogance to work perfectly. Every time a project manager uses some theoretical tools, he should interpret the results and try to give them a mean, knowing all the conditions around that could not be taken as parameters or variables. Therefore, the approach here described is called approach for this purpose, to suggest a different way more structured to the project manager to address better the theme of the uncertainty.

For what concern the information needed, this is a known limit for almost all the theoretical models, tools, approaches,... Even if the nature of this approach is more qualitative than quantitative, the information needed to perform well the analysis is not of secondary importance. This is the reason why it could not be possible to apply the approach to the CTRL case study because there was some information missing about the stakeholders' attitudes, without which it could not be possible to do the calculations and all the evaluations. Therefore, there is the need to implement a good and strong information system because the project

manager has to cover all the information gaps to know as much as possible in order to do a more robust analysis and to lower the uncertainty stemming from the lack of information.

CHAPTER 7

CONCLUSIONS

7.1 Final Conclusions

The aim of this thesis is to shed light on many concepts regarding mega-projects, relatively undertaken and poorly addressed in the scholar literature.

First, I reviewed the literature about mega-projects, uncertainty management and stakeholder management concepts, to make clear the borders of my research and to identify the literature gaps. Then, I emphasized the challenges a mega-project requires in the global context of today. Complexity of the environment, contextual uncertainty and external stakeholders' influence emerged as the major issues of mega-projects, especially of infrastructure mega-projects, that require further attention and deeper study in the project management literature.

I analysed three European mega-projects performed in different countries as Portugal, Italy and UK. The findings obtained from the case studies analysed and the interviews conducted show in fact, from one side, the importance of the context influence and, from the other side, the importance of an integration between the stakeholders management and the uncertainty management processes in the planning phase of a project. In all the projects analysed, the external stakeholders have influenced the project development with different kinds of impact such as the suspension of the project in the HSR (High Speed Rail) Portuguese project, the delays and cost overruns in the Expo 2015 project, a good management of the project in the CTRL (Channel Tunnel Rail Link) project in UK[35]. Also, the complexity of the context played an important role in each of the project studied, impacting in a different way.

This thesis integrates the existing literature with the study of European mega-projects in order to support the thesis with real data and to have different point of views of the same issues.

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[35] The analysis of the CTRL project was based exclusively on the information gathered on internet through reports made by OMEGA CENTRE, some newspapers' articles and the megaproject portfolio analysis made by a MEGAPROJECT COST action. Therefore, all the conclusions and comments are the result of my interpretation.

Using the same framework of analysis was easy to compare the findings of the different projects and draw the right conclusions and interpretations on which I based the new approach proposed in this research work.

The main outcome of this research is the development of a new integrated approach for the external stakeholders and uncertainty analysis. Then I also defined some guidelines for the possible strategies to adopt in the different scenarios of uncertainty, considered as a third step of the approach. Furthermore, the approach proposed should be considered part of a future framework for an effective stakeholder management designed for complex European mega-project in turbulent context. The new approach proposed consists of three parts: the first one for evaluating the importance and influence of the external stakeholders, the second one for identifying the level of uncertainty associated to each category of stakeholders according to the level of complexity of the context, and the third one for suggesting guidelines for strategies to manage the external stakeholders according to the different scenarios of uncertainty.

An important issue for the project manager in fact, is to identify on time the uncertainties related to the external stakeholders and the factors influencing the complexity of the context, and then manage the external stakeholders' network through the right strategy from the early stages of the project. Therefore, the aim of these tools and methods is to help and support the project manager in the planning phase to better manage the external stakeholders' network that can be subjected to changes due to the modifications of the context and due to the high level of uncertainty.

7.2 Further research

Further research is needed to address better the theme of the contextual uncertainty that is still poorly studied and recognized as an integrated process in the project management process.

The suggestions for future research streams are:

- Formalise the framework for an effective stakeholder management that integrates the contextual uncertainty analysis in the planning phase of the project
- Apply the new approach to more case studies in order to test it with a sample numerically significant that can lead to more robust conclusions
- Apply the new approach during the planning phase of a running project in order to verify its applicability and validity
- Formalise the guidelines for the possible strategies to adopt according to the different level of uncertainties
- Identify and study more contextual factors to take as input for the complexity analysis
- Generalise the approach for all the types of mega-projects

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