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Role of Project Development & Management Consultants in Urban Water Supply Projects under AMRUT 2.0.

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AMRUT 2.0, Urban Infrastructure, Project Development and Management Consultants (PDMC), Urban Local Bodies (ULBs), Project Implementation, Detailed Project Report (DPR), Smart Cities, Sustainable Development.

ABSTRACT

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2.0, launched by the Government of India, represents a significant leap in the country's efforts toward sustainable and inclusive urban development. The mission primarily focuses on ensuring universal access to water supply, sewage management, and non-motorized urban mobility, especially in 500 selected cities. In order to execute these multifaceted and technically demanding projects, the role of Project Development and Management Consultants (PDMCs) has become crucial. PDMCs act as the technical backbone of the mission, providing essential services such as the preparation of Detailed Project Reports (DPRs), bid process management, project implementation support, quality assurance, and monitoring and evaluation. This project explores the role of PDMCs in urban infrastructure projects under AMRUT 2.0 by analyzing their functions, responsibilities, and overall impact on project outcomes. It also identifies key challenges such as coordination issues, procedural delays, and resource constraints that affect PDMC performance. Based on the findings, the study proposes practical recommendations for improving the governance structure, operational efficiency, and accountability mechanisms for PDMCs. The research concludes that while PDMCs play a pivotal role in the implementation of AMRUT 2.0, their full potential can only be realized through improved policy support, stakeholder collaboration, and capacity-building initiatives.

1. INTRODUCTION

Urban infrastructure development in India has undergone a transformative journey, evolving from basic municipal service provision to complex, integrated development initiatives aligned with national economic goals. Historically, Indian cities grew rapidly without proportionate investment in infrastructure, leading to severe strain on services such as water supply, sewerage, solid waste management, roads, transport, and housing. With increasing urbanization—where over 34% of the population now resides in urban areas—the demand for robust and sustainable urban infrastructure has intensified. The Government of India recognized the critical role urban centers play in driving economic growth and social development, leading to the formulation of numerous policy initiatives and investment programs. The first major nationwide urban development mission was the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) launched in 2005, which marked a shift from fragmented sectoral interventions to a more holistic city-centric approach. JNNURM focused on strengthening urban local bodies (ULBs), improving service delivery, and ensuring planned urban development through reforms and financial incentives. Post-JNNURM, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) was launched in 2015 with a renewed emphasis on infrastructure creation, water supply, sewerage networks, non-motorized transport, and green spaces in 500 cities. It introduced the concept of Service Level Improvement Plans (SLIPs) and State Annual Action Plans (SAAPs) to guide investments and implementation. AMRUT emphasized capacity building, citizen engagement, and performance-based funding, laying the foundation for a structured and accountable urban development framework. However, despite these efforts, challenges such as delayed project implementation, capacity constraints at the ULB level, and lack of integration among agencies persisted. To address these gaps and scale up the impact, AMRUT 2.0 was launched in October 2021 with a vision of providing universal coverage of water supply and sanitation services across all urban areas, including smaller towns and peri-urban regions. AMRUT 2.0 focuses on leveraging technology, private sector participation, and innovative financing mechanisms such as public-private partnerships (PPPs). It integrates the principles of sustainable development, climate resilience, and inclusive growth, aiming to make Indian cities "water-secure and self-sustainable." In this evolving landscape, the role of Project Development and Management Consultants (PDMCs) has become increasingly vital, acting as technical and managerial partners to ULBs and state missions, ensuring efficient and timely delivery of infrastructure projects. Their involvement bridges the gap between policy intent and ground-level execution, making them a key enabler in India's urban transformation journey.

2. PROPOSED METHODOLOGY

2.1 METHODOLOGY

The present study adopts a comprehensive and systematic research methodology to evaluate the role of Project Development and Management Consultants (PDMCs) in the implementation of urban infrastructure projects under AMRUT 2.0. The research design is primarily qualitative in nature, supported by relevant quantitative data to enrich the analysis and interpretation. The study begins with an extensive literature review to understand the evolution of urban infrastructure policies and the significance of project management in the Indian urban context. This review includes government publications, academic journals, policy briefs, and reports from previous schemes such as JNNURM and AMRUT 1.0. Following this, a case study approach is employed to analyze selected urban local bodies (ULBs) and infrastructure projects executed under AMRUT 2.0, thereby providing real-world insights into the functioning and effectiveness of PDMCs. Data collection is carried out through both primary and secondary sources. Primary data is obtained via structured interviews and questionnaires targeting officials from ULBs, State Mission Directorates, PDMC representatives, engineers, planners, and contractors involved in the project cycle. Secondary data is gathered from project reports, Detailed Project Reports (DPRs), progress records, government portals, and evaluation documents published by the Ministry of Housing and Urban Affairs (MoHUA). The data collected is then analyzed using descriptive techniques to assess project timelines, financial performance, and service delivery outcomes.

2.2 STUDY AREA

The focus of this study is the Wardha Water Supply Scheme, which is part of the broader urban infrastructure initiatives under the AMRUT 2.0 mission aimed at ensuring universal access to safe and adequate drinking water. Wardha, a district located in Maharashtra, is an important urban center with growing demands for water due to urbanization and population growth. The Wardha Water Supply Scheme has been identified as one of the critical infrastructure projects under AMRUT 2.0 to enhance water supply coverage and improve the quality of water supplied to the residents of Wardha city. This project includes reforms

aimed at improving the existing water distribution network, ensuring continuous and pressurized water supply, enhancing the treatment capacity, and upgrading the entire water supply system to meet future demands.

The study examines the role of Project Development and Management Consultants (PDMCs) in overseeing the planning, execution, and monitoring of this water supply project. The study area will focus on various aspects of the reform, such as:

1. **Detailed Project Report (DPR) Preparation:** Assessing the involvement of PDMCs in preparing comprehensive reports that outline the scope, budget, timeline, and technical details of the water supply improvements.
2. **Project Execution:** Evaluating the PDMCs' role in ensuring timely execution of the project, coordination among contractors, and handling challenges related to resource mobilization, procurement processes, and quality assurance.
3. **Stakeholder Engagement:** Analyzing the interaction between PDMCs, ULBs, State Government bodies, and local communities to ensure that the water supply reforms meet the needs of the residents.
4. **Sustainability and Long-Term Impact:** Investigating how the water supply reforms contribute to long-term sustainability in terms of water quality, efficient management, and service delivery improvements.
5. **Challenges and Lessons Learned:** Identifying any challenges faced during the implementation phase and the impact of these challenges on project performance, as well as drawing lessons for future water supply schemes under AMRUT 2.0.

Wardha is "A" class Municipal Council in district of Maharashtra. It is District place, 75 Km from Nagpur. The city is geographically located at latitude 20.75° N and Longitude 78.60° E with an average elevation of 234 m above mean sea level. Wardha city is well connected to most of the parts of India by railways. Wardha city has two railway stations i.e. Wardha and Sewagram. Wardha railway station is an important rail junction on Howrah-Nagpur-Mumbai line. This town is also connected to the southern part of the country through Sewagram & Wardha station. Also, Wardha station city is equally well connected by roads to Yavatmal, Chandrpur, Amravati & Nagpur.

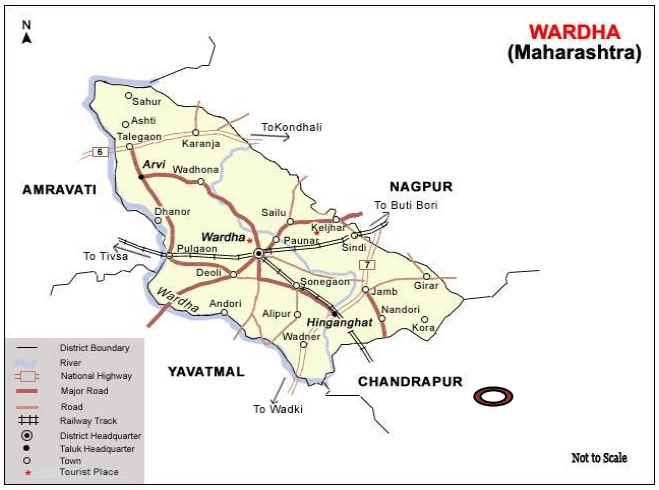

Fig.2.1: Location of Wardha city

This study area provides an opportunity to assess the success of PDMCs in facilitating urban water supply reforms within the AMRUT 2.0 framework and contributes to the broader understanding of infrastructure project management in urban areas.

2.3 PROPOSED REFORM SCHEME

The reform work of Wardha Water Supply Scheme is designed considering all past experiences, latest guidelines & technologies and future sustainability of the project. The detailed survey with respect to new location of headwork, existing structures, existing connecting and rising mains, existing water treatment plant, existing ESRs, existing distribution network and newly developed areas has been carried out and the following provisions are proposed for the scheme:

1. **Source of Water:**
   - For continuous supply of water in dry season also, the location of the proposed Intake Well is finalized where the depth of water level is maximum (in doh) of Dham River 100 m on the downstream side of the existing headwork.
   - The rose piece is proposed under the river bed level for extreme draught condition.
2. **Pumping Machinery:**
   - The pumping machinery of existing jack well will be shifted to the proposed jack well as they are in good condition.
   - The pumping machinery of existing WTP will be shifted to the proposed WTP.
3. **Rising Main:**
   - The rising main from the proposed jack well will be connected to proposed Water Treatment Plant.
4. **Water Treatment Plant:**
   - The life of existing 12.9 MLD water treatment plant is exhausted and does not meet the required demand obtained from the design. So 14.00 MLD water treatment plant is proposed. But the automation of

the existing water treatment plant will be used for proposed WTP.

5. **Elevated Service Reservoir:**

- The existing 5 number of ESRs and 1 GSR are in the condition of serviceability and thus new ESRs is not proposed.
- The provision of compound wall & paver blocks for 3 ESRs was required so the same is considered. Provision of painting, grouting work for the premises of all ESRs is considered.

6. **Solar Power Plant:**

- Solar Power Plant for Headwork & Water Treatment Plant is proposed to increase economic & environmental sustainability of the scheme.

7. **Distribution System:**

- Extension to the existing distribution network is proposed for the recently developed area. Also, some of the existing CI & MS pipe lines which are deteriorated and damaged are replaced for the proposed network, raw and pure water rising main and island crossing.
- The Existing CI pipe line of 2190m is about 50years old. At present the pipe line has many leakages, thus causing repetitive maintenance. Therefore Wardha Nagar Parishad inform to discard & replace this pipeline with new pipeline.
- 24 x 7 water supply system is proposed for Zone 1 along with the provision of DMA to monitor the same.
- Domestic multijet meters are proposed for every property to reduce NRW

Water demand projections are worked out with a norm of 135 liters per capita per day (LPCD) at consumer end. The losses are computed upward for gross demand projections as per CPHEEO manual. Values of the ward wise demand are computed considering probable population density in every ward with respect to the development plan and data available.

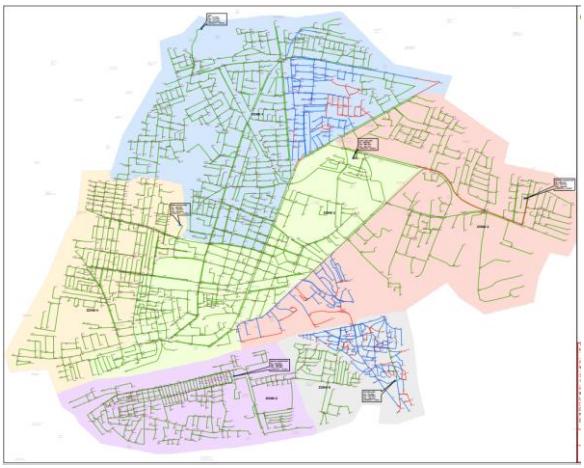

Fig.2.2: Distribution Network System for Wardha Town

Fig.2.3: Proposed Operational Zones in the City

2.4.1 14.0 MLD Conventional Water Treatment Plant

A 14.0 MLD (Million Liters per Day) Conventional Water Treatment Plant is designed to treat raw water to meet potable water standards, ensuring safe and reliable water supply for communities. The treatment process typically involves several key stages:

1. Intake and Screening: Raw water is drawn from the source and passed through screens to remove large debris and suspended solids.
2. Coagulation and Flocculation: Chemical coagulants (such as alum) are added to destabilize suspended particles, followed by gentle mixing to form larger aggregates called flocs.
3. Sedimentation: The water flows into sedimentation basins where the flocs settle under gravity, reducing turbidity.
4. Filtration: The clarified water passes through filters (commonly sand or dual-media) to remove remaining fine particles and microorganisms
5. Disinfection: A disinfectant (typically chlorine) is added to eliminate pathogenic organisms, ensuring microbiological safety.
6. Storage and Distribution: Treated water is stored in clear wells or reservoirs before being distributed to consumers.

Design considerations for a 14.0 MLD plant include calculating the required volumes and dimensions of each treatment unit to handle the flow rate efficiently. For instance, sedimentation tanks must be sized to provide adequate detention time for floc settling, and filters must be designed to accommodate the filtration rate while maintaining water quality standards.

Operational aspects involve regular monitoring of water quality parameters, maintenance of equipment, and ensuring the availability of treatment chemicals. Proper training of plant personnel is essential for effective operation and management.

Implementing such a treatment plant contributes significantly to public health by providing access to clean and safe drinking water, aligning with initiatives like AMRUT 2.0 aimed at improving urban water supply infrastructure.

Fig.2.4: Construction Phase of 14.0 MLD Conventional WTP

3. ROLE OF PDMC IN AMRUT 2.0

3.1 ROLE OF PDMC IN AMRUT 2.0

PDMC stands for Project Development and Management Consultant. The Project Development and Management Consultant (PDMC) plays a pivotal role in the successful implementation of the Wardha Water Supply Scheme under AMRUT 2.0. Their responsibilities encompass a comprehensive range of activities that ensure the project's efficiency, compliance, and sustainability. Initially, the PDMC conducts detailed feasibility studies, surveys, and assessments to evaluate the technical, financial, and environmental viability of the proposed water supply interventions. This foundational work informs the preparation of Detailed Project Reports (DPRs), which include intricate designs, cost estimates, and implementation strategies. Following this, the PDMC facilitates the process of obtaining Technical Sanction and coordinates with relevant authorities to secure Administrative Approval, ensuring that the project aligns with statutory requirements and receives the necessary endorsements. In the procurement phase, the PDMC manages the bid process meticulously, assisting in the preparation of comprehensive bid documents such as Requests for Proposals (RFPs), Bills of Quantities (BOQs), and technical specifications. They also provide critical support during pre-bid meetings and are instrumental in the technical and financial evaluation of bids, ensuring transparency and fairness. Beyond procurement, the PDMC is deeply involved in project planning and design, laying out detailed execution plans and timelines. They oversee project monitoring and supervision, tracking progress against established bar charts and milestones, and maintaining meticulous records of decisions, changes, and approvals. Their role extends to coordinating with third-party quality control and assurance agencies to uphold construction standards and project integrity. Furthermore, the PDMC is committed to capacity building, providing training and support to Urban Local Body (ULB) staff, thereby enhancing local capabilities for sustainable project management. Through these multifaceted responsibilities, the PDMC ensures that the Wardha Water Supply Scheme under AMRUT 2.0 is executed effectively, delivering improved water services to the community.

1. Conduct feasibility studies, surveys, and assessments: In the context of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in conducting comprehensive feasibility studies, surveys, and assessments, which are foundational to the project's success. These studies are multifaceted, encompassing technical, financial, environmental, and social dimensions to ensure a holistic evaluation of the proposed interventions. From a technical standpoint, the PDMC assesses the existing water supply infrastructure, including the condition of pipelines, reservoirs, treatment plants, and distribution networks. This involves detailed surveys to identify areas of

inefficiency, leakage, or obsolescence. The consultant also evaluates the topography and geology of the region to determine the most suitable locations for new infrastructure components, ensuring optimal design and functionality. Financial assessments are integral to the feasibility study, where the PDMC analyzes the cost-effectiveness of various project options. This includes estimating capital expenditures, operation and maintenance costs, and potential revenue streams. The consultant conducts cost-benefit analyses to ascertain the economic viability of the project, ensuring that the proposed solutions offer value for money and are sustainable in the long term. Environmental evaluations are conducted to understand the potential impacts of the project on the local ecosystem. The PDMC examines factors such as water source sustainability, potential pollution risks, and compliance with environmental regulations. Mitigation strategies are developed to minimize adverse effects, ensuring that the project aligns with environmental conservation principles. Social assessments focus on the project's implications for the local population. The PDMC engages with community stakeholders to gather insights into water usage patterns, cultural considerations, and potential social impacts. This participatory approach ensures that the project addresses the actual needs of the community and fosters public support. By integrating these comprehensive studies, the PDMC ensures that the Wardha Water Supply Scheme is grounded in accurate data and informed decision-making. This meticulous approach lays a solid foundation for subsequent project phases, including detailed design, procurement, and implementation, ultimately contributing to the scheme's overall success and sustainability.

2. Preparation of Detailed Project Reports (DPRs): In the context of the Wardha Water Supply Scheme under AMRUT 2.0, the preparation of Detailed Project Reports (DPRs) by the Project Development and Management Consultant (PDMC) is a critical phase that transforms feasibility studies into actionable plans. These DPRs serve as comprehensive blueprints, outlining the project's scope, design, cost estimates, and implementation strategies, thereby facilitating informed decision-making and successful execution. The DPR encompasses an executive summary that provides a snapshot of the project's objectives and proposed interventions. It includes a detailed assessment of the existing water supply infrastructure, identifying gaps and areas for improvement. The report outlines the technical design of the proposed systems, including specifications for pipelines, treatment plants, storage facilities, and distribution networks. Cost estimates are meticulously calculated, covering capital expenditures, operation and maintenance costs, and contingencies. Implementation strategies are detailed, presenting timelines, resource allocation, and risk mitigation plans. Furthermore, the DPR addresses environmental and social considerations, ensuring compliance with regulatory standards and promoting sustainable practices. By integrating these elements, the DPR serves as a vital tool for stakeholders, guiding the project's progression from conceptualization to realization.

3. Obtaining Technical Sanction: In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, obtaining Technical Sanction is a pivotal step that ensures the project's technical soundness and alignment with established standards. The Project Development and Management Consultant (PDMC) plays a crucial role in facilitating this process by meticulously preparing and submitting the necessary documentation to the relevant authorities. The process begins with the PDMC compiling comprehensive technical details, including design specifications, engineering drawings, and cost estimates, derived from the Detailed Project Report (DPR). These documents are then presented to the State Level Technical Committee (SLTC) or equivalent authority for thorough evaluation. The committee assesses the project's feasibility, design integrity, and compliance with technical guidelines. For instance, in the context of AMRUT 2.0 projects in Kerala, the SLTC has been instrumental in reviewing and sanctioning various water supply initiatives after detailed scrutiny of their technical aspects. Upon satisfactory review, the SLTC grants Technical Sanction, signifying official approval of the project's technical components. This sanction is essential before proceeding to subsequent phases such as tendering and execution, as it validates the project's design and cost framework. By ensuring that the project adheres to prescribed technical standards, the PDMC's facilitation of the Technical Sanction process contributes significantly to the project's successful implementation and sustainability.

4. Coordination for Administrative Approval: In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, obtaining Administrative Approval is a critical step that ensures the project's alignment with governmental policies and regulatory frameworks. The Project Development and Management Consultant (PDMC) plays a pivotal role in this process by coordinating with various governmental departments to secure the necessary endorsements. The PDMC begins by preparing comprehensive documentation that reflects the project's objectives, design, cost estimates, and implementation strategies, as outlined in the Detailed Project Report (DPR). This documentation is then submitted to the relevant authorities for review. The

PDMC ensures that the project aligns with the policy objectives of AMRUT 2.0, which focuses on providing universal access to water supply and improving urban infrastructure. They also verify compliance with regulatory frameworks, including environmental clearances, land acquisition norms, and financial guidelines. Throughout this process, the PDMC liaises with multiple stakeholders, including Urban Local Bodies (ULBs), State Level Technical Committees (SLTCs), and State High Powered Steering Committees (SHPSCs), to facilitate a smooth approval process. For instance, in Kerala, the State Level Convention Committee (SHPSC) plays a significant role in granting administrative approvals for AMRUT projects. By ensuring that all prerequisites are met and approvals are obtained in a timely manner, the PDMC enables the project to progress to the implementation phase without unnecessary delays.

5. Bid process management: In the execution of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in managing the entire bidding process, ensuring transparency, adherence to procurement policies, and the selection of competent contractors to secure value for money. The PDMC begins by preparing comprehensive tender documents, including the Request for Proposal (RFP), Bills of Quantities (BOQs), and detailed technical specifications. These documents are crafted to provide clear guidelines and expectations for potential bidders, facilitating a smooth procurement process. For instance, in Andhra Pradesh, the PDMC's role encompasses the preparation of such documents in alignment with state-specific procurement guidelines. Once the tender documents are finalized, the PDMC oversees the publication of the tender, ensuring it reaches a wide audience to attract qualified bidders. They coordinate pre-bid meetings to address queries from prospective bidders, providing clarifications to ensure a thorough understanding of the project requirements. This proactive engagement helps in minimizing ambiguities and fosters a competitive bidding environment. During the evaluation phase, the PDMC assists in setting clear evaluation criteria and facilitates the assessment of both technical and financial bids. They ensure that the evaluation process is conducted impartially, adhering strictly to the established criteria to select the most suitable contractor. In Kerala, for example, the PDMC's involvement in the evaluation and selection process is crucial for maintaining the integrity of the procurement process. Throughout the bidding process, the PDMC ensures compliance with all relevant procurement policies and guidelines, aligning with the overarching objectives of AMRUT 2.0. Their meticulous management of the bidding process not only ensures the selection of competent contractors but also upholds the principles of transparency and accountability, laying a solid foundation for the successful implementation of the Wardha Water Supply Scheme.

6. Assist in preparation of bid documents (RFPs, BOQs, technical specs): In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in assisting the Urban Local Body (ULB) with the preparation of comprehensive bid documents. These documents include the Request for Proposal (RFP), Bills of Quantities (BOQs), and detailed technical specifications, all of which are crucial for attracting competent contractors and ensuring a transparent procurement process. The PDMC begins by collaborating closely with the ULB to understand the specific requirements and objectives of the project. This collaboration ensures that the RFP accurately reflects the scope of work, evaluation criteria, and contractual obligations. The RFP typically comprises several sections, such as the Letter of Invitation, Instructions to Consultants, Technical and Financial Proposal Forms, Terms of Reference, and Standard Forms of Contract. For instance, in Andhra Pradesh, the RFP for PDMC services under AMRUT 2.0 includes these components to provide clarity and structure to the bidding process. In addition to the RFP, the PDMC prepares the BOQs, which detail the quantities and estimated costs of various components of the project. This document is essential for bidders to provide accurate financial proposals and for the ULB to assess the financial viability of the bids received. The technical specifications, another critical component prepared by the PDMC, outline the quality standards, materials, and workmanship required for the project. These specifications ensure that all bidders have a clear understanding of the technical expectations, thereby facilitating uniformity in the proposals submitted. By meticulously preparing these bid documents, the PDMC ensures that the procurement process is conducted efficiently, transparently, and in alignment with the objectives of AMRUT 2.0. This comprehensive approach not only attracts qualified contractors but also lays the foundation for the successful execution of the Wardha Water Supply Scheme.

7. Provide support in Pre-bid meeting, Technical & Financial bid evaluation: In the execution of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in facilitating pre-bid meetings and evaluating technical and financial bids. During pre-bid

meetings, the PDMC collaborates with the Urban Local Body (ULB) to address queries from prospective bidders, providing clarifications on project requirements, technical specifications, and contractual obligations. This engagement ensures that all potential contractors have a clear understanding of the project's scope, promoting a transparent and competitive bidding environment. Following the submission of bids, the PDMC assists in the meticulous evaluation of technical proposals. This involves assessing each bid's responsiveness to the Terms of Reference, examining the proposed methodologies, work plans, and the qualifications of key personnel. Only those proposals meeting the predefined technical criteria are considered for the next stage. Subsequently, the PDMC supports the evaluation of financial bids, ensuring that the financial proposals are consistent with the technical submissions and comply with the project's budgetary constraints. This two-tiered evaluation process upholds the principles of fairness and meritocracy, ensuring that the selected contractor is both technically competent and financially viable. By overseeing these critical stages, the PDMC ensures that the procurement process aligns with the objectives of AMRUT 2.0, facilitating the successful implementation of the Wardha Water Supply Scheme.

8. Project planning and designing: In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in translating the Detailed Project Report (DPR) into actionable plans through meticulous project planning and design. This phase is crucial as it lays the foundation for the project's successful execution, ensuring that all aspects are systematically organized and aligned with the mission's objectives. The PDMC begins by developing a comprehensive project schedule, outlining the sequence of activities, timelines, and milestones. This scheduling ensures that each phase of the project is executed in a timely manner, facilitating efficient resource utilization and minimizing delays. Resource allocation is another critical component, where the PDMC identifies the necessary human, financial, and material resources required for each task, ensuring their optimal deployment throughout the project lifecycle. Risk assessment is integral to the planning process. The PDMC conducts thorough analyses to identify potential risks, such as technical challenges, financial constraints, or environmental concerns. By anticipating these risks, the PDMC can develop mitigation strategies to address them proactively, thereby safeguarding the project's progress and integrity. Furthermore, the PDMC ensures that the project's design adheres to the technical standards and guidelines stipulated by the Ministry of Housing and Urban Affairs (MoHUA). This includes incorporating sustainable practices, such as water conservation measures and energy-efficient technologies, aligning with AMRUT 2.0's emphasis on sustainability and resilience. For instance, PDMCs have been instrumental in integrating water source conservation and rainwater harvesting into project designs, as observed in various states under the AMRUT 2.0. By meticulously planning and designing the project, the PDMC ensures that the Wardha Water Supply Scheme is poised for successful implementation, delivering reliable and sustainable water services to the community in alignment with the goals of AMRUT 2.0.

9. Project monitoring and supervision: In the execution of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in overseeing the project's progress during the implementation phase, ensuring adherence to timelines, quality standards, and budgetary constraints.The PDMC's responsibilities encompass continuous monitoring of construction activities, ensuring that they align with the approved designs and specifications. They conduct regular site inspections to assess the quality of workmanship and materials, ensuring compliance with established standards. Additionally, the PDMC monitors the project's financial aspects, tracking expenditures to ensure they remain within the allocated budget. They also maintain detailed records of project milestones, decisions, changes, and approvals, providing a transparent account of the project's progression. In the event of deviations from the project plan, the PDMC promptly identifies the issues and implements corrective actions to bring the project back on track. Their proactive approach helps mitigate risks and ensures the timely and successful completion of the project. By maintaining rigorous oversight and management, the PDMC ensures that the Wardha Water Supply Scheme is executed efficiently, delivering reliable and sustainable water services to the community in alignment with the objectives of AMRUT 2.0.

10. Monitor project progress (physical and financial) against Bar Chart: In the execution of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) employs bar charts to meticulously monitor both the physical and financial progress of the project. This visual tool serves as an effective means to track milestones, identify delays, and facilitate timely interventions, ensuring that the project remains aligned with its objectives. Bar charts, particularly Gantt charts, are instrumental in project management as they provide a clear graphical representation of a project's schedule. These charts display tasks on the vertical axis and time

intervals on the horizontal axis, with the length of each bar indicating the duration of each task. Modern Gantt charts also show the dependency relationships between activities and the current schedule status, allowing project managers to visualize the project's timeline and progress at a glance. By utilizing bar charts, the PDMC can effectively monitor the project's physical progress, ensuring that construction activities are proceeding as planned. Additionally, these charts facilitate the tracking of financial expenditures, helping to ensure that the project remains within its budgetary constraints. This dual monitoring allows for the early identification of any discrepancies, enabling the PDMC to implement corrective actions promptly and keep the project on track. In summary, the use of bar charts by the PDMC in monitoring the Wardha Water Supply Scheme under AMRUT 2.0 enhances transparency, accountability, and efficiency, contributing to the successful and timely completion of the project.

11. Maintain records of project milestones, decisions, changes, and approvals: In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in maintaining comprehensive records that document every significant milestone, decision, change, and approval throughout the project's lifecycle. This meticulous documentation ensures transparency, accountability, and serves as a valuable reference for future projects.

1. Documenting Project Milestones: The PDMC systematically records each key milestone achieved during the project, such as the completion of design phases, procurement processes, and construction stages. These records provide a clear timeline of the project's progress, facilitating effective monitoring and reporting.

2. Recording Decisions and Approvals: Every significant decision made during the project's execution, including design modifications, budget adjustments, and policy changes, is documented along with the corresponding approvals. This practice ensures that all actions are traceable and aligned with the project's objectives and regulatory requirements.

3. Tracking Changes and Revisions: The PDMC maintains detailed logs of any changes to the project scope, schedule, or budget, including the reasons for these changes and their impact on the overall project. This comprehensive tracking allows for effective change management and helps in assessing the project's adaptability to unforeseen circumstances.

4. Ensuring Compliance and Accountability: By keeping accurate and up-to-date records, the PDMC ensures compliance with legal, regulatory, and contractual obligations. These records provide an audit trail that supports accountability and can be referenced in case of disputes or reviews.

5. Facilitating Knowledge Transfer: The documented records serve as a knowledge repository for future projects, offering insights into best practices, lessons learned, and areas for improvement. This knowledge transfer contributes to the continuous improvement of project management practices within the organization.

In summary, the PDMC's commitment to maintaining comprehensive records throughout the Wardha Water Supply Scheme under AMRUT 2.0 not only ensures the project's success but also establishes a foundation for future endeavors, promoting efficiency, transparency, and continuous learning.

12. Coordinate with third-party quality control/assurance agencies: In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in coordinating with independent quality control and assurance agencies to uphold the highest standards of quality throughout the project's lifecycle. This collaboration ensures that all materials and workmanship meet the specified standards, thereby enhancing the project's durability and performance.

1. Engaging Independent Quality Assurance Agencies: The PDMC facilitates the engagement of third-party quality assurance agencies that are not directly involved in the project. These agencies provide unbiased assessments and inspections, ensuring that the construction activities comply with the approved designs, specifications, and regulatory standards. Their independent evaluations help identify potential issues early, allowing for timely corrective actions.

2. Defining the Scope of Quality Assurance: The PDMC works with the quality assurance agencies to define the scope of inspections and testing required for the project. This includes determining the frequency of inspections, the specific materials and components to be tested, and the criteria for acceptance. A well-defined scope ensures comprehensive coverage of quality aspects and facilitates systematic monitoring.

3. Scheduling and Coordinating Inspections: The PDMC coordinates with the quality assurance agencies to schedule inspections at various stages of the project. These inspections may include reviews of construction processes, testing of materials, and evaluations of completed works. Effective scheduling ensures that inspections are conducted at appropriate times, minimizing disruptions to the construction activities.

4. Monitoring Compliance and Addressing Non-Conformities: During the inspections, the quality assurance agencies assess the project's adherence to

quality standards. If any non-conformities are identified, the PDMC collaborates with the project team to address these issues promptly. This proactive approach helps maintain the project's quality and prevents the recurrence of similar issues.

5. Documenting and Reporting Findings: The PDMC ensures that all findings from the quality assurance inspections are thoroughly documented. These reports provide a detailed account of the inspections conducted, the results obtained, and any corrective actions taken. Maintaining comprehensive records supports transparency and accountability in the project's quality management process.

6. Incorporating Feedback into Project Execution: The PDMC reviews the feedback and recommendations provided by the quality assurance agencies and integrates them into the project's execution plan. This continuous feedback loop facilitates ongoing improvements in construction practices and ensures that the project aligns with the desired quality outcomes. By effectively coordinating with third-party quality control and assurance agencies, the PDMC ensures that the Wardha Water Supply Scheme is executed to the highest quality standards, delivering a reliable and sustainable water supply system to the community.

13. Capacity building and training of ULB staff: In the implementation of the Wardha Water Supply Scheme under AMRUT 2.0, the Project Development and Management Consultant (PDMC) plays a pivotal role in enhancing the capacity of Urban Local Body (ULB) staff through targeted training programs. Recognizing that the long-term success of water supply infrastructure hinges on effective local management, the PDMC collaborates with various stakeholders to deliver comprehensive capacity-building initiatives.

1. Tailored Training Programs: The PDMC designs and delivers training sessions that cater to the specific needs of ULB staff involved in water supply operations. These programs encompass a range of topics, including infrastructure maintenance, water quality monitoring, financial management, and customer service. By addressing the unique challenges faced by ULBs, the PDMC ensures that staff are well-equipped to manage and sustain the water supply systems effectively.

2. Collaboration with Specialized Institutions: To enhance the quality and relevance of training, the PDMC partners with specialized institutions such as the WASH Institute and the Centre for Water in the Urban Environment (CWAS). These organizations bring in-depth expertise and practical experience to the training programs, providing ULB staff with valuable insights and skills applicable to real-world scenarios. For instance, the WASH Institute has trained over 1,500 engineers and government officials across India in areas like water quality and sustainable sanitation.

3. On-the-Job Training and Exposure Visits: Recognizing the importance of practical experience, the PDMC incorporates on-the-job training and exposure visits into the capacity-building strategy. These initiatives allow ULB staff to observe and learn from best practices in other cities, fostering a culture of continuous improvement and innovation. Such hands-on experiences are instrumental in bridging the gap between theoretical knowledge and practical application.

4. Integration with National Capacity Building Frameworks: The PDMC aligns its training programs with national initiatives like Mission Karmayogi, which aims to enhance the capabilities of civil servants across India. By integrating these frameworks, the PDMC ensures that ULB staff receive training that is consistent with national standards and objectives, contributing to the overall strengthening of urban governance

5. Continuous Monitoring and Evaluation: To assess the effectiveness of the training programs, the PDMC implements robust monitoring and evaluation mechanisms. Feedback from participants is collected and analyzed to identify areas for improvement, ensuring that future training sessions are more targeted and impactful. This commitment to continuous learning and adaptation underscores the PDMC's dedication to building a competent and responsive workforce.

Through these comprehensive capacity-building efforts, the PDMC empowers ULB staff to effectively manage and maintain the Wardha Water Supply Scheme, ensuring its sustainability and success in providing reliable water services to the community.

3.2 ONGOING AMRUT 2.0 PROJECTS IN MAHARASHTRA

1. Development & Construction Of 150 Mld Headwork at Mohili Village - Kalyan-Dombivali

2. Drainage Information - Sangli (Kupwad Under Ground Drainage Scheme Under central Govt Amrut -2.0 - SMKC- KUPWAD)

3. Augmentation Of Bhiwandi 100 MlD Water Supply Scheme For Bhiwandi Nizampur Municipal Corporation - Bhiwandi Nizampur

4. Satara Water Supply Scheme - Satara

5. Bhadrawati Supplementary Water Supply Scheme Bhadrawati, Dist. Chandrapur - Bhadrawati

6. Shegaon Water Supply Scheme -Shegaon

4. CONCLUSION

The role of Project Development and Management Consultants (PDMCs) in the implementation of urban infrastructure projects under AMRUT 2.0 is pivotal in enhancing the efficiency, effectiveness, and sustainability of urban services. This study has demonstrated that PDMCs significantly contribute to the successful planning, execution, and monitoring of large-scale projects, such as the reform to the Wardha Water Supply Scheme, by providing essential expertise in project design, management, and quality assurance. PDMCs serve as a critical link between Urban Local Bodies (ULBs), state governments, and other stakeholders, ensuring that projects align with the objectives of AMRUT 2.0, which aims to provide universal access to water supply, sewerage, and sanitation in urban areas. The findings of this study reveal that while PDMCs play an instrumental role in addressing technical gaps, improving project delivery, and ensuring compliance with timelines and budgets, there are still significant challenges, including the need for better coordination, capacity building, and timely resolution of issues at the local level. Furthermore, the study highlights that a more integrated approach, with increased use of digital tools, improved communication, and stronger accountability mechanisms, could further enhance the effectiveness of PDMCs in urban infrastructure projects. Ultimately, the successful implementation of the Wardha Water Supply Scheme and similar projects under AMRUT 2.0 demonstrates the potential for PDMCs to act as enablers of urban

transformation, contributing to the creation of sustainable, resilient, and well-managed urban environments that can meet the demands of growing populations and improve the quality of life for urban residents. To maximize the impact of PDMCs, it is essential to build upon the lessons learned, strengthen their role in project execution, and foster an environment of continuous improvement in urban infrastructure management.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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