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Robust Methodology to Learn Across Megaprojects

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ROBUST METHODOLOGY TO LEARN ACROSS MEGAPROJECTS

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ABSTRACT

Megaprojects are usually defined as projects with a budget above $1 billion and a high level of innovation, complexity & uniqueness both in terms of physical infrastructure and stakeholder network (Brookes and Locatelli 2015). Moreover, they often provide fewer benefits than what were originally expected are affected by delays and cost overrun (Locatelli et al. 2017). Despite this techno-economic magnitude, the relevance of their impact on the context where they are delivered, and consequently the interest they rise among practitioners and researchers, it is still extremely hard to gather lessons learned from these projects in a systematic way. This paper presents an innovative methodology based on benchmarking to investigate both good & bad practices and how to learn from a portfolio of unique megaprojects.

KEYWORDS

Methodology, Megaproject, End of Life, Decommissioning, Benchmarking.

INTRODUCTION

Due to the megaprojects uniqueness, it is difficult to gather good practices and develop empirically-based guidelines in a systematic way. This paper addresses this challenge and presents a methodology to collect and investigate the characteristics that mostly impact on the performance of (mega)projects, through a continuous learning process. This methodology based on benchmarking combines quantitative & qualitative cross-comparison of case studies and statistical analysis into an iterative process.

"Benchmarking" refers to the process of comparing projects and it offers significant potential to identify good practices and improve the performance of project selection, planning and delivery. This framework can be adapted on major and megaprojects where the uniqueness of projects and the low number of cases available hinder the use of analysis based on big numbers. This methodology is exemplified in this paper using the case of Nuclear Decommissioning Projects (NDPs). NDPs are extremely complex, long and expensive, with a budget that often exceed $ 1 billion; they are politically sensitive and involve a large numbers of external and internal stakeholders and therefore can be addressed as megaprojects (Invernizzi et al. 2017).

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METHODOLOGY

The methodology is a development of the seminal work by Eisenhardt (1989), who recommends data collection using multiple methods, introduces the concept of "*theoretical saturation*", and promotes the deep analysis both of a single case and across case-studies to develop theories. The methodology proposed here is largely based on empirical evidence, and employs an "inductive" method,(rather than a "deductive" one) where "induction" is defined as follows (Brookes et al. 2015; Gill and Johnson 2002): "*"the induction of particular inferences from particular instances or the development of a theory from the observation of empirical reality."*. Figure 1 shows the research steps to collect and investigate what drives the project performance.

The first step embraces a preliminary literature review and the collection case studies. This is complemented by semi-structured interviews and site visits. The output is the preliminary collection of the projects characteristics that impact on the project performance.

The second step consists of the data codification with a standard template. This template contains several information grouped into macro-categories, such as:

- an overview of the projects, its physical characteristics and its final end-state;
- governance, funding and contacting schemes;
- internal and external stakeholders.

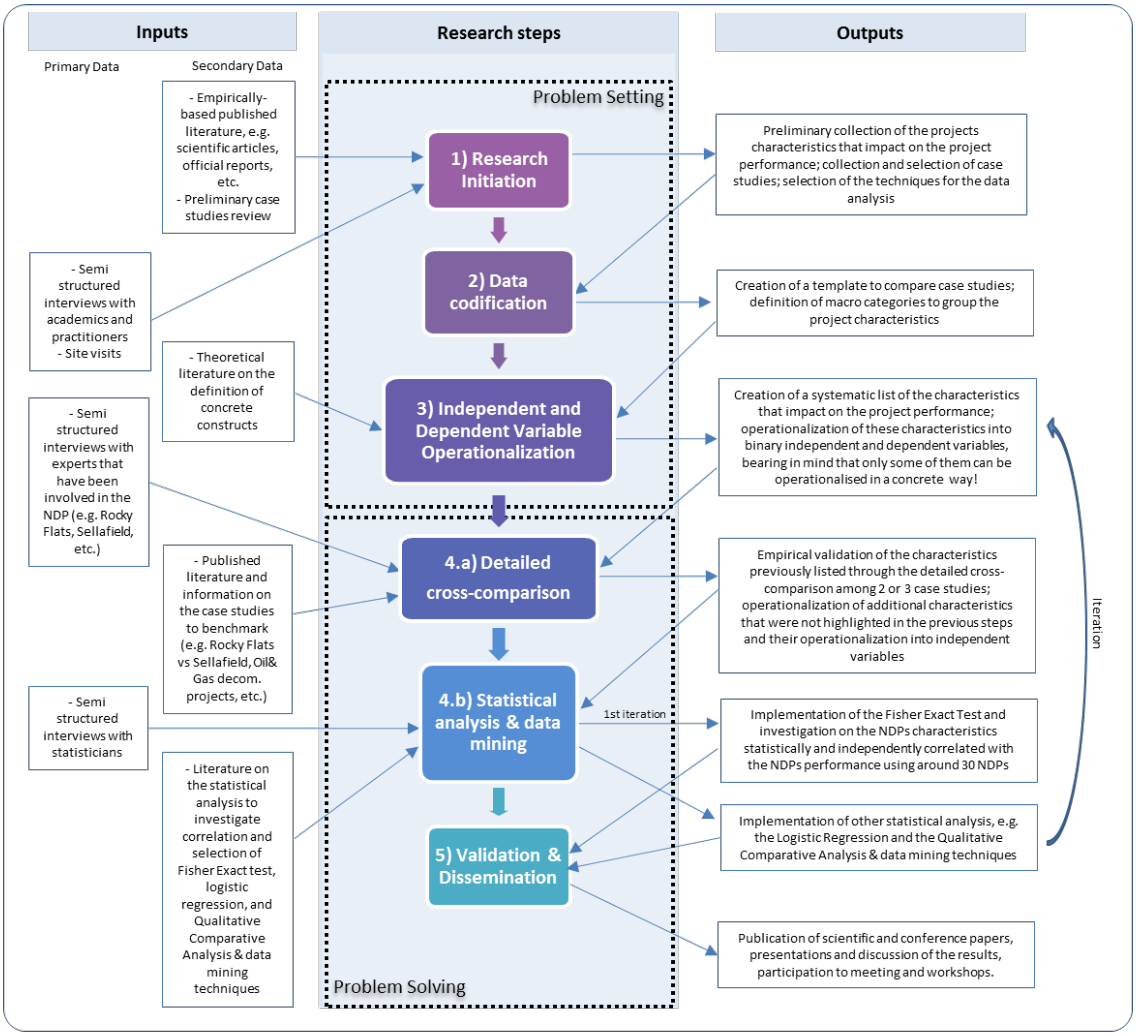

Figure 1. The five-step methodology

The output of the second step is the development and population of a standard template to allow an easier comparison of projects. From this template, lessons learned and good practices can been listed and analysed.
The third step consists of the operationalisation of the independent and dependent variables, i.e. respectively the project characteristics and their performance. To do this it is necessary to firstly differentiate between "concepts" and "constructs", where a construct is a more formalised definition of a concept, being a concept a "*general idea in our heads about a variable which has a part to play in our theories*" but that still cannot be observed directly (Lee & Lings, 2008). The measurement of a construct is "*the process of moving our theoretical constructs into the real world*" […], therefore "*once we work out exactly how we can represent our constructs in the real world, we have what can been called an operational definition*" […]. So, the operational definition outlines exactly "*what in the real word we say represents our theoretical constructs*" (Lee & Lings 2008, p. 161) and implicitly means that operational definitions and constructs are not the same thing, as shown in Figure 2. Constructs can describe the world, which is qualitative, quantitative, complex and dynamic. However, these constructs are not directly observable, therefore observable measures have to be used instead.

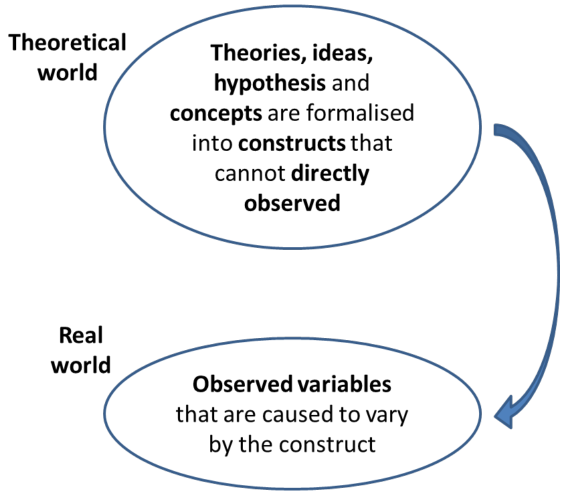

Figure 2. Theoretical word and real world, adapted from (Lee and Lings 2008)

The output of the third step is therefore a systematic list of the characteristics that impact on the project performance and their operationalization into binary independent and dependent variables.
The fourth step consists of the actual data analysis and it is split into two stages, i.e. the qualitative & quantitative cross-comparison and the statistical analysis and data mining, respectively 4.a. and 4.b in Figure 1. The qualitative & quantitative cross-comparison of step 4.a highlights the good practices that empirically resulted to be relevant for the successful performance of a project. The correlation of these good practices, together with "lessons learned" gathered from published literature (e.g. journal articles, official reports, case studies), interviews with experts, site visits and questionnaires is then investigated in step 4.b.
The statistical analysis employed need to address: 1) the low number of cases and 2) their complexity, in other words, their uniqueness. This is why the Fisher Exact Test (FET) is implemented first. Indeed, the FET is able to identify correlations within small data sets (Leach 1979), e.g. 20-30 projects and to evaluate whether or not a single independent variable (e.g. a project characteristic) is associate with the presence (or absence) of a dependent variable (e.g. the project performance), using categorical data in the form of a contingency table as input. Key features, limitations and the implementation of the Fisher Exact Test can be found in (Brookes and Locatelli 2015).

KEY FINDINGS, IMPLICATIONS

The output of the statistical analysis is to highlight the correlation between the project characteristics and the project performance. Table 1 lists four country-specific independent variables that resulted to be correlated with the project performance according to the first statistical test implemented (i.e. the Fisher Exact Test) to a pool of 33 NDPs.

Table 1. Example of independent variables statistically correlated to 50% cost overrun (the table will be more developed in the full paper)

Independent variables, i.e. the NDP characteristics	Correlation of the independent variables with the dependent variable "50% cost overrun"
There are other nuclear facilities still operating in the country	The fact that there are other nuclear facilities operating in the country is correlated **to the absence** of 50% of cost overrun. The p-value, however is 0.15, showing a weak correlation.
The country scores a corruption perception index > 60[4]	The fact that the corruption perception index in a country is less than 60 is correlated with **the presence** of 50% of cost overrun. The p-value is lower than 0.01, showing a strong correlation.
The legal timeframe for review of decommissioning plans is less 2 years	The fact that the legal timeframe for review of decommissioning plans is less 2 years is strongly correlated to **the absence** of 50% of cost overrun. The p-value is lower than 0.01, showing a strong correlation.
The NDP is state owned	The fact that the NDP is state owned is correlated with **the absence** of 50% of cost overrun. The p-value is 0.06, showing a strong correlation

CONCLUSIONS

Shortly, this novel method allow to investigate the relationships between megaproject characteristics and performance. The final goal of this research is to use the understanding that stemmed from empirical analysis to design and deliver more successful megaprojects.
This investigation has identified very few characteristics that have a statistically significant relationship between megaprojects characteristics and performances. Indeed, the relationships uncovered by this investigation both support and contradict some of the existing understanding of the factors that influence Megaproject performance, and this investigation has discovered relationships between characteristics and performance that had not been previously widely identified in the literature. These findings offer guidance for practitioners to ensure that Megaprojects can perform as intended. Additionally, the cross-project comparison using the FET provides a useful mechanism for individual policy-makers to 'benchmark' their Megaprojects against a portfolio of projects that they themselves have initiated or of similar projects that have been initiated in similar context.

[4] http://www.transparency.org/cpi2015#downloads

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