

Identifying factors affecting investment control in form of public-private partnerships for road traffic infrastructure



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ABSTRACT

This study aims to determine the factors affecting investment control in the form of building-operate-transfer (BOT) contracts for road traffic infrastructure. It bases on investment practices in the form of PPP in general and BOT in particular in Vietnam as well as international experiences in implementing PPP projects (both successful and unsuccessful cases). Data is collected through in-depth interviews with 280 subjects with experiences in project management, PPP project management, and BOT project management and who are such service users, etc. After being collected, the data is analyzed qualitatively and quantitatively to remove duplicate factors and factors with insignificant impacts. The research results show that: The groups of factors such as the legal framework-policy, State management, investors, and risk management all affect the control of BOT project investment in road traffic infrastructure in Vietnam. From the above results, the authors propose a system of solutions to strengthen the control of investment in BOT road traffic infrastructure projects in Vietnam.

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1. Introduction

The term “PPP” stands for public-private partnership which can be understood by different interpretations. However, the most common understanding is that the state and private investors sign a mutual contract, share the responsibilities, benefits, and risks in building infrastructure or providing public services (Araújo and Sutherland, 2010).

There are many PPP investment forms, of which building-operate-transfer (BOT) is the most common model in Asia. Not to mention the service contracts, BOT in Asia accounts for approximately 45.79%. A BOT contract is specifically defined as follows: a contract signed between a competent state agency and project investors/enterprises to build infrastructure works. Upon completion, the project

investors/enterprises are entitled to do business for a certain period of time. After that duration, the project investors/enterprises transfer that project to a competent state agency (NAT, 2020).

A PPP project includes many steps and diverse tasks. It also takes place over a long period of time, leading to fluctuations and arising issues that the state management agency is not able to fully anticipate in its original plan. Therefore, controlling the project implementation is very important since it determines the success of the project. Investment project control is specifically defined as follows. The process of using professional methods and data to review the project implementation from the early stage of the competent authorities approving the investment proposals to the stage of construction and operation, in order to obtain socio-economic efficiency (Hurjui, 2008). It can be formulated as follows:

Investment project control

= *Monitoring + Comparison*
 + *Adjustment*

Investment project control is understood as monitoring the project works and comparing

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information obtained from actual works and requirements. After that, we propose measures to adjust the project works according to the approved plans. Specifically, it is the process of accessing project information such as quality, cost, methods, environmental impacts, etc. Then, we synthesize, compare, and evaluate such information with the actual works and propose measures to check, and adjust the project to ensure that the technical and economic requirements are compliant with the set targets. The application of the PPP model in Vietnam, including preliminary assessments of state management of PPP projects, was evaluated in more detail (Nguyen and Notteboom, 2017). However, the author only addressed factors related to project implementation, and construction progress while other factors such as policies to create fair competition, the capacity of state management agencies, legal frameworks, and monitoring and evaluation activities have not been adequately addressed.

The state management's roles in PPP projects were identified according to the management process, including PPP project development planning, implementation of policies and regulations for PPP projects, the state management apparatus for PPP projects, and monitoring and evaluation of PPP projects. However, hundreds of BOT projects across the country still have inadequacies in terms of progress, quality, total investment costs, etc., which have been detected by the state audit. There should be studies on project management in accordance with actual implementation in order to achieve the project's targets from both economic and social perspectives (Nguyen et al., 2022).

The theoretical basis systematized relevant legal documents and applied the management experience of countries with similar conditions to Vietnam on investment project management in PPP form were clarified. It also addressed the main factors affecting project efficiency from project preparation, implementation, and transfer to ensure that the project achieves practical results in a sustainable manner. However, the author has not focused on the study of the project investment control function for effective PPP project management (Nguyen et al., 2020). The success factors of PPP projects in Chile and Mexico in crisis conditions including good PPP project planning, project feasibility studies, fast and accurate forecasting of revenue and costs, appropriate legal framework, strong state institutions, satisfactory macroeconomic management, transparent and competitive bidding were also researched (Cuttaree, 2008). However, the author has not shown the importance of each factor for the success of PPP projects.

In another study, the authors pointed out four factors affecting PPP projects: state, franchise choices, project risks, and project finance. To ensure the success of the road traffic PPP projects, the state needs to perfect its policies in the direction of creating a favorable investment environment, properly allocating risks, selecting appropriate

partners, guaranteeing exchange rates and minimum revenues, and stabilizing the macroeconomy (Hood et al., 2006). However, the study has not considered the state management factors affecting PPP projects.

Previous studies have mainly addressed different factors related to PPP project management. There has not been a research approach based on an overall model of close relationships between general project management activities and specific factors associated with PPP projects in different territories as well as key factors affecting the investment control in PPP projects. Therefore, this article focuses on studying the factors affecting the control function of project investment in PPP form in general and BOT form in particular, in order to create motivation to promote a more professional and efficient BOT project management.

2. Theoretical basis

2.1. BOT projects of traffic infrastructure in Vietnam

In Vietnam, as of January 30, 2019, 336 PPP projects have been conducted. Accordingly, 140 projects were under BOT contracts, 188 projects under BT (Build-transfer) contracts, and 8 projects under other types of contracts. They mobilized approximately 1,609,295 billion VND to invest in developing the national infrastructure system. Particularly in the transport sector, there were 220 projects including 118 BOT projects (accounting for 53.64%) with a total investment capital of approximately 279,367 billion VND; 99 BT projects (accounting for 45.00%) with total investment capital of 117,421 billion VND; 3 projects in other forms (accounting for 1.36%) (MPI, 2018).

By 2020, after over 20 years of applying the PPP (BOT contracts) method to investment and development of the traffic infrastructure, in Vietnam, nearly 2,000 km of highways, including many large bridges, and tunnels were put into operation (MPI, 2018; MOT, 2021). Initially, there have been certain promising results such as: improving the quality of the road traffic infrastructure, promoting socio-economic development, strengthening national security, etc. In order to implement BOT projects effectively, the role of state management in project investment control is very important to ensure the set targets. In order to assess the overall control of BOT projects by the state agencies over the past time, this article summarizes a number of significant achievements, shortcomings, limitations, and proposes effective solutions to improve the efficiency of investment projects on road traffic infrastructure.

2.2. Significant achievements

There have been remarkable achievements in BOT projects on road traffic infrastructure in recent years. Details are as follows.

Capital mobilized from the private sector to improve infrastructure in general and road traffic infrastructure, in particular, has increased significantly. BOT projects put into operation have promoted the efficiency, quality, and service capacity of the transport infrastructure system. This is proven by the fact that thousands of kilometers of roads have been put into operation. Some major projects can be named such as Co Chien bridge, Rach Mieu bridge, Viet Tri bridge, Hanoi-Hai Phong highway, Hanoi-Ninh Binh highway, Ho Chi Minh City-Long Thanh-Dau Giay highway, etc. (MOT, 2021), upgrading traffic infrastructure in those areas.

The road traffic system in Vietnam has changed significantly in terms of time and cost saving, pollution and noise reduction, etc. A 5-year evaluation report (period of 2011-2015) on BOT investment indicated that: regarding Noi Bai-Lao Cai, the Ho Chi Minh City-Long Thanh-Dau Giay highways, there has been an estimated 50% reduction in travel time; as for the National Highway 1 from Hanoi to Vinh and National Highway 14 through Dak Nong Province, it has been nearly 30% decrease in travel time. In addition, there has been a significant decrease in traffic accidents, environmental pollution, etc. According to the Global competitiveness report in term of 2017-2018 of the World Economic Forum, the overall quality of infrastructure in Vietnam ranked 79th in 2018, increasing 11 positions compared to 2011, contributing to improving overall national competitiveness (Azami-Aghdash et al., 2020).

In addition, BOT projects contributed to reducing the burden of the state budget on infrastructure investment, consuming a large amount of domestic raw materials, creating jobs for thousands of citizens, and opening up investment opportunities for investors. The report on monitoring results of the NAT (2020) showed that the project to renovate and upgrade National Highway 1 from Hanoi to Bac Giang and the Phap Van-Cau Gie route are projects with revenue and benefits better than expected (NASCV, 2017).

2.3. Some drawbacks to be considered

In addition to the above-mentioned achievements, BOT projects also exposed some shortcomings in many different aspects in terms of project cost transparency, quality, etc., causing a decrease in investment attraction and efficiency, etc. A number of implemented BOT projects can be mentioned as follows.

2.3.1. Project schedule

The BOT project to expand National Highway 1 from Dong Ha to Quang Tri was 15.54km long with 4 lanes. The road surface was 23m and it was projected to take 24 months to complete (September 2008 to September 2010). The project was completed in February 2014 (44 months behind the schedule). Such delay was due to slow site clearance,

weak investors in financial, management and construction capacities, etc. (NASCV, 2017). It proved that the state management's role in project preparation, bid evaluation, and investor selection was not well performed. The state was also weak in project supervision and control.

The 4-lane Trung Luong-My Thuan highway project with a route length of 51.5km and a road surface of 17m was scheduled for 36 months (November 2009 to November 2012). After 13 years of construction, on January 25, 2022, the project was examined (expected to be delayed by 130 months). The reason for such delay was due to the slow response of the state management on site clearance, the poor coordination between the central, local, and investors, as well as the change of state management personnel. It showed that the controlling role of state management is not satisfactory (MOT, 2021).

The reasons are that the state management is unprepared and inexperienced. There is also a lack of professional experts at the state agencies. Moreover, the process of investor and contractor selection has not been compliant with state regulations, leading to both investors and contractors not satisfying the project's requirements. This certainly caused a delay in progress. Therefore, the main responsibility must be taken by the state management. Also, the changes and transfer of competent state agencies in charge of the projects indicate the overlap of the central and locals, causing a waste of time and costs.

2.3.2. Project quality

The project to renovate the ground and surface of National Highway 1 from Phan Thiet to Dong Nai, with a length of 114km, was completed and put into operation in March 2015. However, after a short period of time, this route has been severely degraded with 11,000m² of surface subsidence, causing traffic insecurity and reducing traffic capacity. It took a large amount of maintenance and repair costs, causing a loss of the state budget (NASCV, 2017).

The BOT project on highway 18 from Uong Bi to Ha Long, a length of 30km, started in October 2011, and on May 18, 2014, it was opened to traffic. After a short time of operation, it degraded and subsided quickly. The reason was that the investor did not conduct the maintenance works according to regulations (NASCV, 2017). Therefore, we questioned the role of the state in supervision and control duties.

In addition, many BOT projects were degraded without any maintenance such as the BOT project of National Highway 2 from Noi Bai to Vinh Yen, National Highway 1 at Ha Tinh area, National Highway 1 from Km 2+478 to Km 12+971, National Highway 1 at Cai Lay area. In these areas, the competent authorities have not taken any measures to repair and maintain the roads (NASCV, 2017).

The reasons can be that road quality is basically formed during construction. Besides, the quality of construction works is greatly affected by processes,

technical regulations, and environmental and weather conditions. The maintenance phase requires a strict monitoring process from contractors, investors, and state authorities. The compliance as well as the sense of responsibility and professional ethics of the state authorities also greatly affect the construction quality. The above examples have shown that the construction contractors have not properly followed the quality requirements and standards. The supervisory role of the project investors/enterprises has not been fully addressed. State management's control is only a routine. They even transfer such responsibility to the contractors.

2.3.3. Cost

The Hanoi-Hai Phong highway project, with a length of 105km, started in 2008. The total initial investment was 24,500 billion VND and then adjusted to 45,000 billion VND (an increase of 45%). The reason was due to changes in basic design, inflation of raw material prices such as cement price increased by 49%, diesel oil increased by 67%, asphalt price increased by 113%, etc. compared to the approved price in January 2008. This led to a delay in construction time and an increase in costs (Azami-Aghdash et al., 2020). It proved that the controlling role of state management is weak, especially in project appraisal, risk management, detailed contract management, and shared responsibilities.

The Cau Gie-Ninh Binh highway project, with a length of 50km, had a total initial investment of 3,734 billion VND, after an adjustment to 8,974 billion VND (an increase of 140,33%). Due to several violations and errors in the survey, design, construction, and cost estimate, it had to be adjusted many times in the budget. This is the responsibility related to project planning, appraisal and management from all technical, economic, and risk control aspects of the state management.

The project to expand Highway 1 in the Khanh Hoa area (from Km1,488 to Km1,525), with a length of 36.1km, had a final settlement cost of 1,400 billion VND out of the total investment of 2,700 billion VND (a decrease of 44%). The capital loss was too great, and the public has questioned why it could not be detected in the project appraisal process.

Regarding the BOT project from Co Chien Bridge to Tra Vinh, the state audit detected many violations. After review, this project has cut down more than 1,000 billion VND compared to the total initial investment of 3,305 billion VND (reducing the estimated fee collection time of 5.5 years, from 20 years to 14 and a half years). The estimate of the initial total investment was incorrect and there were many errors in the design that caused a waste of investment capital. This is completely the responsibility of the state management in the cost appraisal process. The state management has not clarified if there were interest groups in the project.

In addition, there were many other BOT projects that had increases in the total initial investment such

as the BOT project to expand the Nghi Son-Cau Giat route; the BOT project to expand the Hanoi-Bac Giang route; the project to expand National Highway 1 from Km1374+525 to Km1392+000 and Km1405-Km1425, etc. With lessons learned from these projects, the state management is required to get experience to take corrective measures and realize their responsibilities.

Regardless of whether any organization is responsible for the total investment, design, cost estimate, etc., the state management must carry out project appraisal from all economic and technical aspects and take full responsibility before the law for the appraisal process. Nowadays, in Vietnam, however, this process is only a routine and the appraisal quality is not satisfied. Therefore, it is necessary to clarify the roles, responsibilities, and requirements in the appraisal process. State management needs to be separate from business management to clarify the directing role and controlling function of state management.

2.3.4. Site clearance

The 58km highway project of Ben Luc-Long Thanh started in July 2014. The project was expected to be put into operation by 2018. However, after 8 years, the project has been still under construction. This is the total responsibility of the state management when the site clearance is not fully conducted (MOT, 2021).

The 51km highway project of Trung Luong-My Thuan started on 11, 2009. The project was expected to be completed by 2012. However, after 13 years, the project has been still under construction (MOT, 2021). This is also the total responsibility of the state management in terms of site clearance.

The reasons are that the law on land, the law on construction, the policy on-site compensation and clearance, the resettlement, etc. are not synchronized and inconsistent with PPP investment, leading to decreasing investment attractiveness. Thus, it proves that state management has not assessed all potential risks in order to well perform the preparation. This is a shortcoming of state management and they need to make appropriate adjustments.

2.3.5. Environment

The 4-lane highway project from Ho Chi Minh City to Trung Luong with a length and width of 61.9km and 26m, respectively, was put into operation in June 2012. During its operation, there was a negative impact on the environment. Accordingly, the rice fields along the highway, due to continuous high-pressure lights, developed abnormally, leading to poor rice quality (MOT, 2021). The responsibility belongs to the investors when they assess the environmental impacts. The state management also made errors during the project appraisal in terms of environmental impact.

The reasons are that human activities and man-made constructions, in addition to the positive influence on promoting economic development, also have negative impacts on the environment such as pollution. It is very important that we need to assess the environmental impacts of construction projects. However, currently, these requirements are not strictly controlled by state management.

2.3.6. Traffic safety

The 4-lane highway project from HCM City to Trung Luong with a length and width of 51.5km and 17m, respectively, had no emergency lane and it caused traffic insecurity. Report to the Department of Transport of Tien Giang Province in February 2022, in 10 days (from January 28, 2022, to February 6, 2022) there were 4 traffic accidents with 1 dead and 10 damaged vehicles (5 cars, 2 trucks, and 3 coaches (MOT, 2022)). In addition, according to the report of Deo Ca Transport Infrastructure Investment JSC, in 40 days (from April 30, 2022, to June 9, 2022), they received 500 calls about the incidents via their hotline number and rescued 225 vehicles in trouble. Most of the incidents are broken cars, engine failure, tire explosions and running out of fuel, collisions, etc. on the Trung Luong-My Thuan highway (Shen et al., 2014; Haq et al., 2020). This is due to the lack of mandatory standards on highway design and the lack of traffic safety knowledge of the design agency and the state management during the appraisal process. Thereby, it shows that the supervision and control role of the state management is weak, especially in the process of project appraisal.

The reason is that human life is the most important. In the design standards of automobiles, there are mandatory requirements to ensure traffic safety and improve transport capacity. However, accidents can happen anytime. For highways invested in the BOT form without an emergency lane, it indicates that the supervision role of state management is irresponsible, causing both immediate and long-term impacts.

2.3.7. Social security

The BOT project from Cai Lay to Tien Giang which was put into operation on August 1, 2017, immediately encountered fierce opposition from traffic participants and had to stop toll collection (Le et al., 2020).

The T2 BOT toll station located at Km 50+050 on National Highway 91 (under the National Highway 91 project) also faced objections from traffic users. As a result, the Directorate for Roads of Vietnam was forced to relocate the toll station (Le et al., 2020).

These incidents were, perhaps, due to the lack of responsibility and professionalism in management. Or it could be said that there might be group interests that have existed for decades in Vietnam's traffic construction. The lack of transparency needs

to be thoroughly resolved by getting opinions from the public and experts before conducting any project.

In addition to the two above-mentioned projects, there are many other BOT projects that cause social irritation and affect social security such as the toll station on National Highway 3 (the BOT project to build a road from Thai Nguyen to Cho Moi); Ninh Loc BOT toll station (the project of upgrading and expanding National Highway 1, from Km1374+525 to Km1392 and from Km1405 to Km1425+500 in Khanh Hoa Province), etc. (Le et al., 2020). The main reason for those issues was the inappropriate locations of such toll stations. The surveys for choosing a location are not well conducted and the supervising role of the state management is unsatisfied during the project implementation.

2.3.8. Transparency of toll collection

According to the inspection results of the Directorate for Roads of Vietnam in 2016, BOT toll stations on the Phap Van-Cau Gie highway collected nearly 2 billion VND/day (Azami-Aghdash et al., 2020). However, the station managers reported only 1.2 billion VND on the number of collected fees.

Directorate for Roads of Vietnam detected violations at the toll station at Km 18+100, National Highway 5, Van Lam, Hung Yen (Station 1) of the Highway 18 BOT project, from Uong Bi to Ha Long. The ticket salesmen did not issue the tickets to the drivers who passed the station, resulting in a loss of toll revenue (Azami-Aghdash et al., 2020). Thereby, we can see that the inspection of toll collection activities in the operation phase of state management has been abandoned, and the legal frameworks have not been strictly followed.

Electronic toll collection (ETC) is developed for BOT projects to increase transparency and prevent revenue loss. Although there have been many issued decisions and regulations from the state, the implementation of this method has been very slow. There are many problems such as incomplete legal frameworks, in transparency in selecting ETC contractors. Therefore, unless the state management takes stronger action, this process will be hard to be widely applied to BOT projects.

2.3.9. Risk management

The construction of the 654.3km Eastern North-South highway project, period of 2017-2020, was behind the schedule due to the investor's limited capacity in management. Another important reason is the lack of soil materials to build the grounds. The state management has not timely resolved these problems (MOT, 2021). The state management and investors have not performed well the risk prevention and management.

The My Thuan-Can Tho highway project, with a length of 23km, started on January 2021. However, due to the scarcity of sand to build the grounds, only 2.1% of the work volume was completed, 6.3% behind the schedule. Meanwhile, this problem was

actually warned decades ago. However, the project investors and state management did not recognize or take any action to solve this problem before commencing the project (MOT, 2021). It proves the poor risk management of state management and investors.

The above cases show that, at any stage, there can be problems that cause failure to meet the project's targets. These risks are understood as unintended impacts of nature (natural disasters, epidemics, climate change, wars, etc.) and human impacts such as irresponsibility, intentional wrongdoings, group interests, etc. These risks cause damage and loss to the economy and society.

Vietnam, similar to other countries, in addition to the legal framework represented by the statutory system, also has a set of sub-law documents including standards, and regulations. However, the implementation and supervision of the state management are not fully conducted. State management is responsible for not strictly implementing the legal system.

From the above analysis, it can be seen that the state management's supervision role in PPP investment projects in general, and BOT projects, in particular, is still limited. We cannot deny that there are still many issues to be resolved related to aspects such as total investment cost, construction progress, quality, site clearance, environment, traffic safety, social security, etc. Thereby, we can see that the legal system of Vietnam is complete. Weak supervision, control, and capacity of the State management is the main reason for inefficient investment projects, causing loss and waste. In addition, there are a number of other reasons under the control responsibility of state management such as the selection of PPP projects; investor selection criteria; investor capacity; risk management; the sense of responsibility of the subjects, etc. that affect the control of PPP projects.

2.4. International cases of PPP projects in traffic infrastructure

In the UK, PPP project investment control is implemented immediately upon the project selection phase. The British government only selects PPP projects that create superior value compared to traditional forms of investment (projects with costs of 10-15% lower than an investment with the state budget). Before implementation, all projects are carefully and accurately analyzed for feasibility based on highly reliable data (Hood et al., 2006). It proves that state management has performed well in project appraisal and control, right from the stage of project selection.

In the US, the projects selected under the PPP form must be key, large ones, with long-term socio-economic benefits and, have an important influence on the community. As a result, PPP projects in the US have very high investment capital.

The implementation process focuses on quality over quantity. In this country, the federal

government is responsible for perfecting the mechanisms and policies to guide the implementation of this construction modal nationwide. On the other hand, the federal government decentralizes authorities to each state to implement PPP projects (Nguyen et al., 2022). It proves that this country has a good legal framework and the state management has performed well in project control.

In Australia, PPP projects must strictly comply with the schedule to quickly put the project into operation. In addition, in order to control the PPP projects in terms of objectives, quality, cost, and timeline, the Australian government requires an independent audit unit to inspect those projects. This prevents fraud or group interests between investors and the state (Grimsey and Lewis, 2007). The legal frameworks and project control in this country are very effective.

In Korea, the government focuses on building a specialized agency in charge of managing PPP projects (PIMAC). Accordingly, this agency is responsible for promulgating the annual PPP plan, which contains specific and practical guidelines for the application of PPP projects. This organization also promulgates a PPP implementation manual to create transparency, attracting the attention of the private investment sector (Koppenjan, 2005). The Korean government has made a clear separation between state and business management and creates policies that benefit investors, leading to high investment attraction. Some cases of "failure" in PPP implementation:

- Germany: The Warnow Rostock project, which was publicly bid on in 1994, failed. The franchise period must be extended for another 20 years (the original agreement was 30 years) for the investor to recover enough investment capital. The reason was due to inaccurate traffic forecasts, not taking into account objective factors such as the migration of Rostock citizens (Pham and Phan, 2018). The appraisal is not good and they cannot predict possible risks to warn competent state agencies to perform the project well.
- Hungary: The M1/M15 road was the first road with a toll station in Central and Eastern Europe. In 1995, the project was completed on schedule and at the estimated cost. However, the number of vehicles passing here was nearly 40% lower than forecast. The reason was due to an inaccurate survey of traffic participants before construction (Nguyen, 2022). These were the responsibilities of the state management.
- Thailand: The Don Muang toll station project started in 1989 with a total investment of 489 million USD. With a franchise term of 25 years, the project failed because the government did not fulfill its commitments in the contract. The government did not close another road on the same route. This reduced the traffic volume through the Don Muang, and the revenue was not as expected (Pham and Phan, 2018). The relevant

laws and sub-law documents were not strict enough to ensure the success of this project.

- Bulgaria: Due to a lack of transparency in investor selection and the investor's incapacity, the road project in Trakia was behind schedule and the investment cost increased (Pham and Phan, 2018). This case proved weak state management and poor business management.

2.5. Lessons learned for Vietnam

2.5.1. State management

First, it is necessary to complete the Law on PPP, creating an appropriate legal framework to make PPP projects become more attractive and effective. Accordingly, attention needs to be paid to a number of important stages such as criteria for selecting PPP projects, regulations and measures to control the implementation process, etc. Second, we need to clarify specific responsibilities for organizations and individuals, including state management, especially those in the planning, appraisal, and management stages, etc. Third, we need to establish a specialized agency to act as a representative for state management of PPP nationwide, cooperating with local authorities to perform basic functions such as researching policies related to the PPP projects, standardizing and providing guidance documents for PPP projects, promoting PPP investment projects, training human resources of PPP projects. Fourth, the investor selection needs to be carried out in form of competitive bidding, international bidding, etc. to ensure the publicity and transparency of the project. Fifth, risk management needs to be carefully considered in order to reasonably share risks between state management and investors. Sixth, in the context of limited investment capital, it is necessary to receive the support of the state via effective financial tools. Seventh, state management needs to improve the efficiency of contract supervision and management.

2.5.2. Investors

First, the investors are required to have adequate capacities in finance, management, construction, and practical experience in similar projects. Second, the investors should embrace a sense of professionalism, and ethical responsibility in order to minimize the negatives when implementing the bidding package. Third, there must be procedures for management in terms of technical, schedule, etc. Investors must submit such procedures to competent state agencies for approval before construction. Through international experiences in implementing PPP projects in road traffic infrastructure and lessons learned for Vietnam, we can see that the "legal system" and "supervision and control roles of the state management" are two important factors for successful PPP projects.

The above research results are from a qualitative perspective based on the actual implementation of BOT projects in Vietnam and other countries over the past time. In order to specifically identify these factors that need to be checked and re-evaluated, the authors used a quantitative problem with the software SPSS 20÷26.

3. Research methodology

3.1. Research model and hypotheses

Factors affecting the investment control of PPP projects from the perspective of state management can be summarized into 9 groups including:

- Group 1: Legal framework-Policy.
- Group 2: State management
- Group 3: Investors.
- Group 4: Investor selection.
- Group 5: Risk management.
- Group 6: Sense of responsibility.
- Group 7: Social security.
- Group 8: Socio-economic.
- Group 9: Site clearance.

Through primary and secondary investigation methods, together with consultation from experts, the duplicate factors of the above groups are eliminated. From the original 9 groups of factors, they are reduced to 7 groups of factors that affect the PPP project investment control function, shown in Fig. 1.

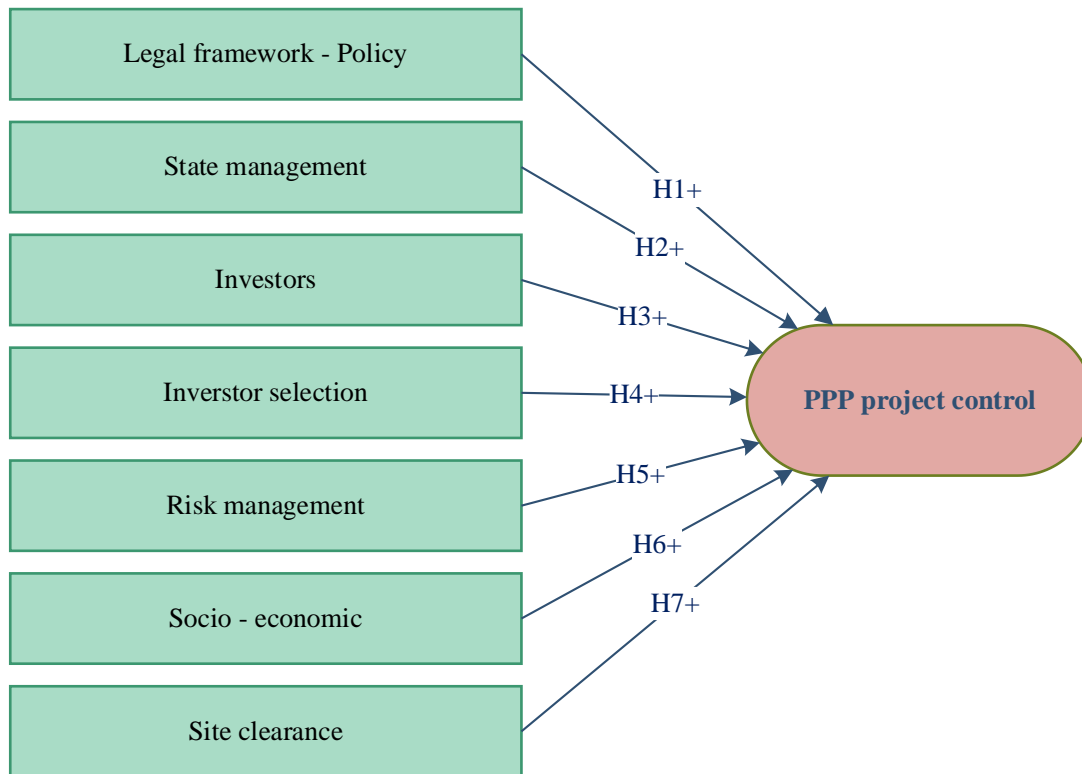
Reasons for reduction: "Group 6: Sense of responsibility" is a group of factors controlled through "Group 2: State management," because when state management plays an important role in project management in terms of schedule, quality, cost, environment, etc. Therefore, this group of factors will be eliminated. "Group 7: Social security" consists of many factors overlapping with those in "Group 8: Socio-economic."

3.2. Questionnaire, the scale of evaluation

The study used a questionnaire consisting of 39 observed variables as follows: Legal framework-Policy (8 variables), State management (8 variables), Investors (5 variables), Investor selection (5 variables), Risk management (4 variables), Socio-economic (4 variables); Site clearance (5 variables).

A Likert scale of 1 to 5 was used to measure these variables. In which:

1. Not affected
2. Very little;
3. Medium
4. High
5. Very high



H1+, H2+, H3+, H4+, H5+, H6+, H7+: groups of factors, according to the research hypothesis that expose positive influences on the control of PPP investment projects

Fig. 1: Proposed modal

3.3. Procedures

To build a multivariable regression equation showing the influence of factors on the control function of PPP projects, we conducted a survey of individuals who have experience in the field of BOT projects, project management, service users for BOT projects, etc. Data was collected from 280 questionnaires.

There were 250 valid questionnaires. After that, the data were processed with the software SPSS 20÷26. The procedure included 4 steps:

- Step 1: Evaluate the reliability of the scale through Cronbach’s Alpha coefficient: The alpha coefficient was developed to measure the internal consistency of variables in the same group (Cronbach, 1951). Accordingly, Cronbach’s coefficient can be used to evaluate the reliability of the scale and remove inappropriate variables from the model.
- Step 2: Exploratory factor analysis EFA: Exploratory factor analysis (EFA) aims to reduce a set of many interdependent measurement

variables into a smaller set of variables, making them be more meaningful but still contain most of the information of the initial set of variables.

- Step 3: Pearson correlation analysis: Pearson correlation analysis aims to test the close linear correlation between the dependent variables and the independent variables and early identify the problem of multicollinearity when the independent variables are also strongly correlated.
- Step 4: Multivariate regression analysis.

4. Results and discussion

4.1. The results of evaluating the reliability of the scale through Cronbach's Alpha coefficient

A scale has good reliability when it varies in the suitable range (0.7÷0.8). If Cronbach's alpha≥0.6, it is an acceptable scale in terms of reliability. The results of Cronbach’s Alpha reliability test are shown in Table 1. Observed variables with a total variable correlation coefficient of less than 0.3 will be removed.

Table 1: The results of Cronbach’s Alpha reliability test

No.	Codes	Group of factors	Cronbach’s Alpha (1 st time)	Cronbach’s Alpha (2 nd time)
1	PLCS	Legal framework–Policy	0.818	0.844
2	QLNN	State management	0.826	0.849
3	NDT	Investors	0.811	-
4	LCNDT	Investor selection	0.729	0.781
5	QLRR	Risk management	0.823	-
6	KTXH	Socio-economic	0.777	-
7	GPMB	Site clearance	0.798	-

Variables PLCS4, QLNN3, and LCNDT4 were removed because the Corrected Item-Total Correlation is less than 0.3

The results of Cronbach's Alpha reliability analysis in Table 1 showed that all factor groups (after removing 3 variables PLCS4, QLNN3, LCNDT4), have Cronbach's Alpha coefficients greater than 0.6.

Therefore, the results showed that the scales with Cronbach's Alpha coefficient were compliant with the requirements. Then, we conducted an exploratory factor analysis of EFA.

4.2. Exploratory factor analysis EFA

The conditions for exploratory factor analysis of EFA must satisfy the following requirements: Factor loading ≥ 0.5 ; $1 \geq$ KMO coefficient (Kaiser-Meyer-Olkin) ≥ 0.5 ; Bartlett test has statistical significance (Sig. < 0.05) and percent of variance explained $> 50\%$. The results of exploratory factor analysis (EFA) (2nd test) are shown in Table 2.

Table 2: KMO and Bartlett test results (2nd EFA)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.875
Bartlett's Test of Sphericity	Approx. Chi-Square	3101.082
	df	528
	Sig.	0.000

Results of the 1st EFA analysis show that:

- Remove the variables KTXH4 and GPMB4 because they have a factor loading of less than 0.5.
- Remove the variable QLRR3 due to loading in both factors.

- KMO was $0.875 > 0.5$, and factor analysis was appropriate.
- Sig. (Bartlett's Test) = 0.000 (sig. < 0.05), observed variables were correlated with each other.

The results of the variance explained are shown in Table 3.

Results of the 2nd EFA analysis, all criteria were satisfactory:

Table 3: Results of variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.881	23.882	23.882	7.881	23.882	23.882
2	3.170	9.608	33.490	3.170	9.608	33.490
3	2.393	7.252	40.742	2.393	7.252	40.742
4	2.104	6.376	47.117	2.104	6.376	47.117
5	1.606	4.866	51.984	1.606	4.866	51.984
6	1.343	4.071	56.054	1.343	4.071	56.054
7	1.152	3.490	59.544	1.152	3.490	59.544

The results of the EFA analysis in Table 3 show that:

- Eigenvalues = 1.152 > 1 at the 7th factor. Therefore, the 7 factors extracted from EFA were meaningful in summarizing the information of the observed variables.
- Extraction sums of squared loadings (Cumulative %) = 59.544% $> 50\%$. 59.544% variation of the data was explained by 7 factors.

4.3. The results of multivariable regression analysis

In the scope of this study, we set up a regression model consisting of 7 independent variables (Table 4) formed from the results of factor analysis and run the Pearson correlation test, with a statistical significance of 10 %.

Table 4: The results of multivariable regression analysis

Model	Coefficients					Collinearity Statistics	
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Tolerance	VIF
	B	Std. Error	Beta				
1	(Constant)	.094	.172		.543	.588	
	LCNDT	.023	.037	.028	.620	.536	.640
	QLRR	.146	.031	.213	4.771	.000	.678
	PLCS	.278	.038	.328	7.408	.000	.691
	GPMB	.006	.037	.006	.163	.871	.878
	NDT	.184	.034	.239	5.472	.000	.707
	KTXH	.032	.031	.045	1.016	.310	.696
	QLNN	.256	.035	.321	7.395	.000	.720

Multivariate regression results in Table 4 showed that:

- Variables KTXH, GPMB, and LCNDT were not significant in the model because sig. was greater than 0.05 and all three variables belong to group 1

and group 2. Therefore, the regression equation has 4 variables.

- Variables PLCS, QLNN, NDT, and QLRR all have an impact on the dependent variable because the sig. of each independent variable was less than 0.05.

- VIF of independent variables were all less than 10, and no multicollinearity occurred.

Thus, the multivariable regression equation, including 4 variables, had the form (according to the standardized Beta coefficient) as Eq. 1.

$$KSDT = 0.328 \times PLCS + 0.321 \times QLNN + 0.239 \times NDT + 0.213 \times QLRR \quad (1)$$

where, *PLCS*: Legal framework – Policy; *QLNN*: State management; *NDT*: Investors; *QLRR*: Risk management.

The slope coefficients (β_i) from the regression equation represent the degree of influence of each group of factors on the control function of PPP projects, the larger the absolute value of this coefficient, the greater the degree of influence and vice versa.

5. Proposed solutions

5.1. Solutions for legal framework-policy

1) Strengthen the capacity and responsibility of the competent authority in charge of perfecting the legal system on the following principles:

- Develop and enforce laws on the principle of ensuring the perfection of legal content, form, and technique (Purposeful-Consolidated-Feasible-Public -Transparent-Dynamic thinking).
- Law completion must follow the process: Construction-Appraisal-Verification (each step must have its own strict process).
- Law must control the power.
- Personnel in the policy design department must have the professional capacity and practical experience in order to minimize overlapping of laws.
- Ensure that the designed laws must be applicable for a long period of time.
- Embrace divergent critical thinking, in order to strengthen the coherence and sustainability of the law.
- Eliminate the group interests and policy corruption.

2) Develop a specific legal mechanism for PPP investment: The specific legal mechanism in investment is applied to a type of production that has its own characteristics and coexists with other types of products with the same characteristics and product categories. Therefore, product-specific policies need to follow specific principles such as product specificity; attraction ability; incentives; risk sharing; rights and obligations; community benefits.

5.2. Solutions for state management

1) Build a system of sub-law documents that ensure the following principles:

- Combine theoretical and practical perspectives.
- Take practical experience from the Vietnam economy as the orientation for the legal system in each period of time for BOT investments.
- Develop regulations on the “allowed time period” that the sub-law documents need to be adjusted. At present, some decrees about PPP investment are too short in validity (Decree No.15/2015/ND-CP, Decree No.63/2018/ND-CP with a validity period of only 3 years), while BOT projects usually last from 4 to 5 years or more. Even, there is a project lasting up to 13 years such as the above-mentioned Trung Luong-My Thuan project.
- The council for drafting sub-law documents must include experts with sufficient experience and expertise.
- Develop a regulation of responsibility for such councils that they need to take references and experiences from developed countries, ensuring international integration and advanced scientific development.
- Establishment of an appraisal council for legal frameworks.
- Separate “legal management” and “technical management” to create fairness and objectivity for PPP investment. In which:
- State management: Guiding-Directing-Adjusting-Objective.
- Technical management: Standards-Regulations - Compliance-No exceptions.
- It is necessary to have effective and strong financial tools to support investors.

2) The controlling role of state management: Construction quality is affected by many factors including State management; project investors/enterprises; construction contractors; consulting contractors, etc. However, in the process of supervising project implementation, each subject has different qualifications, responsibilities, and interests. Therefore, state management must combine those different factors into a common goal, ensuring “Schedule-Quality-Cost-Environment-Social Security, etc.”

5.3. Solutions for project investors/enterprises

The capacity of the project investors/enterprises when participating in PPP projects is usually considered in terms of technical, IT, and financial capacities. In terms of technical capacity, technology has been advanced enough to easily evaluate this. In terms of financial capacity, this is the core factor to ensure the success of PPP projects in general and BOT projects in particular.

Technical and IT capacities: This factor is seriously considered at the bidding stage, starting with examining the transparency of the project investors/enterprise in terms of experience and capacity. Then, they are carefully verified by the details of the technical proposal at the bid evaluation stage.

Financial capacity: Select a project investor/enterprise with financial potential meeting the requirements. And at the same time, financial capacity is also a crucial commitment to bind the responsibility of the investor to accelerate the project's progress.

The financial capacity of the project investor/enterprises participating in a PPP project must ensure the following principles:

- Equity of an independent legal entity or a consortium of independent legal entities actually contributing capital according to the charter of the PPP project enterprise and in accordance with the provisions of the PPP project contract.
- Ensure that there is enough equity to contribute capital according to the financial plan of the PPP project. This is evaluated according to the investor's financial statements of the latest years, which have been audited by an independent audit agency.
- Investors are responsible before the law for the accuracy and legitimacy of provided data and documents related to equity, allocation of equity to projects and their financial investments on long-term projects, and the plan to increase equity according to the implementation of PPP projects.
- Be responsible for providing sufficient capital when performing the contract. In case of investors' insufficient capital, they take full responsibility.

5.4. Solutions for risk management

Building a risk management process with 8 following steps:

- Step 1: Identify objective and subjective risks
- Step 2: Classify and prioritize risks according to the level of impact and frequency of occurrence.
- Step 3: Risk analysis (quantitative, qualitative). Filter and remove risks with insignificant impacts.
- Step 4: Risk prevention (preventive measures by technological plans and processes, etc.)
- Step 5: Risk settlement (possible solutions, backup plans).
- Step 6: Monitor risks (process, time, measures, tools, etc.)
- Step 7: Handle risk situations
- Step 8: Finalized documents

Risk management by contracts, ensuring the following principles:

- Clearly separate responsibilities between the parties in the contract.
- The parties have the right to choose the contract terms suitable for their rights and obligations.
- Risks are properly shared.
- Transparency of the contract terms, allowing direct as well as indirect parties to be updated with adequate information.

Thus, risk identification plays an important role, requiring the state management to carefully research and minimize negligence when composing the contracts to avoid inappropriate legal procedures that negatively affect the progress, quality, and cost of PPP projects.

6. Discussion of research results

According to the above research results, within the collected research sample, the authors determined that there are 4 groups of factors that have a great impact on BOT investment control and are ranked according to the gradually decreasing degree of impact:

1. Legal framework–Policy ($\beta_1=0.328$)
2. State management ($\beta_2=0.321$)
3. Investors ($\beta_3=0.239$)
4. Risk management ($\beta_4=0.213$)

This means that, in order to control investment in road traffic infrastructure projects in Vietnam form of PPP in general and BOT form in particular and ensure efficiency according to the proposed plan, legal framework–policy needs to ensure stability and adapt to reality, the control role of state management must be effectively implemented. And at the same time, it is necessary to ensure the capacity of investors and reasonable risk management of state management and investors during project implementation.

Compared with previous domestic and international research, this study addressed the shortcomings and limitations in the following aspects:

- There are 4 major factors affecting the control of PPP project investment including (1) Legal framework and policy, (2) State management, (3) Investors, and (4) Risk management. Thereby, they built a solution system to ensure a mechanism to create fair competition, strengthen the capacity of state agencies to manage PPP projects, perfect the policy and legal framework, and monitor activities of PPP projects
- The level of impact on project investment control in the form of PPP, from both the perspectives of state management and investors
- The factors affecting PPP project control from the perspective of state management, including the legal framework and policy, state management, investors, etc.

The study achieved the following results:

- Theoretically: This study supplements and develops the previous fundamental studies in the world and Vietnam on the principle of ensuring the success of PPP projects.
- Practically: The study points out the factors that greatly affect the investment control of investment projects in the form of PPP in general and BOT

projects in particular. Therefore, it helps the project participants (Competent state agencies, investors, etc.) get a comprehensive perspective through the practical implementation of BOT projects in Vietnam, in order to gradually perfect the PPP and BOT investment model.

7. Conclusions

Research results are supposed to serve as a scientific and practical foundation to provide more feasible and effective tools for investment control and management in PPP projects in general and BOT projects in particular. Accordingly, managers/management agencies are recommended to focus on controlling investment in PPP projects as per the following aspects:

- Complete the legal framework and policies for BOT investment. This is the basic factor that leads to the success of PPP projects. Legal framework and policies must ensure that the benefits of the state, investors, and community are harmonized. Experts in charge of improving legal frameworks and policies need to have theoretical and practical experience so that such policies can become effective.
- In order for the project to be successful as per set targets, state management is another important factor. The state management agencies are required to build a system of sub-law documents to comply with the laws and satisfy the principles of “practical–long-term–effective.” These will facilitate the state management to effectively control and implement the PPP and BOT projects.
- The project investors/ enterprises must have the strong financial capacity, technical resources, and management qualifications, matching the nature and characteristics of the projects.
- Good risk management is vital to ensure the success of the projects. Therefore, it is necessary to identify possible subjective and objective risks and determine the responsibility of each party via detailed civil contracts. Thanks to that, the related parties of the PPP or BOT projects are always engaged in implementing risk management, resulting in saving costs and partly ensuring the success of the projects.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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