RISKS IN PORT CONCESSIONS: A CONTEXTUAL ANALYSIS AND ALLOCATION METHODOLOGY

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ABSTRACT

The issue of risks and risk allocation is key in the successful application of concessions and other types of private public partnerships (PPP). Transportation in particular, where sunk cost intensive investments are required, is not an exemption. Risks and their allocation has been a topic receiving attention by researchers and practitioners resulting in guidelines for contracting public authorities and concessioners, setting the grounds for successful endeavours.

Ports constitute an integral part of transport services that faces infrastructure development issues in combination with emerging need to provide advanced services to diversified users. Private involvement in the provision of port infrastructure and services is becoming common practice with terminal concessions being the dominant market entry mode. This increases risks and their interdependence as PPPs in Ports (P4s) may be described as the outcome of these combined strategies.

A contextual methodology is proposed for the analysis of risks in P4s based on the prime parameters defining the P4 setting. The importance of respective strategies on risk development is central in this approach. The contextual methodology is described in terms of its context parameters and applied to generic risk categories, illustrating its applicability in effectively analyzing risks and its potential for appropriate risk allocation associated with the concessioning of port terminals. Cause and effect loop diagrams are used to highlight the impact of contextual parameters on risks and propose risk allocation within the context of P4s.

The methodology is proposed as risk allocation guideline and is considered to assist both port and other respective contracting authorities and private investors in optimising their involvement strategies.

Keywords: Port Concessions, Public Private Partnerships, Risk Allocation, Mapping, Procurement

INTRODUCTION

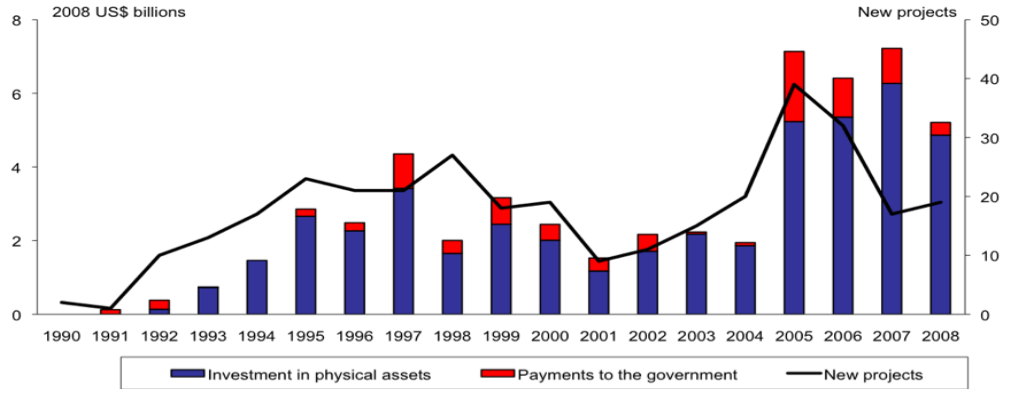
A most prominent feature of public procurement strategies during the last two decades has been the involvement of the private sector in activities, traditionally, undertaken by the public sector. This strategy has been realized through a variety of well known contractual arrangements such as BOTs (Build-Operate -Transfer), BOOTs (Build-Own-Operate-Transfer), BOOs (Build-Own-Operate), DFBOs (Design-Finance-Build-Operate), BTOs (Build-Transfer-Operate), BLOs (Build-Lease-Operate) to name a few and characterized as "concessions" depending on the transfer of ownership during the contractual period. Since the early '90s, these contractual arrangements have been considered under the umbrella term of Public Private Partnerships (PPPs). This strategy has been characterized by two basic approaches (and public-sector objectives): the *finance-based* and the *service-based* approach (Aziz, 2007).

The *finance based* approach has been the prime motivation by governments seeking to respond to demand especially in the transport sector which is characterized by large sunk costs and cost intensive investments, such as the transport sector. This is reflected in PPP statistics: In Europe, 83% of all PPP contracts signed in 2006 concerned transport infrastructure (DLA Piper, 2007) and, internationally, about two thirds of all PPP transport projects concern roads, about 18% rail, 12% airports and less than 7% ports. The average project size varies across sectors ranging from about US$ 105 million in ports to about US$307 million in rail. The average project in roads and airports is roughly US$180 million (Estache et al., 2007). This trend has generated substantial institutional, archival and popular literature and debate concerning the political, social and economic acceptance of the scheme. The latter has been generally focused in varying forms around the issue of Value for Money (VfM), loosely defined as the optimum combination of life cycle costs and quality to meet user requirements (Grimsey and Lewis, 2005; Akintoye et al., 2003; Debande, 2002) and, thus, seeking justification for PPPs through a *service-based* approach.

To this end, there is significant PPP literature on the topic of risk and risk allocation and how it impacts VfM. Yet, published research is mostly on the topic of road PPPs, not least because they represent roughly two thirds of PPPs in transport. Recently, the concessioning of port services and infrastructure to private entities has become common practice generating a growing interest on the subject of concessions in seaports. The World Bank database regarding seaport projects in developing countries alone is illustrative of this trend (figure 1).

Understanding port concessions as '*Public-Private-Partnerships with a port governance function*' (Notteboom, 2007), scholars have started examining various themes, including the different types of terminal awarding procedures (Engel et al. 2004; Theys et al., 2010), techniques to determine concession duration (Theys and Notteboom, 2009), fees (cf. Ferrari and Basta, 2009), and the pre-bidding phase (Notteboom et al., 2009); and the extent that concessions design might result in entry barriers (Pallis et al., 2008). The issues of risk and risk allocation in port concessions (Port PPPs; hereafter termed as P4s) remain under-researched and only occasionally mentioned (i.e. Chlomoudis and Pallis, 2008). Yet, these

issues deserve attention; as Juhel (2001) concludes in his study of port restructuring in the light of globalization, "[*T]he new distribution of roles between public and private actors, in particular, calls for an appropriate allocation of duties and responsibilities, of risks and rewards, to make the global transportation system work to its best efficiency*" *(Juhel, 2001:174).*



Source: World Bank and PPIAF, PPI Project Database. (http://ppi.worldbank.org/ January 2010)

Figure 1 –Investment commitments to seaport projects with private participation in developing countries, by type of investment, 1990–2008

According to classical decision theory, risk is generally understood to be the distribution of possible outcomes, their likelihood, and their subjective values (March and Shapira, 1987). Risks are identified and assessed quantitatively and quantitatively by estimating the probability of occurrence and the impact on project value of the probable occurrence. Probability and impact are project specific. Risk identification is more generic and risk registers have been proposed to rationalise this task. Apparently, the list is extensive, with some variables being always present, albeit termed differently as they stem from different contextual settings (Roumboutsos and Anagnostopoulos, 2008; Ng and Loosemore, 2007; Nielsen, 2006; Kumaraswamy and Zhang, 2004; Dey and Ogunlana, 2004; Kapila and Hendrickson, 2001; Ozdoganm and Birgonul, 2000; Salzmann and Mohammed, 1999; Akintoye *et al.*, 1998). For example UNIDO (1996) developed a checklist for PPP in Asian countries classifying risks under two major categories (general/country risks and specific project risks). Political risks, commercial risks and legal risks are classified in the first category, whereas construction/completion risks and operating risks under the second category. A checklist of 26 risks of PFI projects in the UK is presented by Hardcastle and Boothroyd (2003). Thomas et al. (2003) identify 22 risks associated with BOT road projects in general and unique to Indian project environment and use four project phases (developmental phase, construction phase, operation phase, and project life cycle phase) for classifying risks.

Evidently, in the case of PPP projects, much of the risk comes from the complexity of the arrangement itself in terms of documentation, financing, taxation, technical details, sub-agreements etc. involved in the major infrastructure venture, while the nature of risk alters over the duration of the project life cycle as does its impact but more significantly risk is influenced by the allocation of risks to the contracted private and public sector.

Therefore, risk allocation is highly important in PPPs. The effective distribution of risks, according to Loosemore *et al* (2006) should follow established rules, whereas a risk is undertaken by a party when this party has:

- Full awareness of the risk to be undertaken
- Greater capacity to manage the risk effectively and efficiently (also (Kerf 1998; World Bank 2002; Kerali 1999; Partnership Victoria 2001; Irwin 2007; Irwin *et al.* 1999)
- The capacity and resources to cope with the risk eventuating
- The preference to undertake the specific risk
- The possibility to charge the respective risk premium (also World Bank, 2002).

Lam (1999), in his sectoral review of risks associated with major infrastructure projects implemented all over the world, concluded that optimum risk allocation is not easy to obtain as much depends on the relative bargaining power of the parties and the potentiality of the reward for taking the risks. Roumboutsos and Anagnostopoulos (2008) through a comparative study and analysis identified a maturing process that improves risk allocation through experience and that this is dependent on the specific contextual setting a project is developed in, as also identified by the various risk registers offered in literature.

The present work contributes to the topic of risk assessment and risk allocation in P4s by taking as its starting point the contextual setting of seaports. It proposes a methodology to systematically identify, assess and allocate risks in P4s taking into account developments in mainstream transport PPP research and project risk assessment and by studying the reflected contextual aspects (section 2). Prime (generic) risk categories in P4s are systematically identified and assessed and their respective allocation is evaluated in terms of impacts (section 3). Conclusions are drawn at the end emphasizing the need of a contextual methodology in P4s and suggesting themes deserving further scholarly attention.

CONTEXTUAL METHODOLOGICAL APPROACH

The Contextual Ws Risk Analysis Methodology

Risks are analysed within a “context”. The present study, based on the 6Ws framework introduced by Chapman and Ward (2003), proposes the extended Ws framework of figure 2, where the basic structural elements of any PPP project are presented. In addition, given that the Port sector serves derived demand, risk is greatly influenced by the macroeconomic environment, and this is also represented as the “Whole”. Each risk group is analysed with respect to these structural causal elements. “Who” is the initiating public sector. Its characteristics and strategies are expressed in the scope of the P4 project, the “Why” a P4 and subsequently expressed in the “What” (type of project: brown or greenfield; user type; cargo type; etc.) and the attracted or procured interest, the “Whom”. The private sector implements its own strategy vis-à-vis the project (“Whatwithal”) that is dependent on “where” the project (*port*; in some cases the *terminal* itslef) is located. These Ws take on different emphasis during the various times (“When”) in the project (and contract) life-cycle. Hence, the framework suggests the application of the framework over time. Finally, central to the

overall risk development is risk allocation, as it is addressed through the procurement/contracting process ("Whichway"). Based on the scope of the P4 ('why'), the initiator ('who') structures the "whichway". She does so in the light of the of the (potential) contractors' ('whom') corporate strategies ("whatwithal"). Notably, this is a dialectic process with the "whatwithal' and the 'why' ultimately affected by the "whichway" as well.

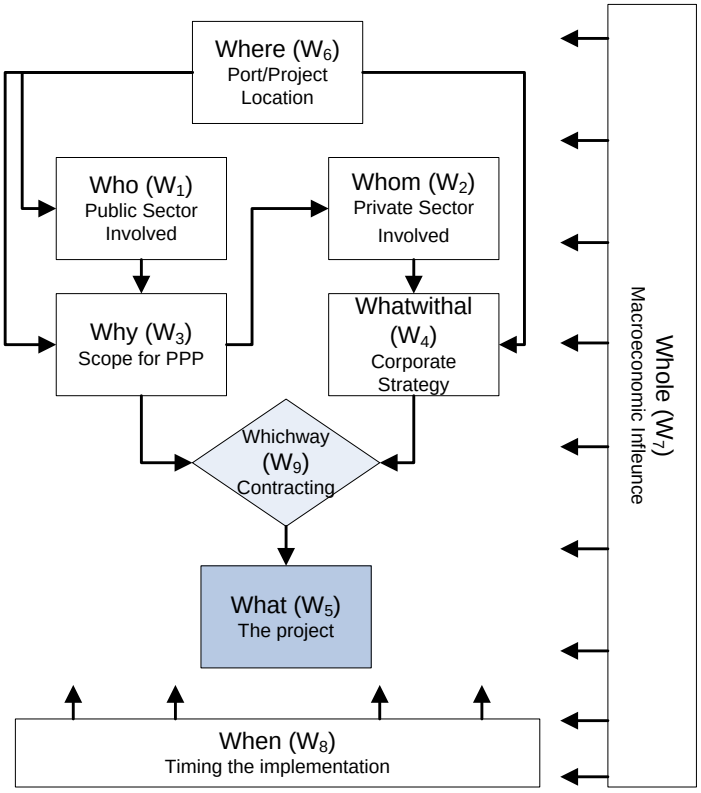


Figure 2: Proposed Extended Ws Risk Analysis Framework

The scope is to identify causal relations connected to either the public or private sector during each of these phases and by this suggesting the potential of risk allocation ("Whichway").

Therefore, the initial analysis of risks with respect to the "context" or the variables influencing their significance in terms of probability of occurrence and impact (as proposed in figure 2) leads to a construct for each risk identified (j) in the form of $R_j = f_{R_j}(W_i)$ where *i=1 to 8* (the Ws of figure 2) or considering the significance of the W_8 = *When* = *Time*, $R_j(t) = f_{R_j}(W_i)$.

Risks are either reduced/mitigated through the "Whichway" process or enhanced. The model could be approached in two iterations. The *first pass* identifies potential risks stemming from the original setting. The parameters of this pass deserve attention given that the dynamic differentiations of the situations observed in seaports and terminals results in diverge original settings. The *second pass* considers the influence of the concessioning process and characteristics. Should an optimum process be established (i.e. appropriate risk allocation) in the first pass, the second pass should lead to improved (i.e. reduced) risk estimations.

The contextual analysis will determine which Ws are important for each f_{R_j} (or risk category), while the weight of each *W* is estimated through a cause and effect diagram. In general, either the "Who" or the "Whom" will have a greater impact on a particular risk. To this party, at time, $t = t_0$ the risk should be allocated. If neither "Who" nor "Whom" can be attributed responsibility, than the risk is considered to be shared.

Ws Contextual Framework Analysis in P4s

As first steps in mapping risks in P4s, it is important to:

a) Identify the "public party" involved, the scope of concessioning, the concessioner's core business and scope in the port project. In other words, to identify the "who", "why", "whom", and the "whatwithal".
b) Consider the critical variables of port location, and potential impact of the broader macroeconomic setting, that is the "where" and the "whole".

The contemplation of the above enables to set the context within which risks are evaluated. The following section presents an overview of the P4s contextual Ws.

Who: Ports are multifaceted activity structures, typically governed by a Port Authority (PA). The absence of such authority is rare, strictly present in (only some) that outright port privatisation has taken place. Even then, as in the case of the UK private ports, a 'managing body' replaces the PA (cf. Baird and Valentine, 2006). Following a wave of devolution of port governance responsibilities over the last 30 years (see 14 cases in: Brooks and Cullinane, 2006; for an Asian perspective: Reveley and Tull, 2008), PAs stand as autonomous bodies, even in the case of legally speaking arms-length public authorities. They act as the 'public party' in the concession setting. PAs act within the rules and the norms of a broader institutionalised political and legal environment defined by other decision makers. Ownership plays a role in terms of transfer of ultimate responsibility, but also in terms of the perspectives, including the risks that they might (or be willing to) undertake. In all these cases ownerships rights are transferred in P4s to the contractors at various degrees.

In terms of roles, PAs act as 'landlords' and their key operational role corresponds to the provision of nautical services (such as navigation, pilotage, removing wrecks, waste reception, ensure safety within harbour waters by providing lighting and buoys, and security by implementing relevant international regimes, etc) either because of the claim that these services retain their 'public good' features, or because of international law requirements.

The PAs also act as regulators. This takes place at various degrees, ranging from a regulatory role limited to specific issues (i.e. license construction works within the harbour area, regulate vessel movements and berthing in the harbour) to one that regulates a whole spectrum of issues, going as far as the relations between the service providers operating in a port.

Most importantly, PAs are the ports' business managers who plan their strategic development, decide on the outsourcing of port services provision, while at the same time may act as a facilitators of strategic and regional networks involving the various actors involved in a port cluster, and as leader in collective action to promote the port in current and perspective users (see: De Langen, 2004). Given the significance of integrating ports in supply chains, this activity is increasingly more important than in the past.

This ultimate role as business managers justifies their role in defining the "Why".

Why: In ports, investment in infrastructure and superstructure tend to follow suite innovations in transport technology, organisation & management, policy and legislation. Endogenous factors rising due to the particular features of the sector also play a key role in determining the drivers towards the endorsement of a P4. Overall, there are four different 'Whys" for initiating a P4 that deserve attention.

W_{31}: The financial restrictions faced by the state and other public agents responsible for port projects stand as a first key 'Why'. As most big infrastructural projects, ports are typically large-scale capital-intensive investments requiring (comparatively) long gestation periods and are also location specific. Seaport projects also tend to be 'lumpy' investments, in other words they tend to be subject to a long period of excess capacity (see: Ho and Ho, 2006), though during the decade that preceded the economic crisis of 2008 reality challenged this feature. Two decades earlier, the juxtaposition of shipping and other port users (i.e. shippers) specialisation combined with vast technological progress had initiated a process transforming the sector to a capital-intensive one. Driven by fiscal limitation, PAs and/or other relevant managing and decision-making bodies aim to overcome financial limitations by introducing private finance.

Importantly for this analysis, port infrastructure development serves both medium- and long-term targets, thus involves projects having different financial perspectives. Long-term projects demand a continuum of expenditure, and possible benefits, along with long-term planning, resources allocation, and investment strategies. In such a context, the seeking of private capital mobilisation is associated with the search for an accommodation of both parties involved, rather than the dissociation of the public sector.

Issues of competition are a second driver for P4s. The involvement of a new entrant might aim to the introduction of competition between a particular port and the other ports in the same geographical region (W_{32}: inter-port competition) and/or within the port (W_{33}: intra-port competition).

W_{32}: The advent of containerisation and transhipment has eroded geographical monopolies, diminished users captivity and loyalty. Port customers mostly have a footloose character, which increases the bargaining power of many maritime businesses: for instance, container shipping companies can decide how and where their container trade is taking place, which leads to the emergence of new transshipment hubs and dedicated terminals. Even over the hinterland, containerization and the development of inland terminals convey more options for

freight forwarders. Ports face the constant risk of losing important clients, as customers can reorganize their service networks or can engage in new partnerships with other carriers (Slack et al., 1996). Advancing entrepreneurship via inter-port competition is seen as a mean to overcome the serious drawback of the location-bound characteristic of port and terminal activities.

W_{33}: Intra-port competition is associated with two groups of benefits (De Langen and Pallis, 2006). The first one the 'monopoly argument' refers to intra-port competition, as a mean to prevent monopolistic rent seeking of port service providers and is relevant when inter-port competition is imperfect (Goss, 1999). The second argument derives from need to foster or enhance specialisation, innovation and diversity of both port and related services provided. With global production organised on the basis of post-fordist models, ports serve a rapidly changing market. P4s are the mean to move beyond the traditionally followed industrial 'world of production' and provide services within alternative frameworks. These include the *interpersonal world*, based on dedicated specialised services, economies of variety, competition centred on quality, skilled labour, and uncertainty; and the *market world*, based on dedicated but standardised services, economies of scale and differentiation, competition centred on price flexibility, semi-skilled labour, and conditions of uncertainty. By advancing the integration in supply chains and the spatial and functional expansion of port activities – a process termed as 'regionalisation' (Notteboom and Rodrigue, 2005) – P4s are endorsed as means to improve the competitiveness of the port.

Even when intra-port competition is not viable (i.e. because of the scale of the services), there are still justifications for introducing P4s. Since the seminal work of Demsetz (1968), initiating competition for the market is proposed in cases where competition in the market fails. In industries characterized by high economies of scale and natural monopolies leading to the highest possible market concentration are most cost efficient, appropriate awarding mechanisms and a sufficiently large number of players competing for the right to serve the market, the effect of such competition for the market – where the most efficient firm is selected – can be similar to that of a competitive market within which many players operate.

W_{34}: Effective management reform is the additional "Why' for the adoption of P4s. Being the symbolic example of 'public goods' definition (Musgrave, 1969), ports have been traditionally managed within the public sector. Today ports constitute a multifaceted business ensemble of interdependent business actors. The rethinking of port (see: Olivier and Slack 2006) leads to concessioning as a tool for reform and governance, and the adoption of new public management forms, involving self-management, contract management and business-like practices. Apart from allowing for the flourishing of 'product/services divisions' this aims to emphasise managerial entrepreneurship, i.e., indicators and benchmarking, replacing what is perceived as highly procedural bureaucracy and risk-minimising culture.

In practice, most PAs in their business development might be looking for all "Whys" in varying weightings such as $W_3 = a_1 W_{31} + a_2 W_{32} + a_3 W_{33} + a_4 W_{34}$. As noted by Goss (1990) these "strategies" are manifested in the way PAs structure tender requirements, i.e. if the

intent is to encourage competition they may seek more than terminal bidders able to engage in a variety of rent and pricing schemes to deliver that competitive climate.

To Whom: The "Why" as defined for P4s justifies the key qualities and experience the concessioner has to present. Hence, actors whose core business or business strategies reflect the PA's "whys" are likely candidates for P4s. In practice, private investments originate mainly from a relatively small number of transnational corporations that own/operate several terminals across a number of countries and continents, with most of them emerging since the 1990s.

W_{21}: Stevedoring companies, the conventional actors that consider port operations as their core business, stand as the first type of actor. There are two different types of stevedoring companies seeking to expand into new locations (for a typology: Mori, 2006). The first one is public agents, whether government, or PAs that leverage their established expertise in specific location (e.g. DPW and PSA), and the second are private companies (e.g. HPH, Eurogate, ICTCI).

W_{22}: The several maritime shipping companies pursuing vertical integration strategies via investments in terminal operations, either directly or through parent companies is the second group. A terminal operator affiliated with a liner company might aim at supporting the core business of a parent company (e.g. CMA-CMG, Evergreen, APL, Hanjin), or to offer service to third party as well (e.g. APMT and NYK). In the former case, terminal business is a "cost center" of shipping lines aiming to offer competitive services but also to prevent rent extraction. In the latter case, the company of this category manages the terminal business as independent and evaluates it as a "profit center". In the same category, one might find examples of public ownership as well (COSCO Pacific).

W_{23}: Other market players envisage vertical integration strategies as well. In an effort to better control costs and operational performance and as a measure to remedy against the effects of schedule integrity problems, railway companies, and logistics companies have turn to new entrants in recent times.[1]

W_{24}: Consortia of the above. Notably, both stevedores and shipping companies are increasingly involved via cooperative strategies (i.e. consortia) rather than going-alone strategies; the case of Maasvlakte II, a major P4 to change capacity dynamics in Europe by 2014 provides an illustrative example of this case.[2] Logistics companies also seek consortia involving stevedoring companies or shipping lines, based on the economic aim at achieving

1 Analysis in this study focuses in container segment. Similar phenomena however are also observed in other trades: many shippers in liquid and dry bulk (such as Shell, Exxon, BP, Corus Steel, and CVRD –Brazil) own terminal facilities, while P4s are increasingly popular in passenger ports (e.g. Barcelona, Marseilles, Southampton).

2 As a note of caution, the post-2008 situation is noteworthy: Record loss-making deep-sea shipping lines in need to re-finance via complex arrangements with financial partners and might result in situations that reverse this trend. Leading shipping lines expect consolidation and bankruptcies as necessary parts to balance the market and rectify the oversupply problem, with the question being in order when and how consolidation will happen. For instance, state bailouts may lengthen the current situation of oversupply and the delay the necessary restructuring.

size, growth, economies of scale, market share and market power. Pitfalls like cultural differences and overestimated synergies are commonly overlooked based on the argument that this is a mature industry and the barriers to entry are relatively high, due to investment volumes required and the development of a customer base.

***Whatwithal*:** A partnership, as defined by Brinkerhoff (2002), is a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labour on the respective comparative advantages of each partner.

To this end, if a PPP is to succeed the objectives of "Who" need to be met by the objectives of "Whom". Hence, the "why" and the "whatwithal" should be in line. In practice, a PPP acts as a tool to leverage the opportunities of the port system via private capital used to expand its own commercial opportunities by financing terminals or indirectly international trade. The concessioner provides this capital based upon expected level of return from existing trade and its growth potential, while the earnings are used to directly finance operational and capital requirements as well as pay back dividends to the institutions providing capital.

All "whoms" described previously are looking forward to expand activities and secure/increase market share through horizontal and/or vertical integration and they are either seeking to improve efficiency within port operations or within the transport chain or both and therefore "Whatwithal" could be expressed as $W_4 = b_1 W_{41} + b_2 W_{42}$. The co-linearity established between W_3 and W_4 may provide a measure of responsiveness in objectives and partnership foundations.

Where: Port locations are specific, developed historically due to their natural positioning and one of the major issues concerned is the availability of waterfront land to serve or procure demand. Natural barriers might constrain capacity for additional berths, warehouses or other facilities can limit entry and its potential. Regulatory issues (i.e. environmental provisions) in particular sites might structure expansion limits. Greenfield development is not always viable, as large investments may be required for dredging, construction, access road and infrastructure, with incumbent firms enjoying the benefits of previous public authorities investments. Another equally important issue is the ability to create, develop and preserve hinterland connections. The potential for spatial and functional regionalisation, along with the potential of bundling services in order to embed them in supply-chains is vital. Given the presence of overlapping hinterlands, all these mean that a port's location in many ways will define its (optimum) W_3 and, its desirability in terms of achieving a W_4.

Whole: Ports serve transportation needs and these are derived needs, sensitive to global market trends and development. Therefore, the "Whole", that is the macroeconomic environment has a dual influence on the context risks evolve. A PA ('who') as a business manager will set strategic targets based on macroeconomic trends and forecasts in order to secure and improve the port's competitive position ('why'). The concessioner ('Whom') will thieve through the port to promote its respective business strategies ('whatwithal'), and therefore estimated trends and forecasts constitute the basic assumption the entire construct

is developed on. Not least, the 'whole' affects the level of risk that they are ready to assume and absorb, as demonstrated by reactions to the 2008 credit-crunch. In this sense, fluctuations from the basic scenario will highly influence the final result.

WS RISK ANALYSIS AND INITIAL RISK ALLOCATION

The contextual analysis of the P4 structures, the actors involved, the broader strategies that these actors might pursue, and the interactions between all these, detail the variables at play as regards the extent and volatility of risks that might occur over the life of the P4. This enables a risk analysis beyond the simple description of potential risks and focuses on the impact of the P4 setting, allowing in turn a realistic allocation of risks leading to project success.

Risk Analysis

The basic risks incurred in any transport project undertaking, although highly interconnected, may be summarized separately as follows:

1. *Technical risks*, such as physical conditions (e.g., soil, weather); problems during design, construction, operation, and maintenance; and natural disasters (e.g., earthquakes, flooding);
2. *Market risks* which may be considered as external to the project (e.g., gross domestic product, growth, inflation, market structure) and internal to the project (e.g., traffic demand, elasticity, competition from other modes or alternative routes);
3. *Financial risks* which may be considered external to the project (e.g., taxation currency, exchange rates, debt rating of the country), and internal (e.g., loan interest rate and payback period, grant financing, loans availability);
4. *Environmental risks*, related to possible changes of environmental laws, the protection of historical sites, the reaction of interest groups due to societal sensitivities about the environment; and
5. *Political risks*, related to country's political stability, record of government interventions and frequency of legal framework changes.

This categorisation of risks is not exhaustive - for example it does not refer to risks stemming from the contractual agreement and possible partner asymmetries in information and power - but focuses only on the project *per se*. These risk categories are viewed with respect to P4s within the Ws Risk Analysis Framework presented.

Technical Risks

Technical risks are present in P4s as in any construction project. These risks, in principal, include: design deficiency; application of innovative techniques/design; late design changes; material / labour availability; poor quality of workmanship resulting in workovers; unforeseen adverse geotechnical conditions; weather; land acquisition/availability; delays in project approvals and permits; change in construction legislation; archaeological findings;

construction contract variation; availability of finance (cash flow) and force majeure, which ultimately result in construction delays and cost overruns or both.

The probability of occurrence of the above noted technical risks is related to the historical knowledge of the construction site and the ability of the directly involved parties to handle In a brownfield project site conditions and design requirements are known to a great extent. A greenfield project in ports bears similar characteristics, as the general prevailing conditions are known. Hence, technical risk in relation to site conditions is minimum.

This does not however imply that there is no relation between technical risks and the stage of development of the terminal site to be concessioned to a private actor. The PA (or any other 'who') might opt to award either (a) an undeveloped site where the operator will have to develop infrastructure; (b) a greenfield site with infrastructure developed to site boundary; (c) an improved site with a quay line, paved yard but without buildings or handling equipment; (d) a site with all civil works completed but the operator supplies quay cranes and yard handling equipment; or (e) a fully developed site including quay cranes but the operator supplies yard handling equipment. This decision is closely related to the technical, as well as financial and market, risks to be transferred to the winner of the concession. Clearly, option (a) is the one associated with the transfer of the highest technical risk, with this risk being diminished as we are heading towards option (e) whereas technical risk transfer is the lowest.

Construction companies, traditionally, undertake most of the technical risks depending on the contract type. Examples from other modes, i.e. PPP road projects, suggest that the private party willingly accepts most technical risks with the exception of those that are essentially related to public sector decisions such as land availability/acquisition, approvals and permits, changes in legislation and archaeological findings. There is evidence that the public sector accepts to maintain these risks as so (Roumboutsos and Anagnostopoulos, 2008; Li et al., 2005).

In P4s, construction companies are not prime agents included in the "Who" or the "Whom", thought they occasionally are partners in consortia competing for the concessions. In this case, additional risks stem from the construction procurement decision (contract type: Design Bid Build, Design Build etc) and the ability of the "Who" or "Whom" (i.e. the concessioner) to oversee and manage the contract as an international assignment (World Bank, 2007). However, considering the overall level of technical risks, it is evident that these risks can be safely mitigated through consequent contractual agreements, the introduction of the "independent engineer" who assures proper project completion and a budget allocated for "unforeseeable" events. Force majeure risks are insured according to international construction law.

While technical risks seem to be rather manageable, the construct itself defines the level of future uncertainties, as it involves sunk costs to be retrieved (cf. Ho and Ho, 2006). The bundling of the construction and operation is one of the merits of PPPs as it is estimated that the private party will make "productive" investments in view that their benefits will be

internalised during the operation and maintenance stage (Roumboutsos, 2008; 2009; Hart, 2003). In an equivalent approach, the "Whom" enforced with the right to apply the strategy should be responsible (in order to be able to internalise benefits) for the technical part of the contract and both in terms of infrastructure and superstructure as it will ultimately define operation costs and financial risks.

In order to reduce or offset the risk of investment, there is a trend in designing the project as a number of consecutive stages where the timing of each stage is valued as a real option. The "nature" of real options is categorized as real options "on" and "in" projects. In ports, real options are viewed as "on" projects (cf. Meersman, 2005).

Market Risks

Market risks may equally be considered as revenue or investment risks. They depend on the size of investment and reflect the uncertainty in predicted traffic volumes/transport demand and the willingness of users to pay for services rendered. Ultimately, market risks refer to serious deviations from the basic macroeconomic scenario considered when initiating the endeavor (i.e both the "Why" and "Whatwithal"). Hence, related to this risk is whether "who" or "whom" or both are responsible for demand predictions at the pre-bidding phase and the respective throughput guarantees included in the P4 arrangement. These predictions and forecasts are sensitive to technical (model) uncertainties (Trujillo et al, 2002; Flyvbjerg et al., 2006) and strategic or optimism bias that is facilitated by technical uncertainties (Guasch, 2004). It is often neglected or underestimated that traffic volumes are very sensitive to income, industrial production, and economic growth, i.e. macroeconomic conditions (Estache et al, 2007). This sensitivity was factually exposed by the 2008 crisis (Pallis and de Langen, 2010).

The probability of risk occurring (risk exposure) depending on the nature of the market, the particular port, or the port region, refers to. Markets may include : (a) no established regional trade; projections based on visionary cargo, or new free trade zone; (b) established regional trade, substantial transhipment; (c) established hinterland general cargo trade but low penetration factor; (d) established regional and national trade but open to competition from other terminal operators within the same or nearby port; and (e) established container trade and need for facilities upgrade. The probability of market risk, in general, varies from highest in case (a) and to lowest possible in case (e).

Given the intervening changes in demand due to traffic fluctuations (i.e. at least due to recessionary cycles that occur over the P4 period), and contestability on the supply side (i.e. Intermediate hubs are particularly contestable), market risk is directly connected to investment risk in a terminal due to the length of the amortization. In recent years this risk was abated by the surge in transshipment throughput as maritime shipping companies organized the networks to cope with the growth in long distance trade. With emerging hinterland access regimes, the contestability of gateway traffic is also more acute.

The magnitude of risks depends on the form of repayment and the financial structure of the investment along with the contractual arrangement concerning payments. Along the same lines, connecting the contractual period with an agreed ROE (as is common in the sector) extends the contract life but does not secure against financial risks (cash flow risks and ability to serve debt).

Ports are more affected by macroeconomic conditions, as ports may be faced with inter-port and intra-port competition - in many cases incurred by the "why"- or be suffering the results of aggressive strategies during the tendering stage, as a result of the "whatwithal". More specifically, as port concessioners' core business is port or freight transport related, their strategic interest in entry may lead to PPP agreements that are only feasible under positive macroeconomic scenarios and/or off-set by the strategic importance of securing port availability (example container port terminals). Ports are an exemplary case where market risks are in whole born by the concessioner – *whom*-, who is responsible for port business development using valuable port land in exchange for services and fees (flat and per unit of cargo handled). The public sector's (Port Authority -*who*-), principal intervention lies in trying to set the inter- and intra- port competition by defining at the tendering/bidding stage the relation between flat rate and fees per unit of cargo handled (Pallis et al, 2008). However, under unfavourable macroeconomic conditions, both the concessioner's core business and the port concession-investment suffer loses, as in the case of the current credit crunch.

Finally, market risks may also refer to strategies developed by other market players describing the so called "secondary PPP market" initiated by financial institutions seeking investment opportunities. While these activities have been identified across the PPP market segment, in the case of P4s it is a secondary source of market risks. This is because it distorts the "whom" identity and therefore, the initial ability to control risks. In the port sector such groups of players emerged the decade before the 2008 credit crunch. In conditions of secured robust traffic growth and remarkable average terminal utilisation, financial investors aggressively directed funds towards port ownership (via acquisitions), leasing, and capacity construction. Investors with little, if any, experience in the sector (e.g. Goldman Sachs, Wall Street Bank, Deutsche Bank, Prudential, AIG, Borealis (Canadian pension fund), Ontario Teachers Pension Fund, BBI), entered into ports focusing on cash flows, deal structure and financial engineering. In this case, ports became financial assets offering opportunities to leverage the financial sector (rather than vice versa), via stable volume growth and, thus, cash flows and low risk led. All these led to extreme valuations (e.g., up to 25 EBDTA) to acquire port assets, with financial investors financing almost half of the $36bn that were invested into the port sector between 2000 and 2007. Assuming risk, despite their lower embededness to local markets, this secondary market secured a comparatively riskless environment for the other actors involved. In the same manner however, once recession appeared, they proved capable to mitigate risk once more, by heavily associating the continuation of investments with the assumption of financial risks by public bodies and state bailouts.

Financial Risks

The active presence of the secondary market has further blurred the distinction between market and financial risks, making them inextricably linked. Financial risks are characterised as external to the project (e.g., taxation currency, exchange rates, debt rating of the country) related to "*where*" (country) the project is implemented, and internal (e.g., loan interest rate and payback period, grant financing, loans availability) related to "*whom*" the loan is provided. The "*what*" of the investment - and contrary to conventional wisdom – is of little importance. Blanc-Brude and Strange (2007) showed that, at the portfolio level, PPP lenders appear to price only "systematic" risks while managing other risks at the project level through contracts and project design. The cost of PPP debt is thus determined only by systematic risks, such as future market demand for a service, while project finance structures effectively shift or diversify most project-level, idiosyncratic risks, such as the risk of construction cost overruns or delays.

What is of importance is the overall financial structure, its sources and its absolute toll. In this aspect, financial risks in ports may be considered as more manageable in comparison to other transport infrastructure for the following main reasons:

- The average size of port projects is smaller than all other based on 1990-2005 WB statistics (Estache et al, 2007)
- The "Whom" as described earlier usually reflect financial significant entities, who manage the concession as part of a global portfolio. In this sense they are potentially able to absorb risks within their structured portfolio. Notably, this very important characteristic of the "whom" may indicate the importance of a classification according to the size of the portfolio managed, i.e. with respect to overall ability to absorb risk.

Finally, financial risks are influenced by market risks, political risks and the macroeconomic environment.

Environmental Risks

Environmental competent project design and impact studies are the norm in securing a project against this category of risks and a prerequisite in obtaining the respective approvals and permits. However, growing environmental concerns increase the risks of new environmental legislation which may influence operation and maintenance. Environmental risks may be seen as related to "what" and the more complex the operation the greater the risks. The "where" is also important as connected to the country and its respective national and international obligations.

Political Risks

Political risks concern government or local stakeholder actions –*where*- that affect the ability to generate earnings. These may refer to actions terminating the agreement, imposing taxes or regulations which severely reduce the value to investors; restrictions of the ability to collect tariffs etc. In many cases these could be either the result of macroeconomic influence on

political stability (example the effect of the credit crunch on many governments) or the resistance to change. Any project undertaking brings about change; the greater the change – the greater the resistance

Initial Risk Allocation

The proposed Ws contextual methodology is supported by cause and effect mapping of influence and impacts of risks within the Ws context. This, initially, allows for a qualitative approach to the risk allocation problem as within the P4 setting the party either leading or receiving the risk may be identified. The cause and effect mapping may also be used over time to identify the potential of risks changing. For demonstration purposes, general cause and effect diagrams of technical, market and financial, environmental and, finally, political risks have been constructed. Their predictions are briefly discussed.

Allocating Technical Risk

The cause and effect diagram of figure 3 reflects typical a negative impact loop. Seemingly, while the cause stems from inadequate technical requirements (as inspired by the "why" and "whatwithal", i.e. both "who" and "whom") the final impact is only reflected on "whom". Notably, the "whom" is responsible (in this setting) for the "builder" and rans the risk of increasing deficiencies. In the scenario presented, "whom" has the potential to influence demand leading to operational profits and exit declining cause and effect loop.

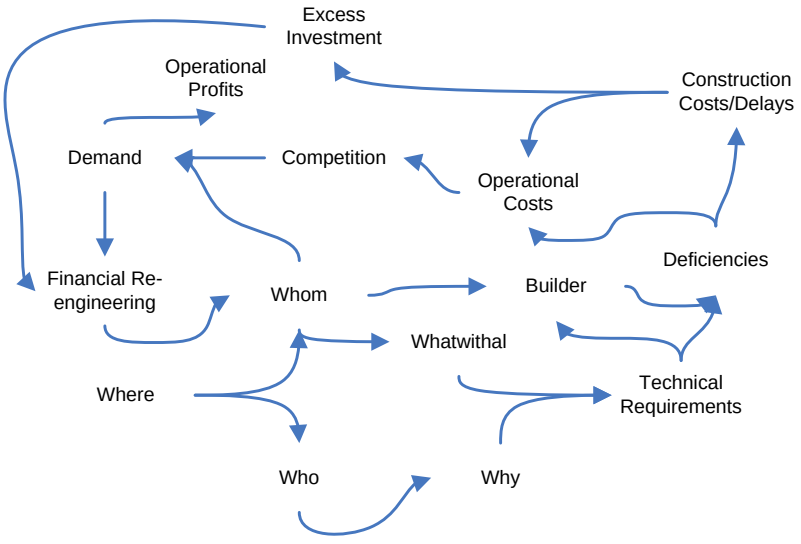


Figure 3- Technical Risks Cause and Effect Diagram

Allocating Market and Financial Risk

Agent relations are partially depicted in the cause and effect diagram of figure 4 for both positive and negative demand scenarios but illustrating the downside effects of both cases. Interestingly, in the scenarios presented both the "who" and the "whom" are effected. The "whom" can only survive the situation if he can absorb the risk, otherwise the risk has to be

absorb by the "who" (exercising step in rights). Evidently, only the "who" has the ability to reverse negative impacts by influencing financial risks, in the case that "whom" cannot absorb risks.

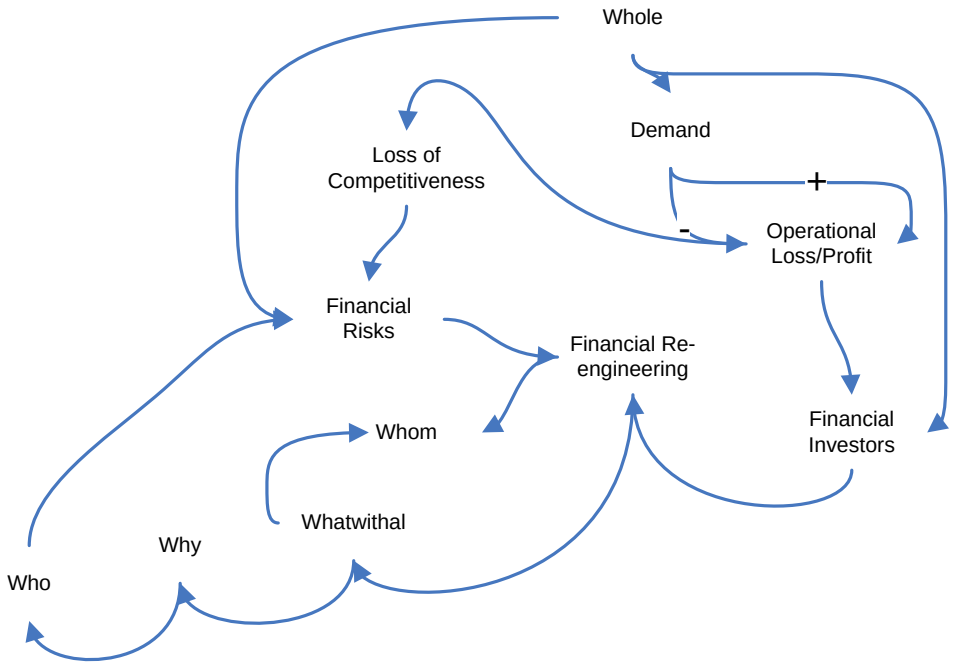


Figure 4 – Market and Financial Risks Cause and Effect Diagram

Nonetheless there are certain mechanisms that enable the leverage of risk. On the one hand, the 'whom' might have, or develop, the capabilities (i.e. long term partnerships with users) and retain company interdependencies (i.e. parental relation or long term relations with shipping lines or shippers; these are the case of $W_{32,}$ W_{33} as described in the previous section) that enable to lower the market risk assumed in any case. The public sector might also leverage this risk, either by assuming the role of cluster manager that enhances the potential of market share enhancement (De Langen, 2004), or by favouring processes that might favour the incumbent firm during further entry or market expansion considerations.

Allocating Environmental Risk

Figure 5 illustrates cause and effects as produced by the realization of environmental impacts. The diagram is based on the consideration of new legislation during the contractual period, which could not be previously foreseen. In mapping effects, it becomes obvious that all indicators point back to "who". It is noted that if legislative changes could have been foreseen than these should have been included in technical requirements and, hence, these are considered under technical risks.

Allocating Political Risk

As presented in figure 6, while political risks have a significant impact on the concessioner, his ability to influence the result is non-existent, as all is derived and returned to "who".

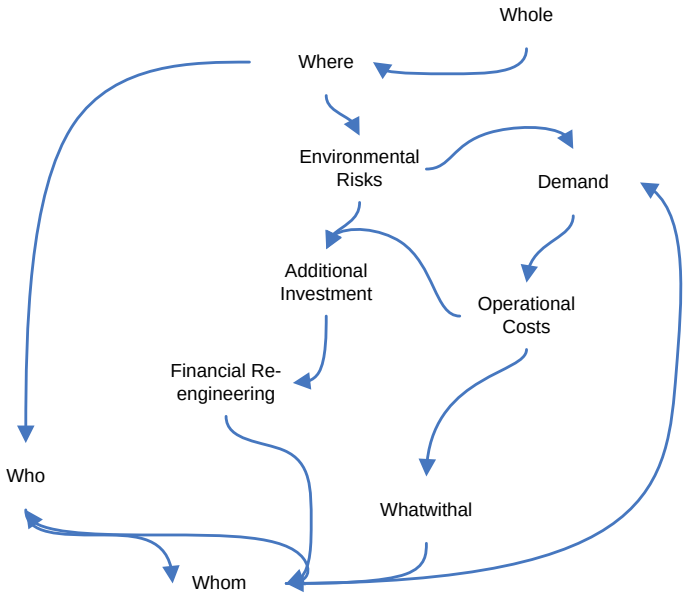


Figure 5 – Environmental Risks Cause and Effect Diagram

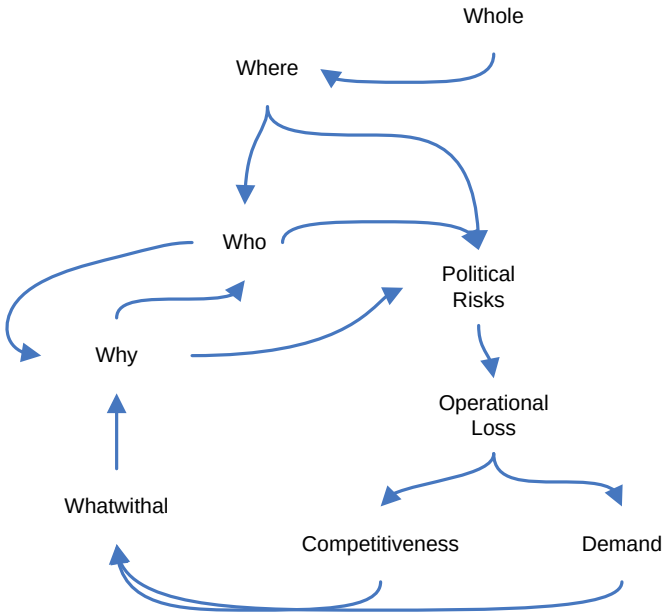


Figure 6 – Political Risks Cause and Effect Diagram

Brief Discussion

The generic risk analysis presented essentially leads to an initial risk allocation. In this “first pass”, Technical risks are better assigned to the concessioner and Political risks to the PA. However, Market, Financial and Environmental risks, while assigned where conditioned to a priori assumptions concerning the contextual Ws.

The risks mapped expressed analytically are as follows:

$$R_{Technical}(t) = f_{Technical}(W_1, W_2, W_3, W_4, W_6)$$
$$R_{Market}(t) = f_{Market}(W_1, W_2, W_3, W_4, W_9)$$
$$R_{Financial}(t) = f_{Financial}(W_1, W_2, W_3, W_4, W_9)$$
$$R_{Environmental}(t) = f_{Environmental}(W_1, W_2, W_4, W_6, W_9)$$
$$R_{Political}(t) = f_{Political}(W_1, W_3, W_4, W_6, W_9)$$

Diagrams indicated the potential impact the weighted W_3 (scope of P4) and W_4 (corporate strategy) may have. In addition, in other cases such as in the case of technical risks, the respective input of technical requirements and their possible respective deficiencies may also be a source of divergent responsibilities in face of risk. These conditions are actually addressed through the “whichway” and the “what” (see figure 2) and constitute the iteration process (second and repetitive passes) to the risk and risk allocation problem, where “constrains” to the problem are sequentially added.

For example, one implicit assumption made in the previous analysis is that the “Who” (PA) is free to partner (contract) with any “whom” depending solely on the co-linearity of W_3 and W_4, as this would maximise utility for both “who” and ‘whom”. However, this is not the case. A pan-European survey concludes that in half cases PAs develop P-4s in line with guidelines or general framework offered by regional/national government and applied to ports only, in 26% of the cases the framework is strict, thus the ‘public party’ is another level of government, and in 21% of the cases they follow the general rules governing PPPs in the economy (ESPO-ITMMA, 2007). Models imposed by government clarify the strategic intent of government and the anticipated outcome (varying from solely non-economic objectives, to strictly economic objectives a mixture of both), to be matched by the imposed model to.

Therefore, the second pass concentrates on the influence of total risk allocation. A further discussion of the methodology and its application at this stage is not possible, as stated initially and supported through the proposed Ws contextual Risk Analysis framework, risks are project specific and as described in the previous section, each W may take many forms or be described by a weighted average which is, once, again project and context specific.

Finally, the contextual approach and mapping the significance of the combined output of the respective agent strategies expressed as “why” and “whatwithal” in the Ws framework.

CONCLUSIONS AND FURTHER RESEARCH

The importance of the contextual setting in analysing risks and identifying appropriate risk allocation has been assumed as the basis for a proposed extended Ws Framework for the analysis of risks within the setting of generic Port Public Private Partnerships (P4s).

The contextual analysis of the structures of the P4 itself, the actors involved, the broader strategies that these actors might pursue, and the interactions between all these, details the

variables at play as regards the extent and volatility of certain types risk that might occur over the life of the P4. This enables a risk analysis beyond the simple description of potential risks, i.e. one focusing on how and in which way the various Ws affect each risk considered. This approach works towards a realistic allocation of risks considering the setting within which risks may demonstrate. Cause and Effect diagrams support the contextual Ws framework to map the influence and impacts of risks within the proposed generic setting.

The general demonstration of the model indicated, as an initial conclusion the significance of the combined outcome of agent strategies with respect the port location and concessioning parameters on the allocation of risks.

The methodology may be used to identify the evolution of risks through the project and P4 agreement life cycle and may be used in the ex-ante and ex-post evaluation of risk allocation in P4s and in the preparation of a system's dynamic framework in addressing risk allocation over time in P4s. This constitutes further research.

As a guiding tool the Ws Risk Analysis Framework may assist both public and private sector parties faced with the risk analysis and risk allocation problem to systematically and holistically address it and estimate future impacts.

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