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Risk Analysis in Transport Infrastructure Concession Project Funding: The Case of Thessaloniki Submerged Highway Project

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Abstract
PPP's are increasingly used for the delivery of new assets and/or services that traditionally were the responsibility of the Public Sector. In the case of transport projects the most popular PPP structures are the DBFO concessions. Concessionaires in these cases collect revenues through actual or shadow tolling or both, to pay off the capital and their loans as well as the operation and maintenance costs. The success of PPP's is based on the allocation of risks among the public and private sector partners and the attainment of value for money as compared to conventional structures. Risks must be undertaken by those who can best deal with them. Weakness in achieving optimal risk allocation will create undesirable effects to both parties of the partnership and will bear financial and socioeconomic losses. This is shown by the Thessaloniki Submerged Highway case where unforeseen factors forcing reallocation of risks in a non-optimal way, created a sequence of events, influencing the whole project. Shifting some risks from one party to the other, affected all project stages from design to construction and to operation. As a result all financial and operational performance indicators are expected to deteriorate. The risks at stake are related to legal, archaeological and environmental aspects. It turns out that in all cases construction and operation costs will increase while demand and revenues will decrease. At the same time socio-economic benefits will be reduced and finally public acceptance for the project may be lost. The conclusion in this case is that avoiding dealing with a risk of low cost for one party in a PPP, bears a disproportional cost not only to the other party, but to both the public and private sector, as well as to the facility users and the public.

Keywords
Risk, Transport infrastructure, Funding, Concession, PPP, Tolling

1. Introduction

Public – Private Partnerships (PPP's) have been used all over the world as a method to deliver project financing and realisation. This method has been employed in several countries since the 19th century, but recently PPP arrangements are growing in use and acceptance in the EU and elsewhere. PPP can be defined as a contractual agreement between one or more Public Sector partners and one or more partners from the Private Sector, with the aim to deliver a service or facility to the public that is traditionally provided by the Public Sector. The partners offer their skills and assets and they share the various risks

associated with the project. PPP is chosen as a method to deliver a service or facility instead of the conventional public debt method due to legislative, budgetary or public pressures.

The main advantages of PPP's (European Commission, Guidelines for Successful PPP's, 2003) are the following:

- Acceleration of infrastructure provision
- Faster Implementation
- Reduced whole life costs
- Better Risk Allocation
- Better incentives to perform
- Improved quality of service
- Generalisation of additional revenues
- Enhanced Public Management

The following are the main characteristics of a PPP arrangement (Cooper *et al*., 2005):

- one or more private parties, fully accountable to Public sector for delivery of the specified assets and/or services;
- clear and accountable risk allocation, with associated prices;
- clearly specified outputs, with measurable key performance indicators (KPIs);
- payments only on delivery of the specified assets and/or services;
- relatively long-term commitments;
- on-going value for money throughout the contract

PPP's can take several different structures such as Build-Operate-Transfer (BOT), Design-Build-Finance-Operate (DBFO) Concession, Build-Own-Operate (BOO), etc. In the case of transport projects, construction of a new asset as well as modernisation, upgrade or expansion of an existing facility is usually made through DBFO concessions. In these cases the private partners – the concessionaire - collect tolls from users in order to pay off the capital and the loans used for delivering the project and also to cover the operating and maintenance expenses. Concession projects are awarded on certain criteria which usually are the end price offered to users of the facility, the level of financial support required by the public sector and the ability to implement the project. Additional criteria may be set such as the figure for the Financial Rate of Return on equity (FRR/E), the so-called Trigger Internal Rate of Return (TRIIRR), which when reached will trigger the project hand over to the Public Sector, maximum concession period, etc.

Transport projects, attained through PPP's, must rely on good estimates of the construction cost, the traffic volumes, the operating costs and the tolls likely to be collected over the concession period. The crucial period for such a project, which is by default long term, is the early years of concession when cash flows are relatively low. In this respect private investors take risks which need to be identified and analysed in considerable detail (Flanagan and Norman, 1993).

This paper presents a specific case study of a major transportation infrastructure project, the so-called "Thessaloniki submerged highway project". It is about the construction of an urban highway in the city of Thessaloniki in Greece, which was procured as concession project and it has been already awarded to one of the candidate bidders. The paper focuses on certain aspects of the whole project having to do mainly with the interrelation of demand and toll systems that need to be implemented, as well as with some unforeseen factors, which may affect its attractiveness to the potential users, but also its acceptance by the public. The paper is structured in 5 sections. Section two of the paper highlights the risk factors identified in Concession Projects. Presentation of the specific project takes place in section three. Section four analyses the risks initially considered for the specific project and the ones that emerged in the early steps of the project implementation. Finally, in section five an attempt to discuss the main issues examined is made along with presentation of the respective concluding remarks.

2. Risk Factors in Concession Projects

Implementation of major infrastructure projects is associated with several risks. Risk can be defined as a factor, event or influence that threatens the successful completion of a project in terms of time, cost or quality. Risks can also threaten the successful operation of a project especially when their use depends on people's acceptance. According to Martin and Tate, (2001), there are three types of risks in PPP's:

- Scope risk, also known as technical risk; this is any potential problem that could prevent somebody from producing a quality final deliverable, ie to meet the customer's acceptance criteria.
- Schedule risk; the risk of not producing the final deliverable on time. Some scope or technical risks are also schedule risks.
- Cost risk or the risk of not meeting the budget

It must be noted that different terminology is used around the world for describing risks; similarly, different methods and techniques are employed for dealing with risk analysis and management, which are necessary in PPP's, thus producing different and conflicting results (Tah and Carr, 2001). Risk management, a task that must included in the project management of any PPP project, refers to both qualitative and quantitative risk analysis (Cooper *et al*., 2005). Qualitative analysis aims at:

- Improving the accuracy of project cost estimates;
- Establishing contingency levels;
- Improving the accuracy of cash flow estimates;
- Ranking competing PPP tender responses with different levels and areas of risk;
- Providing accurate comparison between competing PPP tender responses and the project cost benchmark
- Determining the financial impact of retained and transferable risks

On the other hand quantitative risk analysis is a means for:

- Describing the detailed mechanisms at work in a set of risks;
- Evaluating the uncertainty in the requirement and the overall risk that this places on stakeholders;
- Establishing targets, commitments and contingencies consistent with the level of uncertainty and the risk, the public sector is willing to accept;
- Exploring the relationship between detailed instances of uncertainty and an overall level of risk, to facilitate risk management resource allocation
- Quantifying, with some level of accuracy, the effects that risk might have on cost, schedule or other measurable outcomes.

At a high level, risks can be distinguished in three major categories; country specific risks, project specific risks and PPP model risks. Almost all risks increase with the complexity of the project as well as with the special characteristics of the respective market. In public debt projects (conventional projects) most risks are undertaken by the project contracting authority (Public Sector). In these cases the contractor may be risk free at all. In PPP's, risks are allocated between the involved parties, i.e., the public and the private sector. There is no specific risk allocation model for all PPP's, but in most cases the concessionaire undertakes risks associated with the design, construction and maintenance, and the tendering authority undertakes political, environmental, archaeological and fort majeure risks. However, it is often the case where some risks are not identified at all at the preparation stages and they emerge in the negotiation period or even later. According to the EU Guidelines for successful PPP's (European Commission, 2003), risks in PPP's can be categorized as follows:

Table 1: Categorization of Risks in PPP's According to EU Guidelines

- Revenue Risk
- Choice of Private Sector Risk
- Construction Risk
- Foreign Exchange Risk
- Regulatory/ Contractual Risk
- Political Risk
- Environmental/ Archaeological Risk
- Latent Defect Risk
- Public Acceptance Risk
- Sustainability Risk
- Hidden Protectionism

Most risks in PPP projects are directly translated into financial implications, which may endanger the ultimate success of the project. The wise choice is always to transfer the various risks to the party which is best able to manage them in the most cost effective manner. Transferring the risk to the party which is not the suitable one, even if it agrees to do so, does not facilitate the smooth progress of the project implementation and operation; problems may appear in the future during the project life cycle and affect its operation and viability. The key in the allocation of risks is to maintain value for money. Otherwise any increased risk will be translated to higher cost of the service to be provided.

The objectives in allocating risks to the right party (ies) in PPP's should be:

- To reduce project long term cost
- To provide incentives to the contractor to deliver projects on time, to required standard and within budget
- To improve quality of service and increase revenue
- To provide consistent profile of expenditure

In PPP procurements, candidate concessionaires when preparing their financial offer should carry out a risk analysis covering several risk factors. In the case of tolled highways, risk analysis usually refers to the expected usage of the project and of course to the toll elasticity of demand. Other risks associated with the project are also considered but risk quantification is not always straight forward. The factors influencing these types of analysis are many and often interrelated. Identifying potential risks when studying and evaluating major project becomes often a real challenge for both the Public Sector agencies and the candidate concessionaires. Risks should be allocated between these two sides in PPP's, but the concessionaire must be able to control them in any case, otherwise funding problems may be emerged from the side of the borrowers (financing institutions). Risk management in this respect is necessary. According to Wideman, (1992), the goals of risk management must be to identify project risks and develop strategies which either significantly reduce them or take steps to avoid them altogether; also to maximize associated opportunities. In real world, each project is a special case and requires proper attention from the involved sides. However, useful lessons can be learnt, which can prevent others from doing the same or similar mistakes.

The above issues will be considered in the case of the Thessaloniki Submerged Highway project in the next sections. A short description of this project follows.

3. The "Thessaloniki Submerged Highway Project"

Thessaloniki Submerged Highway (TSH) project was firstly proposed 25 years ago as a bypass of the city centre from the sea side. The main purpose of this bypass has been to remove through traffic from the historical city centre and enable urban redevelopment. Several alternatives were examined since then with some of them raising environmental concerns and with others not being accepted by the public for various reasons. Following public consultation and a lot of discussion in the technical world of Thessaloniki

conurbation, the prevailing alternative arose comprised a combination of submerged tunnel of 1.8 km, and surface sections of another 2.0 km. A cross-section of 3 lanes per direction was chosen as the optimal one. Special effort was given to the likely environmental impacts and in particular to aerial pollution and visual intrusion.

The project initially was conceived as a public debt project with free access to private car users. Traffic forecasts indicated that congestion problems will inevitably emerge beyond the highway end points as a result of the high traffic demand. However, soon a number of concerns emerged. The first one had to do with the high construction cost in conjunction with the potential technical risks due to the complexity of the project. The second concern was about the (high) maintenance and operation cost, given that a staffed control centre must to be in operation 24 hours all year round. For both construction and maintenance & operation phases, a high level of required expertise is necessary from both the private sector and the contracting authority. The lack of experience in similar projects from the public sector side is a sound weakness for the success of such a complex project. Another issue has been the fact that EU policy on funding infrastructure projects includes the "the user pays" and the "polluter pays" principles, and therefore either real or shadow tolling had to be introduced. Finally, the strict economic situation did not allow the luxury of fully funding this project exclusively from public funds. Market research indicated that traffic demand to bypass the congested city centre would be high enough to justify co-financing by private investors who would attain a respectful financial return of their equity.

The project was procured as a concession project (Design – Build – Finance – Operate – Transfer) with preset community and national financial support. Bidders were asked to set in their offers maximum and minimum toll levels and also to set a figure for the annual traffic usage below which the State will have to give subsidy to the concessionaire. Finally, bidders were asked to set in their offer a figure for the Trigger Internal Rate of Return (TRIIRR). Due to the placement of the highway within the city limits and due to lack of adequate space along the surface parts of the highway, tolls were assumed to be electronic with uninterrupted vehicle flow. Figure 1 shows the layout of the project and Table 2 presents the main financial elements of the project (elaborated from the offer of the selected bidder).

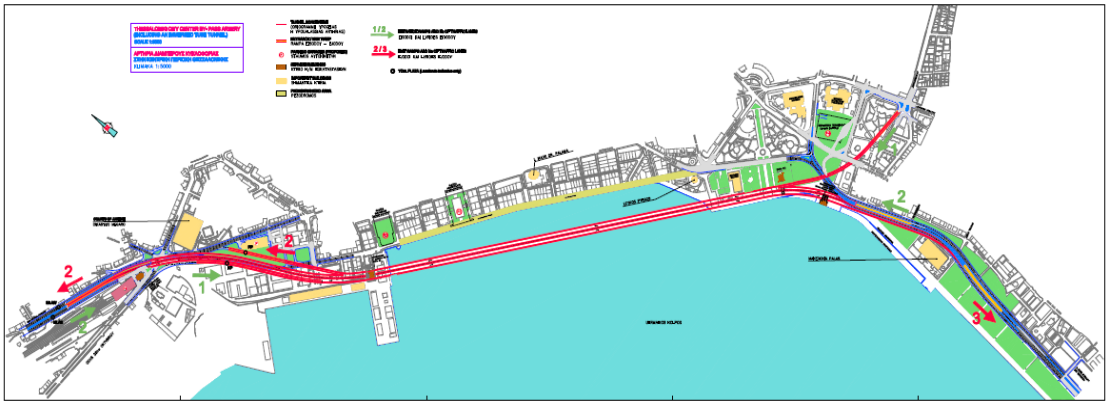

Figure 1: Layout of Thessaloniki Submerged Highway Project

According to the financial data and the funding scheme of the selected bidder (Thermaiki Odos offer, 2006), the project can be viable in financial terms should a certain level of usage is achieved. Traffic demand is not very sensitive to small variations of the toll level but becomes very sensitive with considerable toll increases. Sensitivity analysis tests indicate that revenue changes in the order of 15% will affect the project viability. However, in any case the project is expected to cost less if materialised as a PPP as compared to a conventional public Debt one. This is verified in many cases by using the Public Sector Comparator (PSC) approach (Partnerships, Victoria, 2001, Kerali, World Bank, 2005).

4. Effects of Unforessen Risk Factors to Project Performance

This section focuses on the effects that may endanger the success of PPP project, in our case the TSH project, as a result of a) risk allocation changes and b) of jury decisions pertaining to archaeological and environmental related issues.

It was previously mentioned that TSH was designed to function as an ETC (Electronic Toll Collection) highway enabling uninterrupted flow of vehicles and thus minimising the need for conventional toll plazas. This type of toll operations leads to reductions of the overall construction cost. It also leads to operation cost reduction due to lower personnel expenses. Uninterrupted vehicle flow is well accepted by public and potential users of the new facility who perceive the new project as an attractive and beneficial alternative, without the need to stop and pay the use charge. This setting assumes that private sector partners undertake the availability risk and partially the demand risk. On the other hand the public sector partners undertake the risk for the likely archaeological/ environmental problems and partially the demand risk. They also undertake the political risks.

However, this setting was in fact subverted by a simple legislative shortcoming and by public sector attitude aiming to avoid political risks. In Greece toll violators are not considered Highway Code violators in the case of concession tolled motorways, but only in the case motorways are managed by public authorities. For this reason, public sector authorities do not accept to be responsible for prosecuting drivers who do not pay the respective toll charge in concession roads. Instead, the concessionaire has to prosecute them individually. Given that in ETC motorways with uninterrupted flow, the % of toll avoiding users may be quite high, especially in the first period of operations, the burden and the respective cost for the concessionaire to recover the toll losses will be extremely high. On the other hand violators can prolong the whole legal process by challenging the violation act since there is no public authority involved in its affirmation. The whole issue could have been dealt fairly quickly, should the Government had decided to change this legislation and consider both violations equal against the law. This did not happen though, and for this reason, the concessionaire had no option than to introduce tolls with bars in order to have full control over the passing vehicles. As a result a domino of effects begins; change of design to accommodate large toll plazas due to the fact that capacity of toll lanes with bars is significantly lower than without bars; higher construction cost and need for more space taken from urban public space; higher operation cost as a result of manned toll plaza operations; availability losses due to inevitable vehicle delays at the plazas; reduction of benefits to the users but also to the public; lower acceptance by the public; loss of demand. The final outcome of this sequence will be most likely a project viability risk. In such a case the state will have to balance the concessionaire losses by providing subsidies according to the concession agreement that provides for a minimum guaranteed usage level.

A similar outcome is expected when considering other aspects such as the archaeological and the environmental ones. Court decisions and public authority orders which are compulsory for both the parties in the PPP setting have led to considerable changes in the design and construction of the highway. As a result costs are expected to increase and revenues to decrease, making the project less viable. State subsidy will be again required, putting the burden on the side of the Public Sector and at the same time lowering the expectations and the motives of the private sector partners.

Figure 2 presents in diagrammatic form the sequence of the effects created by the various risks associated with the implementation of this specific project.

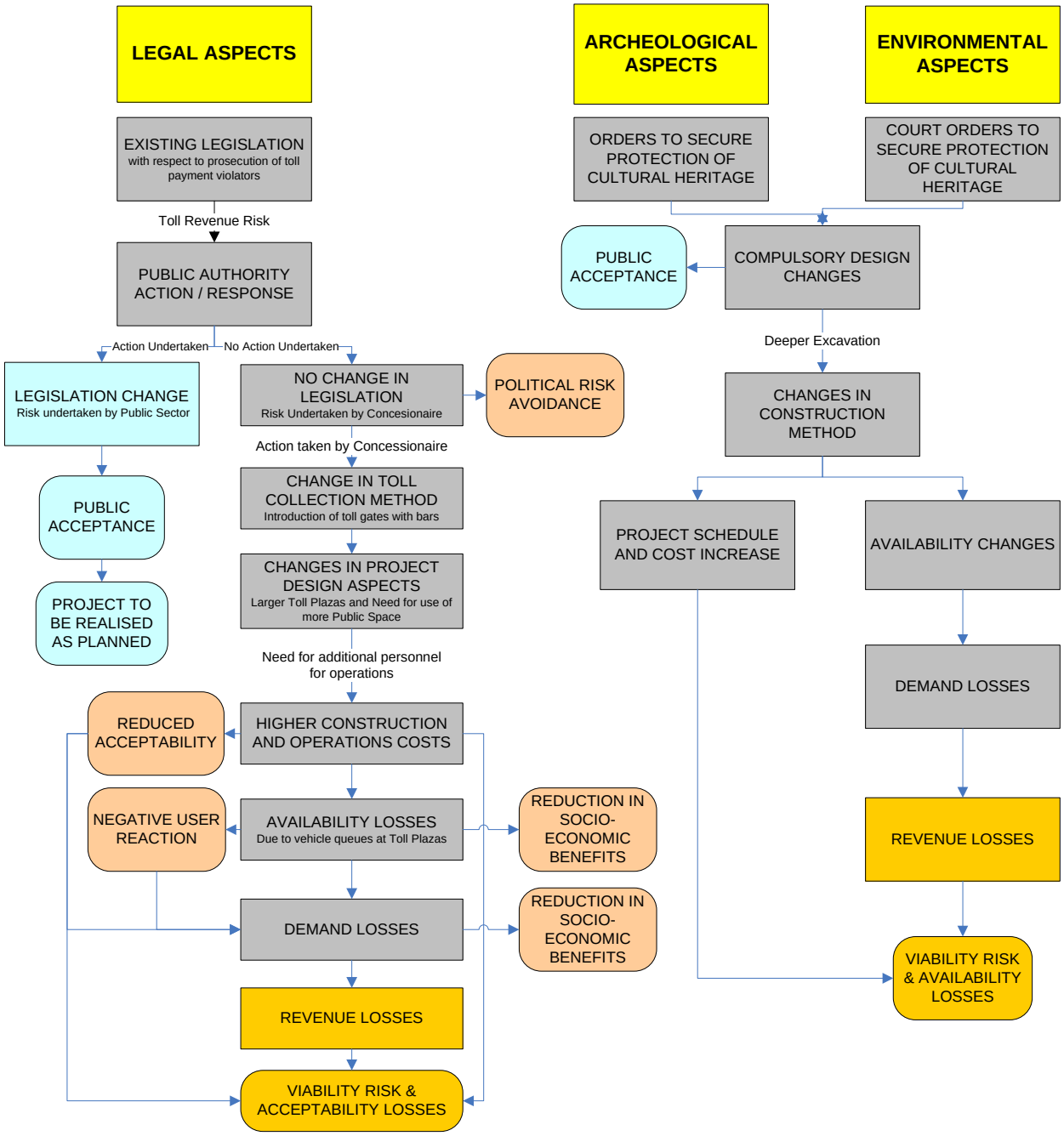

Figure 2: Sequence of Unforeseen Risk Effects to the TSH Project Performance

5. Concluding Remarks

Risk factors in PPP's are one of the most crucial elements that influence the success of a project. It is basic principle that each risk should be undertaken by the partners who can best deal with that risk. Risk impacts may affect not only the partner who has undertaken the specific risks but also the partners form the other side. They can also create other types of risks which may subsequently trigger secondary impacts. In the case of the Thessaloniki Submerged Highway project which was presented in this paper, risks not initially identified by both public and private partners created a sequence of different impacts and influenced important project parameters such as design elements, construction method and operation

aspects. In fact they affected deeply the whole project by increasing its life cycle cost, decreasing the net revenues and at the end deteriorating the project's financial and operational performance. Finally, the make the project to be less feasible from the socio-economic point of view.

PPP's are associated with trade offs between borrowing costs, profit, efficiency, gains and risks. When balances change, the outcome is translated into fiscal impacts and the result is a less attractive project for either one side of partners or for both sides. Risk impacts influence one or more of the three following project parameters, cost, time and quality. The TSM case demonstrates that a simple unforeseen factor such as the current legislation about prosecution of violators can trigger a domino of very significant impacts for the project. Similarly, court appeals from individuals who feel that the environment may be threatened by some elements of the project, may well take a project out of course and even cancel its implementation.

In conclusion, the key success factors of any PPP are the capacity of the Public Sector to manage its side of PPP along with stable political commitment, the transparency and competitiveness of bidding process and the appropriateness of risk sharing that will result in value for money.

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