CROSS SECTORAL FUZZY ASSESSMENT COMPARISON OF CONCESSIONS IN TRANSPORT

VANELSLANDER Thierry, University of Antwerp, Belgum, thierry.vanelslander@ua.ac.be

BONNET Géraldine, CERTU, France, Geraldine.Bonnet@developpement-durable.gouv.fr

CHOMAT Gilles, CERTU, France, Gilles.Chomat@developpement-durable.gouv.fr

ROUMBOUTSOS Athena, University of the Aegean, Greece, athenar@aegean.gr

ABSTRACT

In today's world, PPP's are gaining importance in the way that infrastructure projects are financed, in particular in transportation. Not all transport segments are as well covered today by PPP applications though. For that reason, certain segments can still learn a lot from other segments, where PPP applications have been applied more amply. This paper makes a comparison among the conditions and outcomes of PPP applications in three sectors: a seaport, urban transport and an urban road connection. The methodology relies on the contextual W's fuzzy logic approach, which compares 8 basic characteristics of the respective PPP agreements. As to the 'What', it turns out that the three projects vary in the level of competition and exclusivity of the project. Two of the three projects are rather nationally-driven. The same two projects equally have a finance-based motivation rather than a service one. As opposed to what one might derive with respect to risk division, it is observed that the two cases with higher traffic risk leave that risk mainly to the private operators. All three projects also feature rather significant exposure to the macro environment. The policy and practical dimension of the research results makes them relevant to a range of stakeholders within the transport community, particularly governments, financing bodies, transport service providers, etc. The cross-modal comparison between PPP cases is an exercise which is novel as far as transport infrastructure is concerned.

Keywords: PPP agreements, risk, project finance, service delivery

INTRODUCTION

The most prominent feature of public infrastructure and service delivery strategies during the last two decades has been an increased use of private finance and services in sectors traditionally taken care of by the public sector. Core in this type of public infrastructure delivery are the elements of co-financing and risk sharing. The transport sector, till recently,

has benefited the most from the PPP models of financing, especially in continental Europe, where transport PPPs represented over 90% of total value, according to the EIB (2007). This trend reduced recently after the economic crisis but still remains significant at approximately 75% in Europe as presented in a market study conducted by Kappeler and Nemoz, (2010). Again, according to the same study, the road sector in Europe has been mostly the focus and this is also true internationally (Estache et al, 2007). As interest shifts to other sectors, it is important to identify similarities in project development that may form the grounds for knowledge transfer and improved understanding of the particularities of the various transport subsectors with mutual benefits. In addition, such comparisons are not found in literature.

The present paper takes an initial step in the direction of comparing PPP characteristics across modes. In order to perform the comparison, a case granulation is achieved within a Contextual Ws Risk Analysis Framework (Roumboutsos, 2010) assessed through fuzzy logic linguistic variables to register the comparative findings. These form the methodology as presented in the next section. Following this, three concession cases are presented and systematically compared. This comparison aims at answering the main research question of this paper: “are there contextual characteristics that are similar across different transport modes and that lead to similar PPP outcomes or explain differences?”. The cases include the Deurganckdok lock at the Port of Antwerp in Belgium, the Reims tramway system in France and the Ionia Odos motorway concession in Greece. All three cases represent transport subsectors, where each country of application has considerable expertise. Conclusions are drawn at the end, with discussion of findings with respect to similarities and differences as well as the potential for knowledge transfer. Of primary focus is the potential to have avoided or reduced the impact of the financial crisis.

The approach followed in this paper should allow initial learning across the cases considered. Upon finding similarities in PPP contexts, the aim is to broaden in further research the number of cases analyzed, to see if the similarities and hence the learning potential still hold. To that purpose, other techniques, like fuzzy set QCA (qualitative comparative analysis) may need to be used.

FUZZY LOGIC CONTEXTUAL WS RISK ANALYSIS FRAMEWORK: THE COMPARISON METHODOLOGY

Fuzzy logic is a precise logic of imprecision and approximate reasoning. More specifically, fuzzy logic reflects human behaviour in so far as it allows converting reasoning and making rational decisions in an environment of imperfect information (imprecision, uncertainty, incompleteness of information, conflicting information, partiality of truth and partiality of possibility); furthermore, it allows performing a wide variety of physical and mental tasks without any measurements and any computations (Zadeh, 2008). It also allows for comparisons at an abstract level. This later attribute is the fundamental value of the theory.

At the core of fuzzy logic are the concepts of graduation and granulation. In fuzzy logic, everything is or is allowed to be granulated, with a granule being a clump of attribute-values drawn together by indistinguishability, similarity, proximity or functionality. Graduated

granulation, or equivalently fuzzy granulation, is a unique feature of fuzzy logic. Graduated granulation is inspired by the way in which humans deal with complexity and imprecision (Zadeh, 2008). In the following the "granule" of PPP cases is identified along with the respective "attribute-values". More specifically, this effort is focused on "risk", as risk is central in the PPP process and the structure of the PPP agreement. Risks are analysed within a "context". Therefore, the comparison of case studies with respect to PPPs is proposed to be based on a "Contextual Risk Analysis Framework". The analysis framework applied in the present study, as proposed by Roumboutsos (2010), was inspired by the 6Ws framework introduced by Chapman and Ward (2003). The Contextual Ws Risk Analysis Framework of figure 1 describes the basic structural elements of a PPP project and the fact that the transport sector is greatly influenced by the macroeconomic environment. This impact is represented as the "Whole". This also describes the granulated environment within the fuzzy logic approach in this comparison methodology.

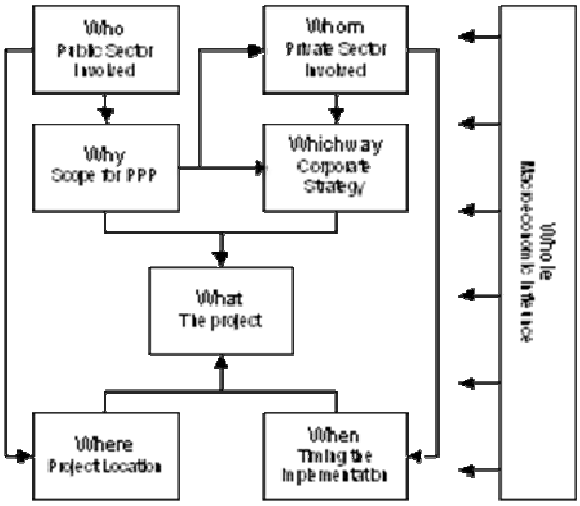

Figure 1 - Contextual Ws Risk Analysis Framework

More specifically, the Ws Contextual Framework represents the granulated environment. The granular value of each W is expressed through a set of linguistic variables. Each linguistic variable has been chosen to reflect the source of impact on the W granular value.

More specifically, one of the most notable characteristics of "What" - the transport project - in describing its function is if it is, predominantly, a node or a link within the transport network. The other very dominant characteristic, especially with respect to the PPP arrangement, describes the level of its "temporary" monopoly: how exclusive its use is (Evenhuis and Vickerman, 2010). "Who" describes the initiating public authority. The predominant characteristic and therefore, variable is proposed to be the level of governance in terms of decision ability, regulating ability and so on. With the "why" characteristic, the search is initiated for the underlying motivation for proceeding with a PPP formula as a way of funding the investment or as a way of delivering a service. "Whom", as described in the framework model, is the identified private entity (PE), that would be able to undertake the endeavor. This PE, depending on project needs and objectives, which in many cases also depend on the transport sub-sector, may have multiple objectives, especially with respect to the nature of the downstream market. Handling of the downstream market may be service-based, i.e.

the PE is only required to operate the service/asset etc. or business development, when the PE is required to strive in a competitive environment. Meunier and Quinet (2010) note the difference in the competitive nature of motorway downstream markets and the downstream markets of railways or ports, which are oligopolistic and more subject to rapid changes, and where actors have strategic power and use it. The "whichway" refers to the key characteristics of the contractual agreement. Within a wide range of variables describing the PPP contractual agreement, the present analysis registers risks and (re-)payment schemes, as the most important elements (Roumboutsos et al, 2012). The linguistic variable values for risks reflect the gradients of risk sharing from solely the private sector assuming the risk to solely the public sector taking over.

In a similar approach the (re-)payment variable is assessed. Location – "Where' - is principally described in this analysis by an urban–regional variable, whilst "When" – time – refers to the maturity of the investment. Finally, the "Whole" expresses the vulnerability of the investment/project to macro-economic influence.

The identified linguistic variables are presented by W-granule in table I.

Based on the above-mentioned project characteristics and dimensions, a number of hypotheses can be formulated, that will subsequently be tested so as to answer the paper's main research question. A very timely one: which characteristics may protect against the impact of the financial crisis?

CASE ANALYSIS

This section tries to answer the main research question of this paper and more in particular test the hypothese just formulated by performing an initial comparison among three cases. The comparison of cases follows a granular Ws Contextual Analysis by the assignment of values to the proposed linguistic variables, as described in section two. The section is structured by granular - W.

The cases were chosen on the basis of a different modal nature, the presence of both nodes and modes, a high capital-intensiveness of the investments, the potential to sufficiently isolate the case from its environment, and finally also data availability. Data for the analysis of the cases is based on a meta-analysis of existing sources as referenced, as well as on site interviews with key executives from both the public and private side the authors had on record from previous activities.

Table I - Linguistic variables of granular value of the Ws Contextual Framework

Linguistic Variable	Variable Range					
Granule: What – The project						
Node – Link	Within a Node	Pure Node	Like a Node	Like a link	Pure Link	Within a Link
Level of exclusivity	Competitive environment	Not exclusive	Quite not exclusive	Somewhat exclusive	Rather Exclusive	Exclusive
Granule: Who – the Public Initiator						
Level of direct governance	No Governance	Limited governance	Some involvement in governance	Involvement in governance	Significant involvement in governance	Absolute direct governance
Nationally-Locally driven	Nationally driven	Mostly nationally driven	More nationnaly driven	More locally driven	Mostly locally driven	Locally driven
Granule: Why – the Scope of PPP						
Finance – Service Based Approach	Solely service-based approach	Mostly service-based approach	More service-based approach	More finance-based approach	Mostly finance-based approach	Solely finance-based approach
Granule: Whom – Private party						
Business Developer	Business Servicer	Mostly Business servicer	More business servicer	More business developer	Mostly business developer	Business developer
Granule: Which way – Strategy with respect to the contractual agreement (Risk Allocation & Payment Structure)						
Design and construction Risks	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Maintenance risk	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Risk of exploitation	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Commercial revenue risk	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Financial risk	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Regulatory risk	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Force majeure	Totally private	Mostly private	More private	More public	Mostly public	Totally public
Payment	Availability fees and subsidy	Availability fees	Shadow tolls and subsidy	Shadow tolls/ No subsidy	User fees and subsidy	User fees no subsidy
Granule: Where – Project Location						
Urban – Interurban - Regional	Urban	Outer urban	Mostly Inter-urban	Inter-urban	Mostly Regional	Regional
Granule: When – Project (Investment) Timing						
Severity of project need	Not very needed	Needed to a point	Rather needed	Needed	Great need	Very severe need
Granule: Whole						
Impact /Influence of macro-environment	No exposure /influence of macro-environment	Very little exposure to macro-environment	Exposure to macro-environment	Some Exposure to macro-environment	Significant Exposure to macro-environment	Extreme exposure to macro-environment

For the Port of Antwerp lock case, the main documentary source was the PPP case overview report issued by the Flemish PPP Knowledge Centre. Interviews were held with the director of the latter centre, as well as with Ministerial officers and financiers concerned. For the Reims Tram Case, all data on mobility are collected from the local household travel survey of Reims for 2006 and the annual survey on exploitation of urban public transport networks (excluding Paris) held by DGITM-CERTU-GART-UTP (2009 figures). A press review, a bibliography study and an interview of a representant of the local transport authority of Reims were also held. Finally, in the case of Ionia Odos, the main source of data collection has been the concession agreement as well as interviews with key stakeholders and information released to the press, as the concession has been under re-negotiation since 2010.

The interviews in most cases turned out to be crucial to get behind real motivations, to get a complete overview of actors involved directly and indirectly, and linkages between the latter actors. The different Ws as described in section 2 get valued by a discursive method: the material collected from documents and interviews is tracked for material that provides insights for each W. The method was proven useful to extract information, which cannot be gained through cross sectional studies, longitudinal designs, event sequence studies, and conversation analysis (McFee et al, 2009).

Granular Ws Contextual Analysis

"What" - Mapping Projects in the Transport Arena

The present comparison concerns three projects, and it is found that they compose a good mixture of nodal- and link-style initiatives. The first concerns the construction and operation of the Deurganckdok lock at the Port of Antwerp in Belgium, designed to be the biggest lock in the world (see box 1 for full description).

BOX 1: Deurganckdok lock at the Port of Antwerp, Flanders, Belgium

The Deurganckdok lock, to be built, is the biggest lock in the world, measuring 68 metres breadth and 500 metres length. The building of the additional lock is part of a wider capacity increase plan for the Port of Antwerp, where a dredging of the River Scheldt access channel was already performed, just like the building of a new dock on the Left Bank, the Deurganckdok. This additional locks allows vessels that need to be handled at the older docks of the Left Bank to use the new Deurganckdok for passing through and reaching the older part, without making the big detour they had to make in the past, involving depth capacity constraints as well as time losses.
Total project cost is € 354.2M
Scheduled start of operation: 2016
Contract Duration: 20 years from beginning of commercial operation

The lock should allow better disclosing of the Left Bank of the Port of Antwerp, which is the most recent and largest development area of the port. It will become the second access way to the Left Bank port area, but by the fact that it allows for a much shorter and hence cheaper connection, it will in fact become the only one, with the old one only being used still as a back-up access in case of emergency, blockage or high traffic volume. The Left Bank developments of the Port of Antwerp behind the lock to be built mainly involve

chemical production and distribution (as liquid bulk or in containers), container storage and handling, and car shipping. The Port of Antwerp annually processes some 180 mn tonnes of cargo (184,134,518 tonnes in 2012), the majority of which are containers (104,060,120 tonnes or 8,635,169 TEU[1] in 2012)[2]. These throughput figures make Antwerp the tenth port globally, all traffic confused, and the fourteenth container port. Within the relevant Hamburg-Le Havre port range, serving a large part of the European hinterland, Antwerp is the second largest, both in total throughput and as far as containers are concerned. In doing so, the port materialized a direct[3] value added of nearly € 8,6 bn in 2009, and 62.577 direct jobs. Annual private investments in the port zone amount to nearly € 3 bn annually.[4] The Deurganckdok lock case covers the construction and the operation of a service, which is needed so as other business units with the Port of Antwerp may conduct or improve their business. Hence, this may even be described as a B2B PPP case.

BOX 2: Reims' Tramway and Urban Transit System, France

This concerns the realization of the tram line 1 and the operation of the public transport of Reims Metropole. The existing bus network was taken over as of the 1st January 2008. The Bus System will be re-organised to accomondate and achieve interoperability with the newly constructed tramway. The restructured bus network will consist of two strong lines of buses. seven lines of structure and bonding in bypass. In parallel, development of supply by 6%.
The entire network will be improved to provide access to disabled people December 31, 2015 (more than 550 bus stops). Development of an intermodal tariff offer in the area of Reims Metropole between bus and tramway and with others public transport organizing authorities is considered. Therefore the assignment concerns the operation of a fully integrated public transport network in Reims.
Total project construction cost is € 372.6 M
Start of operation: 2011
Contract Duration: 30 years from beginning of commercial operation of the tramway

The second case concerns the construction of the tramway in Reims (11,2km, 23 stations and three "Park and Ride" areas) and the operation of the Metropolitan Urban Transit System, which also consists of an existing bus line network (see box 2 for details). Reims is a Metropolitan area of some 91 km^2 with a population of 219 000. The motorization rate is 45 cars per 100 inhabitants and daily mobility is estimated at 3,79 trips per day per capita, of which only 9% is conducted by public transport and 59% by private motorized means (58% car and 1% two-wheel motorized). The average use of public transport is estimated at 135 trips per year per capita. The introduction of the tramway concerns both its construction and its integration into the Reims transport network. This will also support improved ridership. Hence, this case may be seen as the delivery of a global service to the public user. In order to situate this project in the French context, it must be said that 90% of all French urban public transport networks are run by a private operator. But in most of cases, the investment is held directly by the public transport organizing authority. So, Reims is unusual with respect to investment.

[1] TEU = Twenty Foot Equivalent Unit, or the smallest container unit size
[2] Source: Flemish Port Commission (2013)
[3] The term direct refers to values being generated inside the port by activities that are directly port-related. Not included are indirect values, i.e. value added and jobs generated thanks to port activity, but not located inside the port or not exclusively operating in function of the port.
[4] Source: National Bank of Belgium (2011)

BOX 3: The Ionia Odos Concession Motorway, Greece

The Ionia odos motorway consists of two separate branches: a 195 km stretch of green-field motorway between Antirrio and Ioannina (Western Greece axis) and the existing brown-field motorway (to be upgraded and operated during construction) section between Athens and Maliakos Bay, part of the PATHE (Patra – Athens – Thessaloniki – Evzoni) axis. The motorway includes three lanes per direction and one emergency lane, as well as more than 15 km of tunnels. Its construction is financed by sponsor equity, debt capital, tolls from the PATHE section and State/EU funds.
Total project cost is €1200M
Start of agreement: 2007
Contract Duration: 30 years from the beginning of construction.

The Ionia Odos Concession (IOC – see box 3) involves the construction of a newly built motorway extending from Antirrio to Ioannina, 196 km, and is partially financed by using the toll revenues of a 175 km section of a brownfield motorway that connects Athens to Maliakos. Both green and brownfield parts of the project are on the TEN-T Priority Project 7 (PP7), while the eastern axis is on the heavily used motorway connecting the three largest cities in Greece, namely Patra, Athens and Thessaloniki, widely known as PATHE, from the initials of the cities it connects. The project also adds value to an existing concession: the Rio-Antirio Bridge. Due the financial crisis in Greece, the agreement has been under re-negotiation since 2010.

"Who" – Public Initiator

The initiator in each case is the public authority responsible for providing the service. It is found that for the three cases considered, the authority varies from national to local. Notably, the public sector authority initiating and/or involved in the project was at the immediate level of importance, with immediate interests, as assigning and regulating authority.

The Port of Antwerp, following the landlord model, is responsible for the developments and investments within the Port. The NV Vlaamse Havens (Flemish Ports) is a public company according to decree 8/05/2009 owned 100% by the Flemish Government. In addition, the City of Antwerp is the sole shareholder of the Port of Antwerp. Reims Metropole is an intercommunality, which acts also as the urban public transport regulating authority. This authority originated the development of the tram infrastructure. The Greek State, represented by the Special Public Works Agency / Concession Project Operation & Maintenance (S.P.W.A./C.P.O.M.), falling under the General Secretariat for Co-Financed Public Works of the Ministry of Infrastructure, Transports and Networks, monitors and oversees the operation and maintenance of the motorway.

"Why" – Scope for PPP

Most PPP projects have been initiated in an effort to secure project financing and put in operation projects that could not have been completed within the respective budgetary constraints (EIB, 2005). This is the *finance-based* approach to PPPs. However, there has also been another way of justifying private sector participation through a *service-based* approach (Aziz, 2007). This strategy for PPP delivery of the projects holds true in the cases compared.

More specifically, project financing was used to raise funding for the Deurganckdok lock project for the Port of Antwerp. This secured the off-balance delivery of the project for the Flemish Government, while risk was spread over a number of years and transferred to a non-budget party. In a similar approach, Reims Metropole wished to address the dysfunction of the public transport system with respect to low commercial speeds, availability and increased operating costs, without affecting the debt of the urban public transport regulating authority. The assignment of the operation of the urban public transport network to a private entity also allowed for the expenditure to be spread over time and for better management of the urban transport organizing authority subsidy to urban transport. The choice of PPP was also a question of management of the project. So Reims Metropole wanted to delegate the construction of the tramway to a concessionnaire principally in a service-based approach. Finally, the Greek State as dictated by the European Structural Funds focused on raising private funding for the delivery of the Ionia Odos (part of the PP7 of the TEN-T's). This meant off-balance development of public infrastructure supported by EU funding and privately raised financing.

The service-based approach in all cases concerns the delivery of the project within specified budget and time. It also implies that the private partner constructs, respectively, the biggest lock in the world, a tramway and a motorway.

"Whom" – Private Sector Partner

The private sector partner is a group of companies capable of securing financing, having knowhow with respect to construction depending on how demanding this may be, and securing the service. In none of the selected cases does the private partner have the capability of securing demand, even though in all cases, the infrastructure has the position of a natural monopoly.

BOX 4: Deurganckdok lock at the Port of Antwerp, Private Partner Structure
NV Deurganckdoksluis, private company, 26% owned by NV Vlaamse Havens, 74% by Port of Antwerp;
Port of Antwerp: shareholder of NV Deurganckdoksluis and financial contributor
Building consortium:
Jan De Nul Dredging (33.33%)
CEI-De Meyer and Betonac - both part of Koninklijke BAM Groep (33.33%).
Herbosch-Kiere and Antwerpse Bouwwerken – both part of Eiffage (33.33%).
Lenders: European Investment Bank & KBC Bank

At the Port of Antwerp, the lock operator is the sole owner and operator of the entry point, even though other alternatives may be available. However, the project was designed to address increased traffic to the Port. In addition, the position of the Port of Antwerp globally assures a certain level of demand and the associated risk. So, the private operator involved can clearly be called a 'business servicer', as servicing vessels arriving is its main activity. The "third party" companies involved in the private partner, the Special Purpose Vehicle company (SPV) developed, the company responsible for the construction of the lock and, finally, the operator company are presented in box 4.

BOX 5: Reims Tramway. Private Partner Structure
MARS (acronym of Mobility Agglomeration RémoiSe) is the concessionaire company composed of a solidary design-builder-operator group:
Caisse des dépôts et consignations: 27%
Alstom Transport: 17%
Transdev: 17%
Caisse d'Epargne: 17% (8,5% for Caisse d'Epargne Champagne Ardenne and 8,5% for FIDEPP, subisdiary company of NATIXIS)
Bouygues Construction group: 8.5%
Colas: 8.5%
Pingat Ingénrierie: 5%

-Alstom, Bouygues Travaux Publics, Quille SA, Pertuy Construction et Colas for the building division
-Transdev, Pingat Ingénierie, SNC Lavalin for the operating division
-Caisse des dépôts et consignations: (investor), Caisse d'Epargne Champagne Ardenne and Natixis (financial advice) for the financial division

In Reims, the private partner will not only be responsible for the delivery of the tramway and its operation but also for the town bus service. The private partner is expected to run an integrated urban public transport service. This materializes through the integration of service lines. As described by Roumboutsos and Kapros (2008), this can only be achieved by re-designing the bus lines; introducing a unified fare and connecting the tramway to the rail network. These activities are foreseen in the initial contract and in the amemdements. In one, the tramway line was extended to the TGV railway station. Therefore, a set of performance criteria is attached to the PPP contract: for example, an increase in ridership by 40% bringing the number of trips from 30 to 42 million. Therefore, the operator involved is rather to be considered a 'business developer'. The "third party" companies involved in the Concessionaire - Mobility Agglomeration RémoiSe (MARS), the Special Purpose Vehicle company (SPV) developed, the company responsible for the construction of the tramway and, finally, the operator company are presented in box 5. Interestingly, the division of "labour" follows expertise. In addition, through the contractual agreement, MARS becomes the single supplier for Reims Metropole.

BOX 6: Ionia Odos. Private Partner Structure
Nea Odos is the concession company which has undertaken the study, design, construction, operation, exploitation and maintenance of "Ionia Odos" concession project. Nea Odos, a joint venture of the Spanish origin ACS Group and Ferrovial and the Greek GEK TERNA at equal shares (33.33%).

The Greek Parliament ratified the concession agreement of Ionia Odos, which has taken the form of a state law (Greek Law 3555/81/16.04.2007). The brown field section of this concession is one of the busiest sections in motorway traffic in Greece. The green field section, once built, will provide almost exclusive services due to the condition of the existing road. However, as alternative routes do exist and social dismay has also lead to phenomena of toll payment refusal, Ionia Odos is considered of low exclusivity. The Ionia Odos Project was tendered along with four other projects of similar scale limiting the ability of competition at the tendering stage (Nikolaidis and Roumboutsos, 2012).

In this environment, competition is relatively low (Ionia Odos received two bids in 2005 and the Reims tramway three bids in 2005) but in line with reported findings (NAO, 2007; Yvrande-Billon, 2006). This tendency also manifests in the statistical analysis of all public work contracts in France of the period 2005-2007 (Chong et al., 2010). A variety of bidder-endogenous reasons (expertise, backlog, etc.), and project specifications (sector, technical

complexity, financing structure, etc.) in connection to the transaction costs implied, may lead to this less than favourable result in terms of competition.

"Which way" – Financing Scheme

"Which way" describes the strategy applied in achieving goals within the specific environment and with the specific parties involved. It turns out that the funding schemes as well as the risk allocation are rather different among the projects.

The Deurganckdok lock at the Port of Antwerp describes a contract assigned for the design, financing and development of locks, while the maintenance and renewal of assets is allocated to the public service. NV Deurganckdoksluis acts as project master and lock owner who grants the lock to the respective Antwerp Port Authority. The Port Authority is then lock operator, as a concession for an initial 20 years. The construction cost to be borne by NV Deurganckdoksluis is € 311.6 M upon delivery, including a 15% margin on indexation and unforeseen costs bringing the total project cost estimation to € 354.2 M. The Port of Antwerp bears 25% of the total project cost. In order to bear its share in the costs, NV Deurganckdoksluis got loans from the European Investment Bank (€ 160.5 M) and a local, Belgian bank (KBC, € 81.16 M). Upon commercial operation of the lock, the Port of Antwerp will pay an annual concession fee of € 20.8M to NV Deurganckdoksluis, while the Flemish Government will pay an annual subsidy of € 18 M to the Port of Antwerp. As the project is still under construction, it is too early to indicate whether the project has lived up to traffic and revenue expectations.

The construction of the Reims Tramway project costs approximately € 372.6 M (April 2011). This cost includes the procurement of rolling stock (€ 52.8 M for 18 vehicles) and the depot maintenance center (€ 29.8 M) as well as incidental expenses (acquisition of property, travel expenses of water networks, riparian compensation, charges of the urban public transport organizing authority, etc.). The investment is supported by the concessionary by € 345.4 M, the rest is supported directly by Reims Metropole. Further to the construction cost, the public transport project's funding by MARS also includes contract expenditures (bus purchase, concession costs, financial expenses, contingencies and insurance) for a total of € 67.8M. MARS (the SPV) provides € 24 M in equity and € 215 M in external funding (loans). The remaining € 174 M is provided by Reims Metropole, the city of Reims and the central state as a capital grant. This grant was spread over several instalments between 2006 and 2011. Apart from passenger revenues, an overall price operating subsidy (perimeter mileage based on the 2011 network thus including the tram) of € 43.383 M a year is foreseen from 2014. This last subsidy is both a contribution to cover operating expenses (€ 30.7 M) indexed to inflation and a fixed amount to cover depreciation costs of equipment (€ 12.8 M). The increase in Transport Tax in April 2005 partly covers the annual contribution (€ 31M).

Nea Odos has undertaken the study, design, construction, operation, exploitation and maintenance of "Ionia Odos" Concession Project. The project budget exceeds € 1.2 billion and the full description of the financial model is included in the concession agreement, which the Greek Parliament ratified and which constitutes a State Law. According to the concession agreement, the project financing comes from: (i) Greek State funds (including EU funds)

amounting to € 360 M, these also include funding through tolls from the brownfield part of the project (ii) Equity of approximately € 198.6 M (shares and subordinated debt) and (iii) Bank capital of approximately € 662 M. When work ceased in 2010, the project was approximately 25% complete corresponding to some € 489 M in drawn funds (www.ypodomes.gr, accessed 13/12/11). However, at its design, the forecast of the Greek economy was very positive (see figure 2) and it was anticipated that 85% of the revenues would be returned to the State.

Project financing for all cases studied is presented in the following table II.

It is noted that not in all the cases studied, the private partner is provided exclusivity. In the case of the Deurganckdok lock at the Port of Antwerp, the entire risk is borne by the NV Deurganckdoksluis, while the Flemish Government bears no direct risk on lock materialization, maintenance and operation. The payment scheme concerns the payment of availability fees, as it is obvious that the concessionaire is not responsible for demand and revenues. Hence, the commercial risk is borne by the Port of Antwerp. For the Reims Tramway the exclusivity also includes a significant level of responsibility with respect to revenues. This concerns advertisements, other services and pricing policy, which in all cases is approved by the regulating authority, Reims Metropole, as the sole responsible to determine transport policy and service objectives. In contrast, the Ionia Odos concession does not have exclusivity nor regulating power as this is the sole responsibility of the State. Regardless, Ionia Odos is assigned demand risk, while the construction is directly dependent on traffic revenues.

Table II: Financing Structure

	Deurganckdok lock		Reims Tramway		Ionia Odos	
Project Cost	EUR M	%	EUR M	%	EUR M	%
Equity	88.55	25	24	6	198.6	16.3
Loans	241.66	68.22	215	52	662	54.2
Capital Grants	24	6.88	174	42	360	29.5
Repayment	EUR M	%	EUR M	%	EUR M	%
Subsidy	0		12.8			
Availability Fees	20.8	100				
End User Revenues	0		Yes		Yes	100
State Return on revenues					Yes	85

"Where" & "When"

The three case studies, as described in the introduction, are selected from countries with respective experience in the case subsector of application. In addition they have been procured approximately during the same period.

More specifically, in the case of the Deurganckdok lock at the Port of Antwerp, the holding entity NV Vlaamse Havens was founded very recently, on 25 February 2011. The project-

specific entity NV Deurganckdoksluis was founded on 4 July 2011. Financial arrangements and contract were closed on 14 September 2011. At the same date, the order was granted to the temporary commercial association Jan De Nul - CEI De Meyer - Betonac – Herbosch-Kiere - Antwerpse Bouwwerken. Building works started already in November 2011. Finalisation of works and scheduled start of use is 2016.

The PPP contract for the Reims procurement process was conducted under the "Delegation of public service as a concession of public works and public service Act" (Act No. 93-122 of 29 January 1993 Sapin Act), following tender announcement in March 2005. Three consortia applied and took place in the bidding process. Hearings and negotiations were conducted with all three candidates for the delivery of Best Proposal. Negotiations continued with the potential concessionaire. The contract was signed July 12, 2006 for a period of 30 years from the beginning of the commercial operation of the tramway. Construction began May 2008, and the commercial operation began in April 2011.

The Ionia Odos Project was tendered in two phases: a prequalification stage in 2001, following which 4 consortia were selected to submit an offer, and a final stage in 2005, wherein two of the invited consortia submitted bids. The winning consortium, consisting of one national/local contractor (TERNA – 33,33% share) and two international players (Spanish conglomerates Ferrovial and ACS - 33,34% and 33,33% shares respectively), has since 2007 formed the project company that has undertaken the design / construction / operation / maintenance of the project. In addition to the toll revenues that are received from the brown field motorway section, the project is also financed by shareholders' equity, debt as provided by a large syndicate of national and international banks and the Greek State, through a grant that consists of both national and European Structural funds. The Greek Parliament ratified the concession agreement, which has taken the form of a state law (Greek Law 3555/81/16.04.2007).

"Whole"

The "Whole" represents the influence of the macro-environment and this could concern both economic and cultural context. The economic context may concern fuel prices, economic growth at local, national and global level and employment. Increased awareness of environmental issues may lead to modal shift and is a good example of the cultural context.

Both the cultural and the economic context may influence travel behaviour (Reims Tramway, Ionia Odos) and traffic demand, which influences all cases. With respect to the latter, the most influenced is the Ionia Odos, as repayment of loans is highly dependent on end users and traffic demand generated (see figure 2), while the least influenced is the Deurganckdok lock as this is under availability fees.

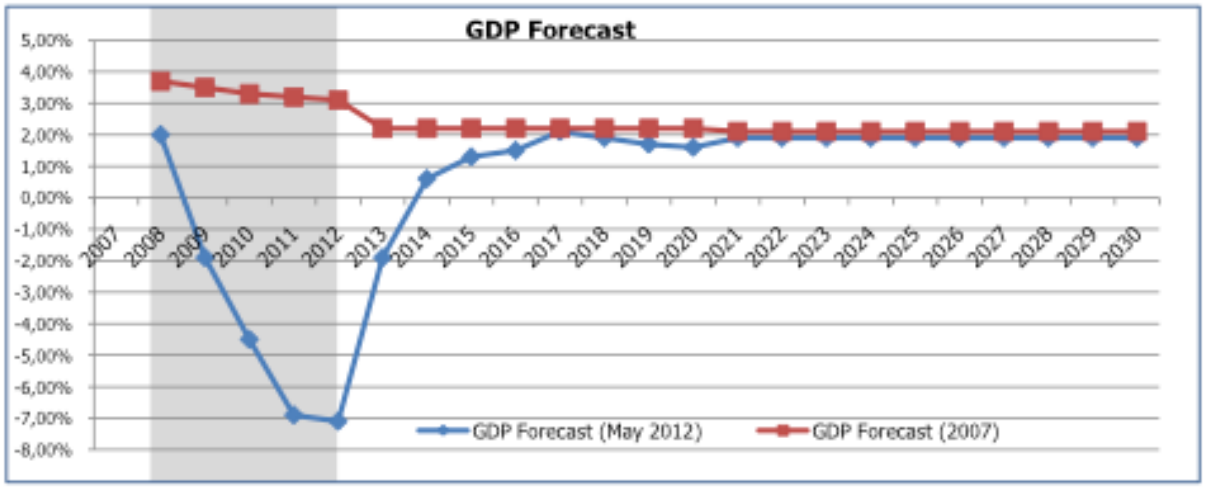

Figure 2: Greek GDP forecast 2007 and 2012 (includes actual 2007- 2012). Source Ernst & Young, 2012

Assignment of Linguistic Variable Value

The fuzzy assessment and comparison of the three cases, is effected by assigning values to the proposed linguistic variables, based on the discurve logic followed in preceding subsections. Table III accumulates all variable value assignments per variable. This assessment allows for the identification of the fundamental differences between the cases and the identification of respective similarities.

When considering the project – What-, the distinguishing difference in this analysis is not that three physically difference cases (port lock, tramway and road) are compared but that they differ as on the node-link value variable and with respect to exclusivity. More specifically, a port clearly is a node case, and a lock is to be considered an infrastructure element within such port. The Reims tram is at the same time part of a local network (the urban public network) and a link between networks (link between the town and the TGV network). Ionia Odos is designed as an Interurban motorway for passengers and freight and part of the TEN-T's.

Concerning the level of exclusivity of the infrastructure, it is the highest for the lock and the lowest for the tram. More specifically, the choice of port concludes the choice of lock. Therefore, there is total exclusivity in this aspect. There are, obviously, other efficient, alternatives to the choice of the Ionia Odos, making the case "not exclusive". Finally, the tram is in full competition with other transport modes as there are multiple other ways of traveling through the city centre. But the competition is limited by the fact that the operator of the tram is granted exclusivity for urban public transport.

All three cases are similar with respect to the public local initiator, who is the one competent for the concerned transport subsector and it has whole initiative on the project management. However one is locally driven, the Reims case whereas the Ionia Odos is managed at the national level. Concerning the Deurganckdok, both local entity (Port of Antwerp owned by the City of Antwerp) and national one (NV Vlaamse Havens owned by the Flemish Goverment).

But as the national actor bears the greatest part of the funding, we can consider the project as more nationally driven.

Cases differ with respect to the scope of the PPP but are quite similar with respect to the private party involved. The reasons for using PPP in the three projects are both finance-based and service-based. Both for the lock and for the motorway, financial reasons are dominating, especially in the Greek case, where European regulatory initiatives have had a big impact on the choice. For the tram, arguments about the urban public transport operating quality have had a big importance in the choice too. Maybe this difference in the reason for choosing a PPP is due to the fact that the Reims contract concerns a whole network inclusive operating and not only a part of the network. Again, it can be seen as a modal specificity as the urban transport is in this case a local competence. As a consequence, the public authority does not deal with a lot of "big" projects and does not have the means and the technical competence to manage such ones.

The cases have been structured differently when it comes to the "Which way" granule. Concerning the share of risks, very big differences can't be noticed, except maybe for the risk of exploitation and for the commercial risk. The commercial risk is not always supported by the same stakeholder. In Reims and Athens, it is the private partner, while in Antwerp it is the public one (Antwerp Port). An explanation could be linked to the sector. Indeed, if the perimeter of the contract is the same as the perimeter where user fees are collected, it is easier to delegate the commercial risk to the private partner. That is what happens for a road or for a complete urban transport network. But when the contract concerns only an infrastructure element, which is a part of an entire system, and when toll is collected for the use of the entire system, or no toll at all is asked, it is difficult to delegate the commercial risk to the private partner. The latter is the case of the lock in Antwerp. And it would have been the case in Reims, if the contract had only concerned the tramway infrastructure. This is directly correlated to the characteristics of the project as identified under "What".

Concerning the impact of macro-economic evolutions, the local transport is to be considered less depending on these factors than long-distance transport. Seaway and transit road transport are directly impacted by changes in the macro-economic situation, whereas local transport demand will be impacted on in the weakest way and maybe with some delay. This again makes the cases different.

Table III: Linguistic variables of granular value of the Ws Contextual Framework per case

	Deurganckdok lock	Reims Tramway	Ionia Odos
Granule: What – the Project			
Node - Link	Within a Node	Like a Node	Like a link
Level of exclusivity	Exclusive	Competitive environment	Not exclusive
Granule: Who – the Public Initiator			
Level of direct governance	Absolute direct governance	Absolute direct governance	Absolute direct governance
Nationally/Locally driven	More nationally driven	Locally driven	Nationally driven
Granule: Why – the Scope of PPP			
Finance – Service	More Financed based	More service based	Mostly Finance based

Based Approach	approach	approach	approach
Granule: Whom – Private party			
Business Developer	Business Servicer	More Business developer	Mostly Business servicer
Granule: Whichway – Strategy with respect to the contractual agreement (Risk Allocation & Payment Structure)			
Design and construction Risks	Totally Private	Mostly Private	Mostly Private
Maintenance risk	Totally Private	Totally Private	Mostly Private
Risk of exploitation	Mostly Private	Totally Private	Mostly Private
Commercial revenue risk	Totally Public	Totally Private	Mostly Private
Financial risk	Mostly Private	Mostly Private	Mostly Private
Regulatory risk	Totally Public	Totally Public	Totally Public
Force majeure	Totally Public	Totally Public	More Public
Payment	Availability fees and subsidy	User fees and subsidy	User fees no subsidy
Granule: Where – Project Location			
Urban – Interurban - Regional	Outer urban	Urban	Interurban
Granule: When – Project Timing			
Severity of project need	Great need	Great need	Needed
Granule: Whole			
Impact /Influence of macro-environment	Significant Exposure to macro-environment	Some exposure to macro-environment	Extreme exposure to macro-environment

CONCLUSIONS AND DISCUSSION OF FINDINGS

Public private partnerships have developed into a preferred method of transport infrastructure delivery. However, as they have developed by case in terms of transport sub-sector and country, it is difficult to transfer best practices and identify common solutions, due to lack of transparency of contextual factors. The present research proposed a methodology based on fuzzy logic with an assessment of a granulation based on a risk analysis contextual framework (Ws risk analysis contextual framework) and the assignment of relevant linguistic variables and respective values, in an effort to create more transparency and a start of a typology. These form the basis of comparison of three deliberately different cases from three different countries: a port lock case, an urban public transport case, and a motorway case.

Initial findings generated from the comparative analysis of the subject cases indicate that this method may be used to compare cases. In this context and returning to the hypothese formulated in the beginning of the paper, the following can be taken as main conclusions from the paper, with respect to protection against the financial crisis.

Comparing the cases it is identified that the Ionia Odos motorway was the most exposed to macro-economic conditions. At the same time it was not exclusive in use. Compared, however, to the other cases, it was the least needed project and with all revenue risks transferred. This is compared to the Reims Tramway case, which are based on “user fees and subsidy” and Deurganckdok lock where “availability fees and subsidy is foreseen”. It is

noted that the other two cases were also described as “Great Need”. Through the comparison, it could be concluded that apart from the severe change in macro-economic conditions a number of other factors did not protect against the impact of the financial crisis: the non-exclusivity, the payment / risk revenue risk transfer and finally the level of project “need”.

The number of cases analysed limits the ability to validate the methodology. Nevertheless, it provides initial insights, and already shows that some supposedly-evident characteristics do not hold for the projects where one expects them. Equally, the applied reasoning seems to enable the building of a typology. To do that, a more advanced methodology would need to be used. In that sense, this paper sets the scope of further research, along with the passing from qualitative to quantitative analysis as linguistic variable values are substituted by fuzzy sets.

REFERENCES

AFD, Certu ,CODATU (2009) Who pays what for urban transport?

Aziz, A.M.A. (2007) Successful delivery of Public-Private Partnerships for infrastructure development, Journal of Construction Engineering and Management, 133(12), 918–931

Beucher R (2010) An urban Transport Concession Reims Tram project, PPP congress, Cyprus

Blanc-Brude, F., Goldsmith, H., and Välilä, T. (2006) Ex ante Construction Cost in the European Road Sector: A Comparison of Public-Private Partnership and Traditional Public Procurement, Economic EIB Financial Report 2006/01, European Investment Bank. Luxembourg

Certu (2008) L'Enquête Ménages Déplacements "Standard Certu"

Certu (June 2008), Direct and delegated management in provincial urban public transport in France,Mobility : fact and figures, leaflet 2,

Chapman C. and Ward S. (2003) Project Risk Management: Processes, Techniques and Insights John Wiley & Sons, UK.

Chong, E., Staropoli, C., and Yvrande-Billon, A. (2010) Auction versus Negotiation in Public Procurement: Looking for Empirical Evidence, HAL: hal-00512813, version 1

EIB (2005) Evaluation of PPP Projects Financed by the EIB. EIB Publications.

EIB (2007) A renewed policy for EIB lending to the transport sector

Estache, A., Juan, E. and Trujillo, L. (2007) “Public Private Partnerships in Transport” The World Bank, Policy Research Working Paper 4436.

Evenhuis and Vickerman (2010) Transport pricing and Public-Private Partnerships in theory: Issues and Suggestions, Research in Transportation Economics , 30, pp. 6-14

Flemish Port Comission (2013) Statistiek Vlaamse Havens, viewed from www.serv.be/vhc on 24 February 2013

Kappeler, A. and Nemoz, M. (2010) Public Private Partnerships in Europe – Before and during the recent crisis, Economic and Financial Report 2010/04, EIB

McFee, R., Corman, S. and Dooley, K. (2009) Characteristic Processes and Discursive Methods in the Study of Organizational Knowledge

Meunier, D. and Quinet, E. (2010) Tips and Pitfalls in PPP design, Research in Transportation Economics, 30, 126-138.

National Bank of Belgium (2011) Economic importance of the Belgian ports: Flemish maritime ports, Liège port complex and the port of Brussels - Report 2009

Nikolaidis, N. and Roumboutsos, A. (2012) The Impact of Recession on Road Concessions: Greece, The Changing Context of Re-negotiations, TRA 2012, Athens 23-26 April 2012

Roumboutsos, A., Pellegrino, R., Vanelslander, T. and Macário, R.. 2012. Transport PPP Projects: a literature review. COST Action TU1001: Public Private Partnerships in Transport: Trends and Theory; 2011 Discussion Papers, ISBN 978-88-97781-04-2

Roumboutsos, A. (2010) A Ws Contextual Risk Analysis Framework: Mapping knowledge transfer potential between Road and Port Public Private Partnerships, CIB World Congress, The Lowry, Salford Quays, United Kingdom

Roumboutsos A. and Anagnostopoulos, K. (2008) Public Private Partnership projects in Greece: Risk ranking and preferred risk allocation, Construction Management and Economics, 26 (7), 751-763.

Roumboutsos, A. and Kapros, S. (2008) A game theory approach to urban public transport integration policy, Transport Policy, 15(4), 209-215

Yvrande-Billon, A. (2006) The Attribution Process of Delegation Contracts in the French Urban Public Transport Sector: Why Competitive Tendering is a Myth, Annals of Public and Cooperative Economics, 77(4), 453-478

Zadeh, L. A. 2008 Is there a need for fuzzy logic? Information Sciences 178, 2751–2779

Others Reference Sources

Greek Law 3555/81/16.04.2007, Ionia Odos Concession contract

MARS, online access <http://www.mars-reims.fr> , accessed on 22nd February 2011

Nea Odos, online access http://www.mars-reims.fr, accessed on 18th October, 2012

Reims Metropole, online access <http://www.tramwaydereims.fr>, accessed on 22nd February 2011