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Financial Management of Large Projects: A Research Gap

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Abstract

This paper analyses the research published in high-impact journals on Financial Management in large projects. Our purpose is to answer the following research questions: (a) Which financial aspects are analysed? (b) How are the financial theories applied to large project management? (c) What are the potential areas for further research? The methodology applied is a bibliographic review of articles related with research questions published from 2000 to February 2013 as stored in the main databases. Our findings show that performance is the most intensely studied aspect although no agreement in performance measurement has yet been reached.

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1. Introduction

The study of the Financial Management of large projects is an issue of major interest, since this type of project often encounters financial distress despite the existence of significant opportunities to improve the way managers make major investment decisions, and then structure and finance them. The criteria for classifying a project in the large or mega category still remain an issue in the literature. Esty (2002) sets the threshold at an investment higher than \$ 500 million. Nevertheless, other authors state that the characteristics that elevate a project to mega-status are more complex. Megaprojects have unique structural attributes, such as a high level of leverage, and therefore, a high level of financial risk, which vividly illustrate why the matters remain in contradiction with (Modigliani & Miller, 1958) and their proposition of "irrelevance". The financial structure of large projects, known as Project Finance, implies the creation of a legally independent project company financed with a concentrated equity ownership and a high level of non-recourse debt (Esty, 2004). The purpose is to invest in a capital asset, however this investment decision cannot be separated from funding decisions, which is another contradiction, concerning the valuation methodology usually applied in finance.

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In spite of the high impact of the financial structure on the success of large projects, very few papers have been published on this topic. This paper analyses the research published in high-impact journals on Financial Management in large projects. Our purpose is to answer the following research questions: (a) Which financial aspects are analysed in the literature on large projects? (b) How are the financial theories applied to large project management? (c) What are the potential areas for further research?

As far as we know, there are not literature reviews focused on the financial aspects of large projects. Therefore, our contribution is to perform a bibliometric analysis of the papers that focus on financial aspects in large projects, with a previous identification and analysis of the financial aspects studied in previous literature. The main result is the identification of gaps in research into financial aspects of large projects.

2. Methodology

In order to identify the articles that have studied financial aspects in megaprojects and thus respond to the research question set, a systematic literature review following the methodology described by Medina-Lopez, Marin-Garcia, & Alfalla-Luque (2010) has been performed. The first step involved a search in the *Web of Knowledge* and *Scopus* databases, to find articles published from 2000 to February 2013 that include the key words “megaproject”, “mega project”, “big project”, “complex project” and/or “large project” in the title, keywords, and/or abstract fields. This first search was extensive to all the articles concerning large projects so that those papers which study the financial aspects would not be overlooked, even though the papers were not primarily focused on financial aspects and analysed them solely in a tangential way. Following this first step, 258 articles were selected.

These articles were then reviewed and classified into three categories: a first group of 68 articles that focus on the financial aspects of megaprojects; a second group containing 39 papers that address the financial aspects in a tangential manner; and finally, a third group of 151 articles that does not address financial aspects of megaprojects. In our study, the 107 items included in the first two categories are analysed in both a quantitative and a qualitative way.

A checklist to systematically review such articles was used. This checklist was developed based both on our previous experience in literature reviews and on a first reading of the 107 selected references. Furthermore, this tool was also reviewed by two experts and was used to classify the papers through numerous criteria, such as year of publication, research methodology, data analysis methods, geographical area of the megaproject, sector, and type of financial aspect studied. Each paper was checked by two of the present authors. In the case of doubtful classification, the paper was discussed in order to assign it to the correct category in the checklist. For this process, RefWorks, Microsoft Excel, and Atlas.TI software have been applied.

3. Analysis of the bibliometric characteristics

Following the explained methodology, 107 articles have been selected (available on request to authors). These articles have been published in a total of 79 journals, although there are only 4 journals (5%) with more than 4 papers; International Journal of Project Management (7), Journal of Operational Research Society (5), International Journal of Urban and Regional Research (5), and Public Road (4). Therefore, the scarcity of literature on the financial aspects of large projects in indexed journals is highlighted.

By analyzing the temporal distribution of these publications in the 13 years reviewed, the financial aspects of megaprojects is found to be a topic into which interest has been steadily growing in recent years. Between 2000 and 2008, a total of 52 papers were published at an average of 5.7 papers per year. During the period 2009-2012, 53 papers were published, with a minimum of 10 papers per year, thereby increasing to an average of 13.25 per year. It is noteworthy that, in the last four years, the volume of published papers has reached the same number as the total of the previous nine years. Regarding the number of authors per paper, the greatest number of articles are written by a single author (44 papers, 41.1%), although the presence of up to three authors is relatively common (33 are signed by two authors (29%), and 22 by three authors (20.6%)). In addition, when there is more than one author, they often belong to different institutions; only in 21 of the papers, were all the authors from the same institution.

3.1. Characteristics of research in financial aspects of megaprojects

To further analyse the selected articles, papers were classified according to the type of research developed. Most of the investigation (59.8%) is empirical, namely, case studies. Moreover, 22.4% of the research is theoretical/conceptual and analyses one or more specific aspects of megaprojects, without focusing on any specific case and/or simply citing cases as examples. Only 14% of the papers develop models or simulations to improve planning or management, or to avoid delays. Finally, 3.7% of the papers are formal reviews of the literature, none of which is focused on the financial aspects of megaprojects.

The most common methodology is case study: analyzing certain aspects from a theoretical perspective and presenting a real case with detailed explanation. These papers have given us a great volume of information for our analysis, since they deal directly with financial issues.

Furthermore, the identified papers are characterized by being mostly descriptive or exploratory in nature (99%), and mainly qualitative and transversal. The information sources most commonly used are document analysis (94.4%) and observation (64.5%). Only 30% of research has performed any basic quantitative analysis. Descriptive statistics are used in 24 papers (72.7%), regressions in 10 (30.3%), correlations in 9 (27.3%), and path analysis in 9 (27.3%).

3.2. Characteristics of megaprojects cases analyzed in the literature

Most of the 64 papers that perform a case study are focused on just one case (52, 81.3%) and analyse various aspects. When analyzing two cases (7, 10.9%), they often compare the same topic, usually in the operational phase of the life cycle of the project, to see the progress after construction, and whether their economic and social profitability was as expected. Analysis of three or more megaprojects (5; 7.8%) is not very common and occurs when one aspect is studied theoretically, whereby cases are employed solely for illustration purposes.

The geographical distribution of megaprojects studied is 42% in Europe, 30% in Asia, 14% in North America, 7% in Africa, 4% in Oceania, and 3% in Central and South America. Within Europe, cases from UK and Germany are more frequent. In these countries, most large projects are technical and are intended to improve communications among the population. In Asia, there are numerous projects relating to the development of new areas in Russia, India and China due to their need for major infrastructure. In America, the largest number of cases studied corresponds to USA and Canada.

The types of large projects analyzed are grouped mainly into transport infrastructure (rail: 11, roads: 3, airports: 7), civil infrastructure (ports: 7, bridges: 5, buildings: 10, hospitals: 4, dams: 2, tunnels: 2), energy (pipeline: 9, others: 5), Urban Developments (5), ICT / Technology (4) and events (Olympic games/universal exposition: 4).

In 22 of the 107 articles analyzed, the investigation does not focus on any particular stage of the life cycle of a project (design, construction, operation). Other papers mainly focus on a more in-depth analysis of a single step (79, 73.8%). There are very few articles that analyse 2 or 3 steps at a time (6, 5.6%). More attention is paid to the stages of operation (36 papers) and construction (34 papers), with the design stage being the least analyzed (23 papers).

3.3. Financial aspects of megaprojects studied in the literature: quantitative analysis

The articles were classified according to nine financial issues (Table 1). The main topics analyzed in the 107 selected articles are Stakeholders, Public-Private Partnerships (PPP) models, and Risk Management. As already stated, there is a growing interest into research on this topic in recent years. Table 1 shows the evolution for each subject by dividing the horizon into three periods (2000-04, 2005-08, and 2009-13). Between 2005 and 2008, a decrease occurs in the volume of published papers. This trend changed in the third period, 2009-2013, surpassing, in general, the level of publication of the first period. The greatest increase was in papers focused on cost-benefit analysis, with 66.7% of papers addressing this issue in the third period. Around 50% of the work on stakeholders, PPP models, risk, investment, and financial performance are published during that period. It is worth bearing in mind the high volume of research on stakeholder management; this topic has more publications in all the periods and is the only topic with publications every year.

Table 1. Financial aspects identified and temporal evolution of the publication

Concepts	2000-04	2005-08	2009-13
Stakeholders	16	11	26
PPP Models	13	8	23
Risk	16	6	20
Cost-Benefit analysis	7	2	18
Investment	10	3	13
Financial performance	8	6	11
Management (not PPP)	1	3	4
Cost	2	0	4
Financial sources	1	0	2
Total published papers per period	74	39	121

On analysing for each stage of the life cycle, the most frequently studied aspects are, in the design stage, stakeholders (20.7%), PPP models (20.7%), risk (15.5%), and cost-benefit analysis (13.8%). In the construction stage, the interest of researchers is focused on stakeholders (27.4%), PPP models (21.9%), risk (15.1%), and investment (13.7%). In the operational phase, the main financial aspects studied are stakeholders (24%), financial performance (18.7%), risk (17.3%), cost-benefit analysis (17.3%), and PPP models (12%). In general, relations with stakeholders, PPP models, and risk management are topics of great interest regardless of the stage of the project analysed. To sum up, stakeholders, PPP models, investment, and financial sources are generating more interest in the stage of construction, whilst cost-benefit analysis, risk, and financial performance do so in the operational phase.

4. A qualitative analysis

Most of the papers selected can be considered multidisciplinary, just the first group (68 articles) focus on the analysis of financial aspects, and others do as a secondary goal. The most common situation involves studying how different strategies influence the financial performance, which is usually used as a negotiation issue among the stakeholders. In this sense, Doloi (2012) develops a framework for an accurate understanding and assessment of the social performance and value creation of public infrastructure projects. By integrating the impact of stakeholders and their satisfaction level, a social performance indicator is synthesized as a measure of quantifying social sustainability in projects. The valuation of the project is analysed by Lemelin, Abdel Sabour & Poulin (2006) who propose Real Options Analysis for dealing with management responses to uncertain future outcomes (Risk Management). Paling (2012) shows how various forms of international finance capital, development capital, and local capital vie for influence amongst a loose assemblage of alliances and conflicts that link elements of the government, international donors and private-sector actors.

Focusing on those papers in which the financial aspects are the main goal, the main topic analysed is the financial performance evaluation: Bruzelius, Flyvbjerg & Rothengatter (2002) describe lessons and recommendations on how to improve accountability in decision making. On redrawing the borderlines of private and public involvement, four specific measures to increase accountability are suggested and detailed: Transparency, Performance specifications, Explication of regulatory regimes, and Involvement of risk capital. De Palma, Picard, & Andrieu (2012) propose various approaches used in finance (Value at Risk, Conditional Value at Risk, Downside Risk Measures, and Efficiency Ratio) to model the impact of risk in project evaluation, for comparison in basic examples. Nevertheless, no criterion is a priori better than the others, since these approaches may lead to different conclusions. Kim (2010) includes a risk performance index to improve the efficiency of the measurement of general performance for megaprojects. Li & Lofgren (2010) derive a dynamic cost-benefit rule for evaluating large projects which entails an extra term involving changes in capital cost. Peters (2010) traces the decision-making processes for a case study, and raises important questions regarding optimistic forecasts, cost overruns, the role of prestige in large infrastructure projects, and the limits of public review procedures. Toor & Ogunlana (2010) state that there is no commonly agreed framework of performance measurement on megaprojects. Their findings indicate that the traditional measures of the iron triangle (on-time, under-budget, and according to specifications) are no longer applicable and that other performance indicators, such as safety, efficient use of resources, effectiveness, satisfaction of stakeholders, and reduced conflicts and disputes, are becoming increasingly important.

The financial management of large projects may challenge the financial theories on capital structure. First, the Theory of Financial Optimum suggests that firms adjust their capital structure to a target debt ratio or optimum, and once reached, firms achieve their maximum value. From a traditional perspective, there is an optimal balance between the benefits of debt, which are linked to the tax deductibility of interest, and the disadvantages of the increase in the probability of bankruptcy involved in the use of higher levels of debt. In the case of large projects, the financial structure links the debt ratio to the negotiation of the different interests of the parties involved, rather than to the value maximization of the megaproject.

Second, the Theory of the Agency, proposed by Jensen & Meckling (1976) and Myers (1984), states that agency costs, arising from the conflict between shareholders and lenders, encourage the former to seek a capital structure to their benefit, even at the expense of the latter and of the loss of value of the company. Given this attitude, lenders react by demanding additional collateral and higher risk premiums. The design of the economic and financial structure of large projects is derived from a previous negotiation process where agency problems are identified a priori, thus avoiding the feared costs thereof. Nevertheless, conflicts may arise between the interests of the public and private sector. Hence, the public sector establishes a series of covenants or control mechanisms to periodically detect the possibility that private interest holds greater priority over the public interest.

A third approach is based on the costs generated by asymmetric information; this has led to two theories. On the one hand, the Theory of Signs, raised by Ross (1977) and Leland & Pyle (1977), argues that managers with strong growth prospects send signals to the market about the quality of their projects through the increased level of debt, which reflects the ability of companies with new investments to meet the payment obligations of that debt. On the other hand, the Theory of Hierarchical Preferences, proposed by Myers (1977) and Myers & Majluf (1984), posits that companies do not seek to adjust to an optimal debt ratio but, due to asymmetric information problems associated with external financing, that firms adjust their funding decisions to a hierarchy. These asymmetric information problems associated with external financing are not easily detected since the financial structure is designed as a whole and adapted to the economic characteristics of the project and the possibilities and needs of all parties involved in the financing.

5. Conclusions

The number of papers in this field has been increasing in recent years, although publications that focus on the financial aspects of megaprojects remain scarce in high-impact journals. Case studies constitute the most widely applied methodology (almost 60%), where, in general, only one single case is presented. The most commonly studied topic is the financial performance although no agreement on performance measurement of megaprojects has yet been reached. The valuation of the megaproject is seldom performed although it represents the financial objective of any corporation. Research into financial aspects remains scarce, as do studies into the financial structure of large projects. Other related areas of research, such as Stakeholder or Risk Management, and Public-private Partnerships, are of major interest.

More research, in general, and more detailed case studies and survey studies, in particular, are required in order to provide a basis for the improvement of megaproject management. Areas of further research can be focused on a comprehensive analysis of the financial structure, performance and valuation of megaprojects.

References

- Bruzelius, N., Flyvbjerg, B., & Rothengatter, W. (2002). Big decisions, big risks. Improving accountability in mega projects. *Transport Policy*, 9(2), 143-154. doi:10.1016/S0967-070X(02)00014-8
- De Palma, A., Picard, N., & Andrieu, L. (2012). Risk in transport investments. *Networks & Spatial Economics*, 12(2), 187-204. doi:10.1007/s11067-009-9109-8
- Doloi, H. (2012). Assessing stakeholders' influence on social performance of infrastructure projects. *Facilities*, 30(11), 531-550. doi:10.1108/02632771211252351
- Esty, B. C. (2002). An Overview of Project Finance- 2002 update. *Harvard Business School Case No. 202-105, Boston MA.*
- Esty, B. C. (2004). Why Study Large Projects? An Introduction to Research on Project Finance. *European Financial Management*, Vol. 10, No. 2, 2004, 213-224.
- Jensen, M. & Meckling, W. (1976). Theory of the firm: managerial behaviour, agency costs and capital structure, *Journal of Financial Economics*, 3, 305-360.
- Kim, B. (2010). Risk performance indexes and measurement systems for mega construction projects. *Journal of Civil Engineering and Management*, 16(4), 586-594. doi:10.3846/jcem.2010.65
- Leland, H. & Pyle, D. (1977). Information asymmetries, financial structure and financial intermediation, *The Journal of Finance*, 32, 371-388.

- Lemelin, B., Abdel Sabour, S. A., & Poulin, R. (2006). Valuing mine 2 at raglan using real options. *International Journal of Mining, Reclamation and Environment*, 20(1), 46-56. doi:10.1080/13895260500430294.
- Li, C., & Lofgren, K. (2010). Dynamic cost-benefit analysis of large projects: The role of capital cost. *Economics Letters*, 109(2), 128-130. doi:10.1016/j.econlet.2010.09.005
- Medina-Lopez, C., Marin-Garcia, J. A., & Alfalla-Luque, R. (2010). Una propuesta metodológica para la realización de búsquedas sistemáticas de bibliografía. *Working Papers on Operations Management*, 1(2), 13-30.
- Modigliani, F. & Miller, M. (1958). The cost of capital, corporation finance, and theory of investment, *American Economic Review*, 48, 261-297.
- Myers, S. & Majluf, N. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13, 187-221.
- Myers, S. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5, 147-175.
- Myers, S. (1984). The capital structure puzzle, *Journal of Finance*, 34, 575-592.
- Paling, W. (2012). Planning a future for Phnom Penh: Mega projects, aid dependence and disjointed governance. *Urban Studies*, 49(13), 2889-2912. doi:10.1177/0042098012452457
- Peters, D. (2010). Digging through the heart of reunified Berlin: Unbundling the decision-making process for the tiergarten-tunnel mega-project. *European Journal of Transport and Infrastructure Research*, 10(1), 89-102.
- Ross, S. (1977). The determination of financial structure: the incentive signalling approach. *Bell Journal of Economics*, 1, 23-40.
- Toor, S. & Ogunlana, S. O. (2010). Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. *International Journal of Project Management*, 28(3), 228-236. doi:10.1016/j.ijproman.2009.05.005