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MANAGEMENT OF CAPITAL INVESTMENT RECOVERY AND PUBLIC EXPENDITURES IN PUBLIC-PRIVATE PARTNERSHIP PROJECTS THROUGH AN ELECTRONIC PLATFORM

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Abstract: Public-private partnership projects have become an important mechanism for financing and developing infrastructure, public services, and strategically significant economic sectors. These projects combine public resources, private capital, managerial capabilities, technological solutions, and long-term contractual relationships, making effective financial management essential for their sustainability. An electronic platform can integrate investment, expenditure, contractual, and financial information into a unified digital management environment, supporting financial planning, investment monitoring, payment management, budget discipline, transparency, and accountability. The article examines the organizational and financial principles of managing capital investment recovery and public expenditures through an electronic platform.

Key words: partnership, investment, recovery, expenditure, budgeting, financing, digitalization, monitoring, transparency, governance, risk, infrastructure.

INTRODUCTION

Public-private partnership projects have emerged as an important instrument for attracting private capital to the development of infrastructure and public services. Under such arrangements, a public authority and a private entity cooperate on the basis of a long-term contractual relationship in which responsibilities for financing, construction, operation, maintenance, service provision, and risk management are distributed between the parties. The public sector seeks to obtain infrastructure and services that meet social and economic objectives, while the private sector expects to recover invested capital and obtain an appropriate return through project revenues or contractual payments. Consequently, financial management becomes one of the most important conditions for the successful implementation of public-private partnership projects.

A particular challenge is the simultaneous management of private capital investment recovery and public expenditures. The private partner may invest substantial financial resources during the construction and development stages, while the public partner may assume long-term obligations associated with service payments, subsidies, availability payments, guarantees, compensation, or other contractual commitments. If these financial flows are not systematically monitored, the project may create unexpected fiscal risks, disputes between contractual parties, delays in investment recovery, or inefficient use of public resources. An integrated electronic platform can provide a technological basis for connecting these processes and ensuring continuous monitoring throughout the project life cycle.

METHODOLOGY

The research applies a theoretical and analytical approach based on international principles of public-private partnership management, public expenditure management, investment planning, digital governance, financial monitoring, and risk management.

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Methodological materials developed by international financial and development institutions, together with academic literature on infrastructure finance and public-private cooperation, are used to identify the main financial processes that should be integrated into an electronic management platform.

The research focuses on the relationship between initial private investment, project revenues, operating expenditures, public payments, contractual obligations, investment recovery, and financial risks. The proposed electronic management mechanism is considered as a conceptual model that can be adapted to transport, energy, healthcare, education, water supply, municipal infrastructure, and other sectors in which public-private partnership arrangements are applied.

MAIN PART

The financial structure of public-private partnership projects. The financial structure of a public-private partnership project is more complex than that of a conventional public investment project because financial responsibility is distributed between public and private participants over an extended period. In a traditional public infrastructure project, the government may finance most construction expenditures directly through the state budget. In a public-private partnership project, however, the private partner may provide a significant proportion of the capital required for construction, modernization, equipment, technology, or other infrastructure components. The private partner subsequently recovers its investment through user payments, government payments, service revenues, or a combination of several financial mechanisms.

The financial model of a public-private partnership project should therefore establish a clear connection between the amount of capital invested, the expected revenues, operating expenditures, financing costs, risks, and the mechanisms through which investment is recovered. Capital investment recovery should not be understood merely as the return of the initial amount of money invested by the private partner. It normally includes recovery of eligible investment costs, financing expenses, maintenance requirements, operational expenditures, taxes, and an appropriate return on invested capital. The precise composition of recoverable costs depends on the contractual conditions, legal framework, sector characteristics, and financial structure of the individual project.

The initial investment may be concentrated during the construction stage, while recovery may occur gradually over ten, fifteen, twenty, or more years. This creates a significant need for continuous financial monitoring. Economic conditions may change during the contractual period, and actual revenues may differ from initial forecasts. Construction costs may increase, demand may decrease, inflation may affect operating expenditure, and exchange-rate changes may influence the financial position of the private partner. Consequently, a financial model prepared only at the beginning of the project cannot provide sufficient information for long-term management. A digital system capable of continuously updating financial information is therefore highly valuable. An electronic platform can record every significant investment made by the private partner and classify it according to predetermined categories. Construction expenditure, equipment purchases, technological investments, design costs, financing costs, and other eligible expenditures can be separately recorded. The system can then calculate total eligible investment, cumulative recovered investment, remaining unrecovered investment, and expected recovery time. Such functionality provides both parties with a common financial information base and reduces the possibility of disagreement concerning the amount of investment that should be recognized for recovery purposes.

Capital investment recovery mechanisms. The recovery of private capital is one of the central financial issues in public-private partnership projects. The mechanism selected for

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investment recovery depends on the economic characteristics of the project and the distribution of commercial and public risks. In some projects, the private partner receives revenues directly from users. This model is common in certain transport, energy, and utility projects where users pay for the services provided by the infrastructure. In other projects, the private partner receives payments from the government based on the availability and quality of the infrastructure or service. There are also mixed models in which user revenues are combined with public financial support.

An electronic platform can provide a detailed record of the investment recovery process regardless of the selected mechanism. When the private partner invests capital, the investment is entered into the system and subjected to appropriate verification. When revenue is generated or a contractual payment is made, the system records the amount and determines its relationship with the investment recovery schedule. The platform can then display the cumulative amount recovered and the remaining balance. This creates a transparent connection between the initial investment and subsequent financial flows. For example, if the approved eligible capital investment of a private partner amounts to 100 million monetary units, the electronic system can record each verified investment expenditure and establish the total eligible amount. If the private partner has subsequently recovered 35 million monetary units through project revenues and contractual payments, the platform can show that 65 million monetary units remain unrecovered. If the project generates lower-than-expected revenues, the system can recalculate the projected recovery period. This allows public authorities and private investors to observe the financial position of the project without waiting for an annual financial review.

More advanced financial analysis can incorporate the time value of money. A monetary amount received today is not financially equivalent to the same amount received several years later. Therefore, long-term public-private partnership projects should consider discounted cash flows when assessing investment recovery and financial sustainability. The electronic platform can incorporate discount rates and automatically calculate the present value of future revenues and expenditures. It can also calculate the net present value of the project and the internal rate of return when these indicators are required for financial evaluation. These calculations can provide a more accurate assessment of whether the project remains financially viable under changing economic conditions.

Electronic platform for integrated financial management. An electronic platform for public-private partnership projects should be designed as a comprehensive management environment rather than merely an electronic document storage system. The platform should integrate information concerning project preparation, financial planning, procurement, contract implementation, investment, expenditures, performance, risks, payments, and reporting. Such integration is important because financial decisions cannot be separated from technical and contractual performance.

The first major component of the platform should be a project registration module. Each project should have a unique digital identification number through which all relevant information can be accessed. The project record should include the name of the project, sector, responsible public authority, private partner, contract duration, investment amount, financing sources, expected revenues, expected public payments, major risks, performance indicators, and other important characteristics. This would prevent important information from being distributed across multiple disconnected systems.

The second component should be a financial planning module. This module should contain the initial investment plan, financing structure, construction expenditure, operating costs, maintenance costs, expected revenues, taxes, financing obligations, and public financial

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commitments. The system should distinguish between planned and actual values. When actual information is entered, the platform should automatically calculate deviations and indicate whether the project remains within the approved financial parameters.

The third component should be a capital investment recovery module. This module should record the amount of private investment, verify eligible expenditures, calculate cumulative recovery, determine the remaining unrecovered investment, and estimate the expected recovery period. It should also maintain a historical record of all adjustments to the investment calculation. This is particularly important when contractual amendments affect the amount or timing of investment recovery.

The fourth component should be a public expenditure management module. This module should record all payments made by public institutions in connection with the project. Each payment should be linked to the relevant contractual obligation, budget source, payment date, amount, performance indicator, and authorization. Such integration would allow the government to determine not only how much has already been spent but also how much it is legally committed to spend in future periods.

The fifth component should be a risk management module. It should contain information about construction risks, financial risks, demand risks, regulatory risks, exchange-rate risks, inflation risks, operational risks, and other relevant factors. Each risk can be assigned a probability, potential financial impact, responsible institution, mitigation measure, and warning threshold. When a predefined threshold is reached, the system can automatically notify the responsible officials.

Management of public expenditures. Public expenditure management represents a critical element of financial control in long-term public-private partnership projects. A public authority may enter into contractual obligations that extend far beyond the annual budget cycle. Payments may be required over ten, fifteen, twenty, or more years. Consequently, government authorities need to understand not only current expenditure but also future contractual commitments.

An electronic platform can support this process by creating a complete schedule of public financial obligations. The system should identify the expected payment date, amount, responsible public institution, contractual basis, budget source, payment status, and relevant performance conditions. Future commitments should be displayed alongside current expenditures so that decision-makers can understand the long-term fiscal implications of existing contracts. This approach is particularly important when projects involve availability-based payments. Under such arrangements, the government makes payments when the infrastructure is available and the private partner satisfies specified performance requirements. If the infrastructure is unavailable or service quality falls below the contractual standard, the payment may need to be reduced. An electronic platform can connect performance information with the payment calculation and thereby strengthen the relationship between public expenditure and actual service delivery. The platform can also establish expenditure limits and warning mechanisms. If projected public payments exceed an approved threshold, the system can notify the relevant authorities. Similarly, if the total value of future commitments creates a potential fiscal pressure, the system can provide an early warning. Such functions support medium-term fiscal planning and help prevent the accumulation of uncontrolled contractual obligations.

Another important feature is the comparison between planned and actual expenditure. If the government has planned a payment of a certain amount for a construction milestone but the milestone has not been completed, the electronic system can prevent automatic confirmation of the payment until the responsible authority verifies compliance with contractual requirements.

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This strengthens expenditure discipline and reduces the risk of payments being made without sufficient evidence of performance.

Relationship between private investment recovery and public expenditure. Private capital investment recovery and public expenditure should be managed as interconnected financial processes. In many public-private partnership projects, government payments constitute a significant source of private investment recovery. Therefore, a delay or incorrect calculation of public payments may affect the private partner's financial position. At the same time, excessive or poorly controlled public payments may increase the fiscal burden without providing corresponding public benefits.

The electronic platform should establish a direct financial relationship between investment and payment. Each public payment can be associated with a specific contractual obligation and a particular component of the financial model. The platform can distinguish between payments related to investment recovery, operating expenses, maintenance, performance incentives, and other contractual elements. This classification enables public authorities to determine how public resources are being used.

Such integration can also improve contractual transparency. When both parties rely on the same verified information, disputes concerning investment amounts, payment schedules, and performance results can be reduced. The platform can maintain a complete record of submitted documents, verification procedures, approvals, calculations, and payments. If a dispute arises, the relevant transaction history can be reviewed without reconstructing information from separate paper files. The relationship between public expenditure and investment recovery is also important for assessing the overall value of the project. A project may attract substantial private investment but simultaneously create excessive long-term government obligations. Conversely, a project may require significant government support while producing major social and economic benefits. Therefore, decision-makers should evaluate the total financial and economic consequences rather than considering private investment alone.

Monitoring financial performance through digital indicators. Continuous monitoring of financial indicators is essential for long-term public-private partnership management. The electronic platform should automatically calculate indicators that describe the project's financial position. One important indicator is the cumulative investment recovery ratio, which compares recovered eligible investment with the total eligible investment. Another is the remaining unrecovered capital balance, which shows how much of the recognized investment has not yet been recovered. The platform can also calculate cumulative revenues, cumulative operating expenditures, cumulative public payments, financing costs, and net project cash flow. These indicators should be available in both numerical and graphical forms. Decision-makers should be able to observe monthly, quarterly, and annual changes and compare actual results with the original financial model.

The use of the net present value of future cash flows can provide information about the economic value of the project under current conditions. The internal rate of return can indicate the expected profitability of the investment. The discounted recovery period can show the time required for the present value of project cash flows to compensate for the initial investment. For projects financed through loans, indicators related to debt-service capacity can also be integrated. However, financial indicators should not be considered independently from performance indicators. A project may demonstrate satisfactory financial results while failing to provide the expected level of public service. Therefore, the electronic platform should connect financial indicators with operational indicators such as service availability, quality, capacity, maintenance performance, customer satisfaction, environmental requirements, and other contractual standards.

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Risk management and early-warning mechanisms. Long-term infrastructure projects are exposed to numerous risks that can influence both private investment recovery and public expenditure. Construction delays can postpone revenue generation. Cost increases can require additional financing. Changes in demand can reduce project revenues. Inflation can increase operating costs. Currency fluctuations can increase the cost of foreign-currency obligations. Changes in legislation or government policy can also affect the financial model.

The electronic platform can establish an integrated risk register in which every significant risk is recorded and monitored. The risk register should include the description of the risk, probability of occurrence, potential financial impact, responsible party, mitigation strategy, current status, and warning threshold. When a risk becomes more significant, the system can automatically generate an alert.

Scenario analysis is another useful function. Decision-makers can simulate different economic conditions and determine how they affect investment recovery and public expenditure. For example, the platform can calculate the consequences of a 10 percent decline in demand, a 15 percent increase in construction costs, higher inflation, exchange-rate changes, or a delay in project completion. Such analysis enables authorities to prepare appropriate responses before financial problems become critical. The platform can also compare the original financial model with current project conditions. If the difference between projected and actual revenue becomes significant, the system can identify the deviation and calculate its potential effect on investment recovery. If public expenditure is growing faster than expected, the platform can estimate the future fiscal impact. This creates an early-warning mechanism that supports proactive rather than reactive financial management.

Transparency and accountability. Transparency is essential because public-private partnership projects involve public resources, private investment, long-term contracts, and services that directly affect citizens. An electronic platform can strengthen transparency by creating a reliable digital record of financial and contractual transactions. Every major action can be associated with a date, responsible official, supporting document, approval status, and financial consequence.

The system should provide different levels of access depending on the role of the user. Public finance institutions may require access to budget information and government commitments. Sector authorities may need information about technical performance. Contracting authorities may require access to detailed contract management information. Private partners may need access to investment, payment, and performance records. Audit institutions should be able to examine the relevant transaction history. At the same time, transparency should be balanced with information security and confidentiality. Commercially sensitive information and protected personal or institutional data should not automatically become publicly accessible. The platform should therefore distinguish between confidential information, authorized institutional information, and information suitable for public disclosure.

Public dashboards can provide citizens and other stakeholders with general information about project implementation. Such dashboards may show total investment, project status, contract duration, implementation progress, government payments, and key performance indicators. This can improve public understanding of how infrastructure projects are financed and how public resources are used.

Institutional organization of the electronic platform. The effectiveness of an electronic platform depends heavily on the institutional structure supporting it. A central public-private partnership authority or another designated government institution may be responsible for maintaining methodological standards and coordinating the system. The financial authority may

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be responsible for monitoring budget commitments and fiscal risks. Sector ministries and local authorities may supervise project implementation and service quality. Private partners may provide investment and operational information in accordance with contractual requirements. Clear responsibilities are necessary to prevent duplication and information gaps. The platform should specify who is responsible for entering data, who verifies the data, who approves financial transactions, who can modify information, and who is responsible for resolving discrepancies. Every modification should be recorded in an electronic audit trail.

The system should also use standardized definitions. For example, all participating institutions should apply the same definition of capital investment, recoverable investment, public expenditure, contractual commitment, operating cost, and performance payment. Without common definitions, even technologically advanced systems may generate inconsistent information. Interoperability with other public information systems is equally important. The electronic platform should be capable of exchanging information with public procurement systems, budget management systems, treasury systems, tax systems, accounting systems, and project management systems. This reduces duplicate data entry and increases the consistency of information.

Economic efficiency and expected results. The introduction of an electronic platform can generate several economic and administrative benefits. First, it can reduce the time required to collect and process financial information. Instead of preparing separate reports for different institutions, information can be entered once and used for multiple analytical purposes. Second, it can reduce errors associated with manual calculations and repeated data entry. Third, the platform can improve budget planning by providing information about future contractual obligations. Public authorities can see expected payments over several years and incorporate them into medium-term expenditure planning. Fourth, it can strengthen investment monitoring by providing a continuously updated picture of private capital recovery. Fifth, the platform can reduce the probability of unauthorized or poorly documented payments. Payments can be connected with contractual milestones and verified performance indicators. Sixth, the system can improve audit efficiency because auditors can access a chronological record of financial transactions, approvals, modifications, and supporting documents. The broader economic effect is an improvement in the quality of public-private partnership decision-making. Public authorities can compare alternative financing structures, assess fiscal risks, monitor value for money, and determine whether a project remains financially sustainable. Private investors can obtain clearer information about payment mechanisms and investment recovery. Citizens can receive greater transparency regarding the use of public resources.

DISCUSSION

The analysis indicates that the digital management of capital investment recovery and public expenditures can substantially improve the financial governance of public-private partnership projects. The principal advantage of an electronic platform is not simply the automation of individual calculations but the integration of financial, contractual, operational, and budgetary information into a common management environment. This makes it possible to establish a continuous relationship between private investment, public expenditure, contractual performance, and project results. At the same time, technology cannot independently solve institutional or financial problems. The effectiveness of the platform depends on the quality of legislation, contractual arrangements, financial data, institutional coordination, professional capacity, and information security. If the underlying data are incomplete or inaccurate, even a highly advanced electronic system may produce unreliable results. Therefore, digitalization should be accompanied by standardized procedures, clear institutional responsibilities, data

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verification, audit mechanisms, cybersecurity measures, and professional training. The electronic platform should serve as a tool for improving governance rather than simply replacing paper documents with electronic files.

CONCLUSION

The management of private capital investment recovery and public expenditures is one of the most important financial dimensions of public-private partnership projects. Long-term contractual relationships create complex financial flows that require continuous monitoring, reliable information, and coordinated decision-making. Fragmented management approaches can make it difficult to determine the actual level of investment recovery, future public obligations, project risks, and financial sustainability. An integrated electronic platform can provide an effective mechanism for addressing these challenges. By connecting project registration, financial modelling, investment monitoring, capital recovery, public expenditure management, payment verification, risk assessment, performance monitoring, reporting, and auditing, the platform can create a unified financial management environment.

The implementation of such a system can strengthen budget discipline, improve transparency, protect legitimate private investment interests, reduce financial risks, and support more effective use of public resources. However, successful implementation requires not only technological development but also appropriate legislation, standardized financial procedures, institutional coordination, data quality, cybersecurity, and qualified personnel. Consequently, the development of electronic financial management mechanisms should be regarded as an important direction for improving the sustainability and efficiency of modern public-private partnership projects.

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