

CITIIS program by the Ministry of Housing and Urban Affairs and a case study of Belagavi Smart City Limited

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Abstract - The Government has undertaken various initiatives to promote climate-sensitive planning and development. "There are eight National Missions under the National Action Plan on Climate Change (NAPCC) which focuses on climate change adaptation and mitigation". One of them is the National Mission on Sustainable Habitat (NMSH) at Ministry of Housing and Urban Affairs (MoHUA). NMSH identifies Waste management as an area of prime importance. MoHUA has launched City Investments to Innovate, Integrate and Sustain (CITIIS 2.0), the second phase of the CITIIS program, in collaboration with Agence Française de Développement (AFD), KfW, European Union (EU), and National Institute of Urban Affairs (NIUA) to supplement such climate initiatives of Gol and MoHUA through its unique model. The CITIIS 2.0 challenge has 3 components. Component 1 is a City Level Action on Promoting Circular Economy with Focus on Integrated Waste Management, Component 2 is a State-Level Action on Strengthening Climate Governance Mechanisms for Climate Action through Data-Driven Planning & Capacity Building and Component 3 is a National-Level Action on Institutional Strengthening, climate research, Knowledge capitalization and Capacity Building. The focus of this article will be component 1 i.e. City level action on Waste Management with a focus on circular economy.

Key Words: 'Waste management', 'Sustainability', 'Circular Economy', 'Social Inclusion', 'Stakeholder', 'Climate control'.

1. INTRODUCTION

Municipal Solid Waste Management (MSWM) being a part of public health and sanitation has been entrusted to the Urban Local Body's (ULBs). MSWM though an essential service was not given much importance till recently due to lack of financial resources, improper choice of technology, institutional capacity and public apathy towards SWM. Improper processing, treatment and final disposal of solid waste in unscientific dumpsites pose problems such as ground and water contamination, air pollution etc. Presently, the Solid waste management is assuming larger importance due to population expansion in municipal areas, legal intervention, Government sponsored schemes, emergence of newer technologies and rising public awareness towards cleanliness.

With the advent of technology it is necessary to adopt such new-age technology in managing waste to ensure maximum efficiency and sustainability. Advanced technologies, such as IoT sensors, data analytics, and automated waste sorting systems, enable real-time monitoring, precise waste categorization, and streamlined operations. This boosts resource utilization along with reducing environmental impact by promoting recycling and minimizing landfill usage. Embracing innovative solutions ensures a smarter and more eco-friendly approach to waste management, addressing the challenges of growing urbanization and promoting a clean, green and healthy environment for future generations.

Belagavi city is situated at latitude 15-51' North and Longitude 74- 31' East and height of 710 meters above M.S.L in the northern slope of the basin of water course called the Bellary Nallah. The City Corporation Belagavi has a total of 58 wards in a total extent of 94.07 sq. km. As per 2011 census the Population of Belagavi City is 4,88,157. The current population of the city is approximately 7,83,000 and it is expected to reach 11,00,000 by the year 2040. Belagavi city has adopted a waste management system which is functional yet not fully effective. The city has achieved 80% collection efficiency and processing. No presorting is being done neither at the household level nor at the plant. Landfill sites are being filled at a fast pace due to the large quantity of rejects consisting of plastic material.

The city currently produces a mixed waste of 250 TPD per day which is projected to reach 500 TPD by 2040. To cater this increase in the waste generation there is a need to implement a sturdy Solid Waste Management system which is efficient and environment friendly. Apart from implementing a SWM system it is equally important to create a sense of faith among all the stakeholders that together we can make our city's municipal waste management system efficient and turn our city clean and healthy. Hence, the project is called as VIISWAS i.e. Vision to Implement Integrated Solid Waste Management And Sustainability Project. With CITIIS initiative Belagavi can achieve the above and put a step forward in preparing itself to become future ready and a leader in Solid Waste Management.

2. OBJECTIVES OF THE PROJECT

The prime aim of the Project is to develop an infrastructure for Integrated municipal Solid Waste Management system for Belagavi city from primary collection to final Scientific Processing and disposal of the waste generated in the City. The development of infrastructure to keep the city clean and green with the help of a technology, keeps up the social and environmental aspects of the city. Apart from this the project aims at promoting circular economy with focus on revenue generation to keep the project self sustainable. The overarching focus of the project is as follows

- To promote skill development programs at each of these facilities, to enhance the capabilities of the local workforce, providing employment opportunities and contributing to the growth within the SWM industry.
- To enforce strict safety protocols by following regulatory compliances ensuring that the operational facilities adhere to international standards
- To establish smart SWM systems with overall technological integration and convergence across other missions and projects
- To engage with the community and civil society and create awareness and sense of belongingness with the citizen-centric project objectives

3. VISION TO IMPLEMENT INTEGRATED SOLID WASTE MANAGEMENT AND SUSTAINABILITY PROJECT (VIISWAS)

Belagavi city is a rapidly growing city in Karnataka. The city, also hailed as the 'Hydraulic Capital' of India, is home to a hundreds of small and medium scale industries that manufacture spares and components for the automobile industry. Belagavi boasts to be the first aerospace SEZ in the country. Naturally, the city provides employment to lakhs of people who work in various sectors. The city hosts several universities, medical and dental colleges and is a large education hub.

Most large cities face crises arising out of inefficient SWM systems. As a rapidly growing city Belagavi can learn from the experiences of larger cities to integrate green and sustainable practices in SWM. The City Corporation Belagavi (CCB) and Belagavi Smart City Limited have a strong team of experts working to achieve favorable objectives and outcomes listed. Belagavi produces an estimated 250 tons of waste per day and is in its nascent stages of SWM. A robust SWM system becomes the need of the hour, as it has been estimated that Belagavi will produce over 500 tons of waste by 2040.

The VIISWAS project will enable Belagavi city to move a step further with some pioneering models. The planned components of the project are as follows;

1. To establish a 100 TPD Bio-methanation plant to treat the wet waste and generate compressed bio-gas.
2. To develop 100 TPD Construction and Demolition (C & D) waste processing facility.
3. To develop 30 ward level Reduce, Re-use, Recycle (3 R) centers for effective segregation of waste.
5. Establishing a key data hub by integrating technology with ICC
6. IEC activities

Efficient planning and implementation of the above mentioned activities will not just ensure effective disposal of solid waste but will also lead to reduction in greenhouse gas emissions, increased public awareness and community participation to integrate with urban planning in an ever-growing city like Balagavi. Belagavi has the potential to adapt energy efficiency technology and zero waste SWM initiatives in order to reduce its impact on environment and carbon footprint. The project will help the citizens of Belagavi towards engaging and participating in climate resilient waste management infrastructure. The project's circular economy practices will also further the goal of minimizing generation of waste and promoting green jobs and local entrepreneurship in waste management and the recycling industry.

4. CITIIS PROGRAM VALUES IN THE PROJECT

4.1 Excellence in Sustainable Development and Impacts

4.1.1 Convergence with ongoing missions

The proposal is aligned with both Swachh Bharat Mission (SBM) 1.0 and 2.0. Out of 58 wards, 44 wards are able to segregate 100 percent of their waste. Total waste processed from these wards is 100 percent. 253 black spots were identified within the City Corporation's jurisdiction, of which 198 black spots have been cleared. 90 percent of progress in SBM 1.0 is attained and tenders are invited for SBM 2.0 related activities.

4.1.2 Environmental protection and climate co-benefits of the project

The considers all aspects of environmental protection and climate co-benefits with special focus on green infrastructure and mitigation measures for the climate change within the Solid Waste Management sector. These measures will be realized through resilient waste management infrastructure, climate-adaptive strategies, and a substantial reduction in emission of greenhouse gasses. The successful integration of the project components contributes not only to sustainable waste management but also to the broader goals of climate action and environmental stewardship.

- **Climate Resilience:** The project's waste management infrastructure can build climate resilience by reducing vulnerabilities to climate-related risks. The project will be executed keeping in mind green spaces and existing biodiversity. Preference will be given to incorporate green spaces and preserve existing biodiversity during the design of waste management facilities to reduce carbon footprint. Green infrastructure would help in mitigating heat island effects, preserving natural habitats of pollinators, and improving overall environmental quality in and around Belagavi.
- **Climate Adaptation:** Incorporating an infrastructure which will withstand and adapt to the increasing impacts of climate change. This includes designing facilities that can manage increased, unanticipated rainfall, flooding, or other extreme weather conditions without causing environmental damage.

One of the foremost steps in climate adaptation involves preparing communities for potential climate risks. The project will include community interaction and engagement, through awareness programs and educate residents about these risks and the role of proper waste management in building resilience.
- **Reduction in GHG Emissions:** The CBG plant that will be set up as a part of the project will significantly give rise to the reduction of greenhouse gas emissions. One of the largest contributors to greenhouse gas emissions is wet waste. Methane, which is an extremely potent greenhouse gas, is released during the decomposition of organic waste in landfills. The CBG plants will minimize the quantity of waste that is sent to the landfills, reducing methane generation thus bringing a drastic reduction in greenhouse gas emissions.

4.1.3 Social inclusion

- **Informal Sector:** Informal waste managing workers run the sector and women form the bane of this workforce. Most Paura karmikas (civic workers) are women and are involved in the door-step pick-up of waste and street-sweeping. Recognizing and integrating informal waste workers, into the formal waste management system and providing them with support to enhance their skills and occupational safety will be an added advantage to the project.
- **Gender Equality:** The project aims to have a sizable women-workforce at the processing plants, segregation centers, waste collection and field operation roles. Specific training and capacity-building programs for women engaged in waste management, empowering them with the skills and knowledge needed to enhance their roles will be provided.

- **Vulnerable Groups:** The proposed work will develop inclusive programs to engage with vulnerable communities such as transgender, disabled persons and women from BPL families with a specific focus ensuring livelihood opportunities for them. It is intended to collaborate with social support services and healthcare providers to provide assistance to vulnerable groups affected by waste management activities. This may include healthcare services, counseling and educational support.
- **Gender Status:** The City Corporation Belagavi (CCB) has established 9 Reduce, Reuse and Recycle (RRR) Centers alongside 6 dry waste collection centers. As a pioneer initiative, 139 women rag pickers have been identified by the CCB and Identity Cards are issued to them instilling a sense of safety and recognition within the community and acknowledging their role in waste management. The recyclables picked by rag pickers during ward-wise segregation are sent to the local recycler.

4.2 Innovation & Integration

4.2.1 Waste Management Infrastructure

The current collection efficiency of solid waste in Belagavi is at 80 percent. The project will help in developing a robust waste collection network covering all areas to bring collection efficiency to 100 percent. Under the project's objectives, a systematic collection schedule will be rolled-out, to ensure accessibility to collection of waste for all households and businesses. The project will help in integrating facilities for waste segregation and recycling at the key segregation centers at the ward-level. This will promote segregation at source and ensure maximum recovery of recyclables.

4.2.2 Behavioral and mind-set change

Penalizing offenders for non-compliance to waste disposal practices must be strictly enforced. Introducing norms such as the Extended Producer Responsibility (EPR) that encourage manufacturers to take responsibility for the end-of-life disposal of their products and packaging materials would encourage producers to understand waste processing and its lifecycle. Incentive mechanisms for private sector involvement, encouraging innovation and efficiency in waste management are a positive step in this direction.

Progressive actions by the community must be rewarded to reinforce civic involvement and encourage collective action in waste management. Several hoteliers, apartment and township resident associations, NGOs and Self Help Groups (SHGs) have offered willingness to extend

cooperation in implementation and operation of the CITIIS project.

4.2.3 Waste value chain:

Stakeholders across the waste value chain will be identified and mapped to generate opportunities for green jobs in the SWM sector. Activities such as composting, recycling and up-cycling will be viewed not only in a technical perspective, but with a generic outlook; so that products and bi-products generated under these conditions are added to a resourceful value chain. Marketing and financial linkages can be provided for such products which could strengthen the circular economy and uplift families.

4.2.4 Continuous improvement, adaptation, monitoring and evaluation

Feedback mechanisms will be set up to gather feedback from residents and stakeholders. The feedback that is gathered will help in making continuous improvements to waste management services. The project will invest in an adaptive management approach, allowing for flexibility in project implementation based on evolving needs, technological advancements, climate conditions, environmental challenges and community feedback.

Performance metrics and indicators will be formulated to measure the effectiveness of services, such as, monitoring waste diversion rates, recycling rates, processed volumetric data, comparative greenhouse gases emission rates, qualitative and quantitative data of waste processes and overall community satisfaction.

4.2.5 Digital Technologies and ICCC Integration

Currently, the CCB is reliant on RFID technology for monitoring the existing system. The Belagavi Smart City Limited has deployed 138 GPS-enabled vehicles for real-time tracking of the primary and secondary vehicles. 20 cameras are installed for surveillance of black spots in the city. 8 cameras are installed at the landfill for real-time monitoring.

Belagavi Smart City Limited (BSCL) has established an Integrated Command and Control Centre (ICCC) through which monitoring of waste management systems is done effectively. Under the CITIIS project emphasis will be on implementation through technology-driven solutions using data analytics, GIS mapping for monitoring and reporting. MyBelagavi mobile application will be further strengthened allowing the residents to report waste-related issues, request services, and provide feedback, fostering community engagement in the planning process.

It has been planned to install 40,000 RFID tags for households without tags. 100 surveillance cameras at identified black spots will be installed with Variable Message Display System (VMDS) and public address system so as to discourage people from dumping garbage at these spots.

4.2.6 Innovation in the project components

The project components are designed in a way that is modular and scalable facilities. This will facilitate easy replication in different locations or expansion at a later date within Belagavi. The flexibility in operations of the project components will allow for adjustments based on changing waste generation patterns or population growth of Belagavi city.

The introduction of green bonds, green credits and PPPs reflects a forward-looking approach to financing and partnerships, fostering environmental responsibility and economic viability, which will be a first for Belagavi City. Enterprises following green and sustainable practices as per SWM Rules 2016 have been identified and rewarded as Green Establishments. The CCB has encouraged bulk waste generators to adopt sustainable practices to ensure efficient disposal of the waste generated by them. A few establishments such as hotels and hostels have installed their own waste disposal mechanisms such as installation of CBG units, where the biogas can be used in their kitchen.

4.3 Participatory Approaches & Partnerships

4.3.1 Involvement of Govt. Agencies

The proposed project will be implemented in close partnership with several government agencies. The Belagavi Smart City Limited (BSCL) and City Corporation Belagavi (CCB) will implement this project jointly.

“The implementation of the project will be monitored by the Project Management Unit (PMU) of the National Institute of Urban Affairs (NIUA) which works under Ministry of Housing and Urban Affairs, New Delhi”.

4.3.2 Stakeholder Engagement Plan

For any stakeholder it is important to live in a clean and healthy living environment without the nuisance of odors, pests, and pollution. Understanding and addressing the specific needs and concerns of each stakeholder is essential to achieve effective waste management outcomes. It is intended to engage all the stakeholders in different ways for successful implementation of the project. Other stakeholders such as educational institutions, institutions, NGO's will be involved in creation of awareness and capacity building program. Several educational institutions, organizations, Associations, NGO's and SHG's have come

forward willingly to cooperate in implementation of CITIIS 2.0 program and also contribute positively to the city's waste management system.

It is proposed to run the Dry Waste Segregation Centers by the Pourkarmikas, women and transgender. Some will be handed over to contractors on a revenue-sharing basis between the CCB, BSCL and the third-party. It is intended to establish two vehicle fueling stations for biogas distribution on the land owned by the CCB, the contracts for which will be awarded to vendors and dealers who have operational experience. Biogas manufactured at the CBG plant will be transported to these gas fueling stations and will be sold to the CNG-run vehicles. Similarly, the manure produced as a byproduct at the CBG plant will be sold in the market as a revenue generating initiative.

In case of processed C&D waste, it will be utilized by those involved in construction works taken up by the CCB, BSCL and other government agencies. The processed and recycled materials will be further made available for sale in the open market. Shredded plastic waste will be utilized in construction of bitumen roads by all the government agencies such as PWD, CCB, BSCL, BUDA. The CCB has already constructed a bitumen road using 8% of the plastic waste as a replacement of bitumen. Combustive waste like dry waste, plastic, paper, wood, cardboard, etc., are being sent to cement kilns.

4.4 Relevance & Feasibility

4.4.1 Existing city level challenges and benefit to the citizens

The CCB has implemented the ongoing waste management program for the benefit of Belagavi city. As a rapidly-growing city Belagavi is saddled by several challenges in solid waste management such as segregation; limited recycling and underutilization of recyclables; improper waste processing resulting to mixed waste; unexplored areas of sustainable treatment of waste and landfill-overloading; unhygienic bio-medical waste management practices, are some of the issues that the CCB is trying to tackle.

The CITIIS 2.0 project will help the CCB and BSCL to adopt a multifaceted approach to take on the drawbacks in a solution-oriented manner. The project will enable implementation of efficient waste collection systems with optimized routes and schedules. It will introduce and promote segregation of waste at source through awareness campaigns and community engagement. It will establish recycling facilities for processing recyclable materials and also install alternative waste treatment methods such as composting, biogas generation, and waste-to-energy initiatives. The project will enable Belagavi to reduce

reliance on landfills, generate energy, and sustainable waste management.

The proposed project aligns seamlessly with the broader goals of city planning. The project is integrated with the city's urban development plans, ensuring that waste management infrastructure evolve in tandem with the city's growth. The incorporation of smart technologies at ICCC is in-sync with modern city planning practices, promoting efficiency, data-driven decision-making, and innovation. The community engagement and awareness programs are aligned with the city's vision of inclusive and participatory development leading to job creation, economic development and poverty reduction. The project's goals are in-line with the CCB's commitment to sustainability and resilience, focusing on environmentally sustainable waste management practices.

4.4.2 Present level of preparedness

The CCB in Belagavi has been able assess the types and quantities of waste generated in the city. During the course of preparation for the CITIIS project, BSCL has conducted a baseline survey, and identified areas which have scope for improvement. It has identified recyclable, organic, and non-recyclable components, for which, a reasonable collection, segregation and processing infrastructure has been established. Logistics and transportation systems for moving waste from collection points to processing facilities for real-time monitoring of waste management are in place.

Belagavi, is one of the first municipalities, replacing bitumen from plastic waste of up to 8 percent, in bitumen roads. Land has been made available within the city limits for setting-up of 30 compacting stations at the ward-level. Further, 40 acres of land is made available for establishment of CBG plant, C&D waste processing unit and bio-medical waste incineration plant. The CCB possesses the ownership to this land and is free of risks and hindrances. During preparation The CCB has, through a circular, on bulk generators in-line with SWM rules of 2019. The ICCC's advanced and progressive approach in real-time tracking and monitoring makes Belagavi a pioneer in adapting technology in SWM.

The CCB is constantly adopting innovative technologies and research-based solutions in waste management and complimenting the integration of circular economy principles. Several pilot initiatives such as recycling of Floral waste in manufacturing of Incent sticks, establishment of waste to energy plant and Biogas plants are established and are successfully running. All these initiatives go on to prove that the CCB and BSCL are well-prepared and hold a lot of potential in making Belagavi as a model city in waste management.

5. CONCLUSION

The project is not only a response to the existing challenges but also a strategic alignment with the city's vision for sustainable, inclusive, and technologically advanced urban development. It represents a comprehensive approach to waste management that considers environmental, social, and economic factors for the betterment of the citizens and the overall well-being of the city.

The project prioritizes social inclusion by recognizing and addressing the specific needs and concerns of informal workers, women, and other vulnerable groups in the waste management sector. Issuing identity cards to women rag pickers is a positive step for a gender-based approach in the project. Ongoing efforts to enhance skills, ensure safety, and promote inclusivity contribute to a more equitable and sustainable waste management system. Various components which are proposed to be established under this project will yield revenue to the City Corporation and Belagavi Smart City Limited achieving the basic underlying principles of sustainability and circular economy.

REFERENCES

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BIOGRAPHIES



Syeda Afreen Banu S Bellary is a visionary bureaucrat with over 15 years of experience and expertise in Revenue, Administration and Urban Development. She has won the Best Civil Servant Award from the Government of Karnataka for Belagavi District in 2022. A Gold Medalist in Economics, she represented Belagavi Smart City at the ISAC Awards 2022, and received Best Smart City – South Zone Award from Hon. President of India.



Nadeem Sanadi is a Civil Engineering graduate with M.Tech in Construction Technology. He has an experience of over 8 years in Urban development projects, project coordination and construction of Major Bridges.