

The Best Project Financing Option for Infrastructure Projects in Developing Nations^{1, 2}

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ABSTRACT

Around the world, infrastructure investment gaps have been a significant problem, and even more severe in developing nations where the needs for more infrastructure facilities are particularly massive. Thus, to address the investment gaps, this paper revolves around infrastructure financing options in the developing world, using a Multi-Attribute Decision Making (MADM) analysis to analyze various financing mechanisms used in infrastructure projects and rank them according to selected criteria and their relative importance. Subsequently, the non-dimensional data technique is applied to, finally, determine the best financing option for infrastructure projects in developing economies. The findings of the paper reveal that project finance is the most preferred financing alternative for infrastructure projects mainly due to its risk allocation feature.

Keywords: Project financing, project funding, infrastructure projects, construction, developing nations, public-private partnerships, infrastructure finance

INTRODUCTION

Infrastructure is, undeniably, a highly important element for the development of a nation. The quality and number of accumulated infrastructure facilities differentiate developed from developing countries regarding economic performance and growth, living standard, and social development. Investment in infrastructure has always been the center of policy discussions for the governments across the globe to keep pace with economic and demographic growth. In 2015, the world spent \$9.5 trillion—14 percent of global GDP—on infrastructure.

As the needs for infrastructure facilities are rising continuously across the globe while governments' budgets are limited, investment gaps have become a serious issue, particularly in developing countries where the infrastructure needs and deficits are particularly huge. By 2035, the global investment need has been estimated to reach

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\$69.4 trillion, 63 percent of which will be in emerging economies, due to an improved GDP growth outlook and some technical improvements. Despite a recent increase in investment in economic infrastructure, the gaps remain.³ Governments and organizations are working to fill in the gaps by searching for alternative funding sources to make sure infrastructure projects are realized.

Every project needs money to start with. As capital-intensive as an infrastructure project is, financing is the essence of the project success; a gap in funding poses a significant obstacle to the execution and the delivery of the infrastructure project. Therefore, it is highly essential that the project has enough funding at disposal at the right time to perform project activities that mark the way to the completion and success of the project. Accordingly, in project management view, choosing the proper financing mechanism helps ensure the sound execution and success of an infrastructure project.

The slow development of infrastructure facilities in developing nations stems from many factors, from political, economic, financial, to environmental causes.⁴ One main reason is the fact that the local governments have limited budget or do not have the incentive to invest in the public infrastructure. The latter can, in turn, be linked to corruption problems in the developing countries.⁵ Another critical factor that slows the infrastructure development in the developing world is the limited alternative financing sources, given current constraints on traditional sources of public and private financing.⁶ In construction projects, the EPC (engineering, procurement, and construction) phase is often risky. Banks have become more careful when making a loan decision, and their lending capacity has grown limited since the Great Financial Crisis in 2008.⁷ The riskier the project is, the higher the debt financing cost.

Consequently, debt financing is not an ideal option for poor governments. Finally, the lack of technical expertise and managerial competency in managing infrastructure projects also impede the infrastructure development in the emerging economies. These factors combine to give rise to the need for an innovative financing mechanism that serves to address these causes of the problem the tradition government budget financing has failed to solve.

³ Woetzel, J., Garemo, N., Mischke, J., Kamra, P., & Palter, R. (2017, October). McKinsey Global Institute Bridging Infrastructure Gaps - Has the world made progress? Discussion Paper in Collaboration with McKinsey's Capital Projects and Infrastructure Practice. Retrieved from <https://www.mckinsey.com/~media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/bridging%20infrastructure%20gaps%20has%20the%20world%20made%20progress/bridging%20infrastructure%20gaps%20how%20has%20the%20world%20made%20progress%20v2/mgi-bridging-infrastructure-gaps-discussion-paper.ashx>

⁴ Root cause analysis by author (Figure 1)

⁵ Hausmann, R. (2018, April 30). The PPP Concerto. Project Syndicate The World's Opinion Page. Retrieved from <https://www.project-syndicate.org/commentary/improving-public-private-partnerships-infrastructure-by-ricardo-hausmann-2018-04>

⁶ Inderst, G., & Stewart, F. (2014, March). Institutional Investment in Infrastructure in Emerging Markets and Developing Economies. Public-Private Infrastructure Advisory Facility (PPIAF), 4. Retrieved from <http://documents.worldbank.org/curated/en/748551468337163636/pdf/913070BR0SecM20itutorial0investment.pdf>

⁷ Posener, M. (2013, April). Funding options Alternative Financing for Infrastructure Development April 2013. Deloitte, 2. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/public-sector/deloitte-au-ps-funding-options-alternative-financing-infrastructure-development-170914.pdf>

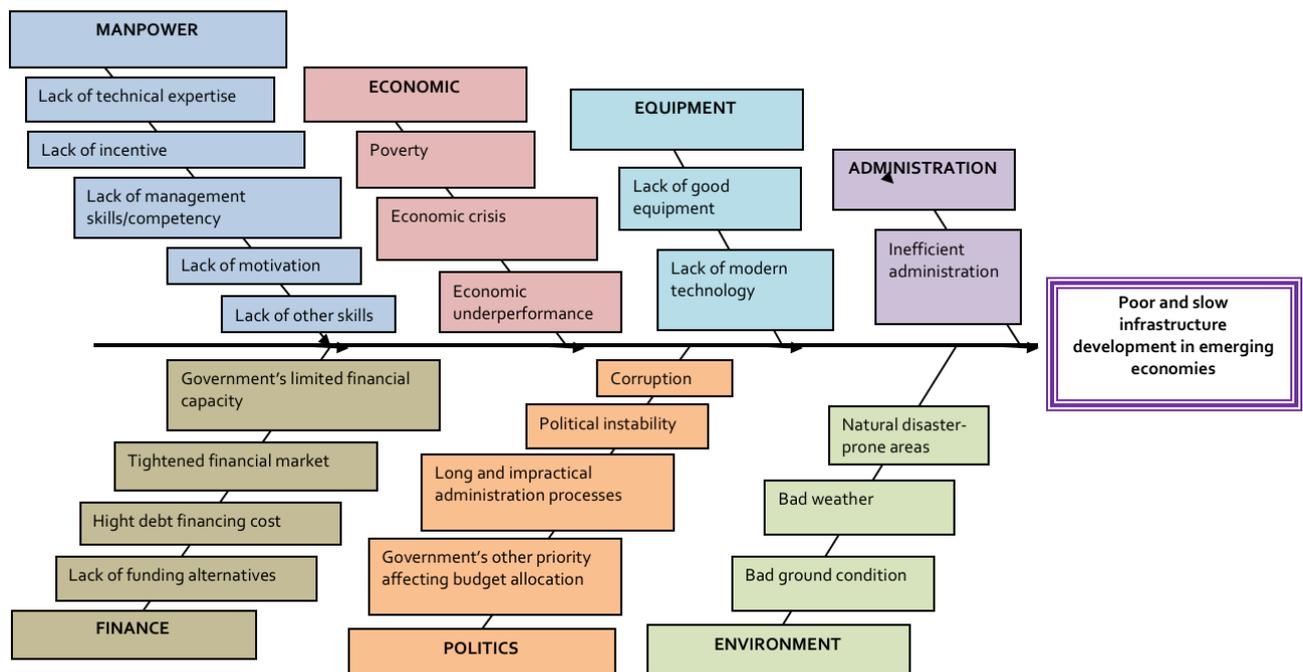


Figure 1: Root cause analysis of the slow development of infrastructure in emerging economies ⁸

An innovative financing model that has become widespread for infrastructure projects is the so-called Public-Private Partnership (PPP). PPP projects have proven to deliver high-quality infrastructure faster with full asset-life guarantees and warranties from the private sector, outweighing the higher financing costs.⁹ Examples of successful PPP projects are water system project in Singapore, metro rail system project in Delhi, India, and Smart grid and communications project in Tennessee, USA.¹⁰

There are various innovative financing mechanisms for infrastructure projects that have been used widely. Primary financing mechanisms for infrastructure projects include government funding, corporate or on-balance sheet finance, and project finance. With government funding, the capital investment in a project is funded by the government while expertise and efficiency are brought from the private sector to construct, operate, and maintain the project. Corporate finance is a way a private operator decides to fund some or all of the capital investment in a project through corporate financing based on the balance sheet of the private operator rather than the project itself. Finally, project finance is a way to raise fund to finance an economically separable capital investment project, so-called special purpose vehicle or "SPV". In SPV, the providers of the funds base their decisions whether to service their loans on the capacity of the project to generate revenue

⁸ By author

⁹ Budden, B. (2017, December). The debate over private infrastructure financing in the United States. *Voices*, 3. Retrieved from https://www.globalinfrastructureinitiative.com/sites/default/files/pdf/private-infrastructure-financing_0.pdf

¹⁰ Next City. (2014, May 7). Siemens Report: Public-Private Partnership Success Stories. *Investor Ready Cities*. Retrieved from <https://nextcity.org/daily/entry/siemens-report-public-private-partnerships>

streams, risks, or a return on equity capital invested in the project after the construction has been completed, and the project is in operation.^{11, 12}

There have not been many studies that conduct a comparative analysis of each financing mechanism for infrastructure projects, in particular for those in the developing world. The primary objective of this paper is, thus, to analyze each of the main financing options, and to compare and contrast them to ultimately determine which financing mechanism is the best for infrastructure projects in developing nations.

METHODOLOGY

The methodology used to answer the research question of the paper contains the following four steps.

Step 1: Problem Definition

In this section, the paper summarizes the problem to be solved by answering the research question as mentioned earlier.

Problem:

- The financing gaps of infrastructure projects in developing nations leading to long-term poor and slow development of infrastructure in these countries

The paper addresses this problem by comparatively analyzing common financing mechanisms used for infrastructure projects to determine the most efficient financing option regarding cost and benefits or VM (value for money) for infrastructure projects in emerging economies.

Step 2: Development of feasible alternatives

Alternative solutions

¹¹ Hu, F., & Wang, D. (2015). The Research on the Problems of the Project Finance in the Energy Saving Service Industry of China and Its Countermeasures. *CSCanada Management Science and Engineering*, 9(4), 72-75.

¹² World Bank Group. (2016, September 6). Main Financing Mechanisms for Infrastructure Projects. Retrieved from <https://ppp.worldbank.org/public-private-partnership/financing/mechanisms>

The following financing mechanisms available for infrastructure projects in developing nations are studied in detail and contrasted against one another^{13, 14, 15, 16, 17, 18}:

1. Government funding
2. Corporate or on-balance sheet finance
3. Project finance
4. Forfeiting model
5. State and municipal bonds
6. Bank loans
7. Official Development Assistance (ODA) grant
8. Countertrade

Measurement attributes

Based on the following key considerations when choosing the right project financing method^{19, 20}:

- Cost of financing
- Cash flows generating ability of the project,
- Time,
- Risk,
- Security and covenants,
- Availability of finance,
- The yield curve,
- Maturity,
- Control, and
- Costs and ease of issue,

¹³ Emenike, K. O. (2015). Infrastructure Finance Mechanism and Challenges in Nigeria. *Independent Journal of Management & Production (IJM&P)*, 6(3), 832. doi:10.14807/ijmp.v6i3.317

¹⁴ The Jakarta Post. (2017, July 26). World Bank to offer blended financing for Indonesia. Retrieved from <http://www.thejakartapost.com/news/2017/07/26/world-bank-to-offer-blended-financing-for-indonesia.html>

¹⁵ Deloitte. (2013). Funding Options - Alternative Financing for Infrastructure Development - April 2013. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/public-sector/deloitte-au-ps-funding-options-alternative-financing-infrastructure-development-170914.pdf>

¹⁶ Verougstraete, M., & Aras, A. (2018). Tapping Capital Markets and Institutional Investors for Infrastructure Development. Working Paper Series - Macroeconomic Policy and Financing for Development Division. Retrieved from https://www.unescap.org/sites/default/files/publications/WP-18-04%20Tapping%20Capital%20Markets-last%20version_MV_TS%20%28002%29_formatted.pdf

¹⁷ The Asian Development Bank Institute. (2018, August 14). Municipal bonds: Innovative mechanisms to finance smart cities in India | Asia Pathways. Retrieved from <https://www.asiapathways-adbi.org/2018/08/municipal-bonds-innovative-mechanisms-to-finance-smart-cities-in-india/>

¹⁸ Daube, D., Vollrath, S., & Alfen, H. W. (2007). A Comparison of Project Finance and the Forfeiting Model as Financing Forms for PPP Projects in Germany. *International Journal of Project Management*, 26(2008), 376-387. Retrieved from http://www.b-capitalpartners.com/media/dwl/a_comparison_of_project_finance.pdf

¹⁹ ACCA. (2011). Analysing the suitability of financing alternatives. Retrieved from https://www.accaglobal.com/content/dam/acca/global/PDF-students/2012s/sa_june11_alternatives.pdf

²⁰ Oskoei, M. (2015, January 31). Project financing methods. Retrieved from <https://www.slideshare.net/MahmoodOskoei/project-financing-methods/32>

Seven attributes to measure the financing mechanisms for infrastructure projects are selected as follows.

- Affordability
- Minimum size of a capital
- Risk management capacity
- Transaction cost
- Access to expertise
- Dependency
- Term of finance

Step 3: Development of the outcomes

Financing alternatives to be examined are as follows.

1. Government funding

The government provides all the funding for the project, assuming the associated risks in return for a lower cost to the government. This approach is already used for the majority of infrastructure provision in Australia, including the use of Design-Construct (DC); Design-Build-Maintenance (DBM); Design-Build-Operate (DBO); Design-Build-Operate-Maintenance (DBMO) or Alliance contracts.²¹ Another example would be traditional procurement where the Government chooses to outsource the civil works for the project and then brings in a private operator to operate and maintain the facilities or provide the service.

Under conventional procurement, subject to specific risk transferred to contractors, the state carries ultimate responsibility for infrastructure service delivery and the multiplicity of risks that this involves.^{22, 23}

2. Corporate finance

Corporate finance or on-balance sheet finance is used by corporations to finance some of the capital investment for a project based on their corporate balance sheet rather than the project itself. This mechanism is typically used in lower value projects where the cost of the financing is not significant enough to warrant a project financing mechanism or where the private operator is so large that it chooses to fund the project from its own balance sheet. In corporate finance, the assets are financed as part of a corporate balance sheet.

There is an opportunity cost attached to corporate financing because the company will only be able to raise a limited level of finance against its equity (debt to equity ratio). The

²¹ Deloitte. (2013). Funding Options - Alternative Financing for Infrastructure Development - April 2013. [online]

²² Maryouri, L. (2013). A comparative analysis of PPP financing mechanisms for infrastructure projects. PPP International Conference 2013 - Body of Knowledge Public-Private Partnerships, 209-218.

²³ World Bank Group. (2016, September 6). Main Financing Mechanisms for Infrastructure Projects. [online]

more the company invests in one project, the less available fund it will have left to invest in other projects.²³

3. Project finance

Project finance is defined as raising of funds to finance a special economic unit, the so-called Special Purpose Vehicle (SPV), in which a lender examines the cash flow and revenue stream of the economic unit. The assets of the economic unit are collateral for the loan.²⁴ Accordingly, the lender relies on the project's ability to generate revenue and cash flow to cover interest and debt repayment, operating costs, and return on equity. It is necessary for the lender to conduct extensive due diligence in advance of financing the project to evaluate a project based on the expected future cash flows that influence the financing decision and the interest terms established by the lender. Through project finance, the lender is a partner in the project and, therefore, takes substantial risks.

One primary risk is the insolvency risk of the private SPV. The lender estimates the risk-related financing costs by conducting due diligence checks of the project's technical and economic viability. Moreover, controlling measures are employed during the negotiation and contracting processes. With the substantial risk transfer, the interest margin of the lender is higher in project finance. Thus, in this context, the lender's risk-related financing costs are higher.²⁵

4. Forfeiting model (FM)

The Forfeiting Model is a specific arrangement that the private contractor sells claims for payments that result from the construction contract with the public sector to the bank, while the public principal declares a waiver of objection regarding the claims sold. The financing costs associated in the FM are considerably lower than those in Project Finance due to the lower levels of risk transfer to the private contractor and the declaration of a waiver of objection by the public principal. In FM, due diligence or controlling measures are not conducted by the lender. As a result, the transaction costs remain on a relatively lower level. Furthermore, the FM is based on the creditworthiness of the high-rated public principal.²⁵

5. Municipal bonds

Many governments raise private capital for infrastructure development by issuing bonds. In many cases, the bonds are issued by the regional authority seeking to raise the capital, and the interest payable on the bonds are tax-exempt. The central or provincial government guarantee fully or partially supports the obligations of the issuing authority. Developed economies with established capital markets trade infrastructure bonds in competition with traditional public and private bond issues. In emerging economies, small

²⁴ Nevitt, P. K., & Fabozzi, F. J. (2000). *Project Financing*, 7th Edition (7th ed.). London: Euromoney Books.

²⁵ Daube, D., Vollrath, S., & Alfen, H. W. (2007). A Comparison of Project Finance and the Forfeiting Model as Financing Forms for PPP Projects in Germany. *International Journal of Project Management*, 26(2008), 376-387. [online]

or inefficient capital markets, unstable exchange rates, high rates of interest and sub-investment grade sovereign credit ratings limit the opportunities for this source of capital.²⁶

6. Bank loans

With bank loans, the project owners only have to worry about making regular installment payments on time. This kind of debt finance does not require a change in control. However, bank loans might offer a shorter tenor and banks often requires security or covenants. Availability of credit for economic infrastructure projects (even those without revenue risk) is constrained by application of more conservative debt sizing covenants.²⁷

7. Official Development Assistance (ODA) grant

ODA is government aid designed to promote the economic development and welfare of developing countries. Assistance may be provided bilaterally, from the donor (developed countries) to recipient, or channeled through a multilateral development agency such as the United Nations or the World Bank. The aid includes grants, "soft" loans (where the grant element is at least 25% of the total) and the provision of technical assistance.²⁸

The World Bank Group will use an innovative financing method that combines grants from donor countries such as the Nordic countries with the bank's resources to create lower cost project financing and reduce the risk for infrastructure in Indonesia.²⁹

8. Countertrade

Countertrade is a reciprocal form of international trade in which goods or services are exchanged for other goods or services rather than for hard currency. This type of international trade is more common in less-developed countries with limited foreign exchange or credit facilities. Countertrade can be classified into three broad categories: barter, counterpurchase and offset. In any form, countertrade provides a mechanism for countries with limited access to liquid funds to exchange goods and services with other nations.³⁰

Step 4: Selection criteria

Using the multi-attribute decision model (MADM), the following attributes are ranked according to their relative importance as illustrated in Table 1.

²⁶ Regan, M. (2009). A Survey of Alternative Financing Mechanisms for Public Private Partnerships. Infrastructure Association of Queensland. Retrieved from <https://infrastructureaustralia.gov.au/policy-publications/publications/files/MichaelReganReport.pdf>

²⁷ PwC. (2011). Funding Infrastructure: Time for a new approach? Retrieved from <https://www.pwc.com/gx/en/psrc/pdf/time-for-a-new-approach.pdf>

²⁸ OECD. (2018). Net ODA. Retrieved November 5, 2018, from <https://doi.org/10.1787/33346549-en>

²⁹ The Jakarta Post. (2017, July 26). World Bank to offer blended financing for Indonesia. [online]

³⁰ Investopedia. (2018, May 10). Countertrade. Retrieved from <https://www.investopedia.com/terms/c/countertrade.asp>

- *Affordability* – financing cost, e.g., interest, tax, other financing fees, and contingent liabilities. The lower the financing cost is strictly preferred.
- *Minimum size of capital* – different kinds of financing tool has different levels of the minimum size of capital. Since infrastructure projects require the largest capital expenditures, the most preferred financing option is the one that provides the biggest size of capital.
- *Risk management capacity* – financing vehicles may differ in risk management and the degree to which specific project risks can be transferred to the other contractual party. Key risks that need to be allocated and managed to ensure the successful financing of the project include Construction and Completion Risk, Tenor and Refinancing Risk.³¹ The most preferred financing method is the one that allows project risks to be transferred to parties most capable of managing the risks.
- *Transaction cost* – the cost of arranging and managing finance, and costs associated with delay or uncertainties with the availability of funding.³² Transaction cost can arise from the paperwork process while acquiring the financing, as well as delays in negotiation. The financing mechanism that incurs the least transaction cost is strictly preferred.
- *Access to expertise* – access to technical expertise and management skills and capability to implement the project. The ongoing role and expertise of project sponsors will be vital for the long-term success of a project, and in particular, the ability of the project to reach completion. Hence, the financing option that allows the most unlimited access to expertise is deemed the most attractive for infrastructure projects in developing nations.
- *Dependency* – for some financing mechanism, the financing providers required a part of the ownership of the project's assets. It is most common for a debt and equity provider to need protection against a change of control which requires certain or all of the sponsors to maintain control of the ownership, decision making, and voting rights in the project company. A change of control would often result in the event of default or mandatory prepayment of debt.³³ The finance option that imposes the least dependency on project sponsors or lenders is preferred.

³¹ World Bank Group. (n.d.). Risk Allocation, Bankability, and Mitigation in Project Financed Transactions | Public-private partnership. Retrieved October 23, 2018, from <https://ppp.worldbank.org/public-private-partnership/financing/risk-allocation-mitigation>

³² Chan, A. P., Lam, P. T., Chan, D. W., Cheung, E., & Ke, Y. (2009). Drivers for Adopting Public-Private Partnerships—Empirical Comparison between China and Hong Kong Special Administrative Region. *Journal of Construction Engineering and Management* (c) ASCE, 101061(1943-7862.0000088), 1115-1124.

³³ Afme, & ICMA. (2015, June). Guide to infrastructure financing - Bank loans, debt private placements, and public bonds. Guide to infrastructure financing. Retrieved from https://www.afme.eu/globalassets/downloads/publications/afme_guide_to_infrastructure_financing2.pdf

- *Term of finance* – Since infrastructure projects always take a long time to complete, they require a long-term financial commitment. The term of finance should match the term of the need “Matching principle”.³⁴ Otherwise, refinancing risk will occur to pose a severe threat to the project. Therefore, the financing method that ensures enough financial resource in the longest-term is most preferred, i.e., the one with the least restrictions in the tenor.

As the main problem of infrastructure deficits in developing nations stems from the local Government’s limited budget, the most critical attribute in choosing a financing mechanism is affordability, i.e., the cost of financing. Due to the capital-intensive nature of infrastructure projects, risk management has to be very carefully planned. The risk management capacity is, therefore, ranked the second most important criterion. Another essential factor to consider when determining a way to fund a project is transaction cost. Statistics show that delays in negotiation have become the most significant obstacle to implementing PPP in China.^{35, 36}

The third most important criterion is, thus, the transaction cost associated with each financing model, followed by the term of finance. Restrictions in the finance term or tenor are directly related to refinancing risk, i.e., the possibility of an individual or company being unable to replace an existing loan with a new one at a critical time.³⁷ The fifth most important attribute is the minimum size of capital. Access to expertise that comes with each financing mechanism is ranked sixth.

Finally, rights, responsibilities, and relationships amongst government, project deliverers, and end users can be clearly defined through a specific financing method. However, in infrastructure projects, the public sector is still dominant in initiating, funding, and owning public projects. Therefore, the absoluteness of ownership or dependency on sponsors or lenders is considered the least important compared to the other criteria.

³⁴ ACCA. (2011). Analysing the suitability of financing alternatives. [online]

³⁵ Chan, A. P., Lam, P. T., Chan, D. W., Cheung, E., & Ke, Y. (2010). Potential Obstacles to Successful Implementation of Public-Private Partnerships in Beijing and the Hong Kong Special Administrative Region. *Journal of Management in Engineering*, 26(1), 30-40.

³⁶ Grimsey, D., & Lewis, M. K. (2007). *Grimsey, Darrin, and Mervyn Lewis. 2004. Public-Private Partnership: The Worldwide Revolution in Infrastructure Provision and Project Finance.* Edward Elgar Publishing.

³⁷ Investopedia. (2018, July 22). Refinancing Risk. Retrieved from

https://www.investopedia.com/terms/r/refinancing_risk.asp

Attribute	Affordability	Minimum size of capital	Risk management capacity	Transaction cost	Access to expertise	Dependency	Term of finance	Score	Ordinal Ranking
Affordability	1	1	1	1	1	1	1	6	1
Minimum size of capital	0	0	0	0	1	1	0	2	5
Risk management capacity	0	1	0	1	1	1	1	5	2
Transaction cost	0	1	0	0	1	1	1	4	3
Access to expertise	0	0	0	0	0	1	0	1	6
Dependency	0	0	0	0	0	0	0	0	7
Term of finance	0	1	0	0	1	1	0	3	4

Table 1: Ranking of the features of the financing mechanisms according to their relative importance ³⁸

FINDINGS

Step 5: Analysis and comparison of the alternatives

Attribute	Financing Alternatives								Color	Score	Meaning
	Government funding	Corporate (on-balance sheet) finance	Project finance	Forfeiting model	Municipal bonds	Bank loans	Official Development Assistance (ODA) grants	Countertrade			
Affordability	4	1	2	3	4	2	4	2	Red	1	Bad/Short-term
Minimum size of capital	1	2	4	2	4	2	3	1	Orange	2	Acceptable/Medium-term
Risk management capacity	2	2	4	3	2	1	3	2	Yellow	3	Good/Long-term
Transaction cost	4	2	3	4	2	1	1	2	Green	4	Excellent
Access to expertise	1	4	4	2	1	1	2	1	Red		
Dependency	4	1	2	2	4	3	1	3	Orange		
Term of finance	3	3	3	3	3	1	2	1	Red		
Total score	19	15	22	19	20	11	16	12			
Average score	2,71	2,14	3,14	2,71	2,86	1,57	2,29	1,71			

Table 2: MADM analysis of alternatives ³⁹

³⁸ By author

³⁹ By author

In this section, an MDAM analysis on each financing alternative is conducted based on the selection criteria, as shown in Table 2, and the preliminary summary of the rank order of the options in Table 3. Given the lack of information on a real specific project and its context, the scoring is based on a comparative analysis of each alternative against one another, regarding each criterion. For example, the score that each financing alternative gets for the minimum size of capital is based on the size of capital or borrowing of each alternative compared to the others.

Rank	Financing Alternative
1	Project finance
2	Municipal bonds
3	Government funding
	Forfeiting model
4	Official Development Assistance (ODA) grants
5	Corporate (on-balance sheet) finance
6	Countertrade
7	Bank loans

Table 3: Preliminary rank order of the financing alternatives ⁴⁰

From Table 2, project finance is the most preferred financing alternative for infrastructure projects in developing countries with the highest average score of 3.14, followed by municipal bonds with an average score of 2.86. The government funding and forfeiting model come as the third best options. The least preferred alternative is bank loans with the average score of 1.57 due to the conservative and limited lending capacity of banks and tight tenor limit.

The relative values of the attributes are then calculated to determine the relative weight of each alternative. The calculation result of the attribute values and the relative importance of each financing alternative are shown in Table 4 and Table 5, respectively.

As the selection criteria are not equally important, the alternative analysis is developed further based on the preliminary MDAM analysis, with a relative weight assigned to each attribute based on the ordinal ranking of the attributes from Table 1. Table 6 shows the final comparison of the financing alternatives using non-dimensional data technique and Table 7 the summary of the final rank order of the options.

⁴⁰ By author

The result from Table 6 shows that project finance is the best financing alternative followed by municipal bonds, with a nominalized overall score of 0.774 and 0.667, respectively. The third best alternative is government funding. Finally, bank loans and countertrade are the least desirable alternatives for infrastructure projects in developing nations.

Attribute	Value	Formula	Dimensionless Value
Affordability	Excellent	Relative Rank (4-1)/(4-1)	1
	Good	Relative Rank (3-1)/(4-1)	0.67
	Acceptable	Relative Rank (2-1)/(4-1)	0.33
	Bad	Relative Rank (1-1)/(4-1)	0
Minimum size of capital	Excellent	Relative Rank (4-1)/(4-1)	1
	Good	Relative Rank (3-1)/(4-1)	0.67
	Acceptable	Relative Rank (2-1)/(4-1)	0.33
	Bad	Relative Rank (1-1)/(4-1)	0
Risk management capacity	Excellent	Relative Rank (4-1)/(4-1)	1
	Good	Relative Rank (3-1)/(4-1)	0.67
	Acceptable	Relative Rank (2-1)/(4-1)	0.33
	Bad	Relative Rank (1-1)/(4-1)	0
Transaction cost	Excellent	Relative Rank (4-1)/(4-1)	1
	Good	Relative Rank (3-1)/(4-1)	0.67
	Acceptable	Relative Rank (2-1)/(4-1)	0.33
	Bad	Relative Rank (1-1)/(4-1)	0
Access to expertise	Excellent	Relative Rank (4-1)/(4-1)	1
	Good	Relative Rank (3-1)/(4-1)	0.67
	Acceptable	Relative Rank (2-1)/(4-1)	0.33
	Bad	Relative Rank (1-1)/(4-1)	0
Dependency	Excellent	Relative Rank (4-1)/(4-1)	1
	Good	Relative Rank (3-1)/(4-1)	0.67
	Acceptable	Relative Rank (2-1)/(4-1)	0.33
	Bad	Relative Rank (1-1)/(4-1)	0
Term of finance	Long-term	Relative Rank (3-1)/(3-1)	1
	Medium-term	Relative Rank (2-1)/(3-1)	0.50
	Short-term	Relative Rank (1-1)/(3-1)	0

Table 4: Relative value of each selection criterion ⁴¹

⁴¹ By author

Attribute	Financing Alternatives							
	Government funding	Corporate (on-balance sheet) finance	Project finance	Forfeiting model	Municipal bonds	Bank loans	Official Development Assistance (ODA) grants	Countertrade
Affordability	1	0	0.33	0.67	1	0.33	1	0.33
Minimum size of capital	0	0.33	1	0.33	1	0.33	0.67	0
Risk management capacity	0.33	0.33	1	0.67	0.33	0	0.67	0.33
Transaction cost	1	0.33	0.67	1	0.33	0	0	0.33
Access to expertise	0	1	1	0.33	0	0	0.33	0
Dependency	1	0	0.33	0.33	1	0.67	0	0.67
Term of finance	1	1	1	1	1	0	0.5	0
Total score	4.33	2.99	5.33	4.33	4.66	1.33	3.17	1.66

Table 5: Relative weight of each financing alternative ⁴²

Financing Alternatives			Government funding		Corporate (on-balance sheet) finance		Project finance		Forfeiting model		Municipal bonds		Bank loans		Official Development Assistance (ODA) grants		Countertrade	
Criteria	Ordinal Ranking	Nominalized Weight (A)	(B)	(A)*(B)	C	(A)*(C)	(D)	(A)*(D)	E	(A)*(E)	(F)	(A)*(F)	(G)	(A)*(G)	(H)	(A)*(H)	(I)	(A)*(I)
Affordability	1	0,036	1	0,036	0	0,000	0.33	0,012	0,67	0,024	1	0,036	0.33	0,012	1	0,036	0.33	0,012
Risk management capacity	2	0,071	0.33	0,024	0.33	0,024	1	0,071	0,67	0,048	0.33	0,024	0	0,000	0.67	0,048	0.33	0,024
Transaction cost	3	0,107	1	0,107	0.33	0,036	0.67	0,071	1	0,107	0.33	0,036	0	0,000	0	0,000	0.33	0,036
Term of finance	4	0,143	1	0,143	1	0,143	1	0,143	1	0,143	1	0,143	0	0,000	0.5	0,071	0	0,000
Minimum size of capital	5	0,179	0	0,000	0.33	0,060	1	0,179	0.33	0,060	1	0,179	0.33	0,060	0.67	0,119	0	0,000
Access to expertise	6	0,214	0	0,000	1	0,214	1	0,214	0.33	0,071	0	0,000	0	0,000	0.33	0,071	0	0,000
Dependency	7	0,250	1	0,250	0	0,000	0.33	0,083	0.33	0,083	1	0,250	0.67	0,167	0	0,000	0.67	0,167
Sum	28	1		0,560		0,476		0,774		0,536		0,667		0,238		0,345		0,238

Table 6: Comparison of the financing alternatives using non-dimensional data technique ⁴³

⁴² By author

⁴³ By author

Rank	Financing Alternative
1	Project finance
2	Municipal bonds
3	Government funding
4	Forfeiting model
5	Corporate (on-balance sheet) finance
6	Official Development Assistance (ODA) grants
7	Bank loans
	Countertrade

Table 7: Final rank order of the financing alternatives ⁴⁴

Step 6: Selection of the preferred alternative

This section discusses and analyzes the best financing alternative, considering the selection criteria; affordability, risk management, transaction cost, the term of finance, size of capital, expertise, and dependency, as defined in step 4.

Based on the final comparison of the alternatives on Table 6, project finance, the best financing option, is 16% better than municipal bonds, the second best alternative, and 38% better than government funding. The result of the percentage comparison is shown in table 8.

Financing Alternative	Project finance	Municipal bonds	Government funding	Forfeiting model	Corporate (on-balance sheet) finance	ODA grants	Bank loans	Countertrade
Nominalized Score	0,774	0,667	0,560	0,536	0,476	0,345	0,238	0,238
Percentage Comparison								
Project finance vs Municipal bonds	116,07 %							
Project finance vs Government funding	138,30 %							
Project finance vs Forfeiting model	144,44 %							
Project finance vs Corporate funding	162,50 %							
Project finance vs ODA grants	224,14 %							
Project finance vs Bank loans	325,00 %							
Project finance vs Countertrade	325,00 %							

Table 8: Percentage comparison of project finance and municipal bonds to the other financing options ⁴⁵

Concerning the selection criteria, project finance is the most preferred for infrastructure projects in developing countries because of the following attributes.

⁴⁴ By author

⁴⁵ By author

As infrastructure projects are one of the most capital-intensive types of projects and involve many stakeholders, risk management is utterly essential. Despite the higher financing cost compared to government funding, municipal bonds, and ODA, project finance allows risk allocation so that risks will be managed and controlled by various project partners (financiers, managers, public sector) based on their varying abilities to manage and control risks (ibid).⁴⁶ Table 9 shows that the project owner is well protected in case of bad-performance of the contractor. The lender also primarily bears the risk and consequences when the private contractor is unable to fulfill the contract, i.e., the risk of insolvency. Due to this, the lender has the interest to control and influence the fulfillment of the PPP contract. In case of an insufficient or non-performance of the private contractor, Step-in-Rights arranged with the public principal allow the lender to replace the contractor by another.⁴⁷

Besides, the higher cost of financing of project finance represents its better risk allocation feature, the so-called risk-related financing costs, compared to that of the other financing alternatives such as forfeiting model, as shown in Table 10. This feature is also one fundamental rationale of Public-Private Partnerships. Additionally, the cost of financing, the interest term set by the lender, as well as the financing decision of the shareholder are influenced by the expected future cash flows that the SPV will generate.

	Project Finance	Forfeiting Model
Bad-performance	<ul style="list-style-type: none"> • Unrestrained reduction of the unitary payment, • Bonus-malus-arrangements for the whole sum of the unitary payment 	<ul style="list-style-type: none"> • Reduction only for that part of the unitary payment resulting from the operation, • Bonus-malus-arrangements for the operation part of the unitary payment
Non-performance in the construction period	<ul style="list-style-type: none"> • The private partner has to pre-finance the construction costs - the insolvency risk bears the lender 	
Non-performance in the operation period	<ul style="list-style-type: none"> • The lender bears the insolvency risk and the related costs • He replaces the contractor (Step-in-Rights) 	<ul style="list-style-type: none"> • The public principal bears the insolvency risk and additional costs

Table 9: A comparison of possibilities to react in the case of bad- and non-performance 47

⁴⁶ OECD. (2015a). Infrastructure Financing Instruments and Incentives. Retrieved from <http://www.oecd.org/finance/private-pensions/Infrastructure-Financing-Instruments-and-Incentives.pdf>

⁴⁷ Daube, D., Vollrath, S., & Alfen, H. W. (2007). A Comparison of Project Finance and the Forfeiting Model as Financing Forms for PPP Projects in Germany. *International Journal of Project Management*, 26(2008), 376-387. [online]

	Project Finance	Forfeiting Model
Interest reference rate (e.g. EURIBOR)	<ul style="list-style-type: none"> The interest rate is base for each financing form and its height is equal for all 	
Risk-related financing costs	<ul style="list-style-type: none"> Substantial risk transfer Includes insolvency risk of the SPV Due Diligence costs because of the project's complexity 	<ul style="list-style-type: none"> Lower extent of risk transfer Does not include insolvency risk of the SPV No Due Diligence made

Table 10: Composition of financing costs 47

In corporate finance, the lenders or investors in the relevant financing will have recourse to the whole corporate entity, and not just to the specific asset being financed. Project finance, on the contrary, is the financing of a non-recourse project that will be carried out through a bankruptcy-remote Special Purpose Vehicle (SPV), whose assets are primarily, or exclusively, the project debt and the sponsor equity within the SPV.⁴⁸ Consequently, the financing cost of corporate finance is generally higher than that of project finance.⁴⁹

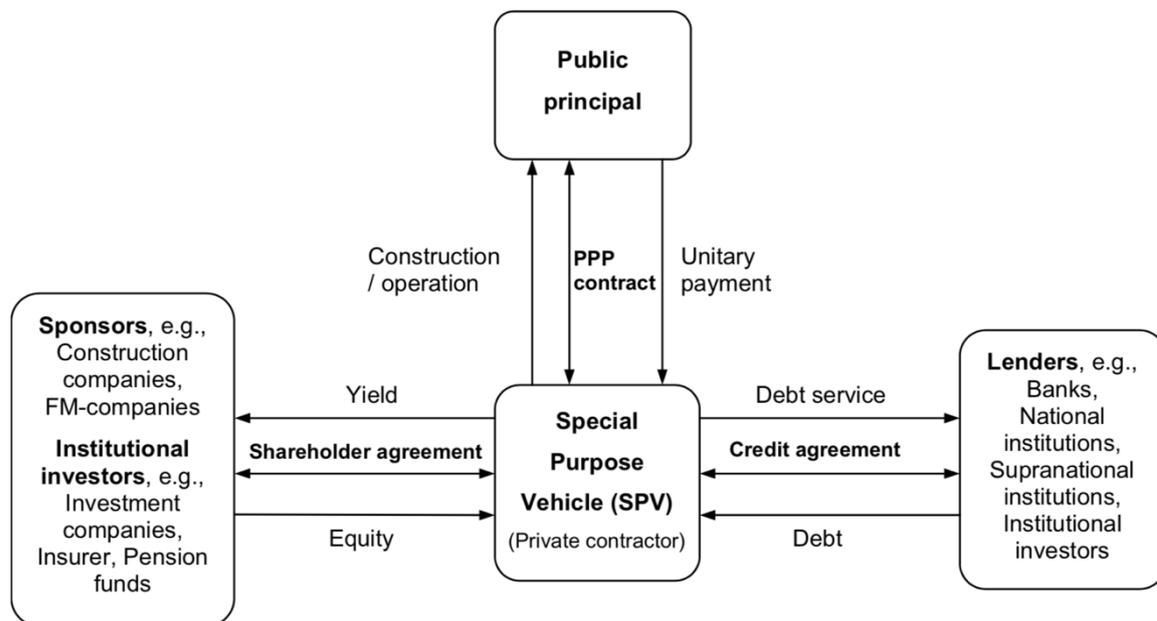


Figure 2: The structure of Project Finance 50

⁴⁸ Afme, & ICMA. (2015, June). Guide to infrastructure financing - Bank loans, debt private placements and public bonds. Guide to infrastructure financing. [online]

⁴⁹ OECD. (2015a). Infrastructure Financing Instruments and Incentives. [online]

⁵⁰ Daube, D., Vollrath, S., & Alfen, H. W. (2007). A Comparison of Project Finance and the Forfeiting Model as Financing Forms for PPP Projects in Germany. International Journal of Project Management, 26(2008), 376-387. [online]

Moreover, project finance incurs acceptably low transaction cost due to the co-investment platforms it offers that pool investor capital to be deployed directly in infrastructure projects, bypassing intermediaries such as investment managers or banks. This trend is reinforced by large funds looking to reduce the cost of infrastructure investment, and to align internal governance and portfolio management models with direct infrastructure investments, offsetting the transaction cost of pre-investment decision making assessments. Various expert investors on the platforms bring with them different competencies required to assess the risk and return of infrastructure investments, and to conduct extensive due diligence on infrastructure assets required before the investment decision.⁴⁹ This can save much time for other less expert investors, reducing delays in the decision making and investment process.

Another critical attribute of project finance is its long-term nature that matches the long project life-cycle of infrastructure projects. Accordingly, the refinancing problem is far less severe for projects financed with project finance than for those funded with bank loans that typically offer a much shorter tenor and with stricter tenor restrictions.⁴⁸

Project finance was introduced due to government budgetary constraints as co-investment platforms to leverage institutional investors' capital in project finance. The size of aggregated capital is also another positive aspect of project finance, where capital comes from various forms and sources, from bonds and loans to listed and unlisted equity, as shown in the third column from left on Table 11. In total, debt represents the primary source of capital in project finance. In the case of a larger project, the gap between equity and debt can be filled with mezzanine-capital.^{49, 51}

Finally, as debt represents the primary source of capital in project finance and the lender only intervenes in the case of non-performance in the operation period ⁵², the degree of dependency is well acceptable, regarding the extensive technical and commercial competence of the sponsor who is a shareholder of the SPV to fulfill the contractual obligations.^{49, 53}

⁵¹ Braune, G. D. (2006). Finanzierung - Public Private Partnership im öffentlichen Hochbau. Littwin/Schöne (Ed.). Stuttgart: 264-300.

⁵² Daube, D., Vollrath, S., & Alfen, H. W. (2007). A Comparison of Project Finance and the Forfeiting Model as Financing Forms for PPP Projects in Germany. *International Journal of Project Management*, 26(2008), 376-387. [online]

⁵³ Merna, T., & Njiru, C. (2002). Financing Infrastructure Projects. *Construction Management Series*, 5-6.

Modes		Infrastructure Finance Instruments		Market Vehicles
Asset Category	Instrument	Infrastructure Project	Corporate Balance Sheet / Other Entities	Capital Pool
Fixed Income	Bonds	Project Bonds	Corporate Bonds, Green Bonds	Bond Indices, Bond Funds, ETFs
		Municipal, Sub-sovereign bonds		
		Green Bonds, Sukuk	Subordinated Bonds	
	Loans	Direct/Co-Investment lending to Infrastructure project, Syndicated Project Loans	Direct/Co-investment lending to infrastructure corporate	Debt Funds (GPs)
Syndicated Loans, Securitized Loans (ABS), CLOs			Loan Indices, Loan Funds	
Mixed	Hybrid	Subordinated Loans/Bonds, Mezzanine Finance	Subordinated Bonds, Convertible Bonds, Preferred Stock	Mezzanine Debt Funds (GPs), Hybrid Debt Funds
Equity	Listed	YieldCos	Listed infrastructure & utilities stocks, Closed-end Funds, REITs, IITs, MLPs	Listed Infrastructure Equity Funds, Indices, trusts, ETFs
	Unlisted	Direct/Co-Investment in infrastructure project equity, PPP	Direct/Co-Investment in infrastructure corporate equity	Unlisted Infrastructure Funds

Table 11: Taxonomy of instruments and vehicles for infrastructure financing ⁵⁴

Step 7: Performance monitoring and the post-evaluation of results

Based on the selected attributes, project finance is the best option for infrastructure financing in developing nations. Project finance is, by far, considered one of the most efficient financing mechanisms for infrastructure projects.⁵⁵ For example, Malaysia has been prosperous in financing its infrastructure development through the issuance of project bonds “sukuk” (Islamic bonds structured to generate returns for investors without contravening Islamic law). However, as each country and market has different inherent features, project financing might not be the best option for every developing country, despite many successful projects and extensive use of project finance in the developing economies.

Furthermore, project financing might not be the only “best” solution. This notion can be illustrated by the rising trend of municipal bonds in some major developing countries,

⁵⁴ OECD. (2015b). Mapping Channels to Mobilise Institutional Investment in Sustainable Energy, Green Finance and Investment. OECD Publishing, Paris. Retrieved from <http://dx.doi.org/10.1787/9789264224582-en>

⁵⁵ World Bank Group. (2016, September 6). Main Financing Mechanisms for Infrastructure Projects. [online]

such as India and China,⁵⁶ the world's largest infrastructure market in 2015 with 38 percent of global spending.⁵⁷ Municipal bonds can also be the best option for some developing nations because, if appropriately structured, they can be issued at a very low cost. An example of a successful project financed by municipal bonds is the "smart cities missions" project in India. However, the government needs to invest in meeting the prerequisites of its first-bond issue, thereby establishing the market for municipal bonds.⁵⁸

No one particular market is necessarily optimal for financing infrastructure projects while fulfilling all the project's requirements. As a result, consideration of the relative values and priority weighing should be given to a variety of factors, such as the flexibility to accommodate changes to circumstances over the life of the project.⁵⁹

Besides, the degree of development and liquidity of the national capital markets is an essential factor for the financing choice. Of the 53 countries in the Asia-Pacific region, 35 have a stock exchange though at a different level of development. Also, with the exceptions of a few countries, market capitalization is relatively limited in the region. Furthermore, the liquidity in the Asian equity markets tends to be low, which reduces their attractiveness for investors seeking the possibility of rapid exits at a stable price.⁶⁰

Other important factors to consider when choosing a financing method are the legal framework, the risks presented by each option, and most importantly, the government's objective given a set of constraints.⁶¹ Furthermore, the financing choice much depends on project-specific criteria, such as the investment volume and the allocation of risks as well as the individual risk-return-structure of the investor.⁶² For example, the level of debt financing that a local authority can bear, public law guidelines for the federal budgets as well as other restrictions for the public principal have to be considered. Furthermore, the project's goals and the decision maker's willingness to transfer risks determine which financing form is the most efficient one and may attain a better value for money.⁶³

In summary, no one best financing option fits all infrastructure projects in all countries.

⁵⁶ Verougstraete, M., & Aras, A. (2018). Tapping Capital Markets and Institutional Investors for Infrastructure Development. Working Paper Series - Macroeconomic Policy and Financing for Development Division. [online]

⁵⁷ Woetzel, J., Garemo, N., Mischke, J., Kamra, P., & Palter, R. (2017, October). McKinsey Global Institute Bridging Infrastructure Gaps - Has the world made progress? Discussion Paper in Collaboration with McKinsey's Capital Projects and Infrastructure Practice. [online]

⁵⁸ Sheikh, S., & Asher, M. G. (2012). A Case for Developing the Municipal Bond Market in India. *ASCI Journal of Management*, 42(1), 1-19. Retrieved from

https://www.researchgate.net/publication/256037822_A_Case_for_Developing_the_Municipal_Bond_Market_in_India

⁵⁹ Afme, & ICMA. (2015, June). Guide to infrastructure financing - Bank loans, debt private placements and public bonds. Guide to infrastructure financing. [online]

⁶⁰ Verougstraete, M., & Aras, A. (2018). Tapping Capital Markets and Institutional Investors for Infrastructure Development. Working Paper Series - Macroeconomic Policy and Financing for Development Division. [online]

⁶¹ Republic of the Philippines Public-Private Partnership Center. (2017, May 31). Press Statement: Public funds, ODA, PPP, Hybrid — which one? Retrieved from https://ppp.gov.ph/?press_releases=press-statement-3

⁶² Merna, T., & Njiru, C. (2002). Financing Infrastructure Projects. *Construction Management Series*, 5-6.

⁶³ Daube, D., Vollrath, S., & Alfen, H. W. (2007). A Comparison of Project Finance and the Forfeiting Model as Financing Forms for PPP Projects in Germany. *International Journal of Project Management*, 26(2008), 376-387. [online]

CONCLUSION

In the face of continuously rising needs for infrastructure facilities across the globe, while governments' budgets are limited, investment gaps have become a serious issue, particularly in developing countries where the infrastructure needs and deficits are particularly huge.

However, infrastructure financing in developing countries is constrained by many challenges, as follows: ^{64, 65}

- Exposure to currency risk
- Inadequate contractual protection
- Limited scope and flexibility for divesting equity holdings in infrastructure investment through IPOs
- Bankability of projects
- Inadequate legal and regulatory framework
- Underdevelopment of the national financial or capital market

In the attempt to help close the infrastructure financing gaps, the primary objective of this paper is to analyze the main financing options and to compare and contrast them to ultimately determine the best financing mechanism for infrastructure projects in developing nations.

As some project financing methods (i.e., PPP) often involve private construction companies as the shareholders, projects are only “bought now and paid later”; the public principal pays a unitary charge (unitary payment) over the whole life cycle that refinances the private contractor’s investments in public infrastructure.⁶⁶ Delivery contracts of PPP projects are different from those of traditional procurement projects regarding delivery, liability, management, control, and payment. These different contracts require different ways of management. These contractual terms also influence the financing choice of the public sector. This paper, therefore, has added to the knowledge on the contract management domain.

By using the MADM analysis and the subsequent non-dimensional data technique, the paper reveals that project finance is the best financing option, based on the following selection criteria:

- Affordability
- Minimum size of a capital
- Risk management capacity

⁶⁴ Emenike, K. O. (2015). Infrastructure Finance Mechanism and Challenges in Nigeria. *Independent Journal of Management & Production (IJM&P)*, 6(3), 832-833. doi:10.14807/ijmp.v6i3.317

⁶⁵ PwC. (2017b). Exploring Alternative Solutions to Infrastructure Financing - What you need to know? Retrieved from <https://www.pwc.com/id/en/publications/Infrastructure/Alternative%20Solutions%20to%20Infrastructure%20Financing.pdf>

⁶⁶ Weber, M., Schäfer, M., & Hausmann, F. (2006). *Handbuch Public Private Partnership*.

- Transaction cost
- Access to expertise
- Dependency
- Term of finance

However, due to the lack of real project-specific context and the fact that the paper does not take every possible factor (e.g., legal framework and specific market features) into account, there is no guarantee that project finance will be the optimal financing option for every project in every developing nation.

RECOMMENDATION

Follow-on research and further investigations into this subject using case studies are required. Therein, an analysis of risks and financing costs based on data from real projects seems to be helpful. This empirical evidence can support and verify the more theoretical approach and findings of this paper. Finally, more qualitative selection criteria should be applied, and hybrid financing models should be studied.

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