Applying information technology to maximize resources for investment and development of airport infrastructure in Vietnam

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C H R O N I C L E	A B S T R A C T
	This study aimed to quantify the relationship between factors influencing the investment outcomes of airport infrastructure development in Vietnam. On that premise, suggesting the ideas for applying information technology systems to maximize resources to improve investment outcomes in Vietnam's airport infrastructure development. Data for the study were gathered from the Airports Corporation of Vietnam's annual report and a survey of 316 officials involved in the investment and development of airport infrastructure in Vietnam. The linear regression model is used to quantify the impact of various factors. According to the research findings, the most influential variable according to the survey subject's opinion is the contractor (NT), with an adjusted beta coefficient value of roughly 0.3915.

1. Introduction

Transport in general, and air traffic, have demonstrated an important position and role in creating favorable conditions for the country's socioeconomic development, convenient transportation facilitates smooth production and movement, adding value to the process of performing its functions. As a result of growing awareness of the aviation industry's growing importance and role in contributing to Vietnam's socio-economic growth, The Ministry of Transport also has plans to encourage development investment in this industry; by the end of 2021, Vietnam will have 22 airports, comprising 9 international airports and 13 domestic airports. The overall number of passengers transported via Vietnam's airports is relatively significant; in 2019, the total number of passengers reached around 116.3 million (This comprises 41.8 million foreign passengers and 74.6 million domestic passengers); the port handles around 1540 thousand tons of merchandise. Airport income is also extremely high; in 2018, net revenue was around 16,123 billion VND, and this figure climbed to 18329 billion VND in 2019. This is a positive one for future investment in Vietnam's aviation infrastructure. On the other hand, investment in infrastructure development has drawn the attention of not only policymakers and practical researchers but also domestic and foreign scientists (Urfer & Weinert, 2011; Ferrulli, 2016), there are quite a lot of different research works have been done in this field of study, with each study focusing on a different exploitation aspect ranging from development investment efficiency to factors influencing development investment, capital mobilization for infrastructure development, etc. Apart from these accomplishments, investment in the construction of aviation infrastructure faced several challenges owing to the "thirst for investment capital" condition. As a result, socialization and diversification of investment capital mobilization from the private sector and foreign-invested firms are becoming increasingly popular in this field. Furthermore, resource optimization has not been realized as envisaged while employing resources in investment and expansion of airport infrastructure in Vietnam.

Therefore, this study was carried out to investigate the role of resources in the development of airport infrastructure in Vietnam. From there, there are assessments of the influence of factors and suggestions in the use of information technology with resources to maximize resources and contribute to the development of airport infrastructure in Vietnam.

2. Research overview

There are several measuring methodologies used to examine and make decisions on airport infrastructure investment and development, with the goal of achieving a favorable outcome from those investments. According to Daniel (2002) and Jorge & De Rus (2004), there is agreement on the use of measurement indicators and cost-benefit analysis approaches in investment choices infrastructure at airports, Contrary to Jorge and De Rus (2004), Daniel's study (2002) used the port infrastructure in the parking and movement zones for taxis as a model rather than choosing every component of the airport. The author concurs that the foundation and decision-making process for investments in this category is the use of indicators to assess the advantages of developing a new infrastructure system. Reduced travel wait times, improved airport accessibility, increased safety, fewer emissions, and decreased noise are the Daniel (2002) suggested criteria, etc. In general, the unity of these two studies is to examine additional advantages that projects can provide when funding transportation infrastructure investments rather than only concentrating on projected profits based on paper.

Airport management is also mentioned when considering the impact of factors on investment results in airport infrastructure development, management model to achieve efficiency has been interesting in the research by Laksono et al. (2018); Kapur (1995); Urfer and Weinert (2011). The study of Laksono et al. (2018) used the model at Indonesian airports for their analysis, including 297 airports in Indonesia, 148 of which are operational, use data from these airports to examine the airport management model, especially the management of materials in projects and the relationship between airport investment and development and airport efficiency management. Meanwhile, according to Kapur's (1995) study, which was chaired by The World Bank, the ownership and management structure of airports, including the involvement of private investors in the funding and development of airport infrastructure, will have an impact on management activities at airports. Using data from in-depth interviews with airport authorities in developed countries, it was discovered that, with five structural models of airport ownership in developed countries, no model is optimal and unique; each model has different characteristics, but in the end, it is aimed at management efficiency and airport competitiveness. Meanwhile, Urfer and Weinert (2011) contributed to the study of airport infrastructure management by providing readers with an overview of the link between Airport infrastructure management with airport development and its sustainable development. According to the author, airport infrastructure management is a complicated process that takes place in an ever-changing environment that is susceptible to economic and socio-political influences. Operating efficiently in such a setting necessitates a thorough awareness of airport infrastructure, operations, and advancements. The airport's benefits and expenses are also analyzed to ensure that the airport's operations are efficient. Ferrulli (2016) suggested a strategy to create green airports based on methodologies and tools for evaluating airport design, especially enhancing the airport infrastructure system (GrADE Method) to develop airports.

3. Research Methods

3.1. Data collection methods

The data is collected from published documents such as Statistics at all levels, Ministry of Transport reports on the situation of capital attraction and use of investment capital, annual summary reports and operational direction of the Ministry of Transport, and the Ministry of Transport's Statistical Yearbook. Annual data from the Civil Aviation Authority of Vietnam and the Airports Corporation of Vietnam (ACV). Next, to have data for quantitative analysis, the study then developed a questionnaire and conducted interviews with individuals knowledgeable about investment activities at agencies affiliated with the Ministry of Transport, the Ministry of Construction, and the units directly carrying out investment and development activities in aviation at Vietnam's airports, etc, the author conducts interviews with individuals to analyze their perceptions of the degree of influence, significance, and realism of the elements determining the outcomes of investment in the development of airport infrastructure in Vietnam. Determining the sample size in the study of socioeconomic phenomena is an essential task; there are many various points of view to be able to pick a research sample, such as:

The sample is chosen using convenience sampling, one of the non-probability sampling forms, and the researcher may then choose the elements (research object) that are accessible (Nguyen Dinh Tho, 2012) the minimum sample size is 100.

The sample size applied in this study is based on the requirements of factor analysis and multivariate regression:

For factor analysis: Based on the study of Hair et al. (1998) for reference about the expected sample size. Accordingly, the minimum sample size is 5 times the total number of observed variables.

For multivariate regression analysis: The minimum sample size to be obtained is calculated by the formula: $50 + 8 \times m$ (m: number of independent variables) (Tabachnick & Fidell, 1996).

The scale of the questionnaire: The author uses a 5-level Likert scale to perform research on the topic: The rating scale from 1 to 5 is sorted by increasing the level of influence of factors on the results of investment in airport infrastructure development using state budget capital.

Survey sample size: 316 observations.

The author employs standardized questions to send interviews to officials directly working at units and agencies relevant to airport infrastructure investment and development utilizing state budget money, if these authorities cannot be reached directly, the author selects alternate options: Email the questionnaire to wait for an answer or submit it to the agency and it will be returned in 10 days.

After completing the primary data collection, the author cleans the data and conducts data analysis.

3.2. Data Analysis Methods

The multivariable regression approach is used in the study to examine the linear correlation between independent and dependent variables in the research model as $Y_i = B_0 + B_1X_{1i} + B_2X_{2i} + B_3X_{3i} + … + B_kX_{ki}$ where:

> Y_i: dependent variable (Results of investment in airport infrastructure development using state budget)
> X_k: independent variables (factors affecting investment results in airport infrastructure development using state budget capital)
> B_0: constant
> B_k: regression coefficients
> Data were analyzed with the help of SPSS 20.0 software.

The independent variables are selected as follows:

+ The State management agency variable (CQQL): This variable measures the capacity of officials of state management agencies as well as their professional qualifications. Variables used are inherited from the study of Chia- Li Lin and Gwo-Hshiung (2009); Yung Kil Lee and Ki Woong Kim (2013).

+ The Investor variable (CDT): This variable assesses the project investor's capability, which includes bidding capacity, implementation capacity, the investor's scientific and technological level, and project assessment capacity. This variable is used from the inheritance of Smit (2003); Kapur (1995); Yung Kil Lee and Ki Woong Kim (2013); Tu Quang Phương, Pham Van Hung (2013).

+ The Contractor Variable (NT): This variable assesses the contractor's capability by looking at things like project implementation technological capacity, experience, and the contractor's capacity. This variable is used and inherited from the study of Chia-Li and Gwo-Hshiung (2009); Smit (2003); Kapur (1995); Yung Kil Lee and Ki Woong Kim (2013).

+ The Natural condition variable: (DKTN): This variable is used and inherited from the study of Xu (2007); Cu Thanh Thuy (2018); Tu Quang Phuong, Pham Van Hung (2013).

+ The Economic variable (KT): This variable is used and inherited from the study of Laksono et al (2018); Xu (2007); Glen Weisbrod (2009) and Phang (2003).

+ The Political, cultural and social variables (CS): This variable is used and inherited from Phang's study (2003); Cohen and Paul (2003); Tu Quang Phuong, Pham Van Hung (2013).

Within the scope of this study, the focus will be on exploiting and analyzing the elements related to governmental management agencies, contractors, and investors that influence the investment outcomes of airport infrastructure development in Vietnam. From there, recommendations are made about the use of information technology in maximizing resource utilization to further improve investment outcomes in the development of airport infrastructure in Vietnam.

4. Research findings

During the 2016-2020 period, the amount of investment money to expand Vietnam's airport infrastructure from the state budget is executed for projects at Noi Bai, Tan Son Nhat, and Da Nang airports, as well as Phu Quoc, Phu Cat, Chu Lai, Can Tho, Pleiku, Lien Khuong, Phu Bai, and Cat Bi. During the research period, each airport had a varied investment capital scale.

Phu Quoc Airport, Tan Son Nhat International Airport, and Da Nang Airport have the most investment capital. Tan Son Nhat International Airport's implemented capital is about 1741.233 billion VND, of which building investment capital and equipment are expected to be 1558.681 billion VND and other investment capital is assessed to be 182.552 billion VND.

In the 2016-2020 period, the size of investment capital for airport infrastructure development at Noi Bai international airport - one of the two largest airports in the country - is around 691.419 billion VND, of which 596.756 billion VND is for

investment in construction and equipment. During this time, Noi Bai International Airport invested in a variety of standard airport infrastructure items, such as: To build an aircraft parking lot at the planned position 15 of Noi Bai Airport; Expansion of passenger terminal T2. The ultimate objective of airport infrastructure investment and growth not only in Vietnam but also in other nations across the world, is to improve and ensure that the port system operates better than before the investment. Utilizing funds from the national budget, Vietnam has invested in the construction of airport infrastructure, which has increased the efficiency of investment operations. As follows:

Table 1
Scale of investment capital to develop airport infrastructure by airports in Vietnam in the period 2016-2020

Unit: Billion VND

Airports	Investment capital size	Construction and equipment investment capital	Other investment capital
Total investment capital	**7739.598**	**6732.186**	**1007.412**
Noi Bai International Airport	691.419	596.756	94.663
Tan Son Nhat International Airport	1741.233	1558.681	182.552
Phu Quoc Airport	2002.3	1749.86	252.44
Phu Cat Airport	494.019	458.432	35.587
Danang Airport	1040.823	786.986	253.837
Chu Lai Airport	148.928	124.551	24.377
Pleiku Airport	109.398	99.101	10.297
Can Tho Airport	358.352	334.455	23.897
Lien Khuong Airport	193.32	160.249	33.071
Phu Bai Airport	329.855	233.533	96.322
Cat Bi Airport	629.951	629.582	0.369

Source: Airports Corporation of Vietnam

For airport passenger transport volumes from 2016 to 2021, as follows:

Table 2
Passenger transport volume of airports in Vietnam in the period 2016-2021

Unit: Million passengers

Years	2016	2017	2018	2019	2020	2021
1. Total passengers	81	94.1	103.5	116.3	65.2	30.0
1.1. International passengers	24	30.3	36.7	41.8	7.4	0.5
1.2. Domestic passengers	57	63.8	66.9	74.6	57.8	29.5

Source: Airports Corporation of Vietnam

The total number of passengers transported by airports in Vietnam continues to rise between 2016 and 2019; in 2016, the number of passengers transported by airports was around 81 million; this number climbed to approximately 94.1 million passengers in 2017 and reached 103.5 million passengers in 2018. By 2019, the number of passengers at Vietnam's airports reached about 116.3 million. However, due to the impact of the Covid 19 pandemic on airline transportation and operation, the number of passengers transported by airlines at Vietnam's airports has decreased sharply; the number of passengers at Vietnam's airports is estimated to be only about 65.2 million passengers in 2020, a nearly 50% decrease compared to the same period in 2019. The aviation industry is one of the industries most affected by the Covid-19 pandemic, therefore, it also affects the performance of airports in Vietnam. The study collects data from primary surveys and employs OLS analysis to assess the link relationship determinants and investment outcomes in airport infrastructure development utilizing the state budget. The specific outcomes are as follows:

Table 3
Testing the suitability of the research model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.778[a]	0.6052	0.5976	0.4423

a. Predictors: (Constant), KT, DKTN, CS, CQQL, NT, CDT

ANOVA[a]					
Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	92.6756	6.0000	15.4459	78.957	.000[b]
Residual	60.4478	309.0000	0.1956		
Total	153.1234	315.0000			

a. Dependent Variable: Y
b. Predictors: (Constant), KT, DKTN, CS, CQQL, NT, CDT

Source: Author's calculation based on survey data

With the coefficient R square = 0.6052, it shows that the independent variable explains about 60.52% of the dependent variable.

The test F = 78.957 and Sig = 0.00 show that the selected research model is appropriate.
The regression parameters of the model are as follows:

Table 4
The summary of the regression estimates

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-2.5039	0.2804		-8.930	.000		
	CQQL	0.1799	0.0360	0.1830	5.004	.000	.956	1.047
	DKTN	0.2088	0.0348	0.2216	6.007	.000	.939	1.065
	NT	0.4643	0.0477	0.3915	9.734	.000	.790	1.266
	CS	0.2401	0.0370	0.2377	6.493	.000	.953	1.049
	CDT	0.2782	0.0450	0.2526	6.183	.000	.766	1.306
	KT	0.3007	0.0302	0.3693	9.963	.000	.930	1.075

Dependent Variable: Y

Source: Author's calculation based on survey data

The results of the data table show that the variables are statistically significant with the 95% confidence level, the Sig coefficients of the scales are all less than 0.05. All variables influence the same direction on the investment outcomes of airport infrastructure development utilizing state budget money, although the degree of impact of these elements varies. As seen below:

The variable that has the most influence according to the assessment of the survey subject is the contractor (NT). This variable has an influence level expressed through an adjusted beta coefficient of around 0.3915. This is entirely suitable when the real process of investment and development of airport infrastructure, the contractor is the direct implementation unit, and if the contractor is inept and lacks expertise, it will immediately damage the investment's outcome. Furthermore, the investment and development of airport infrastructure is a unique activity that necessitates both technology and professional and financial ability, as well as the expertise and managerial competence of implementing units. Consequently, if the contractor executes this work properly, the investment in airport infrastructure expansion will provide good results. The remaining elements all have a positive influence on the development of airport infrastructure utilizing state budget funding to varied degrees. The findings of the participants' research back up the findings of prior studies by Cu Thanh Thuy (2018), Laksono et al. (2018), Chia-Li and Gwo-Hshiung (2009), and Phang (2003).

5. Some recommendations

This study will provide technological solutions to maximize resources for investment and growth of airport infrastructure in Vietnam.This is the proposed solution for units implementing investment projects to develop airport infrastructure with State funds. Whether or not the implemented projects achieve the expected results is dependent on the capacity of the implementing units, including the technical capacity (machinery, equipment, and technology) to support project implementation. If the implementing units have current equipment and facilities, applying technology will help to ensure project progress and eliminate dangers. On the contrary, if the equipment implementation unit does not match the minimal standards, the machinery frequently breaks down, potentially delaying project completion. Airport infrastructure development and investment require the assistance of science and technology, particularly specialist software, machinery, and technical equipment. As a result, higher investment in these technical means will contribute to boosting the quality of work content while also speeding up job progress. Specifically, units involved in the construction, supervision, and consulting of investment projects to develop airport infrastructure must invest in a variety of high-quality exploration and survey machinery and equipment to improve the quality of surveying and exploration work, as well as construction equipment to ensure the safe construction process and quality. If the implementing units' financial capacity does not allow since these machines are all extremely expensive, the units can rent machines on the spot to satisfy their needs or collaborate with other units from overseas - where contemporary machinery and equipment are available to accomplish the task. Furthermore, investment in the purchase of specialized software licenses for professionals is required. Project employees should routinely attend training programs to increase their professional credentials, save money and promptly utilize scientific and technological breakthroughs.

Besides that, units participating in the investment and development of airport infrastructure using the State budget may utilize subcontractors to support equipment, machinery, and technology if the units have constraints on this item. However, the employment of subcontractors must comply with State requirements for investment projects to construct airport infrastructure using State funds.

In addition, units implementing investment projects to develop airport infrastructure using the State budget can use the option of renting or cooperating for some time with modern machinery and equipment from suppliers of machinery, equipment, and technology to implement investment projects to develop airport infrastructure using the State budget to save initial investment costs of projects and implement units, minimizing the financial burden for units.

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