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Original Article

Factors Affecting the Consideration of Public-Private Partnerships (PPPs) for Smart City Projects in Indore City

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Abstract *- This paper provides an in-depth analysis of Public-Private Partnerships (PPPs) in the context of urban development in Indore city, with a focus on initiatives undertaken under the Smart City scheme. It explores the conceptual framework of PPPs, elucidating governance structures, risk allocation mechanisms, and contractual arrangements crucial for effective collaboration between the public and private sectors. The rationale for PPPs in Indore's smart city initiatives, encompassing access to resources, risk mitigation, innovation, efficiency, and public accountability, underscores their significance in urban development. The paper examines the existing PPP projects implemented under the Smart City scheme in Indore, highlighting key achievements, challenges encountered, and lessons learned. It also discusses proposed PPP projects and future recommendations for enhancing urban infrastructure, service delivery, and quality of life for residents. The analysis encompasses diverse PPP models and structures, including Build-Operate-Transfer (BOT), Design-Build-Operate (DBO), Concession Agreements, and Service Contracts tailored to the specific needs and characteristics of Indore's smart city projects. Furthermore, the paper addresses indexing, providing a comprehensive overview of the literature on PPPs in Indore City and related urban development initiatives. By synthesizing existing knowledge and offering insights into future research directions, this paper contributes to the understanding of PPPs in urban development. It provides practical recommendations for policymakers, urban planners, and stakeholders involved in Indore's smart city transformation.*

Keywords *- Smart city Indore, Public-Private Partnerships (PPP), Smart cities mission, Urban development.*

1. Introduction

1.1. Topic and Context

The Smart Cities Mission (SCM) was launched on June 25, 2015, by the Ministry of Housing and Urban Affairs (MoHUA), formerly known as the Ministry of Urban Development (MoUD).

This initiative aimed to transform urban areas across India, with 100 cities and towns selected from various states and union territories. Uttar Pradesh led with the highest number of selected cities (13), followed by Tamil Nadu (12) and Madhya Pradesh (7). Noteworthy among the selected cities in Madhya Pradesh were Bhopal and Indore, chosen in the first phase of the mission (MoUD, 2015).

1.1.1. Smart City Mission Components

The Smart Cities Mission encompasses two primary strategies: the Area-Based Development (ABD) approach and the pan-city approach. ABD strategy involves three main components: Retrofitting, Redevelopment, and Greenfield development.

Under the ABD strategy, specific areas are designated for the implementation of Smart City Proposals (SCPs). Retrofitting focuses on enhancing the infrastructure of existing built-up areas spanning over 500 acres by integrating smart applications. Redevelopment targets areas exceeding 50 acres to replace existing built-up environments with mixed land use and increased density. Greenfield development focuses on previously vacant land covering more than 250 acres for innovative planning.

ABD incorporates various components such as Affordable Housing, Open spaces management, Preservation of lakes, rivers, and sea shores, Promotion of heritage protection and activities, Development of Central Business Districts and markets, Enhancement of street façades, Improvement of transit infrastructure, and Promotion of sustainable transportation methods, among others.

In contrast, the pan-city approach integrates smart solutions to enhance infrastructure and services through the application of technology and the Internet of Things (IoT).

An evaluation of the Smart Cities Mission highlights commendable performance by Indore and Bhopal in terms of issuing project tenders and completing projects. This prompts an intriguing assessment of Indore's performance to understand the involvement of Public-Private Partnerships (PPPs) in this endeavor (Special Report No. 155 ORF, 2021).

1.1.2. Indore

Indore, located in the western part of Madhya Pradesh, serves as the commercial nucleus of the state, accommodating approximately 12.1 percent of its urban population, making it the most densely populated city based on the 2011 Census data. Renowned as a pivotal hub for major business undertakings within the state, Indore's significance extends beyond its demographic prominence.

The Smart Cities Challenge, a competitive framework for selecting cities for funding, hinges on area-based development strategies. Indore distinguishes itself through its robust citizen engagement program aimed at shaping the city's vision, goals, and strategies. This inclusive approach extends to the selection and planning of both Area-Based Development (ABD) and Pan-city proposals.

Remarkably, this participatory process saw over 25% of the city's population engaged, reflecting a broad spectrum of involvement across various communication channels. Despite its rich historical background dating back to the 1800s, Indore has proactively embraced the challenge of enhancing its identity and fostering associational values. Indore's success in the competition for smart city implementation primarily stemmed from its Smart City Proposal (SCP), which encompassed comprehensive ABD and Pan-city solutions. Evaluation criteria included the quality of the city's vision, goals, and strategic plans, along with the caliber of proposals for ABD and Pan-city initiatives.

1.2. Scope of Research

The scope of this project encompasses a thorough examination of Public-Private Partnerships (PPPs) within the framework of urban development, with a specific focus on the city of Indore and its initiatives under the Smart City scheme. The study will explore various dimensions of PPPs, including governance structures, risk allocation mechanisms, and contractual arrangements, to provide a comprehensive understanding of effective collaboration between the public and private sectors.

Furthermore, the research will analyze the rationale for adopting PPPs in Indore's smart city initiatives, emphasizing aspects such as resource access, risk mitigation, innovation, efficiency, and public accountability. This analysis will involve a review of existing PPP projects implemented in Indore under the Smart City scheme, highlighting key achievements, challenges encountered, and lessons learned.

Additionally, the study will assess the effectiveness of PPPs in achieving the goals of Smart City Indore, including improvements in urban infrastructure, service delivery, and the quality of life for residents. It will also provide recommendations for policymakers, urban planners, and stakeholders to enhance the effectiveness and sustainability of PPPs in Indore and similar urban contexts.

Overall, the scope of this project aims to contribute to the understanding and practice of PPPs in urban development, with a specific focus on their implementation in the context of Smart City Indore. By synthesizing existing knowledge and offering insights into future research directions, the study seeks to inform and guide urban development strategies for creating more resilient, efficient, and livable cities.

1.3. Significance of Project

The significance of this study lies in its contribution to the understanding and advancement of urban development strategies, particularly in the context of Public-Private Partnerships (PPPs) within the Smart City framework. By focusing on the city of Indore, Madhya Pradesh, this research aims to shed light on the efficacy of PPPs in achieving the objectives of Smart City initiatives.

Firstly, the study addresses a critical gap in the literature by providing an in-depth analysis of PPPs in the context of Smart City Indore, offering insights into the governance structures, risk allocation mechanisms, and contractual arrangements involved in these collaborations. This understanding is essential for policymakers, urban planners, and stakeholders seeking to implement similar PPP projects in urban development. Secondly, by evaluating the effectiveness of PPPs in Smart City Indore, the research aims to identify best practices, key challenges, and lessons learned from past initiatives. This knowledge can inform decision-making processes and help optimize future PPP projects, leading to more efficient urban infrastructure, service delivery, and improved quality of life for residents.

Furthermore, the study's recommendations for enhancing the effectiveness and sustainability of PPPs in Smart City Indore and similar urban contexts have practical implications for policymakers and stakeholders. By providing actionable insights and strategies, the research seeks to guide the development of PPP frameworks and policies, ultimately contributing to more resilient, inclusive, and livable cities.

1.4. Aim and Objectives

This study aims to evaluate the implementation of the PPP strategy in Indore, Madhya Pradesh.

1.4.1. Objectives

- Identifying the diverse components of Public-Private Partnership (PPP) implemented across different modules of the Smart City Proposal.

- To analyze the effectiveness of PPPs in achieving the goals of Smart City Indore, including improvements in urban infrastructure, service delivery, and quality of life for residents.
- To provide recommendations for policymakers, urban planners, and stakeholders to enhance the effectiveness and sustainability of PPPs in Smart City Indore and similar urban contexts.
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2. Literature Review

PPPs enable governments to leverage private sector expertise, innovation, and investment capital to finance and implement smart city projects (Lam and Yang, 2020). By partnering with private sector companies, governments can access additional resources and capabilities to accelerate the deployment of smart technologies and infrastructure. PPPs allow for the sharing of risks between public and private sector partners, thereby reducing the financial burden and liability for both parties (Selim and ElGohary et al., 2020). By allocating risks to the party best equipped to manage them, PPPs help mitigate project risks and uncertainties, enhancing project viability and sustainability.

The private sector brings expertise in technology, project management, and operations that can drive innovation and efficiency in smart city projects (Darko et al., 2018). PPPs foster competition and incentivize private sector companies to deliver high-quality services and solutions, leading to cost savings, performance improvements, and better outcomes for residents. PPPs facilitate the timely delivery of smart city projects by harnessing the efficiency and agility of the private sector (Llacuna et al., 2018). Private sector partners are often incentivized to complete projects on time and within budget, reducing delays and ensuring that cities can quickly realize the benefits of smart technologies and services.

PPPs promote transparency, accountability, and citizen participation in smart city initiatives by involving multiple stakeholders in project planning and decision-making processes (Darko et al., 2017). Public sector oversight and regulatory frameworks ensure that PPPs uphold public interests and values while delivering value for money and desired outcomes. Overall, PPPs offer a compelling rationale for collaboration between public and private sector entities in smart city initiatives, enabling governments to capitalize on private sector expertise, resources, and innovation to address urban challenges effectively.

PPPs encompass a variety of models and structures tailored to the specific needs and characteristics of smart city projects. Common types of PPP models include:

2.1. Build-Operate-Transfer (BOT)

Under the BOT model, a private sector entity finances, builds, and operates a project for a specified period, after which ownership is transferred to the public sector (Rice and Martin, 2020). This model is often used for large-scale infrastructure projects with revenue-generating potential, such as toll roads, airports, and utilities.

2.2. Design-Build-Operate (DBO)

In the DBO model, a private sector consortium is responsible for designing, building, and operating a project under a long-term contract (Liu et al., 2015). This model allows for greater integration of design and construction activities, leading to cost savings, efficiency gains, and improved project outcomes.

2.3. Concession Agreements

Concession agreements involve the granting of exclusive rights to a private sector entity to develop, operate, and maintain a project or service in exchange for specified payments or performance obligations (Liu et al., 2015). Concessions are commonly used for infrastructure projects such as ports, airports, and public transportation systems.

2.4. Service Contracts

Service contracts involve the outsourcing of specific services or functions to private sector contractors under a fixed-term agreement (Liu et al., 2015). This model is often used for non-core functions such as facility management, janitorial services, and IT support in smart city projects.

The choice of the PPP model depends on various factors, including project complexity, risk profile, funding requirements, and regulatory environment. By selecting the appropriate PPP model and structure, cities can optimize project outcomes, enhance value for money, and achieve their smart city objectives effectively.

The successful implementation of Public-Private Partnerships (PPPs) in Smart City Indore is contingent upon several key factors and best practices:

2.5. Clear Policy and Legal Framework

A clear and robust policy and legal framework is essential to provide a conducive environment for PPPs. This includes well-defined regulations, guidelines, and procedures governing PPP procurement, contract management, and dispute resolution (UN ESCAP, 2018)

2.6. Stakeholder Engagement and Collaboration

Effective stakeholder engagement and collaboration are critical to the success of PPP projects. Engaging stakeholders, including government agencies, private sector partners, civil society organizations, and communities, fosters ownership, transparency, and accountability, leading to better project outcomes (Darko et al., 2018).

2.7. Comprehensive Risk Management

PPP projects entail various risks, including financial, technical, operational, and legal risks. Implementing comprehensive risk management strategies, such as risk identification, assessment, allocation, and mitigation, helps to minimize uncertainties and ensure project success (Liu et al., 2015).

2.8. Capacity Building and Knowledge Transfer

Building institutional capacity and promoting knowledge transfer between public and private sector partners are essential for successful PPP implementation. This includes investing in training programs, skills development initiatives, and knowledge-sharing platforms to enhance the capabilities of stakeholders involved in PPP projects (Selim and ElGohary, 2020).

2.9. Performance Monitoring and Evaluation

Implementing robust monitoring and evaluation mechanisms enables stakeholders to track project progress, assess performance against predetermined objectives, and identify areas for improvement. Regular monitoring helps to ensure accountability, transparency, and compliance with contractual obligations, enhancing the likelihood of project success (Lam and Yang, 2020).

2.10. Flexibility and Adaptability

PPP projects often face uncertainties and changes in the operating environment. Maintaining flexibility and adaptability in project design, implementation, and management allows stakeholders to respond effectively to emerging challenges, unforeseen risks, and evolving stakeholder needs (Quan et al., 2023).

2.11. Financial Viability and Sustainability

Ensuring the financial viability and sustainability of PPP projects is essential for long-term success. This involves conducting rigorous financial analysis, assessing revenue streams, cost-benefit analysis, and ensuring that projects generate sufficient returns to attract private-sector investment and maintain operational viability (Jaysena et al., 2022).

Overall, integrating these success factors and best practices into PPP implementation processes in Smart City Indore can enhance project outcomes, mitigate risks, and maximize the value proposition for all stakeholders involved. Despite the potential benefits, PPP implementation in Smart City Indore may face several challenges and barriers:

2.12. Regulatory and Policy Constraints

Complex regulatory frameworks, bureaucratic hurdles, and legal challenges can hinder the procurement, approval, and execution of PPP projects. Unclear or outdated policies may create ambiguity and uncertainty, deterring private sector participation and investment (Siokas et al., 2022).

2.13. Financial Risks and Market Uncertainty

PPP projects often involve significant upfront investment, long gestation periods, and revenue uncertainties, making them susceptible to financial risks and market fluctuations. Economic downturns, changes in market conditions, and currency volatility can affect project viability and investor confidence (UN ESCAP, 2018).

2.14. Stakeholder Resistance and Opposition

Resistance from stakeholders, including government agencies, local communities, and interest groups, can impede PPP implementation. Concerns related to privatization, accountability, transparency, and socio-economic impacts may trigger opposition and public protests, delaying project execution (Yand and You, 2019).

2.15. Capacity and Capability Gaps

Limited institutional capacity, technical expertise, and project management capabilities within government agencies can hinder PPP implementation. Inadequate skills, knowledge, and resources may lead to project delays, cost overruns, and quality issues, undermining project success (Yang and You, 2019).

2.16. Contractual and Legal Disputes

Disputes and conflicts over contract terms, performance standards, and risk allocation can arise during PPP implementation. Poorly drafted contracts, ambiguous clauses, and inadequate dispute resolution mechanisms may lead to litigation, arbitration, and project delays, resulting in financial losses and reputational damage (Voorwinden, 2021).

2.17. Political and Regulatory Instability

Political changes, regulatory reforms, and policy shifts can introduce uncertainty and volatility into PPP projects. Political interference, corruption, and regulatory instability may undermine investor confidence, erode trust, and deter private sector participation in smart city initiatives (Yang and You, 2019).

2.18. Public Perception and Acceptance

Building public trust and acceptance is crucial for the success of PPP projects. Negative perceptions, misconceptions, and lack of awareness about PPPs may create scepticism, resistance, and opposition among citizens, affecting project legitimacy and social license to operate (Pianezzi et al., 2019). Addressing these challenges and barriers requires proactive measures, collaborative approaches, and adaptive strategies to mitigate risks, build resilience, and ensure the successful implementation of PPP projects in Smart City Indore.

3. Methodology

The detailed methodology is shown in Figure 1.

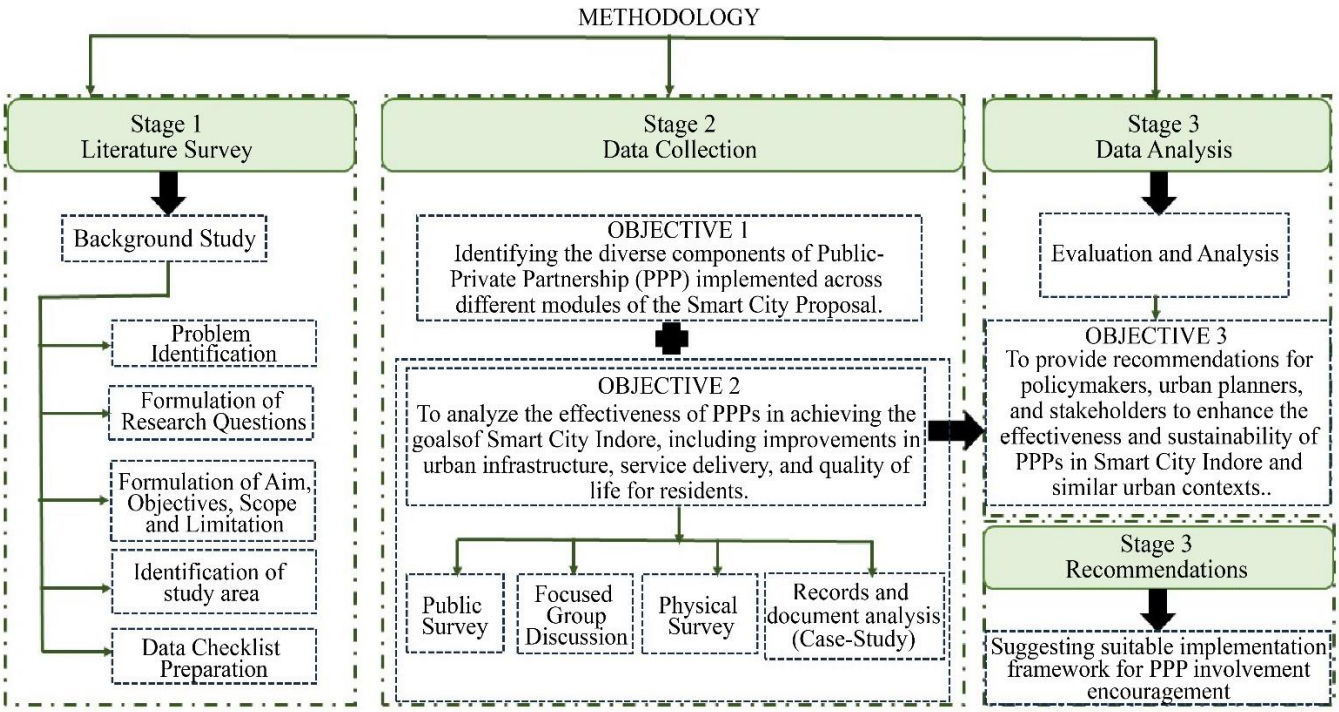

Fig. 1 Representation of methodology

3.1. Details of Data Collection

The data for this study were collected using a comprehensive and multi-faceted approach to ensure robustness and validity. The collection methods included:

3.1.1. Questionnaire Surveys

Structured questionnaires were distributed to participants from both the public and private sectors to gather quantitative data on their perspectives and experiences related to smart city projects and Public-Private Partnerships (PPPs).

3.1.2. Public Surveys

Surveys were conducted among the general public to capture the opinions and insights of citizens regarding smart city initiatives, their expectations, and their concerns.

3.1.3. Focus Group Discussions

These discussions involved selected participants from various stakeholder groups to delve deeper into specific issues, challenges, and opportunities associated with smart city development. This qualitative method provided rich, detailed data through interactive dialogue.

3.1.4. Physical Surveys

On-site surveys and observations were carried out to collect empirical data on the current state of infrastructure, technology usage, and urban development initiatives. This method provided ground-level insights and contextual information.

Study of Records and Documents

Relevant documents, reports, and records from governmental and private organizations were reviewed to obtain historical data, policy information, and documented experiences of previous smart city projects. This archival research added a layer of depth and historical perspective to the study.

By combining these diverse data collection methods, the study aimed to achieve a comprehensive understanding of the factors influencing the feasibility and success of PPPs in smart city projects. The data are robust and multi-dimensional, offering both quantitative and qualitative insights.

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

3.2. Key Features Considered to Categorise the Data

3.2.1. Smart City Project

Infrastructure Development

The initiative focuses on upgrading and modernizing urban infrastructure, including transportation, water supply, sanitation, waste management, energy, and digital connectivity. This involves the construction of new infrastructure, as well as the retrofitting and revitalization of existing assets to make them smarter and more efficient.

Technology Integration

Smart City Indore leverages cutting-edge technologies such as the Internet of Things (IoT), artificial intelligence, data

analytics, and cloud computing to enhance the efficiency, effectiveness, and responsiveness of urban services. This includes the deployment of smart sensors, meters, and devices to collect and analyse data in real time, enabling better decision-making and resource allocation.

Citizen Engagement

The initiative places a strong emphasis on citizen engagement and participation in decision-making processes. It seeks to empower residents by providing them with opportunities to contribute their ideas, feedback, and suggestions for improving their neighbourhoods and communities. This includes the use of online platforms, mobile apps, and community forums to facilitate communication and collaboration between citizens and government aaaa.

Sustainability and Resilience

Smart City Indore prioritizes sustainability and resilience in its planning and development processes. It promotes eco-friendly practices, renewable energy sources, green building standards, and climate-resilient infrastructure to mitigate environmental risks and enhance the city's long-term sustainability.

Overall, the Smart City Indore initiative represents a holistic approach to urban development, integrating social, economic, environmental, and technological dimensions to create a city that is smarter, greener, and more inclusive.

3.2.2. PPP for Smart Cities

Collaboration between the Central government, state governments, and urban local bodies will drive the development of smart cities. Funding for these projects will come from various sources, including internal revenues, grants, Viability Gap Funding (VGF), and Public-Private Partnerships (PPP). The Central Government will specifically provide VGF, which will be allocated to each smart city with the following distribution: approximately 60% for infrastructure investment, 10% for e-governance initiatives, and the remainder for government equity contributions in integrated township, greenfield, and redevelopment projects in partnership with private developers.

Cities interested in the smart city program are advised by the Government of India (GoI) to formulate financing plans alongside their Smart City Development Plans (SCDP) and Detailed Project Reports (DPRs). These plans should consider resources from various government agencies and departments. City administrations can assess their current borrowing capacity using credit ratings and other performance indicators such as economic stability, service levels, user charge recovery, and the sustainability of proposed investments.

They may also develop investment and financing strategies, exploring innovative financing options like accessing the bond market or structuring projects as PPPs. In addition to budgetary resources from different levels of government, funds must be sourced from domestic and overseas investors. Initially, the GoI may establish a fund in consultation with other ministries, multilateral and bilateral development agencies, and banks. This fund may blend grant funds from central government allocations, borrowings from multilateral and bilateral agencies (e.g., ADB), and bonds subscribed by national and state-level land development agencies (e.g., HUDA, PUDA, DDA).

Pooling funds from various sources is anticipated to reduce borrowing costs and extend financing terms. The fund may offer VGF and credit guarantees to municipal bonds and term loans, leveraging debt resources from financial markets.

Additional financing sources could be explored, including the utilization of Public-Private Partnerships (PPPs) in feasible smart city projects to attract private sector investment. To encourage PPPs in the urban sector, incentives may be considered, but discussions with relevant ministries of the Government of India and concerned departments in the Central and State Governments are necessary.

The Pooled Municipal Debt Obligation (PMDO) facility, established in 2006 with participation from various banks, aims to promote and finance urban infrastructure projects on a shared risk basis. The current corpus of the facility stands at GBP500 million, with a proposal to increase it to GBP5 billion by 2019.

The GoI targets Real Estate Infrastructure Trusts (REITS) to receive incentives, offering pass-through benefits for taxation purposes. This initiative is expected to attract fresh equity and long-term financing from both foreign and domestic sources, including Non-Resident Indians (NRIs).

Infrastructure Debt Funds (IDFs) could be directed to invest in highly rated municipal bonds or green bonds, serving as a means to refinance debt incurred during the construction phase and providing additional cash for operational financing.

Tax-free municipal bonds issued by creditworthy local governments aim to lower the cost of borrowing, offering another avenue for financing urban development projects.

3.3. Measurement of Success Indicators and Performance Metrics

To measure the success of PPP projects in Smart City, Indore, various performance indicators and metrics can be used to assess progress towards project objectives and desired outcomes. Key Performance Indicators (KPIs) and metrics may include:

3.3.1. Financial Performance

Financial indicators such as project cost, investment returns, cost savings, revenue generation, and Return on

Investment (ROI) can measure the financial viability and sustainability of PPP projects.

3.3.2. Project Delivery

Project delivery indicators such as project timeline, adherence to budget, construction progress, and completion milestones can measure the efficiency and effectiveness of project implementation.

3.3.3. Service Quality

Service quality indicators such as service availability, reliability, responsiveness, customer satisfaction, and Service Level Agreements (SLAs) can measure the quality and performance of infrastructure services delivered through PPP projects.

3.3.4. Stakeholder Engagement

Stakeholder engagement indicators such as stakeholder satisfaction, participation levels, community feedback, and public trust can measure the extent to which stakeholders are engaged and involved in PPP projects.

3.3.5. Impact Assessment

Impact assessment indicators such as economic impact, social inclusion, environmental sustainability, and innovation outcomes can measure the broader socio-economic and environmental impacts of PPP projects on Smart City Indore.

4. Results and Discussion

4.1. Key Findings from the Interviews, Surveys, and Data Collections

4.1.1. Case Studies of PPP Projects in Smart City Indore Bus Rapid Transit System (BRTS)

The Bus Rapid Transit System (BRTS) project in Smart City Indore represents a key initiative aimed at improving urban mobility, reducing traffic congestion, and enhancing public transportation services. The BRTS project involves the development of dedicated bus lanes, modern bus stations, and intelligent transportation systems to facilitate faster, more reliable, and efficient bus services across the city.

The implementation of the BRTS project in Indore has been facilitated through a Public-Private Partnership (PPP) model, with collaboration between the municipal government, private sector operators, and financing institutions. Private sector partners have been engaged in various aspects of the project, including design, construction, operation, and maintenance of BRTS infrastructure and services.

Integrated Solid Waste Management

The Integrated Solid Waste Management project in Smart City Indore aims to address the city's waste management challenges through a holistic approach that encompasses waste collection, segregation, treatment, recycling, and disposal. The project involves collaboration between the municipal government, private sector service providers, community-based organizations, and other stakeholders to implement sustainable waste management practices.

Urban Renewal, Affordable Housing and Redevelopment

The Urban Renewal and Affordable Housing project in Smart City Indore aims to revitalize urban neighbourhoods, upgrade infrastructure, and provide affordable housing options for low-income households. The project encompasses the redevelopment of blighted areas, slum rehabilitation, and the construction of affordable housing units to improve living conditions and promote social inclusion.

Completed projects conducted under the PPP model are listed below:

- Laying of UG Gas Lines in ABD Area on PPP Model was a 30 Cr. project which started in May 2017 and completed in May 2018.
- Slum Housing - at various locations in the ABD Area (under the PPP model) was 150 Crore. The project started in June 2018 and completed in September 2021.
- Slum Housing - Lodha Colony and Sethi Nagar (960 units) - under PPP model, 74.40 Crore. The project started in June 2018 and was completed in September 2023.
- Compensatory Housing - MOG Lines Area under PPP Model, 200 Crore. The project started in June 2018 and ended in March 2022.
- Free-Sale Housing - MOG Lines Area under PPP Model, 1000 Crore. The project started in September 2017 and ended in September 2018.
- Infrastructure Development at MOG Lines Area under PPP Model, 500 Crore Project started in Sept 2017 and completed in September 2018. (Indore Development Plant 2021)

Smart Solutions, Digital Infrastructure and E-Governance

The Digital Infrastructure and E-Governance project in Smart City Indore aims to leverage Information and Communication Technologies (ICTs) to enhance government service delivery, citizen engagement, and administrative efficiency. The project involves the development of digital platforms, e-governance applications, and ICT infrastructure to facilitate online transactions, access to information, and public participation in governance processes. Completed projects conducted under the PPP model are listed below:

- Installation and O & M of LED Lights in Pan-city, Indore on PPP Model, 180 Cr. Started in Oct 2017 and completed in April 2020.
- Smart Poles Project, including CCTV, Environmental Sensors, WiFi, C4 Integration, OFC, etc., under the PPP Model, 250 Crore Project, started in Oct 2017 and completed in October 2018.
- Smart Parking Management (Sensors, Hardware, Software, App development, smart cards) for MLCP - 3 Locations under PPP Model, 2 Cr. The project started in June 2017 and completed in Oct 2017.

Implementation of Waste-to-Energy Plant on PPP Model, 473 Cr. The project started in Nov 2017 and completed in May 2018. (Indore Development Plant 2021).

4.1.2. Summary of Initiatives/ Projects under the Madhya Pradesh Urban Infrastructure Investment Program (MPUIIP) Municipal Solid Waste Management Based on Clustering

The State Level Executive Committee (SLEC) has approved the cluster-based, regional Integrated Solid Waste Management (ISWM) model. The Directorate of Institutional Finance has allocated £10 million (£5 million from a concessional loan provided by DFID-supported MPUIIF) for 378 Urban Local Bodies (ULBs), including seven Smart Cities in Madhya Pradesh.

The project's financial structure aligns with SBM, with a 20% grant from the Government of India, a 20% grant from the State Government, and the remaining 60% from private sector investment.

This performance-based Public-Private Partnership (PPP) project operates under a 21-year Concession Agreement, incorporating Design, Finance, Build, Operate, and Transfer (DFBOT) components, along with smart monitoring to enhance system efficiency.

The project features a waste-to-energy plant, affordable user charges (Rs. 30-40 for Below Poverty Line households and Rs. 60-80 for other households), utilization of existing Solid Waste Management (SWM) workforce, vehicle differentiation to prevent mixing of high-calorific-value waste, Information, Education, and Communication (IEC) campaigns on Environment, Health, and social aspects, and citizen involvement in monitoring the Concessionaire's performance.

Additionally, a cluster-based regional integrated MSW PPP pilot project has been successfully implemented for two clusters, including Sagar City. Here, waste is collected, transported to a waste-to-energy processing facility, and scientifically disposed of in accordance with MSW Rules, 2000, and other statutory obligations.

Formation and Commencement of Operations of Madhya Pradesh Urban Development Company Ltd. (MPUDCL)

The MPUIIP has aided the Government of Madhya Pradesh (GoMP) in establishing MPUDC Ltd., a state government-owned company, and MP Urban Infrastructure Fund (MPUIF) as an intermediary for urban infrastructure financing. MPUIIF has subsequently facilitated the approval of a $266 million loan from the Asian Development Bank (ADB), with MPUDC Ltd. as the borrower, and also secured approval for a $116 million loan from the World Bank. These funds will be utilized to replicate the model Public-Private Partnership (PPP) projects developed by MPUIIP and further implemented by MPUDC Ltd.

Preparatory Efforts for the Establishment of Special Purpose Vehicles (SPVs) for SMART CITIES

MPUIIP is providing supportive guidance to UADD and the seven ULBs of Madhya Pradesh selected under the Smart City Mission. A novel approach proposed by MPUIIP involves establishing an integrated institutional framework for the Smart City Mission, which includes incorporating MPUDC Ltd. as a fully state-owned holding Special Purpose Vehicle (SPV). MPUDC Ltd. will serve as a conduit for channeling the state government's equity to all seven smart city SPVs and will possess adequate convening power at the state level to expedite approvals for the swift implementation of Smart City Projects.

Furthermore, MPUIIP is crafting an implementation advisory note for UADD, which will be disseminated to the seven smart cities. This advisory will focus on institutional and functional structure, organizational procedures, business processes, delegation of authority, financial management, and financial planning. These guidelines will assist cities in establishing and operationalizing their respective SPVs.

Formation and Operationalization of Public-Private Partnership (PPP) Cell

MPUIIP has supported the Government of Madhya Pradesh (GoMP) in establishing and operationalizing the PPP Cell in accordance with the government notification issued by the UADD Commissioner. The PPP Cell is responsible for evaluating PPP projects before they receive approvals from the State-Level Executive Committee (SLEC). Additionally, the PPP guidelines for urban infrastructure development, prepared by MPUIIP, are currently undergoing the review and approval process by GoMP.

PPP Policy for Urban Housing

The MPUIIP team has formulated the PPP policy for urban housing, with a specific emphasis on affordable housing, which has received approval from the Madhya Pradesh Cabinet. Presently, MPUIIP is aiding the Madhya Pradesh Housing and Infrastructure Development Board (MPHIDB) in creating a pilot PPP project dedicated to affordable housing initiatives.

In terms of the Accrual-based Double Entry Accounting System (DEAS) and Uniform Accounting Software, MPUIIP has adopted a novel approach to ensure the sustainability of DEAS implementation. Instead of engaging external consultants, the TC City Finance Team has provided direct support to Urban Local Bodies (ULBs). ULB staff members have been actively involved in fundamental tasks such as bank reconciliation, preparation of grant details and fixed assets schedules, and voucher entry in accounting software.

All 14 ULBs have prepared Annual Financial Statements (AFS) up to 2013-14, with seven ULBs chosen for the Smart City Mission having extended their AFS preparation up to

2014-15. Subsequent analysis identified gaps and constraints in sustaining DEAS, pinpointing suitable accounting software and regular technical support as key requirements. To address these needs, the following key activities have been proposed to establish a foundation for sustaining DEAS in ULBs:

- Acquisition of appropriate accounting software (as an interim solution until the e-Nagarpalika finance module is deployed).
- Consistent entry of vouchers into the accounting software.
- Regular reconciliation of bank accounts.
- Utilization of the MPMAM Chart of Accounts.
- Gradual adoption of MPMAM voucher forms.
- On-the-job and software training for ULB staff.
- Evaluation and enhancement of the Chart of Accounts to ensure consistency across all ULBs in the state.
- Streamlining MPMAM voucher forms for improved usability and capturing necessary accounting data.
- Development of comprehensive checklists to guide ULB staff and ensure consistency and quality improvements in financial statements.
- Capacity building of local Chartered Accountants (CAs), when appointed by ULBs, for the preparation of Annual Financial Statements (AFS) (SAAR, 2023)

5. Conclusion

5.1. Summary of Findings

The evaluation of Public-Private Partnerships (PPPs) in Smart City Indore underscores their pivotal role in driving urban development, fostering socio-economic progress, and enhancing the quality of life for residents. Through a comprehensive assessment of PPP projects, it becomes evident that these collaborations have yielded significant benefits across various dimensions of urban development.

- PPPs have played a crucial role in catalyzing infrastructure improvements in Smart City Indore. Projects spanning transportation networks, utilities, digital connectivity, and public amenities have been successfully implemented, contributing to enhanced mobility, access to essential services, and the creation of vibrant urban spaces. The partnership between the public and private sectors has leveraged expertise, innovation, and resources to address infrastructure deficits and meet the evolving needs of the city's growing population.
- PPPs have delivered tangible socio-economic outcomes, fostering inclusive growth and community development. By promoting job creation, economic opportunities, and social inclusion, PPP projects have contributed to poverty alleviation, empowerment of marginalized communities, and enhancement of social cohesion. Moreover, the collaborative nature of PPPs has facilitated community engagement, participation, and ownership, empowering residents to shape the development trajectory of their city.
- PPPs have demonstrated their efficacy in enhancing citizen satisfaction and improving the quality of life in Smart City Indore. Through improved service delivery, infrastructure reliability, and environmental sustainability, PPP initiatives have enhanced citizen well-being, safety, and convenience. Citizens have benefitted from better access to essential services, enhanced public spaces, and increased opportunities for recreation, cultural enrichment, and civic engagement.

In conclusion, the evaluation of PPPs in Smart City Indore underscores their transformative impact on urban development. These partnerships have proven to be effective mechanisms for leveraging private sector expertise, innovation, and investment to address urban challenges and achieve sustainable development goals.

Moving forward, it is imperative to build on the successes of PPPs, address governance challenges, promote innovation, and strengthen capacity building to ensure their continued effectiveness in driving inclusive and resilient urban development in Smart City Indore and beyond.

5.2. Contributions to Theory and Practice

This research contributes to theory and practice by providing insights into the impact of PPPs on urban development and offering recommendations for enhancing governance, promoting innovation, and strengthening capacity building in PPP implementation.

5.3. Recommendations for Future Research

Future research should focus on longitudinal studies, comparative analyses, and case studies to further explore the dynamics of PPP implementation, assess long-term impacts, and identify best practices for sustainable urban development. Additionally, research is needed to evaluate the role of PPPs in addressing emerging urban challenges such as climate change, digital transformation, and inclusive growth.

This comprehensive evaluation provides a foundation for informed decision-making, policy formulation, and investment strategies to maximize the socio-economic benefits of PPPs and drive inclusive and sustainable urban development in Smart City Indore.

References

[1] Government of India, Smart Cities Mission, 2015. [Online]. Available: https://smartcities.gov.in/content/

[2] Smart Cities and Academia towards Action and Research (SAAR). Part C: Urban Infrastructure, National Institute of Urban Affairs, SAAR, 2023. [Online]. Available: https://smartcities.gov.in/sites/default/files/2023-06/PartC-UI.pdf

[3] Indore Development Plant, 2021. [Online]. Available: https://mptownplan.gov.in/LU-panel/Indore/Indore%20development%20plan%202021.pdf.

[4] Junxiao Liu et al., "Conceptual Framework for the Performance Measurement of Public-Private Partnerships," *Journal of Infrastructure Systems*, vol. 21, no. 1, pp. 918-931, 2015. [CrossRef] [Google Scholar] [Publisher Link]

[5] Maria-Lluïsa Marsal-Llacuna, Joan Colomer-Llinàs, and Joaquim Meléndez-Frigola, "Lessons in Urban Monitoring Taken from Sustainable and Livable Cities to Better Address the Smart Cities Initiative," *Technological Forecasting and Social Change*, vol. 90, pp. 611-622, 2015. [CrossRef] [Google Scholar] [Publisher Link]

[6] Amos Darko et al., "Influences of Barriers, Drivers, and Promotion Strategies on Green Building Technologies Adoption in Developing Countries: The Ghanaian Case," *Journal of Cleaner Production*, vol. 200, pp. 687-703, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[7] John Rice, and Nigel Martin, "Smart Infrastructure Technologies: Crowdsourcing Future Development and Benefits for Australian Communities," *Technological Forecasting and Social Change*, vol. 153, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[8] Ahmed M. Selim, and Amr Soliman ElGohary, "Public-Private Partnerships (PPPs) in Smart Infrastructure Projects: The Role of Stakeholders," *HBRC Journal*, vol. 16, no. 1, pp. 317-333, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[9] Patrick T.I. Lam, and Wenjing Yang, "Factors Influencing the Consideration of Public-Private Partnerships (PPP) for Smart City Projects: Evidence from Hong Kong," *Cities*, vol. 99, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[10] T.S. Ramakrishnan, "Financing Infrastructure Projects through Public–Private Partnerships in India," *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2450, no. 1, pp. 118-126, 2014. [CrossRef] [Google Scholar] [Publisher Link]

[11] United Nations, World Urbanization Prospects: The 2018 Revision, Department of Economic and Social Affairs, Population Division. 2018. [Online]. Available: https://population.un.org/wup/

[12] UN ESCAP, Public-Private Partnerships in Infrastructure Development: Developing Sustainable Models, United Nations, 2018. [Online]. Available: https://www.unescap.org/sites/default/files/PPPs%20in%20Infrastructure%20Development%20report.pdf

[13] World Bank, Public-Private Partnerships Reference Guide Version 2.0. World Bank Group, 2017. [Online]. Available: https://ppp.worldbank.org/public-private-partnership/library/publications/ppp-reference-guide-version-2.0

[14] Xiangyu Quan, and Marte C.W. Solheim. "Public-Private Partnerships in Smart Cities: A Critical Survey and Research Agenda," *City, Culture and Society*, vol. 32, pp. 1-8, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[15] Nimesha Sahani Jayasena, Daniel W.M. Chan, and Mohan M. Kumaraswamy, "Is Public-Private Partnership (PPP) a Preferred Strategy for Procuring Smart Infrastructure in Developed Countries: An Empirical Study of the Perceived Benefits, Barriers and Recommended Strategies," *Sustainability*, vol. 14, no. 11, pp. 1-25, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[16] Georgios Siokas, Valia Kelaidi, and Aggelos Tsakanikas, "The Smart City as a Hub for Nourishing Public-Private Partnerships," *Sustainable Cities and Society*, vol. 76, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[17] J.Q. Yang, and J.L. You, "Research on the Application of PPP Model in Smart City Projects," *IOP Conference Series: Earth and Environmental Science*, vol. 330, no. 5, pp. 1-8, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[18] Daniela Pianezzi, Yuji Mori, and Shahzad Uddin, "Public–Private Partnership in a Smart City: A Curious Case in Japan," *International Review of Administrative Sciences*, vol. 89, no. 3, pp. 632-647, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[19] Astrid Voorwinden, "The Privatised City: Technology and Public-Private Partnerships in the Smart City," *Law, Innovation and Technology*, vol. 13, no. 2, pp. 439-463, 2021. [CrossRef] [Google Scholar] [Publisher Link]