Critical Factors Affecting the Efficient Use of Public Investments in Infrastructure in Vietnam

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Abstract: This paper examines the critical factors affecting the efficient use of public investments in infrastructure to support trade and economic development. Investments in infrastructure have increasingly been used to improve the infrastructure quality, thus stimulating trade and economic development in developing countries. Nevertheless, a number of infrastructure challenges faced by developing countries remains. This raises the question about the efficiency in the use of public investments in infrastructure. Based on the case of Vietnam, this paper identifies a number of deficiencies in the planning and policymaking process as well as in the implementation of infrastructure plans. This paper aims to show policymakers that the critical challenge faced by developing countries in infrastructure construction is thus not about the funding but should be more about effective planning and implementation for long-term benefits. **DOI: 10.1061/(ASCE)IS.1943-555X.0000243.**

Introduction

Infrastructure is regarded as one of the determinants of international competitiveness, which directly impact the ability of countries to engage in international trade and to compete for foreign direct investments (APEC 1997; Nwankwo 2000; Kohsaka 2006; Brooks 2008). The poor quality and inadequacy of infrastructure thus become one of the major development challenges in many developing countries. Considerable financing is required to meet large-scale infrastructure expansions in developing economies. As a result, the literature is dominated by studies focusing on potential difficulties in project financing for infrastructure development (Fay and Yepes 2003; Davis 2008; Khasnabis et al. 2010; Arnold 2011; Heravi and Hajihosseini 2011).

The study of infrastructure in developing countries by Devarajan et al. (1996), however, indicated that infrastructure actually had negative impacts on economic growth. The empirical analysis by Flyvbjerg (2008) indicated that cost overruns, benefit shortfalls, and waste were found in most infrastructure projects around the world. The low efficiency and quality of public investments in infrastructure found in these studies suggest that there are important issues beyond the difficulties in project financing for infrastructure development. A focus on financing issues therefore does not provide a comprehensive answer to the infrastructure development problems in developing countries.

Globally, government investments accounted for 78% of total investments in infrastructure construction from 1994 to 2003 (Estache 2006; Kenny 2007). It is therefore important to focus on the way infrastructure is planned and built at the national level, to support trade and economic development. Based on the case of Vietnam, this paper identifies a number of deficiencies in the planning and policymaking process as well as in the implementation of infrastructure plans. This paper aims to show policymakers that the critical challenge faced by developing countries in infrastructure construction is thus not solely about the funding but should be more about effective planning and implementation for long-term benefits.

The paper starts with a literature review on major problems in infrastructure development in developing countries. Next is an overview of infrastructure development in the case of Vietnam. The research methodology adopted in the research reported in this paper and data analysis is presented next. Finally, the paper summarizes the subject matter and the major research findings. Notably, infrastructure can be categorized into economic and social infrastructure. While social infrastructure supports social development, economic infrastructure supports economic activities of the national economy (World Bank 1994). Since the paper focuses on infrastructure built to support economic development and trade, the scope of this paper is confined to economic infrastructure.

Infrastructure Planning and Delivery in Developing Countries

Problems in Infrastructure Planning

There are a number of issues relating to the quality of infrastructure planning outcomes, including the absence of an adequate problem analysis, lack of alternatives, ambiguities about the effects of improved infrastructure on the development of a wider area, inadequate research of the interaction across infrastructure sectors, and underestimated costs and overestimated benefits (E. Estache and M. Fay, working Paper No. 4410, World Bank, Washington, District of Columbia, 2007; Flyvbjerg 2007; Priemus 2010). The poor quality of infrastructure planning outcomes would thus result in bad policy choices, which subsequently have a wider effect on the economy. Although infrastructure planning tools have recently been developed (Schweikert and Chinowsky 2012; World Economic Forum 2012), there are deficiencies in the capacities required for using these tools. Tackling deficiencies in planning and policymaking capacities of governments can therefore play a crucial role in determining the efficiency of public investments in infrastructure, for trade and

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economic growth in developing countries. Reviewing the literature on government planning, especially in the area of infrastructure development, the subsequent factors can be attributed to deficiencies in the infrastructure planning and policymaking process.

Capacity for Estimation and Monitoring of Rates of Return of Projects

Unexpected infrastructure planning outcomes can first be explained by the lack of capacity for estimation and monitoring of rates of return of projects (including limitations of forecasting methods and appraisal techniques) inadequate data, inherent problems in predicting the future and monetizing external and indirect effects), lack of experienced forecasters, lack of quality checks on planning outcomes, and inadequacy in routinely ex post analysis and external audits [on whether policies and projects meet objectives (Short and Kopp 2005; Flyvbjerg 2007; Collier and Venables 2008)].

Politicized Decision Making

Besides these technical factors, failures of the planning process could be explained by the political factor (Devarajan and Swaroop 1993; Todaro and Smith 2003; Flyvbjerg 2007). Political leaders and government bureaucrats can use investments in infrastructure construction as a tool for securing political positions or competing for scarce funds. Lack of commitment of political leaders and government bureaucrats to national goals could therefore make infrastructure planning and decision making politicized rather than rationalized. In addition, powerful groups with vested interests can create pressure to affect the planning that serves their own interests (Todaro and Smith 2003; Henisz and Zelner 2006).

Transparency and Accountability

Infrastructure planning and policymaking processes are rarely fully transparent to the public. Forecasting methods, criteria of project selection, and the determination of planning objectives are often not made available for consultation with the interested (or affected) individuals or groups. Independent peer reviews and quality checks, on forecasts and planning outcomes by independent-review bodies as well as the scientific and professional community, are not sufficient. Lack of penal systems to enforce penalties on those that deliberately and consistently produce deceptive forecasts is also attributable to the accountability problem (Short and Kopp 2005; Flyvbjerg 2007).

Institutional Weaknesses in Planning

Since planning and policymaking for infrastructure is a multiactor process, nurturing of an institutional capacity that coordinates efforts and resources is considered one of the determinants of infrastructure development (Mody 1997). However, there are a number of institutional weaknesses of the planning processes of most developing countries, including the poor communication between the planning agency and the day-to-day decision-making machinery of government, intersectoral rivalries, lack of interaction between political leaders, planners with nongovernmental actors, incompetent and unqualified civil servants, as well as complicated and bureaucratic administrative systems (Todaro and Smith 2003).

Problems in Delivery of Infrastructure

While there may be widespread agreement with a policy of supporting the increase of infrastructure investments for trade and economic growth, there are concerns in infrastructure construction. In recent years, governments, especially those in developing countries such as China and India, have initiated ambitious infrastructure investment plans (Arnold 2011). Empirical evidence in developing countries has shown that even if sufficient investments are raised, there are still a number of issues in infrastructure construction (for example, delays, cost overruns, poor quality, safety, and productivity) to transform these master plans into physical infrastructure capital (Ahmad 2004; Long et al. 2004; Le-Hoai et al. 2008; Toor and Ogunlana 2008; LaFraniere 2011; Memon et al. 2011). To improve the quality and efficiency of infrastructure investment and planning, these issues in the implementation of infrastructure development plans need to be examined.

Political Commitment

Studies on infrastructure development in east Asia have emphasized that sustained and powerful government leadership is crucial (Mody 1997). Infrastructure development involves a long-range vision that sustained commitment from the government is essential to support the development of a concrete strategy and subsequent actions. Lack of political commitment thus could have direct effects on the implementation of infrastructure development plans (Waterston 2006; Womack 2008). Lack of political commitment could be the result of political discontinuity, political inconsistencies at the national level and between different tiers of governments, and lack of a high-powered government institution that provides an effective mechanism for implementing national infrastructure plans (Priemus 2010).

Corruption in Infrastructure Construction

Construction, in particular infrastructure construction, continues to be ranked as one of the most corrupt sectors worldwide. Corruption in the sector occurs in all stages from securing government contracts to the delivery of infrastructure. Major impacts of corruption in infrastructure can lead to poor construction, limited occupational safety, and low returns to government infrastructure investments (Kenny 2007). There are a number of causes of corruption in infrastructure construction, including the lack of transparency and competitiveness in bid processes, the discretionary power of individual bureaucrats involved in the award of contracts, inadequate financial and physical auditing, and inadequate capacity of regulatory bodies to enforce regulations (Kenny 2007; Dabla-Norris et al. 2011).

Land Acquisition

Problems in land acquisition can cause substantial delays and cost overruns in infrastructure construction (Priemus 2010). In many developing countries, land acquisition is considered one of the major barriers to government plans to develop infrastructure (Agrawal 1999; S. Morris, working Paper, Indian Institute of Management, Ahmedabad, India, 2007). Major problems in land acquisition for infrastructure in developing countries can include poor compensation and undervalued market price of land. Several causes for these problems can be identified, including (1) lack of a negotiating mechanism to make land acquisition compensation more market-oriented, (2) bureaucracy in settling land disputes and claims, (3) lack of a land acquisition compensation monitoring system, (4) lack of clarity about compensation valuation methods, and (5) lack of law enforcement to regulate land price speculation (Chan 2003; Raghuram et al. 2009; Widhiarto 2011).

Building Capacity of Local Firms

Various construction components, including finance, technology, management, materials, and labor, are required in the construction of infrastructure projects. The inadequate capacity of the domestic construction firms in developing countries to meet the level of construction activities required for the construction of infrastructure could thus affect the implementation of infrastructure development plans (Dang and Low 2011). Moreover, the inadequate capacity of the domestic construction firms could lead to increasing foreign participation, which in turn could limit the opportunities for local firms to win contracts and for the local labor to gain employment

(Raftery et al. 1998). Current issues pertaining to the capacity that domestic construction firms in developing countries are facing include poor level of efficiency and quality of work, poor level of professionalism and entrepreneurship, and resources shortages [especially in construction technology, management, and finance (Howes and Robinson 2005; Ofori 2012)].

Institutional and Legal Weaknesses in Infrastructure Construction

Other concerns involve institutional and legal weaknesses in infrastructure construction, including obsolescence of building regulations, changing and inconsistent law and regulations, ineffectiveness of implementation of existing statutes and codes, and bureaucracy in formal procedures [relating to project planning, construction permissions, and administration (Raftery et al. 1998; Ofori 2000, 2006)].

Case of Vietnam

Infrastructure-Related Indicators Compared to Other Asian Countries

Over the last decade, Vietnam has sustained about 9–10% of gross domestic product (GDP) invested in infrastructure (Nguyen and Dapice 2009; Moore et al. 2010). Compared to other east Asian countries during their period of rapid industrialization, Vietnam's level of infrastructure investment was relatively higher. For example, Taiwan invested 9.5% of GDP during 1970–1990, South Korea invested 8.7% during 1960–1990, and China invested about 8% between 2003 and 2004. Development experience also suggests a lower level of infrastructure investment, 7% of GDP, in order to maintain high economic growth (Nguyen and Dapice 2009).

However, the progress of infrastructure development in Vietnam remains slower than other regional countries. Vietnam's infrastructure ranked 111th out of 133 countries surveyed in a global competitiveness report (GCR) of 2009–2010 (Schwab 2009). From 2006–2010, time and costs of exporting and importing in Vietnam have been increasing (Doing 2010). Share of logistics costs was about 20–25% of Vietnam's GDP in 2009, which was far higher than that of developed countries and even higher than its neighbor and rival, China (Manila 2009).

According to various GCRs published by the World Economic Forum (Schwab 2008, 2009), among the major competitiveness indicators, Vietnam's infrastructure remained the biggest drag on the country's further economic development. Similarly, in other recent surveys such as those conducted by the Vietnam business forum and the Japanese external trade organization [as cited by Moore et al. (2010) and Nguyen and Dapice (2009)], poor infrastructure was identified as the largest bottleneck for doing business in Vietnam. Weak infrastructure is holding back the country to compete for both domestic and foreign investments, in manufacturing and exports, even though Vietnam is still a globally competitive, low-wage manufacturer and commodity producer (Tran 2009; Vo and Nguyen 2009).

Limited state budget and overseas development assistance (ODA) funds have been identified in many studies as the major cause for this poor progress. Solutions to the infrastructure bottlenecks in Vietnam thus seem to lie in further improvement in the public-private partnership (PPP) regulatory regime and the encouragement of private sector participation in infrastructure delivery (Warlters 2006; Vo 2007; Vo and Nguyen 2009; Moore et al. 2010). Although investment in infrastructure development has recently increased, the quality of the infrastructure system of Vietnam has not improved as expected.

Infrastructure Project Planning and Implementation

Official planning documents of Vietnam have varying time frames, ranging from 1 to 10 years. The 10-year socio-economic development strategy (SEDS) and 5-year socio-economic development plan (SEDP) also served as the basis for the formulation of sectoral and local development plans, including economic infrastructure development. Accompanying the 5-year SEDP was a public investment program (PIP). The PIP formed the basis for developing a framework of capital allocation among investments (Pincus and Nguyen 2004; Ministry of Planning and Investment 2007). The planning system is shown in Fig. 1.

In relation to capital investments, the coordination was led by the Ministry of Planning and Investment (MPI) and the Ministry of Finance (MOF). While the MPI provided the public investment program (PIP), including the list of investments, and investment budget compiled from sectoral master plans, the MOF was in charge of preparing the fiscal framework and recurrent expenditure for each sector. The PIP was prepared with reference to assessment of investment priorities given by the agencies involved. The PIP was finalized by the MPI and approved by the prime minister. Investments were classified into four levels [(1) National, (2) Group A, (3) Group B, and (4) Group C] in terms of their scale and importance. National projects along with other special projects have to be approved by the prime minister after the resolution issued by the national assembly. If necessary, the prime minister could set up a state committee to evaluate the investments which require approval by the prime minister, and the head of the state committee must be the minister of the MPI. Group A projects were decided by relevant line ministries. Group B and C investments were evaluated by relevant agencies at the provincial level (Prime 2009).

Over the past few years, the government of Vietnam has approved a number of infrastructure investment projects. However, there are a number of issues related to inappropriate master planning in project selection and investment coordination. Investments in infrastructure in rapidly growing and key regions should be the most essential. However, many large-scale roads, ports, and airports have been planned and built without consideration given to these regions (Nguyen and Dapice 2009; Vo and Nguyen 2009). Consequently, these newly built infrastructures were underutilized, while many rapidly growing regions were still facing severe infrastructure bottlenecks.

Besides inappropriate planning, the report by the Standing Committee of the National Assembly of Vietnam on the implementation of the state-funded infrastructure construction policy from 2005 to 2007 indicated that the disjointed distribution of investments was common and showed an upward trend. A number of investments were planned individually albeit their overlaps (Phuong 2008).

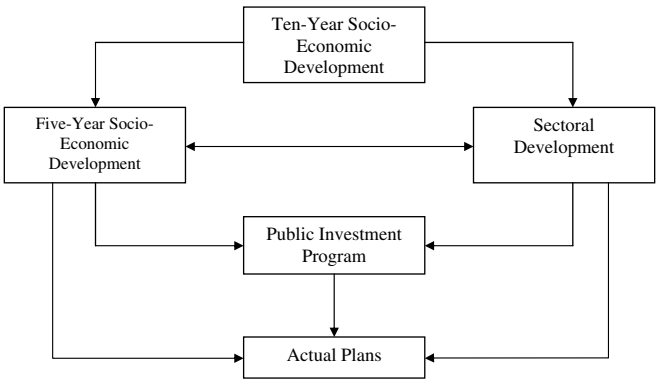

Fig. 1. Vietnam's national planning system

In addition, the increasingly poor performance of existing civil engineering works is affecting the effectiveness of these investments. Many roads in Vietnam are still in bad condition, suffering from inadequate structural design and construction (such as poor drainage and inadequate foundations or supporting structures) as well as poor maintenance. Even some newly built major municipal roads and bridges also suffer severe quality problems (Nguyen 2007; Kap 2008; Vu 2008; Tien and Huong 2009; Tuan 2010; Quang 2011).

The feasibility and cost-effectiveness of major infrastructure projects were questionable as well. One of the most problematic issues in building municipal roads is site-clearance related issues, which often remarkably raised total development time and costs of these roads (Vo 2008). Likewise, many ports have been built albeit in a very low cost-effective manner (Do 2006; Moore et al. 2010).

A report by the Standing Committee of the National Assembly discovered that within 3 years from 2005 to 2007, the number of infrastructure developments with fraudulent practices (or with time delay, low quality, or low-cost effectiveness) have gone up both by total amount and by percentage. The number was 1,882 projects, accounting for 14.57% of the total number of projects in 2005; and 3,173 projects, accounting for 18.1% of the total number of projects in 2006. The number continued to increase to 4,763 projects in 2007. According to the general secretary of Vietnam Federation of Civil Engineering Associations (VFCEA), Mr. Tran Ngoc Hung, time delay was worse than what was reported; constructionreported; construction time in Vietnam was often 1.5–2 times longer than that in other regional countries, and an upward trend could also be found in loss and waste in construction. Unnecessary bureaucracy was one of the major causes of time delay. On average, total time from acquiring investment approval to the beginning of construction works was about 42 months for Group A projects, 29 months for Group B, and 23 months for Group C. Some Group A developments took 4 years to clear the site and 5–7 years to complete the construction works (Vo 2008).

Long et al. (2004) conducted a survey of the issues relating to the poor performance of large construction projects in Vietnam. The survey's respondents were owners, designers/consultants, and contractors/subcontractors. Top-ranked factors included incompetent designers and contractors, poor estimation and change management, social and technological issues, site-related issues, and improper techniques and tools. The problems for these factors are listed in Table 1.

Similarly, Le-Hoai et al. (2008) conducted a survey on the cause of delay and cost overruns in large construction projects located in robust development economic zones in Vietnam. The study revealed a number of issues in the implementation of construction projects, which were often funded by the government. These issues included (1) slow payment of completed works, poor contract management, obsolete or unsuitable construction methods, and unforeseen site conditions, (2) poor site management and supervision, slow information flow between parties, and poor project management assistance; (3) mistakes in design, design changes, and additional works; (4) shortages of materials, inaccurate estimates, and price fluctuations; (5) financial difficulties of contractors and owners; (6) obstacles from government; and (7) shortages of skilled workers. Besides delay and cost overruns, other consequences caused by these problems were project failure, reduction of profit margin, waste of resources, and loss of sponsor as well as citizen trust in government-funded projects (Le-Hoai et al. 2008).

In a recent work by Ling and Hoang (2010), a number of risks related to the implementation of construction projects in Vietnam were also identified. The major risks were corruption; termination of public projects; bureaucratic administrative system; changing and inconsistent regulations; inadequate legal framework; and fluctuation of exchange, interest, and inflation rates. These risks, which can be classified as contextual risks (Marques and Berg 2011), are often a result of institutional weaknesses in the public sector.

Table 1. Major Factors Explaining the Poor Performance of Large Construction Projects in Vietnam

Factors	Problems
Incompetent designers and contractors	Inadequate project management assistance
	Impractical design
	Lack of involvement through project life
	Contractor financial difficulties
	Incompetent project team
	Poor site management
Poor estimation and change management	Excessive contractors and/or subcontractors
	Inaccurate time-estimating
	Inaccurate cost-estimating
	Excessive change orders
Social and technological issues	Obsolete technology
	Bureaucracy
	Fraudulent practices and kickbacks
Site-related issues	Slow site clearance
	Unsatisfactory site compensation
Improper techniques/tools	Inadequate modern equipment
	Improper planning and scheduling

Note: Adapted from Long et al. (2004).

While investments in infrastructure have increased, Vietnam was still suffering from more and more infrastructure weaknesses. Investments in infrastructure developments were often large and funded by state budget, loans, and aids from international organizations. Low quality, time overrun, and poor cost-effectiveness of infrastructure construction in Vietnam thus not only resulted in huge waste of resources and undercapacity performance of infrastructure in the short-term, but also affected economic development in the long-term. As noted previously, weak infrastructure is holding back the country from further economic development (Nguyen and Dapice 2009; Schwab 2009; Tran 2009; Vo and Nguyen 2009; Moore et al. 2010).

From the literature review, it is hypothesized that the efficient use of infrastructure funding is affected by the following problems:

- Infrastructure planning,
- Capacity for estimating and monitoring of rates of return of infrastructure projects,
- Politicized decision making,
- Transparency and accountability problems,
- Institutional weaknesses in planning,
- Infrastructure delivery,
- Political commitment,
- Corruption in infrastructure construction,
- Land acquisition problems,
- Building capacity of local firms, and
- Institutional weaknesses in infrastructure construction.

These problems can be reflected by various issues identified from the literature review (Table 2).

Research Methodology

A questionnaire survey was adopted in the research reported in this paper to obtain the views of the concerned parties on the research issues. The survey was conducted to explore the factors affecting the use of public investments in infrastructure for supporting

Table 2. List of Variables Affecting the Efficient Use of Public Investments in Infrastructure

Categories	Variables	Symbol
Capacity for estimating and monitoring of rates of return of infrastructure projects	Limitations of forecasting methods and appraisal techniques	X_1
	Inadequate data	X_2
	Inherent problems in predicting the future and monetizing external and indirect effects	X_3
	Lack of experienced forecasters	X_4
	Inadequacy in ex post analysis on whether projects meet objectives	X_5
Politicized decision making	Political leaders and government bureaucrats make decisions in their personal, sectoral, or regional interests—e.g., securing political positions or competing for scarce funds—as opposed to national goals	X_6
	Interest group pressure	X_7
Transparency and accountability	Lack of consultation with the interested or affected individuals or groups about forecasting methods, criteria of project selection, and the determination of planning objectives	X_8
	Lack of independent peer reviews and quality checks on forecasts and planning outcomes by independent-review bodies, and the scientific and professional community	X_9
	Lack of penal systems to enforce penalties on those that deliberately and consistently produce deceptive forecasts	X_{10}
Institutional weaknesses in planning	Poor communication between planning agency and the day-to-day decision making machinery of government	X_{11}
	Lack of interministerial and intersectoral coordination	X_{12}
	Lack of interaction between political leaders and planners with nongovernmental actors	X_{13}
	Incompetent and unqualified civil servants	X_{14}
	Complicated and bureaucratic administrative system	X_{15}
Political commitment	Lack of political will on the part of top leaders and high-level decision makers	X_{16}
	Changes in the political affiliations of the government responsible for the projects	X_{17}
	Political inconsistencies at national level and between different tiers of governments; central, regional, and local	X_{18}
	Lack of a high-powered government institution that provides an effective mechanism for implementing national infrastructure plans	X_{19}
Corruption in infrastructure construction	Lack of transparency and competitiveness in bid processes	X_{20}
	Discretionary power of individual bureaucrats involved in award of contracts	X_{21}
	Inadequate financial and physical auditing	X_{22}
	Inadequate capacity of regulatory bodies to enforce regulations	X_{23}
Building capacity of local firms	Poor level of efficiency and quality of work	X_{24}
	Poor level of professionalism and entrepreneurship	X_{25}
	Resource shortages, especially in construction technology, management, and finance	X_{26}
Land acquisition	Lack of a negotiating mechanism to make land acquisition compensation more market-oriented	X_{27}
	Bureaucracy in settling land disputes and claims	X_{28}
	Lack of a land acquisition compensation monitoring system	X_{29}
	Lack of clarity about valuation methods for compensation	X_{30}
	Lack of law enforcement to regulate the price of land acquired for infrastructure projects	X_{31}
Institutional and legal weaknesses in infrastructure construction	Obsolescence of building regulations	X_{32}
	Changing and inconsistent law and regulations	X_{33}
	Ineffectiveness of implementation of existing statutes and codes	X_{34}
	Bureaucracy in formal procedures relating to infrastructure project planning, construction permission, and administration	X_{35}

economic development. A five-point Likert scale was applied for questions relating to the degree of occurrence and influence of factors. The population of interest consists of both public and private organizations in Vietnam.

Since the level on which the research reported in this paper focuses is at the national level, the public group thus consists of planners and policymakers working in central government agencies, which have a role in policymaking as well as planning for construction, infrastructure, and international trade of Vietnam, including relevant departments and agencies under the Ministry of Planning and Investment, Ministry of Construction, Ministry of Transport, Ministry of Information and Communications, and Ministry of Industry and Trade as well as the ministries' think tanks. In addition, this paper is interested in perceptions of private actors who are involved in the implementation of government-funded infrastructure projects. The private group in the research reported in this paper thus refers to actors other than the planners and policymakers, including bankers, traders, developers, clients, consultants, contractors, and suppliers. The sampling frame is the lists of registered firms with the Ministry of Construction, Ministry of Transport, Ministry of Information and Communication, and Ministry of Industry and Trade. Bankers are identified from the list of commercial banks on the website of the state bank of Vietnam. The selected respondents were those involved in infrastructure investment and construction. The process started with the original list of relevant organizations mentioned previously. Each potential survey participant was personally contacted to see if they were interested and the contacted individuals would also

be asked to suggest other individuals who were of interest to the research reported in this paper. Selected respondents would have at least 5 years of relevant work experience since they would be senior enough to provide both a technical and a policy perspective.

Since all major government agencies are headquartered in Hanoi, most questionnaires were delivered to professionals in Hanoi. Only a small number of questionnaires were delivered to professionals in Ho Chi Minh City via e-mail to save on cost and time. In total, out of 346 questionnaires sent out, 126 respondents returned their responses, resulting in a response rate of about 36%. The sample size is adequate for meaningful statistical analysis (Hair et al. 2010). Out of 126 respondents, 39 respondents, accounting for 31%, were from government agencies. Most of them are advisors, senior advisors, and researchers. There were two department heads and three department deputies participating in the survey. The remaining respondents consist of clients, consultants/contractors/suppliers, traders, and bankers, accounting for 69% of total respondents.

Data Analysis

First, the analysis examined whether there was any difference in perceptions of different groups of respondents by using rank correlation. The respondents' mean ratings of the critical problems in terms of occurrence and criticality were therefore converted to ranks. Based on the ranks, the Spearman's rank correlation coefficient was computed to test the strength of associations between the rankings of respondent groups (Tan 2007). The Spearman rank correlation coefficients for ranking of the occurrence of problems and of the criticality of problems between the two groups are 0.748 and 0.844 (with $p = 0.00$), respectively. With $p < 0.01$, there was strong evidence to believe that the correlations are significant at the 1% significance level. The statistically significant correlation thus implies that there is a high degree of agreement between the two groups on the level of occurrence and criticality of problems. Thus, separate factor analyses for each group are not necessary to be performed (Hair et al. 2010).

Further data analysis in the research reported in this paper involved the analysis of 35 variables in order to identify key factors affecting the efficiency of government-funded infrastructure construction. In order to identify key factors, data analysis is performed to extract the problems that are perceived as critical by the respondents based on their degree of criticality. Factor analysis was then used to extract key causal factors limiting the efficient use of public investments in infrastructure based on the respondents' ratings of the occurrence of these critical problems.

Among 35 problems, only problems with their degree of criticality perceived from moderate to very significant are selected for factor analysis in the subsequent section. In other words, these problems should have their mean of criticality more than 3 on a scale 1–5 and pass the hypothesis test on the mean of criticality with test value of 3. As shown in Appendix I, the top 27 ranking problems have the mean critical ratings more than 3 from the combined group of respondents from both private and public agencies, thus being selected for factor analysis. The remaining eight problems were identified as unimportant, including X_1, X_8, X_{11}, X_{13}, X_{16}, X_{17}, X_{18}, and X_{32}).

Factor Analysis of Problems' Occurrence

Assumptions in Factor Analysis

As mentioned previously, the top 27 high-ranked problems in terms of their criticality were selected for factor analysis. The purpose of this analysis is to capture the multivariate relationship existing among problems in terms of their degree of occurrence. As suggested by the results of the Spearman rank correlation coefficients, the sample constitutes a homogeneous set of perceptions. The sample size of 126 provides an adequate basis for the calculation of the correlations between variables (Hair et al. 2010).

Several tests are required to justify the application of factor analysis. The purpose of these tests, including visual inspection, the Bartlett test of sphericity, and the measure of sampling adequacy (MSA) is to ensure that the data matrix has sufficient correlations for the factor analysis to proceed (Hair et al. 2010). Visual inspection of the correlations among the 27 variables reveals a substantial number of correlations greater than 0.30 and all correlations are significant at a 5% level. The partial correlations also show no value greater than 0.5, indicating that factor analysis is appropriate. The value of the Bartlett test of sphericity is 2,275.5 and the correlation matrix has significant correlations. The overall MSA value is 0.91 and the MSA value for each variable is more than 0.8, meeting the fundamental requirements for factor analysis. Overall, the results of these tests suggest there is a structure that exists to group variables and thus the next steps of factor analysis are applicable (Hair et al. 2010).

Choosing Factor Models and Number of Factors

In this model, there are 27 variables (p) and k common factors (F) to be determined. The degree of association of each factor to each variable is reflected by factor loadings (l). The process of estimating factor loadings starts with determining the number of factor to be retained. Principle component analysis is used to extract factors. The results are shown in Appendix II.

According to the latent root criterion, only the factors having Eigenvalues greater than 1 are considered to be retained. As shown in Appendix II, there are five factors with eigenvalues greater than 1. The five factors represent about 67% of the variance of the 27 variables, meeting the requirement of total variance explained. As a result, five factors are retained for the computation of factor matrix of loadings. Appendix III presents the rotated factor-loading matrix based on varimax rotation. Given the sample size of 126, factor loadings of 0.5 or higher will be considered significant for factor interpretation (Hair et al. 2010). Variables X_{10} and X_7 were not considered in the interpretation of factors as their loadings are lower than 0.5.

As shown in Appendix III, with varimax rotation, the factor structure for the remaining 25 variables is now defined, comprising five distinct groups of variables, which can be utilized in further data analysis. Factor 1 is heavily loaded on variables X_5, X_6, X_9, X_{12}, X_{14}, X_{19}, X_{22}, and X_{33}. These variables center on issues relating to the government capacity in planning, coordinating, and monitoring infrastructure development, and commitment of political leaders. Hence, Factor 1 relates to insufficient institutional capacity of the government.

Factor 2 is characterized by variables X_{15}, X_{20}, X_{21}, X_{23}, and X_{35}. These variables describe weaknesses in transparency and accountability in infrastructure development. Hence, Factor 2 relates to lack of transparency and accountability in infrastructure development.

Factor 3 represents the group of variables X_{27}–X_{31}. Hence, Factor 3 relates to the lack of an effective land acquisition framework.

Factor 4 is defined by variables X_2–X_4 and X_{34}. Since X_{34} has the lowest loading among these variables, and all variables X_2–X_4 refer to issues related to the capacity of forecasting, Factor 4 therefore relates to inadequate forecasting capacity.

Factor 5 is highly loaded on variables X_{24}–X_{26}. Hence, Factor 5 relates to insufficient building capacity of local firms.

Factor Interpretation

The five factors listed previously are elaborated in the subsequent paragraphs.

Factor 1, Insufficient Institutional Capacity of the Government

This factor raises questions about the institutional capacity and political leaders' commitment. The key question of such capacity lies in the ability of the government to create a strong planning authority for spearheading infrastructure development. Strong government leadership and commitment are considered crucial in determining infrastructure development strategies (Mody 1997). However, several variables (X_6, X_9, X_{12}, X_{14}, and X_{19}) included in this factor suggests that there is a lack of commitment to national goals and planning agencies in Vietnam are fragmented. As a result, they fail to serve as focal points for interministerial and interagency coordination, and as vehicles that enable political leaders and government bureaucrats to develop collaboration in infrastructure development. The insufficient institutional capacity also restricts planning agencies to determine priorities and organize resources with a broader vision. Other variables of Factor 1 emphasizes on the limit of monitoring aspect of institutional capacity. Two constraints in this aspect are highlighted, including lack of ex post analysis on whether projects meet objectives (X_5), and insufficient financial and physical auditing for infrastructure construction (X_{22}). With these constraints, planning agencies are prevented from being well-informed of how the plans are implemented and how the resources are allocated. Planning outcomes are difficult to achieve without ongoing assessment of the effectiveness of plan implementation. The deficiencies in government capacities become more critical in such a developing country as Vietnam where the government still accounts for a majority of funding invested in infrastructure construction. In addition, changing and inconsistent law and regulations in infrastructure construction (X_{33}) also reflects the weaknesses of the institutions in supporting efficient infrastructure delivery.

Factor 2, Lack of Transparency and Accountability in Infrastructure Development

Factor 2 directs attention to areas associated with transparency and accountability. Variables with high loadings on Factor 2 include the lack of transparency and competitiveness in bid processes (X_{20}), the abuse of power by the bureaucrats involved in contract awarding (X_{21}), and the weak enforcement abilities of regulatory bodies (X_{23}). The survey evidence also classifies bureaucracy in administrative system and formal procedures relating to infrastructure construction into this factor group (X_{15} and X_{35}). The occurrence of these problems highly correlates with each other, implying the low level of transparency and accountability in funded infrastructure construction in Vietnam. The variables highlighted in this factor suggest that the lack of accountability can be found in all stages of infrastructure construction from government planning, contract awarding to the execution of physical facilities. The consequences of this factor would range from the low efficiency of services delivered by government agencies to the increasing bureaucratic corruption in infrastructure construction. Corruption in infrastructure construction is significant (Kenny 2007). More importantly, it would affect the quality of infrastructure construction and ultimately on the delivery of infrastructure services. The lack of transparency and accountability thus can have significantly negative impact on the efficiency of funded infrastructure construction.

Factor 3, Lack of an Effective Land Acquisition Framework

The factor group describes problems with the current framework of land acquisition for infrastructure construction in Vietnam. The survey evidence identifies that land acquisition problems are among those that have the highest degree of occurrence. Two major aspects contributing to the factor include (1) land prices, and (2) regulations. With land prices, the attention focuses on approach to valuation, and methods of valuation and monitoring (X_{27}, X_{30}, and X_{29}). The current approach to valuation does not adequately reflect the market price of land. Methods of valuation are not clearly defined and a monitoring system is not in place to ensure that the land owner gets the correct value for the land. The factor also raises concerns about the regulatory framework used to control land price and the process of acquisition (X_{28} and X_{31}). Increasing land demand for infrastructure would boost land price to an unreasonably high level, thus requiring government to have a control policy. As a result, lack of tools for government to improve market efficiency for land acquired for infrastructure could make it hard to meet land demand driven by rapid growth. Finally, bureaucracy in setting land disputes and claims is listed in this factor. The presence of the issue implies that the current land management practices could pose significant risks to the success of land acquisition process.

Factor 4, Inadequate Forecasting Capacity

This factor presents deficiencies in forecasting of government planning. Attention is directed to inherent problems in forecasting, and concerns about input data and human resources (X_2–X_4). The existence of inherent problems in predicting the future and monetizing external and indirect effects reduces forecast accuracy. As Vietnam is open to international trade, aid, and foreign investment, the country is more vulnerable to external economic disturbances. Unanticipated external effects thus can induce serious errors in forecasting. The statistical results also placed inadequate data and lack of experienced forecasters in this factor group. This reveals problems in the quality of statistical data and planning personnel used in the formulation of development plans in Vietnam. X_{34} is also included in this factor. Collectively, these problems diminish the government forecasting ability and subsequently the value of development plans.

Factor 5, Insufficient Building Capacity of Local Firms

Variables highly loading on this factor emphasize on issues with local construction firms in Vietnam. The statistical results support the view that local construction firm problems can be reflected by problems of construction quality; problems of professionalism; and problems of resource shortages in construction technology, management, and finance (X_{24}–X_{26}). Taken together these problems enhance the understanding of building capacity of local construction firms in meeting growing demand for infrastructure construction.

Conclusions

Major Findings

To meet the huge demand for infrastructure, increasing infrastructure investments are encouraged in developing countries. However, empirical evidence has shown that these development objectives might not be realized as expected due to the low efficiency

and quality of administering these public investments. It was hypothesized that the low efficiency and quality of public investments in infrastructure could be attributed to a large number of issues in both planning and implementation of infrastructure development plans. Factor analysis was used to extract key factors from a questionnaire survey of 126 government officials and professionals using snowball sampling.

The paper found that the inefficient use of infrastructure funding could be attributed to five distinct groups of factors, as follows: (1) insufficient institutional capacity of the government, (2) lack of transparency and accountability in infrastructure development, (3) lack of an effective land acquisition framework, (4) inadequate forecasting capacity, and (5) insufficient building capacity of local firms. Findings of the paper suggest that although massive funding is necessary for accelerated economic development, on its own it is not sufficient to ensure long-term benefits. Provision of capital is only part of the equation. The way that infrastructure policies is planned and executed is just as important, especially when financial resources are tight. In order to improve the efficiency of government funding invested in infrastructure to support trade growth and economic development, these issues must first be resolved.

Recommendations for Further Research

As revealed in the paper findings, there are several aspects on which further studies can focus, including (1) governmental commitment, (2) institutional capacity, (3) transparency, and (4) accountability (in infrastructure development, land acquisition framework, and building capacity of local firms). However, due to space limitations, this paper will not elaborate further on how these issues are to be resolved. These are instead recommended for further studies. Further economic development would require the government of Vietnam to develop capacities that would remove these constraints on the efficient use of public investments in infrastructure. Future studies on significant capacity-building work, which are useful for policy implications, could bring out key insights beyond the present case.

Appendix I. Hypothesis Test on the Mean of Criticality Ratings

	One-sample statistics				Test value = 3			Ninety-five percent confidence interval of the difference	
Rank	Median		SD	Standard error mean	t	df	Median difference	Lower	Upper
1	X_{23}	3.85	1.066	0.095	8.939	125	0.849	0.66	1.04
2	X_{35}	3.75	0.987	0.088	8.481	125	0.746	0.57	0.92
3	X_{15}	3.73	0.933	0.083	8.784	125	0.730	0.57	0.89
4	X_{20}	3.66	0.948	0.084	7.800	125	0.659	0.49	0.83
5	X_{24}	3.66	0.878	0.078	8.423	125	0.659	0.50	0.81
6	X_{28}	3.66	1.021	0.091	7.242	125	0.659	0.48	0.84
7	X_{30}	3.52	1.033	0.092	5.691	125	0.524	0.34	0.71
8	X_{14}	3.50	1.101	0.098	5.098	125	0.500	0.31	0.69
9	X_{25}	3.50	0.927	0.083	6.052	125	0.500	0.34	0.66
10	X_{27}	3.49	0.978	0.087	5.649	125	0.492	0.32	0.66
11	X_{29}	3.45	0.985	0.088	5.157	125	0.452	0.28	0.63
12	X_{31}	3.45	1.001	0.089	5.074	125	0.452	0.28	0.63
13	X_{26}	3.44	0.872	0.078	5.719	125	0.444	0.29	0.60
14	X_{10}	3.36	0.975	0.087	4.110	125	0.357	0.19	0.53
15	X_{7}	3.33	1.066	0.095	3.511	125	0.333	0.15	0.52
16	X_{22}	3.31	1.039	0.093	3.344	125	0.310	0.13	0.49
17	X_{4}	3.29	1.011	0.090	3.173	125	0.286	0.11	0.46
18	X_{19}	3.24	1.099	0.098	2.433	125	0.238	0.04	0.43
19	X_{33}	3.22	1.019	0.091	2.448	125	0.222	0.04	0.40
20	X_{6}	3.21	1.211	0.108	1.987	125	0.214	0.00	0.43
21	X_{21}	3.17	0.989	0.088	1.983	125	0.175	0.00	0.35
22	X_{5}	3.15	1.089	0.097	1.555	125	0.151	−0.04	0.34
23	X_{2}	3.14	1.056	0.094	1.518	125	0.143	−0.04	0.33
24	X_{9}	3.13	0.950	0.085	1.595	125	0.135	−0.03	0.30
25	X_{34}	3.07	0.989	0.088	0.810	125	0.071	−0.10	0.25
26	X_{3}	3.02	0.907	0.081	0.295	125	0.024	−0.14	0.18
27	X_{12}	3.02	1.000	0.089	0.267	125	0.024	−0.15	0.20
28	X_{16}	2.98	1.039	0.093	−0.257	125	−0.024	−0.21	0.16
29	X_{1}	2.91	0.938	0.084	−1.044	125	−0.087	−0.25	0.08
30	X_{13}	2.90	0.875	0.078	−1.324	125	−0.103	−0.26	0.05
31	X_{8}	2.87	0.880	0.078	−1.722	125	−0.135	−0.29	0.02
32	X_{32}	2.82	1.061	0.095	−1.931	125	−0.183	−0.37	0.00
33	X_{18}	2.79	1.100	0.098	−2.187	125	−0.214	−0.41	−0.02
34	X_{11}	2.74	0.981	0.087	−2.996	125	−0.262	−0.43	−0.09
35	X_{17}	2.47	1.001	0.089	−5.960	125	−0.532	−0.71	−0.36

Appendix II. Component Analysis

Component	Initial Eigenvalues		
	Total	Variance (%)	Cumulative (%)
1	12.595	46.649	46.649
2	1.626	6.022	52.670
3	1.490	5.517	58.187
4	1.227	4.544	62.731
5	1.046	3.875	66.607
6	0.900	3.333	69.940
7	0.803	2.975	72.915
8	0.709	2.625	75.539
9	0.639	2.365	77.905
10	0.633	2.344	80.248
11	0.610	2.258	82.507
12	0.559	2.069	84.576
13	0.469	1.736	86.312
14	0.424	1.572	87.883
15	0.412	1.526	89.410
16	0.391	1.448	90.858
17	0.367	1.359	92.216
18	0.326	1.207	93.424
19	0.283	1.048	94.472
20	0.267	0.990	95.461
21	0.237	0.878	96.339
22	0.207	0.765	97.104
23	0.205	0.760	97.865
24	0.171	0.634	98.499
25	0.162	0.601	99.100
26	0.131	0.486	99.586
27	0.112	0.414	100.000

Appendix III. Rotated Factor-Loading Matrix

	Rotated component matrix					
	Component					
	1	2	3	4	5	Communality
X_2	0.397	0.096	0.209	0.585	0.066	0.556
X_3	0.089	0.094	0.116	0.759	0.211	0.651
X_4	0.232	0.153	0.136	0.722	0.135	0.636
X_5	0.564	0.145	0.302	0.432	0.122	0.632
X_6	0.551	0.281	0.169	0.218	0.344	0.577
X_7	0.467	0.253	0.260	0.282	0.373	0.568
X_9	0.658	0.081	0.168	0.415	0.237	0.695
X_{12}	0.649	0.347	0.268	0.320	−0.024	0.716
X_{14}	0.623	0.384	0.139	0.066	0.422	0.736
X_{15}	0.450	0.604	0.195	0.068	0.099	0.620
X_{19}	0.597	0.240	0.258	0.168	0.071	0.515
X_{20}	0.270	0.775	0.298	0.084	0.235	0.824
X_{21}	0.139	0.768	0.022	0.141	0.199	0.669
X_{22}	0.528	0.360	0.061	0.362	0.327	0.650
X_{23}	0.292	0.659	0.192	0.298	0.224	0.695
X_{24}	0.161	0.158	0.239	0.050	0.796	0.745
X_{25}	0.227	0.186	0.221	0.265	0.757	0.777
X_{26}	0.127	0.239	0.047	0.424	0.665	0.698
X_{27}	0.072	0.358	0.536	0.484	0.108	0.667
X_{28}	0.128	0.494	0.633	0.173	0.122	0.705
X_{29}	0.214	0.132	0.777	0.128	0.112	0.696
X_{30}	0.182	0.258	0.753	0.182	0.304	0.792
X_{31}	0.416	0.043	0.705	0.188	0.177	0.739
X_{33}	0.518	0.384	0.128	−0.067	0.423	0.615
X_{34}	0.379	0.325	0.339	0.570	0.133	0.707
X_{35}	0.221	0.680	0.329	0.234	0.127	0.691

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