SYSTEMIC TRANSFORMATIVE ADAPTATION IN PROCUREMENT RISK MANAGEMENT OF RAIL TRANSPORT INFRASTRUCTURE MEGAPROJECTS

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The socioeconomic impacts of the Covid-19 pandemic are likely to increase further across economies. There is increasing apprehension on the status of rail transport infrastructure megaprojects which are already complex and face many uncertainties and it is imperative to initiate a restoration coupled with support to be implemented in a timely manner. Investors continue to invest in rail megaprojects that run high risks of being over-scheduled and over-budgeted, which has raised the need to improve rail megaporjects and their investments in order to establish the economic base of any society. Hence it is vital to analyse the systemic risks in rail megaprojects given their complexity and uncertainty towards developing an efficient risk management framework. To improve the performance of the procurement of rail megaprojects, the present study conducts a detailed literature review to explore the key procurement risk indicators and critical success factors for public procurement of rail megaprojects. The key findings are used to develop an integrated approach towards a systemic transformative adaptation to enable the effective incorporation of the procurement risk management process into the planning and decision-making of rail megaprojects in the UK. This study develops a conceptual framework that indicates that one of the most critical enablers of improvement in the performance of procurement of rail megaprojects is by enabling a collaborative approach. This is a unique study that presents key procurement risk indicators and critical success factors to derive sustainability based enablers to improve the performance of the procurement process of rail megaprojects.

Keywords: collaboration, complexity, pandemic, procurement risk, rail transport infrastructure megaprojects, systemic risk, uncertainty.

INTRODUCTION

Urban Infrastructure systems are complex and expensive megaprojects that often involve social, technical, institutional, economic and environmental challenges to their management. Despite these challenges, project sponsors and investors invest huge amounts of money in megaprojects that run high risks of cost and time overruns. Though some schedule and cost risks are reflected within project scheduling, the challenges of modelling interactions of risks and their effects on project implementation still remain. Urban infrastructure megaprojects are essential to the socio-economic development of a nation. The demand for infrastructure is increasing with the rapid pace of globalisation and urbanisation. (Bhattacharya and Romani 2013). Consequently, there is increasing apprehension about the status of infrastructure megaprojects and their contribution to the economic growth of all countries, and the need to improve infrastructure to establish the economic base of society. However, better quality infrastructure involves substantial amounts of resources for the planning, construction, operations and maintenance.

BACKGROUND AND RATIONALE

Construction, like many other industries is a free-enterprise system, and has sizeable risks built into its structure (Guo et al. 2014). From the initiation to the closing stages, the construction process, especially that for megaproject development, is complex and characterised by a number of uncertainties that can influence the project negatively from feasibility through to the commissioning stages (Flyvbjerg et al. 2003). Many megaprojects fail to achieve their time, cost and quality goals (Brookes 2015) due to a lack of accurate assessment and timely control of risk associated with STEEP issues.

Transport Infrastructure Megaprojects

A holistic strategy towards an appropriate risk management process is vital for successful delivery of large and complex projects, such as highways, tunnels, bridges and aviation projects. Evidence suggests that such megaprojects are usually money pits where funds are simply ‘swallowed up’ without delivering sufficient returns as a result of unbalanced subjective beliefs and information in assessing risks and uncertainties, and not taking corrective actions to control and manage the identified risks (Boateng et al. 2015). Poole (2004) asserts that the track record of transportation infrastructure industry is terrible during development. For example, in Flyvbjerg et al. (2003b), as many as 258 highway and rail projects ($90 billion worth) in 20 countries did not perform well on budgets as estimated. Flyvbjerg et al. (2003b) revealed that nearly all (90%) of these projects suffered cost overruns, with the average rail project costing 45% more than what was projected, while it was over 20% on average for highway projects.

Risk Management Process in Transport Infrastructure Megaprojects

The study of risk management in urban infrastructure megaprojects is validated by the rising concern being established in them as a research area because of their unique attributes (Fiori & Kovaka 2005); the vital role that risk management plays in the implementation of megaprojects (Dimitriou, Ward, & Wright 2013); the need to focus on all types of risks to take a more holistic view (Lehtiranta 2014); the growing development in number and value of megaprojects (Flyvbjerg 2014); besides the heterogeneity identified in current literature on megaprojects, which do not appear to implement a framework that is dissimilar to small-scale projects. Complexities and uncertainties are integral parts of infrastructure megaprojects. With the intensification of globalisation trends, the significance of managing complexities cannot be overstated for the success of megaprojects. Regardless of its high significance to the success of infrastructure megaprojects, risk management is one of the least established research concerns, despite its wider discussion on small- and medium-scale construction projects. Risk management of infrastructure megaprojects involves systematic processes of planning, identifying, analysing, responding, monitoring and controlling of project risks (Dey 2012). While numerous studies have focused on infrastructure and financing as separate issues, no single investigation covers the holistic view of risk management in the planning and implementation of megaprojects. To address this gap, this research aims to cover the risk management process of procurement from a holistic perspective, by identifying and assessing the state of the art in systemic nature of risk management in the planning and implementation of infrastructure megaprojects.

RESEARCH AIM

The aim of this study is to develop an integrated approach to a systemic transformative adaptation to enable the Procurement Risk Management process towards urban economic resilience to address the pandemic's uncertainties and future shocks for effective incorporation into the planning and decision-making of Rail Transport megaprojects in the UK to build resilient and sustainable urban infrastructure systems.

Research Outcome

The proposed risk decision-making framework as the outcome of the research incorporates systemic risk management process of procurement and their effective incorporation into the planning and decision-making of Rail Transport megaprojects. It would assist the project teams of megaprojects to develop their understanding of the risks in the Procurement with their interactions, leading to effective and efficient decision-making in Rail Transport megaproject development. The efficient use of the new integrated framework will eventually benefit the stakeholders by saving them time and money from construction delays.

Nature and Scope of Proposed Framework

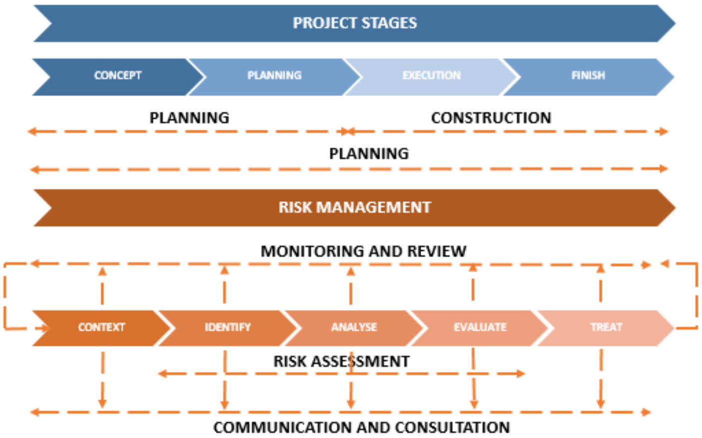

Figure 1: Conceptual Framework of Risk Management Process (Authors)

The objective of this research is to create a framework to identify and model the factors from the project's external environment that contribute to risk in the development of such projects. The risks considered include those from social, technical, economic, environmental and political (STEEP) problems in Rail megaprojects. Following data obtained from the literature, semi-structured interviews and the administration of survey questionnaires, this proposed risk decision making model will be developed for Procurement Risk Management of UK Rail Megaprojects. STEEP complexity is not a discrete characteristic, but can be defined along a continuum which ranges from very simple to extremely complex. As complexity is relative and a function of current intellectual manageability, which is evolving as new tools and techniques are developed (Leveson 2000). Owing to limitations of space, only the review of the literature is presented in this paper.

LITERATURE REVIEW

Characteristics of Transport Infrastructure Megaprojects

Megaprojects are inherently risky due to long planning horizons and complex interfaces (Flyvbjerg 2006). Decision-making, planning, and management are typically multi-actor processes involving multiple stakeholders, public and private, with conflicting interests (Aaltonen and Kujala 2010). Technology and designs are often non-standard, leading to "uniqueness bias" amongst planners and managers, who tend to see their projects as singular, which impedes learning from other projects. Frequently, there is over-commitment to a certain project concept at an early stage, resulting in “lock-in” or “capture,” leaving alternatives analysis weak or absent, and leading to escalated commitment in later stages. "Fail fast" does not apply; "fail slow" does (Cantarelli et al. 2010). Due to the large sums of money involved, principal-agent problems and rent-seeking behavior are common, as is optimism bias (Flyvbjerg el al. 2009). The project scope or ambition level will typically change significantly over time. Delivery is a high-risk, stochastic activity, with overexposure to so-called "black swans," i.e., extreme events with massively negative outcomes (Taleb 2010). Managers tend to ignore this, treating projects as if they exist largely in a deterministic Newtonian world of cause, effect, and control. Statistical evidence shows that such complexity and unplanned events are often unaccounted for, leaving budget and time contingencies inadequate. As a consequence, misinformation about costs, schedules, benefits, and risks is the norm throughout project development and decision-making that undermine project viability during project implementation and operations (Flyvbjerg 2014).

Procurement Strategy for Rail Megaprojects

Procurement

Procurement is the process of finding, agreeing terms, and acquiring goods, services, or works from an external source, often via a tendering or competitive bidding process (Laffont & Tirole 1993). The process is used to ensure the buyer receives goods, services, or works at the best possible price, when aspects such as quality, quantity, time, and location are compared (Weele 2010).

Collaborative Procurement

Traditionally, procurement strategies involve competitive tendering based on detailed and strict contracts and subsequent control and surveillance. Recent studies, however, advocate that complex infrastructure projects need new types of management practices, promoting a more flexible way to deal with change by collaborative teams rather than strict planning and control (Gransberg et al. 2013). Some non-traditional strategies focus on client–contractor collaboration (Bresnen and Marshall 2002), while others emphasise supply chain collaboration and integration by performance-based delivery models that may also comprise maintenance and financing (Lenferink et al. 2012). Although such procurement strategies are not new to some countries and industry segments, infrastructure clients in many European countries have been slow to adopt such non-traditional practices (Eriksson et al. 2017a).

Collaborative Procurement has within the public sector already managed to deliver considerable financial savings, improved working practices and allowed the realisation of cashable savings providing much needed financial resources for improving public services or works. With the current efficiency targets set by central government to all departments, clients need to consider the adoption of best practice that will deliver the targets. Current guidance from the Office of Government Commerce (OGC) and other government agencies actively promotes to take up Collaborative Procurement to realise the proven benefits that exist in adopting this approach. This sets a challenge to all clients within the industry to deliver significant cost savings through demand aggregation that gives due consideration to shared expertise, knowledge and information, improved planning and ways of working. True cost savings can be achieved in advance of any works being completed through the optimisation of available resources where the duplication of effort is minimised (CIPS-CE 2009).

Classification of Risks in Transportation Megaprojects

The objectives of this research seek to classify and illustrate all major procurement risks of the fractional or holistic set of social, technical, economic, environmental and political (STEEP) risks for rail megaprojects and the significant issues relating to their performance during planning and implementation.

Social Risks

The wide range of stakeholders involved in transport megaprojects are likely to have inconsistent interests, which should be identified and carefully governed as part of the engagement process. Besides, increasing degrees of interaction of social risks with other STEEP factors would in turn generate collateral effects via spreading and cascading failures within project interrelated subsystems (Boateng et al. 2012). The involvement of project investors to resolute changes to company policies, the change requests from customers and suppliers, and grievances from employees and other external stakeholders from the civil society, NGOs, local business owners and others may result to social risk (Kytle and Ruggie 2005).

Technical Risks

Tatum (1987) defined construction technical risks as risks associated to the combination of construction methods, construction resources, work tasks, and project influences that define the manner of performing a construction operation to “unaccomplished desired aim necessary for human sustenance and comfort” (Shin et al. 1989). However, because of rapid advances in new technologies which cause new problems to engineers and contractors, technological risk has become greater in many instances (Dvir 2005). Klein and Cork (1998) concluded that the designs may have to be modified after construction has begun because construction procedures may not have been fully anticipated. Complexity, uncertainty and ambiguity associated with megaproject requirements influence the difficulty of managing such large infrastructure projects. Flyvbjerg (2009) stated that project promoters appear to be particularly prone to cost underestimation. However, Shin et al. (1989) emphasised the need to manage technical risks.

Economic Risks

Economic risks for megaproject development are mostly risks of project finance that evolve during the project delivery (Baloi and Price 2003). Capital costs of projects are also influenced by fluctuations in the exchange rates of foreign currencies against the dollar, inflation, and many other financial and economic factors such as tariffs and fiscal policies (Chen et al. 2004). The term Project Financing refers to a wide range of financing structures where the provision of funds is not primarily dependent upon credit support of the sponsors or the value of the project’s physical assets but on project’s capacity to service the debt and provide an equity return to the sponsors through its cash flows (Wang et al. 2000). A successful economic structure for megaprojects entails a balanced allocation of project risks (Kapila and Hendrickson 2001).

Environmental Risks

‘Environmental risks are risks to the natural health and productivity of environmental systems and risks to human health stemming from alteration and/or degradation of environmental systems’ (Lerche & Glaesser 2006). These risks include extreme natural disasters and socioeconomic consequences (Chen et al. 2011). According to Chen et al. (2000), dust, harmful gases, noise, solid and liquid wastes, fallen objects, and ground movements are types of pollution and/or hazards sources from construction activities which impact on the environment. Failure to mitigate these risks can result in further potential occupational health and safety risks, primarily in the areas of erosion, permanent loss of wild life, community severances, increased accidents, and destruction of indigenous lifestyles (Chau 1995).

Political Risks
Political risks may result from interactions between government and the neighbouring environment or society. According to Kettis (2004) political risk is difficult to clarify due to the fact that it is a phenomenon present in the interface between an organisation and a political environment and involves concepts of risk, uncertainty, political sources and political environments. At a general level political risk is 'an implicitly unwanted political activity' (De-Mortanges and Aller 1996) and has been classified under two categories: risks arising from government action and risks arising from government and societal events. In several cases there is an inclination to emphasise the measureable features and retain the subjective political data for decision making outside of the case.

Process of Risk Management

ISO 31000 has defined risk management as the central part of the strategic management of any organisation. The BS 31100:2011 recognizes the risk management process as "an essential part of good management" and defines it as the "effect of uncertainty upon objectives". Risk management is the "coordinated activities to direct and control an organization with regard to risk".

Concept of Systemic Risks

Definition of Systemic Risks
Systemic risk refers to the risk or probability of breakdowns in an entire system, as opposed to breakdowns in individual parts or components, and is evidenced by co-movements (correlation) among most or all the parts (Kaufman and Scott 2003). These risks lead to many uncertainties in the urban infrastructure economics, however if the risks are identified and recognised, then the rate of loss can be reduced.

Systems approach
Large public projects for example usually take several years from conception to eventual project completion, making predictability rather challenging. However, even though risk and uncertainty seems to pervade the construction industry, all too often, they are either ignored or dealt with in a completely arbitrary manner using rules-of-thumb or contingency funds (Ahiaga-Dagbui & Smith 2014b). Project risk matrixes or registered have also been extensively used to identify or quantify risk. Yet, these do not account for the interactions or dynamics between risk factors. The crucial skill in risk management is not to be able to list or rank different factors as though they were stand-alone, but to be able to see the connections and dynamics between these various factors. Ackermann et al (2007) suggest that different risks occurring at the same time, example, could form a portfolio where the impact of the whole is greater than the sum of the parts. Boateng et al. (2013) found the inability of project managers to assess risk dynamically in large projects are mostly a major cause of cost and time underperformance of megaproject construction. The aim of this research, therefore, is to assess the dynamics of key economic risks on large Rail Transport infrastructure projects.

Systemic Risk Management
The management of infrastructure megaprojects due to their social, technical, economic, environmental and political nature of the infrastructure system and owing to

new tendencies in its improvement caused by external stimuli, such as, globalisation, privatisation and liberalisation, is constantly recognised by challenges of complexities and uncertainties that emerge from these stimuli. Frequently such challenges are managed traditionally through a “reductionistic” approach which inclines to perceive issues as unidirectional cause and effect relationships. Planners (Goodman and Hastak 2006) have proposed the requirement for concepts of systems thinking and a holistic approach to planning and implementation on transport infrastructure megaprojects.

Systems thinking is a methodological outline for understanding complexity and uncertainty, which is based on the System Dynamics approach developed by Forrester during the 1950’s by applying feedback control theory to simulation models of organizations (Forrester 2003). Hence, by modelling the simple structure of a system in order to depict the actions that the system creates, Systems Theory logically endeavours to deal with complexities and uncertainties caused by it. In this hypothesis it is frequently assumed that it is likely to give evident, quantitative cause-and-effect interactions. Recognising all these interactions accurately and unequivocally is the way to understanding complex systems.

Decision-making in Performance of Megaprojects

Planning a megaproject is not only about making a rigorous step-by-step plan. There are risks, contingencies, and irreducible uncertainties that can become disastrous when ignored. Planning is a science of navigation in which there is a balance between opening and closing a process and the content, between the certain and the uncertain, the simple and the complex. Planning a megaproject needs a responsive, adaptively designed decision-making and planning process that does justice to the uncertainty and complexity of the project and its context. When simplification of the process is impossible, the reduction of complexity can introduce a lot of uncertainty. One has to navigate constellations of actors, oceans of uncertainty, and archipelagos of complexity, and for that a project process has to be designed to take into consideration issues of strategic ambiguity, redundancy, in order to build in adaptive capacity (Giezen 2013).

The linking of the two key analytical concepts, strategic capacity and adaptive capacity within the planning process of megaprojects are derived from the observation that policy makers and planners have a tendency to close or simplify the process in order to keep out complexity and uncertainty. This affects the process and content framing of a megaproject. Adaptive capacity categorizes the types of adaptations or nonadaptations that are made to the organisation and scope of megaprojects and relates them to changes in a project and its context. Strategic capacity focuses on the strategic organisation of the decision-making process and looks at issues such as ambiguity, redundancy and resilience (Giezen 2013). The basic principles in project decision-making that may serve as a strategic frame of reference for the more focused decisions are defined as three hypotheses (Giezen 2012):

1. A strategic ambiguity of project mission is needed to create a productive interaction between moments of strategic reflection and moments of hedging and closing the process, instead of tunnelling decision-making towards pre-determined outcomes. Thus, throughout unfolding decision-making process, different outcomes of negotiations may be found under the changing conditions and different contexts.
2. A certain redundancy of knowledge and actor constellation is needed to enable innovative outcomes (via recombination of solutions) in the

operational lines of decision-making that face emergent uncertainties. Screening decisions off from external ideas and opposition would limit the capacity to generate added value to the project.

3. A balance has to be found between adaptive and reactive resilience. Within the decision-making process the project should be deliberately designed to estimate potential adaptations should the context change and at the same time it should be able to prevail when changes threaten its survival.

Where adaptive capacity looks at tactics to deal with complexity and uncertainty, strategic capacity shows what is required to plan and prepare for these eventualities. By exploring the relationship between the two concepts in the different cases, the decision-making and planning process can be organised, in such a way that it is able to deal adequately with the uncertainties and complexities that come with megaprojects (Giezen 2013).

The Triple Bottom Line and the Systemic Approach

Though Sustainability has been the apple of the eyes of the major infrastructure projects in recent years, a corresponding improvement in socioenvironmental, socioeconomic, global, national or even regional parameters has not yet been observed. In fact, as one looks more closely at the initiatives taken, considering the process and project life cycle as well as its externalities, one sees that most acclaimed sustainability actions fall into the prism of green marketing, with little or nothing actually adding to the social and environmental improvement (Laufer 2003). The main cause for this difficulty is how to approach sustainability in the context of the interests of major infrastructure projects. Currently, there are two different ways to address sustainability issues: the Triple Bottom Line (TBL) and Systemic. This section presents the similarities and differences between them and with some clarifications to eliminate confusion between the two concepts.

The Triple Bottom Line

We have different definitions to explain sustainability such as the company's ability to stay competitive (CEO), employee satisfaction in the workplace (HR), financial health of the company, corporate governance (Financial) and compliance with environmental standards to meet stakeholder interests (Environment), and with different views with different opinions on sustainability. The main reason for such a variety of approaches lies in what is known as the Triple Bottom Line, proposed in 1994 by the British consultant John Elkington, and practised since then in many organisations which rely on three different areas: Social and Environmental Responsibility and Profitability, also known as 3Ps, People, Planet, Profit (Figure 2).

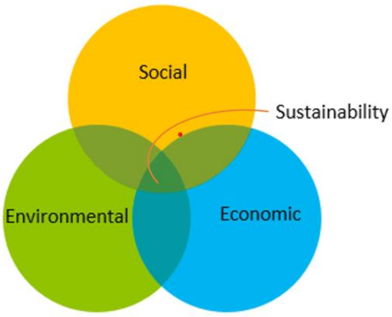

Figure 2: Interaction of spheres according to TBL (Authors)

The lack of multidisciplinary and transdisciplinary education (resulting from specializations in sustainability), as well as the complexity of the systemic approach, makes the TBL a model to be followed, and summarized the performance of the company's sustainability professionals to the analysis boundary of the economic, social and environmental criteria, as a framework for the determination of corporate sustainability (Laufer 2003).

The basis for determining the sustainability of each sphere, and as a consequence of the company, lies in the concept of "what you measure is what you get", according to which the level of responsibility of a company. In a given sphere depends exclusively on how much it is able to measure a given parameter, whether in its economic, social or environmental (Perrini & Tencati 2006). Thus, sustainability is achieved only when the three spheres overlap at the equilibrium point (Figure 2).

The need for this overlap is that TBL is not used when trying to systemically evaluate a particular problem. The overlapping view of the three spheres is in the holistic view context, but not in the systemic view. There are three criticisms of this approach based of its conceptual framework.

1. The first involves the "what you measure is what you get" which determines that it is necessary to measure the impact of a company to determine its sustainability. The obvious shortcoming of this approach is to ignore that in the social and environmental spheres what can be measured is a fraction of a total whose largest component is intangible (Perrini & Tencati 2006) and as a result, the economic sphere will always be more represented than the others (Milne & Gray 2013).
2. The second criticism is the lack of systemic vision of the issue of sustainability, providing a rigid structure of analysis that does not allow a correct integration between spheres, besides leaving ecological issue aside. (Milne & Gray 2013).
3. The third criticism lies in the fact that the concept of working in three distinct spheres does not realistically represent the complex interactions involved in them and their existing dependency relationships (De Giovanni 2012).
4. The fourth criticism, as a consequence of first one, is the presentation and socio-environmental results derived from internal activities, such as water saving, emission reduction (a popular point for companies in detriment of their other environmental impacts) and (on the social issue) integration of employees on the basis of race and gender. It is obvious from an analysis of its corporate sustainability reports that it does not have the same concern about what happens outside the TBL overlap zone, i.e. corporation borders(Isaksson & Steimle 2009).

Although the vision of the three components working together as a holistic view, ignoring the intangible issues and considering sustainability as the interposition of three distinct spheres, it is not possible to consider TBL in any way within the scope or as part of the systemic approach.

The Systemic Approach

The systemic approach is based on the theory of complex systems to analyse sustainability issues (De Giovanni 2012) and although it is also a holistic view, it is also holistic approach, i.e. it is not enough to know what factors are involved in the problematic, it is necessary to know how they are involved and interacting, regardless of the form of their measurement (Puccia & Levins 2013). A practical way to understand these interrelationships is presented in Figure 3, in which one can observe how the systemic approach deals with the structure of environment, society, and economy (Perrini and & 2006).

The first point to be observed is the distinction between the hierarchical concept structure of the economy, society and the environment. While the TBL considers them to be distinct, the systemic approach correctly hierarchises them, considering the dynamic interrelationships between the three spheres, so, as we observe in reality, the social dimension cannot exist outside the environmental as well as the economic cannot exist outside of the social system (Sridhar & Jones 2013). This analysis becomes obvious when we consider that there are still traditional societies that have no form of economic organisation (Milne & Gray 2013), just as there are environments without the existence of any human society.

The second point is that the systemic approach, as represented by arrows, correctly identifies not only the constant relations of interdependence but also the positive or negative feedback loops involved as well the permeability between the three components (Figure 4), (Isaksson & Steimle 2009).

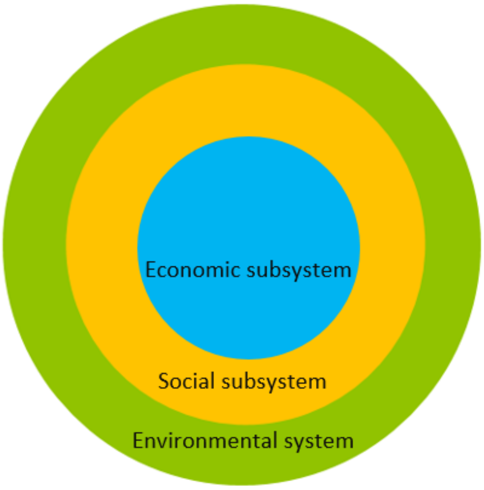

Figure 3: Relationship between economy, society and the environment according to the systemic approach (Authors)

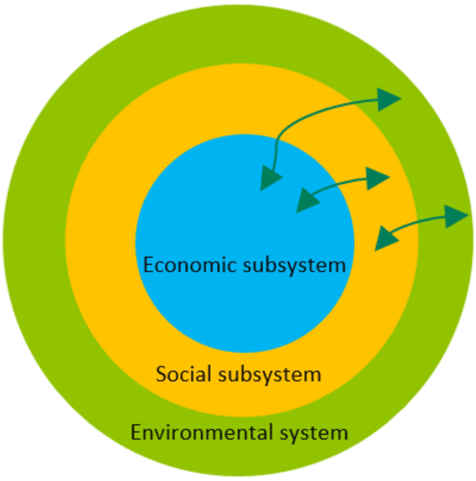

Figure 4: Dynamics of interrelationships and feedbacks between the economy, society and the environment (Authors)

In this way, it is possible to establish that the TBL approach, considering the spheres limiting the company's response to what can be measured, results in the incorrect understanding of the real scope of the corporate action with regard to sustainability. In addition, when the spheres are correctly organised by hierarchy level, it is evident in their pyramidal structure that all sustainability proposals are based (and derived from) environmental sustainability. Without it, the search for the others becomes obviously irrelevant (Sridhar & Jones 2013). As stated, it is also fundamental to understand that although both approaches represent a holistic view (this being the only similarity between them), the holistic view is not synonymous with systemic vision.

CONCLUSION AND RECOMMENDATIONS

The systematic literature review identifies that procurement risk management of medium and small-scale projects has been the subject of research on various measures, yet this research is considerably narrowed while studying just those analyses that concentrate on rail infrastructure megaprojects and an integrated approach to achieve efficiency in the project performance by mitigating the cost and time overruns through an integrated systemic approach. This continues to be a part of research still being developed and into further development. Regardless of the extent of research in this realm has been escalating recently, the ideas such as complexity, uncertainty, governance, stakeholders and sustainability, associated with procurement risk management necessitate further research.

The fundamental concept of this research is to provide the project teams of project managers, consultants, engineers and other project stakeholders engaged in megaproject development, an opportunity to have a clear understanding of the expected competencies of them to produce outstanding decision-making procedures during procurement risk management of rail megaprojects. The outcome of this research will have implications for stakeholders and in turn to society involved in rail megaproject development. This will be realised by providing the project stakeholders with a decision-making framework for procurement risk management, upon which a diverse range of social, technical, economic, environmental and political issues influencing the procurement risk management strategies can be tested before implementation.

REFERENCES

Aaltonen, K. and Kujala, J. (2010) A Project Lifecycle Perspective on Stakeholder Influence Strategies in Global Projects. Scandinavian Journal of Management, 26, 381-397.

Ahiaga-Dagbui, D D and Smith, S D (2014b) Dealing with construction cost overruns using data mining. Construction Management and Economics, 32(7-8), 628-94.

Ackermann, F, Eden, C, Williams, T and Howick, S (2007) Systemic risk assessment: a case study. Journal of the Operational Research Society, 58(1), 39-51.

Baloi, D. and Price, A.D.F. (2003) 'Modeling global risk factors affecting construction cost performance', International Journal of Project Management, Vol. 21(4), 261–269.

Bhattacharya A and M Romani (2013), 'Meeting the Financing Challenge for Sustainable Infrastructure', Paper for the Global Green Growth Summit 2013 'The Future of Green Growth: Finance, Innovation and Policy', Incheon City, 10-11 June.

Boateng, P., Chen, Z., Ogunlana, S., 2012. A conceptual system dynamic model to describe the impacts of critical weather conditions in megaproject construction. J. Constr. Project Manag. Innov. 2, 208–224.

Boateng, P., Chen, Z., Ogunlana, S., Ikediashi, D. (2013) A system dynamics approach to risks description in megaprojects development. Organ. Technol. Manag. Constr. 4.

Boateng, P., Chen, Z., Ogunlana, S.O. (2015) An Analytical Network Process model for risks prioritisation in megaprojects, International Journal of Project Management, Volume 33, Issue 8, November 2015, Pages 1795-1811.

Bresnen M and Marshall N (2002) The engineering or evolution of cooperation? A tale of two partnering projects. International Journal of Project Management 20(7): 497–505.

Brookes, N., 2015. The Greater Gabbard Wind Farm. A Megaproject case study.

BSI, (2011) BS 31100:2011-Risk management-Code of Practice and Guidance for the Implementation of BS ISO 31000. London: British Standards Institute.

Cantarelli, C. C., Flyvbjerg, B. van Wee, B., Molin, E.J.E. (2010) Lock-in and Its Influence on the Project Performance of Large-Scale Transportation Infrastructure Projects: Investigating the Way in Which Lock-in Can Emerge and Affect Cost Overruns, Environment and Planning B: Planning and Design, vol. 37, pp. 792-807.

Chau, K. C. (1995) ‘The 3 Gorges Project of China - Resettlement Prospects and problems’, Ambio, 24(2) 98-102.

Chen, Z., Li, H. and Wong, C.T.C. (2000) ‘Environmental management of urban construction projects in China’, Journal of Construction Engineering and Management, 126(4) 320-324.

Chen, H., Hao, G., Poon, S.W. and Ng, F.F. (2004) ‘Cost Risk Management in West Rail Project of Hong Kong’, 2004 AACE International Transactions.

Chen, Z., Li, H., Hong, R., Xu, Q. and Hong, J. (2011) ‘Total environmental risk assessment for international hub airport projects’, International Journal of Project Management, 29(7) 856-866.

CIPS-CE, Collaborative Procurement (2009), Construction Excellence in the Built Environment, www.constructingexcellence.org.uk.

De Giovanni P (2012), Do internal and external environmental management contribute to the triple bottom line? International Journal of Operations & Production Management; 32(3):265-90.

De-Mortanges, C. and Allers, V. (1996) ‘Political risk assessment: theory and the experience of Dutch corporations’, International Business Review, 5(3): 303-318.

Dey, P. K. (2012), Project risk management using multiple criteria decision-making technique and decision tree analysis: A case study of indian oil refinery. Production Planning & Control, 23(12), 903-921.

Dimitriou, H. T., Ward, E. J., & Wright, P. G. (2013). Mega transport projects—Beyond the “iron triangle:” Findings from the OMEGA research programme. Progress in Planning, 86, 1–43.

Dvir, D. (2005) ‘Transferring projects to their final users: the effect of planning and preparations for commissioning on project success’, International Journal for Project Management; 23(4), 257–265.

Eriksson PE, Lingegård S, Borg L and Nyström J (2017a) Procurement of railway infrastructure projects – a European benchmarking study. Civil Engineering Journal 3(4): 199–213.

Fiori, C., & Kovaka, M. (2005). Defining megaprojects: Learning from construction at the edge of experience. In Construction Research Congress 2005 (pp. 1–10).

Flyvbjerg, B., Bruzelius, N. and Rothengatter, W. (2003) Megaprojects and risk. Cambridge University Press, Cambridge.

Flyvbjerg, B., Skamris Holm, M.K., and Buhl, S.L. (2003b) ‘How Common and How Large Are Cost Overruns in Transport Infrastructure Projects?’, Transport Reviews, 23(1), pp. 71-88

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. Qualitative Inquiry, 12, 219-245.

Flyvbjerg, B., Garbuio, M., & Lovallo, D. (2009). Delusion and Deception in Large Infrastructure Projects: Two Models for Explaining and Preventing Executive Disaster. California Management Review, 51, 170-193.

Flyvbjerg, B. (2009) Survival of the unfittest: why the worst infrastructure gets built—and what we can do about it. Oxf. Rev. Econ. Policy 25, 344–367.

Flyvbjerg, B. (2014) What You Should Know about Megaprojects and Why: An Overview, Project Management Journal, vol. 45, no. 2, April-May, pp. 6-19.

Forrester, J. W. (2003), "Dynamic models of economic systems and industrial organizations (archive paper from 1956)," System Dynamics Review, 19 (4), 331-45.

Giezen, M. (2012). Keeping it simple? A case study into the advantages and disadvantages of reducing complexity in mega project planning. International Journal of Project Management, 30(7), 781–790.

Giezen, M. (2013). Adaptive and Strategic Capacity: Navigating Megaprojects through Uncertainty and Complexity. Environment and Planning B: Planning and Design, 40(4), 723–741.

Goodman, A. and Hastak, M. (2006). Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw-Hill, USA.

Gransberg D, Shane J, Strong K and Lopez del Puerto C (2013) Project complexity mapping in five dimensions for complex transportation projects. Journal of Management in Engineering 29(4): 316–326.

Guo, F., Chang-Richards, Y., Wilkinson, S., Li, T.C. (2014), Effects of project governance structures on the management of risks in major infrastructure projects: a comparative analysis. Int. J. Proj. Manag. 32, 815–826.

Isaksson R, Steimle U (2009), What does GRI-reporting tell us about corporate sustainability?, The TQM Journal; 21(2):168-81.

ISO, (2009) BS/ISO31000:2009 - Risk Management Principles and Guidelines, International Organization for Standardization.

Kapila, P., and Hendrickson, C. (2001) ‘Exchange rate risk management in international construction ventures’, J. Manage., Eng., 17(4), 186–191.

Kaufman G.G. and Scott K.E. (2003), The Independent Review, v. VII, n. 3, Winter 2003, ISSN 1086-1653, Copyright © 2003, pp. 371– 391.

Kettis, M. (2004) ‘The Challenge of Political Risk Exploring the Political Risk Management of Swedish Multinational Corporations’, Department of Political Science, Stockholm University, Stockholm Studies in Politics.

Klein, J. H, Cork, R.B. (1998) ‘An approach to technical risk assessment’, Int. J Proj Manage; 16(6):345–351.

Kytle, B., and Ruggie G.J. (2005) ‘Corporate Social Responsibility as Risk Management, A Model for Multinationals’. Corporate Social Responsibility Initiative Working Paper No. 10, Cambridge, MA: John F. Kennedy School of Government, Harvard University.

Laffont, J.J. and Tirole, J. (1993) A theory of incentives in procurement and regulation. MIT press.

Laufer WS (2003), Social accountability and corporate greenwashing. Journal of business ethics; 43(3):253-61.

Lehtiranta, L. (2014). Risk perceptions and approaches in multi-organizations: A research review 2000–2012. International Journal of Project Management, 32(4), 640–653. doi:10.1016/j.ijproman.2013.09.002 Little, R. G. (2011).

Lenferink S, Arts J, Tillema T, van Valkenburg M and Nijsten R (2012) Early contractor involvement in Dutch infrastructure development: initial experiences with parallel procedures for planning and procurement. Journal of Public Procurement 12(1): 1–42.

Lerche,I. & Glaesser,W. (2006) Environmental Risk Assessment:Quantitative Measures, Anthropogenic Influences, Human Impact Springer Berlin Heidelberg Ltd: US.

Leveson, N. G. (2000). "Intent Specifications: An Approach to Building Human-Centered Specifications." IEEE Transactions on Software Engineering.

Milne MJ, Gray R (2013), W(h)ither ecology? The triple bottom line, the global reporting initiative, and corporate sustainability reporting. Journal of business ethics; 118(1):13-29.

Perrini F, Tencati A (2006) Sustainability and stakeholder management: the need for new corporate performance evaluation and reporting systems. Business Strategy and the Environment; 15(5):296-308.

Poole, R. (2004) Addressing the “Big Dig Syndrome”: Transportation Projects Have Credibility Problem. The Reason Foundation, Los Angeles, USA.

Puccia CJ, Levins R (2013), Qualitative modeling of complex systems: Harvard University Press Cambridge, MA.

Shin, H., Watanabe, H., and Kunishima, M. (1989) ‘A new methodology for evaluating a new construction technology from the viewpoint of constructability’, Proceedings of the 47th Doboku Gakkai Rombun-Hokokushu, Japan Society of Civil Engineers April 1989, JSCE, Japan, p4.

Sridhar K, Jones G (2013) The three fundamental criticisms of the Triple Bottom Line approach: An empirical study to link sustainability reports in companies based in the Asia-Pacific region and TBL shortcomings. Asian Journal of Business Ethics; 2(1):91-111.

Taleb, N.N. (2010) The Black Swan: The Impact of the Highly Improbable, Second Edition, London and New York: Penguin).

Tatum, C. B. (1987) ‘Process of innovation in construction firm’, Journal of Construction Engineering and Management, 113(4), 648-663.

Wang, S. Q., Tiong, R. L. K., Ting, S. K., and Ashley, D. (2000) ‘Evaluation and management of foreign exchange and revenue risks in China’s BOT projects; Construction Management and Economics., 18 (2), 197–207.

Weele, Arjan J. van (2010) Purchasing and Supply Chain Management: Analysis, Strategy, Planning and Practice (5th ed.). Andover: Cengage Learning.