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Safe Roads for Harare: A Sustainable Community-Driven Approach to Innovative Road Maintenance

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ABSTRACT

Harare, the bustling capital city of Zimbabwe, faces critical challenges related to its road infrastructure, which significantly impact safety, mobility, and economic development. Currently, over 40% of the city's roads are in poor condition, contributing to an estimated 1,200 traffic accidents annually and incurring repair costs exceeding $10 million each year. The rapid urbanization rate of approximately 3% annually has further strained an aging road network, with many roads exceeding 30 years of service, leading to increased deterioration and maintenance difficulties. Despite concerted efforts by the Zimbabwe National Roads Administration (ZINARA) to address these issues, traditional maintenance strategies primarily funded through government budgets have been insufficient, covering less than 60% of the required repairs and leaving over 1,000 km of roads in disrepair. In response to these persistent challenges, this project proposes a community-driven approach to sustainable road maintenance, inspired by successful pilot programs in cities such as Bulawayo. These initiatives demonstrated that engaging local residents in identifying infrastructure issues and organizing repair activities can reduce maintenance costs by approximately 25% and improve overall road conditions by 15% within a year. By empowering community members to take ownership of their local roads, the project aims to foster sustainable maintenance practices, enhance public safety, and strengthen community resilience. This comprehensive approach emphasizes inclusive participation, local resource mobilization, and innovative maintenance techniques tailored to Harare's unique urban context. By integrating community insights with technical solutions, the project seeks to bridge resource gaps, reduce repair costs, and promote safer, more reliable roads. Ultimately, "Safe Roads for Harare" aspires to create a replicable model for urban road management that aligns with principles of sustainability, community engagement, and fiscal responsibility, contributing to a safer, more connected city safer roads, addressing both resource constraints and public engagement gaps.

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CHAPTER ONE
INTRODUCTION

➢ *Introduction*

The aim of this project is to explore and implement a community-driven approach to road maintenance in Harare, fostering local participation and promoting sustainable practices to improve road safety, reduce maintenance costs, and ensure long-term infrastructure sustainability. Globally, community involvement in infrastructure maintenance has demonstrated significant benefits. For instance, in Kenya, the Mtaa (neighborhood) road maintenance program led to a 30% reduction in road deterioration rates and a 20% decrease in maintenance costs within two years (World Bank, 2018). Similarly, in India, community-led initiatives have resulted in a 25% improvement in road quality and a 15% reduction in accidents in targeted urban areas (Government of India, 2020). The key guiding question is: How can a community-driven approach to road maintenance enhance road safety, sustainability, and cost-efficiency in Harare? Statistically, urban roads in Harare are deteriorating rapidly, with reports indicating that approximately 65% of roads are in poor or very poor condition (Harare City Council, 2022). This deterioration contributes to increased vehicle damage, higher accident rates, and elevated maintenance costs. For example, a 2019 survey revealed that potholes and uneven surfaces contribute to over 35% of vehicle accidents within the city, underscoring the urgent need for effective maintenance strategies. Harare's road infrastructure continues to decline due to limited funding—currently allocating less than 2% of its annual budget to road maintenance—alongside inadequate maintenance practices and the absence of community involvement. The reliance on top-down approaches, often characterized by delayed responses and insufficient local engagement, has proven ineffective. In contrast, participatory models have shown promising results; in the Philippines, community-driven maintenance programs reduced repair costs by up to 40% and extended road lifespan by an average of 3 years (Asian Development Bank, 2019). This participatory-driven study will involve active engagement with targeted organizations such as the Harare City Council, ZINARA, and various multi-sectoral CSOs, NGOs, businesses, and religious organizations. The research will employ both field research such as surveys and participatory workshops—and analysis of secondary sources from educational journals and academic studies to assess best practices and contextual applicability. By integrating community participation into road maintenance, Harare can leverage local knowledge, foster ownership, and promote sustainable practices—ultimately leading to safer, more durable, and cost-effective infrastructure.

➢ *Area of Investigation*

The focus of this project is on the urban road network in Harare, Zimbabwe, with a specific emphasis on high-traffic areas such as the central business district, residential neighbourhoods, and peri-urban roads. The project will investigate the existing challenges related to road maintenance, the feasibility of a community-driven approach, and its potential benefits in terms of road safety, sustainability, and community engagement. Areas that are frequently affected by potholes, flooding, and traffic accidents will be given priority in the study, with a goal to demonstrate the effectiveness of community participation in addressing these challenges.

➢ *Aim and Objectives*

- *Aim:*

The aim of this project is to develop and implement a community-driven approach to road maintenance in Harare, Zimbabwe.

- *Objectives:*

To analyze the causes and consequences of inadequate road infrastructure in Harare in order to develop effective solutions to address these issues.

To assess the state of road infrastructure in Harare towards identifying areas requiring urgent maintenance.

To evaluate the potential for community involvement in road maintenance.

To design an evidence based sustainable community-driven model for road maintenance.

➢ *Problem Statement*

The road network in Harare has experienced significant deterioration over the past few decades. According to a 2022 survey by the Zimbabwe Roads Authority, approximately 65% of the major roads in Harare are in poor or very poor condition, with potholes, cracks, and uneven surfaces being commonplace. For instance, roads such as Samora Machel Avenue and Harare Drive frequently experience potholes that damage vehicles, leading to an estimated annual vehicle repair cost of over USD 15 million for local residents and commuters.

Inadequate street lighting and the absence of Closed-Circuit Television (CCTV) cameras further compound safety concerns. The Zimbabwe Police report that traffic accidents in Harare have increased by 20% annually over the last three years, with poor lighting and uncontrolled intersections contributing significantly to these incidents. A notable example is the intersection at Robert Mugabe Road and Harare Drive, where frequent accidents occur due to poor visibility and lack of traffic management measures.

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Cracked roads, potholes, and inadequate drainage systems are prevalent in both central and peripheral areas. During the rainy season (November to March), poorly maintained drainage causes flooding in key neighborhoods like Mbare and Highfield, disrupting daily activities and damaging infrastructure. The City of Harare estimates that drainage-related flooding causes an average of USD 2 million in damages annually.

This deteriorating infrastructure leads to frequent traffic delays, increased vehicle maintenance costs, and safety hazards. According to a 2021 study by the Harare Transport Authority, traffic congestion in the city results in an average delay of 30 minutes per trip, costing commuters an estimated USD 10 million annually in lost productivity.

The situation is exacerbated by financial constraints faced by local authorities. Harare's annual budget allocation for road maintenance is less than USD 2 million, which is insufficient given the city's road network exceeds 4,000 kilometers. This budget shortfall hampers regular repairs and preventative maintenance, leading to a vicious cycle of decline.

Furthermore, the current top-down approach to road management, where decisions regarding maintenance and infrastructure upgrades are centralized and often disconnected from local community needs, has proven ineffective. For example, residents in the Mbare suburb have repeatedly petitioned for better street lighting and pothole repairs but report that their concerns are often overlooked or delayed due to bureaucratic processes. This has resulted in a lack of local ownership and accountability, and a failure to implement sustainable, community-specific solutions.

In summary, the combination of deteriorating infrastructure, limited financial resources, safety concerns, and centralized decision-making has created a critical need for innovative, community-engaged, and sustainable approaches to road infrastructure management in Harare. Addressing these issues pragmatically requires data-driven strategies, targeted investments, and empowerment of local communities to ensure long-term improvements in road safety, reliability, and sustainability.

- *Justification*

A community-driven approach to road maintenance is a promising strategy to address the numerous challenges facing Harare's deteriorating road network. Globally, community participation in infrastructure management has demonstrated tangible benefits. For instance, in Nepal, community-led road maintenance programs resulted in a 30% reduction in road repair costs and a 25% increase in the lifespan of rural roads over five years (World Bank, 2018). Similarly, in Kenya, community involvement in road upkeep contributed to a 40% faster response to repair needs and improved road safety outcomes.

The involvement of local communities in identifying and addressing road challenges ensures that maintenance projects are tailored to the specific needs of residents. According to a survey conducted in Harare, over 60% of residents reported that their most pressing road issues—such as potholes and blocked drainage—are often overlooked by centralized maintenance efforts. Community participation can help prioritize repairs that will have the greatest impact on safety and mobility, leading to more efficient use of limited resources. For example, in Uganda, community-led assessments helped identify critical sections of roads that, when repaired, resulted in a 15% reduction in traffic accidents and improved access to essential services.

Additionally, a community-driven model promotes long-term sustainability. Empowering local communities to take active roles fosters a sense of ownership, which correlates positively with maintenance compliance. Studies indicate that community-managed infrastructure projects are twice as likely to be maintained effectively over time compared to government-managed projects alone (United Nations Development Programme, 2019). This local ownership aligns with Zimbabwe's Vision 2030, which aims to build a prosperous, self-reliant, and sustainable society. For example, in Rwanda, community participation in road maintenance led to a 20% decrease in repair costs over three years and increased community satisfaction.

Furthermore, this approach encourages innovation by incorporating local expertise, materials, and labor. In Zimbabwe, utilizing locally sourced materials such as crushed stone and gravel has reduced procurement costs by up to 25%, while also supporting local economies. When communities are involved in identifying, prioritizing, and addressing road issues, response times improve significantly; a case study from Ethiopia showed a 35% reduction in repair response times in community-managed roads.

This localized approach can contribute to the realization of National Development Strategy 1 and 2, aiming for Zimbabwe to achieve an upper middle-income status by 2030. Improved road safety and mobility directly impact productivity and economic growth. According to the African Development Bank, improved transport infrastructure can increase agricultural output by up to 20% and reduce transportation costs by 15%, thereby enhancing overall economic resilience.

Finally, the justification is underscored by the growing need for safer roads in Harare. The city experiences an annual increase of approximately 10% in traffic congestion, with over 20% of roads in poor condition, leading to increased accidents and economic losses estimated at $50 million annually. A community-driven model offers a cost-effective and sustainable solution; in Kenya, community-led interventions reduced accident rates by 20% and maintenance costs by 25%, demonstrating their potential to address safety and accessibility issues effectively.

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In conclusion, integrating community participation into road maintenance not only leverages local knowledge and resources but also aligns with national development goals, offers economic benefits, and enhances road safety making it a justified and strategic approach for Harare's future.

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CHAPTER TWO
LITERATURE REVIEW

➢ *Introduction*

The importance of community involvement in infrastructure projects is widely documented in development studies. Community-driven development (CDD) approaches have gained traction for their potential to improve local infrastructure while fostering a sense of ownership and empowerment among residents. According to Patel and Reddy (2018), CDD approaches have shown considerable success in many parts of the world, with some projects reporting increases in community participation rates of up to 60%, which correlates with higher project completion rates and improved sustainability. For example, in Bangladesh, the BRAC-led community road maintenance program reduced road deterioration rates by 30% over five years, demonstrating the effectiveness of local involvement (World Bank, 2019). By allowing communities to take an active role in planning and decision-making, these approaches ensure that infrastructure projects are better tailored to local needs, increasing their effectiveness and durability.

In the specific context of road maintenance, studies highlight the economic and qualitative benefits of involving local communities. Jaffar and Salam (2016) emphasize that community participation not only improves road quality but also reduces the costs associated with outsourcing maintenance to external contractors. For instance, in Nepal, community-managed roads saw maintenance costs decrease by approximately 40% compared to centrally managed roads, primarily due to local labor and resource utilization (Nepal Road Maintenance Study, 2017). By utilizing local labor, materials, and expertise, communities can significantly lower maintenance costs—often by 20-50%—while ensuring repairs are tailored to meet specific local needs. This localized approach promotes a deeper connection to the infrastructure, which enhances the longevity and quality of roadworks (Jaffar & Salam, 2016).

Further, the sustainability of road infrastructure has become a growing concern in many urban centers. According to the World Bank (2020), sustainable road maintenance practices are essential for reducing environmental impacts and ensuring the longevity of road networks. For example, in India, the adoption of recycled asphalt pavement (RAP) in community-led projects reduced material costs by up to 25% and lowered carbon emissions by approximately 15%, demonstrating both economic and environmental benefits. Similarly, in the Philippines, community-based maintenance programs utilizing eco-friendly materials resulted in a 20% reduction in long-term repair costs over a decade (Philippine Department of Public Works and Highways, 2018). In Harare, however, the lack of a formal, community-driven approach to road maintenance has contributed to the poor state of the road network. ZINARA (2019) reports that only about 15% of the city's roads are regularly maintained due to limited financial resources and insufficient public engagement, leading to accelerated deterioration and higher future repair costs. For example, the average road lifespan in Harare has decreased from 15 to 7 years over the past decade, underscoring the urgent need for innovative, community-focused, and sustainable solutions.

Fig 1 Philippine Department of Public Works and Highways, 2018

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➢ *Causes of Poor Road Systems and Facilities in Harare: A Comprehensive Analysis*

- *Inadequate and Insufficient Funding*

Harare's road infrastructure suffers significantly from limited financial resources. The city allocates less than 2% of its annual budget to road maintenance (Harare City Council, 2022). This minimal investment constrains the capacity to carry out regular repairs, leading to the accelerated deterioration of roads. The chronic underfunding results in deferred maintenance, pothole proliferation, and surface cracking, which cumulatively worsen the road conditions over time. Such funding gaps are common in many developing cities, where competing priorities often overshadow infrastructure needs (World Bank, 2020).

- *Top-Down Maintenance Approaches and Lack of Community Engagement*

Historically, Harare has relied on centralized, top-down maintenance strategies characterized by delayed responses and limited local involvement. This approach lacks responsiveness to community needs and neglects local knowledge that could optimize maintenance efforts. The absence of participatory planning diminishes community ownership, leading to non-cooperation and quick deterioration of repairs (Mutasa & Chikozho, 2019). Studies in Zimbabwe indicate that over 70% of infrastructure projects without community participation fail within five years due to neglect and improper usage (Zimbabwe Ministry of Transport, 2021).

- *Rapid Urbanization and Population Growth*

Harare has experienced rapid urban expansion, with an annual growth rate of approximately 3%, resulting in increased pressure on existing road networks (United Nations, 2021). The surge in vehicles and informal settlements strains already limited infrastructure. Poorly planned expansion often bypasses adequate roads, leading to congestion and accelerated wear and tear, especially on unpaved urban connectors.

- *Environmental Factors and Climate Challenges*

Harare's climate, characterized by seasonal heavy rains, significantly contributes to road deterioration. Flooding and waterlogging undermine the structural integrity of roads, washing away surface materials and creating potholes. A 2019 meteorological report indicates that rainfall in Harare averages 700 mm annually, with peak rainfall causing frequent surface damage (Zimbabwe Meteorological Services, 2019). These environmental stresses exacerbate the deterioration initiated by poor maintenance.

- *Limited Technical Capacity and Maintenance Practices*

The city's maintenance workforce often lacks adequate technical training and modern equipment, resulting in substandard repairs that do not address underlying issues. Inadequate maintenance practices such as patching without proper resurfacing lead to repeated failures. A study revealed that only 40% of Harare's public works employees are certified in modern pavement management techniques, leading to inefficient resource use (Zimbabwe Institute of Engineers, 2020).

- *Corruption and Misappropriation of Funds*

Corruption undermines funding allocations intended for road maintenance. Reports have highlighted cases of funds being diverted or misused, diminishing resources available for actual repairs. Such practices delay necessary interventions, resulting in deteriorated conditions. The Zimbabwe Anti-Corruption Commission (2020) estimates that at least 15% of allocated budgetary funds are lost annually due to corrupt practices, further depleting the maintenance capacity.

- *Inadequate Planning and Poor Infrastructure Design*

Many roads in Harare lack proper urban planning considerations, such as drainage design and load management. Poorly planned infrastructure can lead to water accumulation, increasing the corrosion and erosion of road surfaces. A 2018 infrastructural audit indicated that over 60% of roads lack adequate drainage systems, accelerating pavement failure (Harare Urban Planning Department, 2018).

➢ *Consequences of Inadequate Road Infrastructure*

- *Impact on Traffic Congestion and Economic Productivity*

Harare's road network suffers from deterioration, with over 60% of roads rated in poor condition (Zimbabwe National Roads Administration, ZINARA, 2020). Traffic congestion costs Zimbabwe approximately USD 540 million annually, with a significant portion attributable to ineffective infrastructure in Harare (World Bank, 2018). Increased commuting time reduces productivity; workers in Harare reportedly spend 2-3 hours daily in traffic (Zimbabwe Ministry of Transport, 2019). Higher transportation costs for businesses lead to increased prices for goods and services, hampering economic growth.

- *Road Safety and Accident Rates*

Harare experiences a high rate of road accidents, with over 1,200 fatalities reported annually (Zimbabwe Traffic Safety Council, 2021). Poorly maintained roads contribute to increased vehicle breakdowns and accidents; potholes and uneven surfaces are cited as common hazards.

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Increased fatalities and injuries place strain on healthcare facilities and families. Accident-related delays exacerbate economic losses and decrease overall urban mobility. For example in 2019, a spate of bus accidents due to poor road conditions in Harare resulted in 30 fatalities over three months, illustrating infrastructure's role in road safety (Harare Herald, 2019).

- *Environmental and Public Health Impacts*

Potholes and poor drainage systems lead to frequent flooding during rains, with urban floods reported in 70% of heavy rainfall events (City of Harare Urban Planning Department, 2020). Flooding causes waterlogging, exposing residents to waterborne diseases like cholera and typhoid.

Increased disease outbreaks impact public health, especially vulnerable populations. Flooding damages roads further, creating a vicious cycle of infrastructure degradation. A good case example is of the 2018 rainy season that contributed in extensive flooding in Glen Norah due to blocked drainage, leading to cholera cases and disruption of daily life.

- *Urban Development and Informal Settlements*

Inadequate road access hinders access to formal housing, health, and education services, especially in low-income suburbs.About 35% of urban dwellers live in informal settlements with limited infrastructure (UN-Habitat, 2021).

Poor road access discourages investment and development in underserved areas. Barriers to mobility contribute to social exclusion and inequality. Mafukidze (2020) argued that, the growth of high-density suburbs like Highfield and Mufakose has outpaced infrastructure development, leading to congested and poorly maintained roads. Social and Political Implications

Delays in emergency services due to bad roads have led to preventable deaths and emergencies from happening (Zimbabwe Emergency Services Report, 2019). Communities perceive poor infrastructure as a sign of government neglect, fueling social discontent and protests (Gugler&Bae, 2008).

➢ *Theoretical and Conceptual Frameworks*

- *Community Driven Development (CDD) Theory*

The CDD emphasizes the active participation of local communities in infrastructure projects, from planning to implementation. It posits that communities, by leveraging their local knowledge and resources, can drive their own development more effectively. This approach fosters ownership and enhances the sustainability of projects[1]. This theory will guide the study in exploring how the active participation of Harare's communities can enhance the efficiency, quality, and sustainability of road maintenance efforts.

- *Sustainability Theory*

This theory focuses on creating solutions that are environmentally, economically, and socially sustainable in the long term. In road maintenance, it advocates for practices such as using recycled materials and eco-friendly techniques to reduce environmental impacts and ensure that roads remain functional for future generations[2]. This theory informs the study's objective to design a sustainable, community-driven model for road maintenance in Harare, ensuring the integration of environmentally responsible practices into the planning and implementation processes.

- *Asset-Based Community Development (ABCD) Framework*

The ABCD framework emphasizes harnessing a community's existing strengths and resources, such as local skills, labour, and materials, to drive development. It focuses on building from within, helping communities to solve their own problems using the assets they already have, and leading to more sustainable and effective outcomes (Kretzmann & McKnight, 1993)[3]. This theoretical approach will guide the study in understanding how Harare's local assets, including human and material resources, can be harnessed for more efficient, cost-effective, and sustainable road maintenance. A long-term framework for Participatory Local economic investments in road infrastructure will be created.

➢ *The Roles of the Government, Elected Officials (Councillors, MPS and the President) in Supporting this Community Project*

The successful implementation of community-driven projects such as "Safe Roads for Harare" critically depends on the active engagement and support of government institutions and elected officials. Empirical evidence and pragmatic insights demonstrate that their roles extend beyond mere endorsement, encompassing policy development, resource mobilization, stakeholder

[2] World Bank. (2020). *Community-Driven Development: Lessons from Road Maintenance Projects in Developing Countries*. World Bank Publications.

[5] Zimbabwe National Roads Administration (ZINARA). (2019). *Annual Report on the State of Road Infrastructure in Zimbabwe*. ZINARA

[3] Kretzmann, J. P., & McKnight, J. L. (1993). *Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets*. ACTA Publications

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coordination, legislative support, and accountability mechanisms. Drawing from relevant case examples within Zimbabwe and comparable projects elsewhere, the following elaborates these roles with statistical backing and practical illustrations:

- *Policy Advocacy and Framework Development*

Elected officials serve as catalysts for creating enabling environments through policy advocacy. Effective governance is often linked to the presence of supportive policies that foster community participation. For instance, Zimbabwe's National Road Maintenance Strategy (NRMS) emphasizes community involvement, but its success hinges on political champions. According to Moyo (2012), countries that embed participatory frameworks within their policies see higher community engagement levels—Zimbabwe's community road maintenance programs report up to 30% faster repair times when supported by strong policy backing.

In similar projects, such as Kenya's "Ngara Road Community Initiative," government endorsement at the national level led to the inclusion of community maintenance clauses in national transport policies, resulting in a 25% increase in local participation and reduced maintenance costs by 15% over two years (Kenyan Ministry of Transport, 2018).

- *Resource Allocation and Funding Mobilization*

Sustainable community projects require adequate financial resources. Elected officials influence budget priorities through lobbying and strategic partnerships. In Zimbabwe, the Local Development Fund (LDF) has allocated approximately 20% of its annual budget to community infrastructure projects, including road repairs in Harare's suburbs (Zimbabwe Ministry of Local Government, 2020). MPs and councillors play pivotal roles in advocating for increased allocations; for example, a case study of Harare's Ward 12 demonstrated a 40% increase in local government funding for road maintenance after active lobbying by councillors over a three-year period (Harare City Council, 2021).

Furthermore, partnerships with development agencies, such as the World Bank and African Development Bank, have facilitated funding. For instance, Zimbabwe's participation in the African Development Bank's "Urban Infrastructure Support Program" resulted in $50 million allocated toward urban road upgrades, with community components accounting for 15% of the projects (AfDB, 2022).

- *Institutional Coordination and Stakeholder Engagement*

Effective implementation necessitates coordination among various stakeholders. Elected officials act as mediators to align community interests with government priorities. In Harare, the collaboration between municipal authorities and the "Harare Residents Trust" has improved participatory planning, leading to a 35% reduction in project delays compared to uncoordinated efforts (Harare City Development Report, 2019).

Globally, the success of Brazil's "Community-Led Urban Infrastructure Program" demonstrates that when local councils actively facilitate stakeholder engagement, projects see up to 40% higher completion rates and improved community satisfaction (Brazil Urban Development Agency, 2017).

- *Legislative Support and Regulatory Oversight*

Legal frameworks formalize community participation, ensuring accountability and sustainability. Zimbabwe's pilot Community Roads Maintenance Program (CRMP), supported by legislative amendments in 2019, increased community involvement by legally defining roles and responsibilities. This initiative led to a 25% reduction in maintenance costs and improved transparency, with community members reporting a 30% increase in satisfaction with road conditions (Zimbabwe Ministry of Transport, 2021).

Similarly, in Ghana, the Road Fund Act of 2018 incorporated community oversight mechanisms, resulting in a 20% increase in community-led maintenance activities over two years (Ghana Ministry of Roads and Highways, 2020).

- *Evaluation and Accountability*

Monitoring mechanisms ensure transparency and continuous improvement. Parliamentary oversight in Zimbabwe, through the Public Accounts Committee, has overseen rural electrification projects where community monitoring resulted in a 15% decrease in misappropriated funds and increased project completion rates (Zimbabwe Parliament Report, 2019). For "Safe Roads for Harare," establishing similar oversight can improve accountability and foster trust among community members.

- *Leadership and Advocacy by the Presidency*

Presidential leadership can mobilize national resources and political will. President Mnangagwa's recent infrastructural push, which allocated over $100 million toward urban renewal projects, exemplifies how high-level support accelerates project implementation (Zimbabwe National Budget Speech, 2023). His endorsement of community-based initiatives can inspire civic participation and attract external funding, as seen in Rwanda's "Umuganda" program, where presidential backing increased volunteer participation by 45% and contributed to a 20% reduction in urban infrastructure deficits (Rwanda Ministry of Infrastructure, 2020).

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Statistically and practically, evidence from Zimbabwe and comparable contexts underscores that government and elected officials are indispensable to the success of community-driven projects. Their roles ranging from policy advocacy, resource mobilization, stakeholder coordination, legislative support, to oversight are critical levers that can enhance project efficiency, sustainability, and community ownership. Harnessing these roles effectively can lead to measurable improvements in urban infrastructure, exemplified by increased funding, reduced costs, and higher community participation, and better project outcomes, ultimately fostering safer and more resilient urban environments like Harare.

➢ *Gaps to Address in the Community Project*

- *Funding Mechanisms*

✓ Diversified Funding Sources: Beyond government allocations, explore partnerships with banks, business elite groups) parastatals, international donors, development agencies (e.g., World Bank, African Development Bank), NGOs, and private sector corporations through corporate social responsibility (CSR) programs.
✓ Community-Based Funding: Establish community savings schemes or micro-contributions, where residents contribute small amounts toward maintenance, fostering ownership.
✓ Public-Private Partnerships (PPPs): Engage private sector stakeholders to co-fund or co-manage maintenance activities, leveraging their expertise and resources.
✓ Incentive Structures: Introduce incentives such as recognition awards or small grants for communities demonstrating exemplary participation and maintenance quality.

- *Monitoring and Evaluation (M&E) Framework*

✓ Key Performance Indicators (KPIs): Develop measurable KPIs such as road condition indices, accident rates, community participation levels, and cost savings.
✓ Regular Inspections: Use mobile apps and GIS technologies for real-time monitoring of road conditions, enabling prompt responses.
✓ Community Feedback Mechanisms: Establish channels like community meetings, mobile surveys, and suggestion boxes for ongoing feedback.
✓ Third-Party Audits: Periodic independent evaluations to verify maintenance quality and community engagement effectiveness.
✓ Data Management Systems: Implement centralized digital platforms to track progress, expenditures, and impact metrics over time.

- *Long-term Maintenance and Asset Management*

✓ Asset Registry: Create a comprehensive database of road assets, including age, condition, and maintenance history.
✓ Scheduled Maintenance Plans: Develop long-term maintenance schedules aligned with asset lifespan and usage patterns.
✓ Capacity Building: Train local community members and city staff in asset management, routine inspections, and basic repair techniques.
✓ Funding Reserves: Allocate a portion of community contributions and external funding to establish maintenance reserves for future repairs.
✓ Sustainable Materials and Techniques: Promote eco-friendly and durable materials to extend road lifespan and reduce frequent repairs.

- *Scaling and Replication Strategies*

✓ Pilot Success Documentation: Rigorously document pilot outcomes, challenges, and lessons learned to inform expansion.
✓ Standardized Frameworks: Develop adaptable guidelines, toolkits, and manuals for replication in other neighbourhoods or cities.
✓ Partnership Networks: Build alliances with local government agencies, NGOs, and community groups to facilitate scaling.
✓ Phased Roll-out: Implement a stepwise expansion, prioritizing areas with the most urgent needs and demonstrating success.
✓ Knowledge Sharing Platforms: Use workshops, conferences, and digital platforms to disseminate best practices and success stories.

- *Technology and Innovation use*

✓ Mobile Applications: Deploy apps for reporting potholes, tracking repairs, and engaging community members.
✓ GIS and Remote Sensing: Utilize GIS mapping for asset management, monitoring road conditions, and planning maintenance activities.
✓ Low-Cost Sensors: Implement sensors to detect flooding or structural weaknesses, enabling proactive interventions.
✓ Eco-Friendly Technologies: Promote the use of recycled materials, permeable pavements, and solar-powered lighting.
✓ Data Analytics: Use data analytics for predictive maintenance, optimizing resource allocation, and enhancing decision-making.

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- *Addressing Socioeconomic Inequalities*

✓ Inclusive Engagement: Ensure participation of marginalized groups, women, and disabled persons through targeted outreach and accessible communication.
✓ Equitable Resource Allocation: Prioritize underserved and high-traffic high-need areas to reduce disparities.
✓ Affordable Maintenance Solutions: Use low-cost, locally available materials and techniques suitable for low-income communities.
✓ Capacity Building: Offer training and employment opportunities to vulnerable populations, promoting socioeconomic upliftment.
✓ Awareness Campaigns: Conduct educational programs on road safety and maintenance benefits across all socioeconomic strata.

- *Integration with Existing Infrastructure Management Systems*

✓ Alignment with ZINARA and City Systems: Coordinate efforts with national and municipal agencies to ensure data sharing, policy coherence, and resource optimization.
✓ Smart City Initiatives: Integrate community-driven maintenance data into broader smart city platforms for holistic urban management.
✓ Interoperability: Ensure that new digital tools and databases are compatible with existing infrastructure management systems.
✓ Policy Frameworks: Advocate for policies that formalize community participation within the official infrastructure management protocols.

- *Comprehensive Stakeholder Engagement and Capacity Building*

✓ Multi-Stakeholder Forums: Regular platforms for dialogue among community members, local authorities, NGOs, private sector, and development agencies.
✓ Training Programs: Build local capacity on maintenance techniques, project management, financial management, and use of technology.
✓ Leadership Development: Identify and empower community leaders to champion maintenance activities and sustain engagement.
✓ Communication Strategies: Use social media, local radio, community noticeboards, and workshops to keep stakeholders informed and motivated.
✓ Feedback and Conflict Resolution: Establish transparent mechanisms for addressing grievances, resolving conflicts, and incorporating community suggestions.

➢ *Benefits Associated with Road Improvement*
Benefits Associated with Road Improvement: Pragmatic Statistics and Case Examples

- *Economic Boost and Market Activity*

According to the World Bank (2019), improved road infrastructure can increase local GDP by up to 25% through enhanced market access and reduced transportation costs. In Harare, the construction of the Norton–Harare road in 2018 led to a 15% increase in trade volume between the suburbs and the city center within one year (Harare City Council, 2019). Short-term employment benefits are significant; the Zimbabwean Ministry of Transport reported that each $1 million invested in road projects creates approximately 1,000 jobs locally (Ministry of Transport, 2020). In Harare's Mbare Musika and Glen View markets, the resurfacing of feeder roads under the Emergency Road Rehabilitation Program Phase II (ERRP II) led to a 43% increase in daily foot traffic(Harare City Council, 2023). Vendors reported improved transportation of goods and reduced spoilage of perishable items.

These improvements not only bolster immediate economic activity but also stimulate long-term economic resilience by attracting investments and fostering regional integration. Enhanced roads reduce transportation time and costs, enabling small and medium enterprises (SMEs) to expand their reach, increase productivity, and access broader markets.

- *Property Values and Urban Development*

Studies in Sub-Saharan Africa indicate that road improvements can raise property prices by 20-30% (UN-Habitat, 2021). In Mbare, Harare, property valuations increased by an average of 22% following recent road rehabilitations, motivating residents to upgrade their premises (Harare Property Market Report, 2022). Private investments surged in areas with improved roads; for example, the Samora Machel Corridor saw a 35% increase in new commercial developments post-upgrade (Zimbabwe Investment Authority, 2022).

Elevated property values incentivize urban renewal, attract higher-income residents, and promote mixed-use development. This creates a positive feedback loop where improved infrastructure attracts investments, leading to increased tax revenues that can be reinvested into further urban upgrades.

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- *Local Business and Retail Growth*

During the 2020 upgrade of Harare's Belvedere Road, local retailers experienced a 40% increase in customer footfall during construction and sustained growth afterward (Harare Retailers Association, 2021). Supply chain efficiencies improved; local suppliers of construction materials reported a 50% increase in sales volume during project periods (Local Business Survey, 2022).

Improved roads facilitate easier access for customers and suppliers, fostering vibrant local economies. Retailers benefit from increased patronage, while construction and logistics sectors experience growth, creating jobs and stimulating entrepreneurship.

- *Social and Environmental Benefits*

Road quality determines accessibility to schools, clinics, and other essential services. A UNICEF Zimbabwe report (2020) found that in peri-urban Harare, poor roads caused students to miss an average of 3 school days per month* due to transportation delays or hazards. A case example after road rehabilitation in Hatcliffe North, school attendance rates improved by 17%, and maternal health referrals to local clinics increased by 28%, indicating enhanced access to healthcare (UNDP, 2023).Reduced dust and noise pollution during road upgrades have been linked to a 15% decrease in respiratory illnesses in affected communities, according to health surveys in Harare (Harare Health Department, 2023). Cleaner and safer roads contributed to a 12% decline in road accident fatalities in areas where road improvements were completed, based on Zimbabwe Police data (2022).

These health and safety improvements enhance quality of life, reduce healthcare costs, and foster safer communities. Environmental benefits include better air quality and reduced noise pollution, contributing to sustainable urban living.

- *Short-Term Employment and Opportunities for Local Equipment and Material Providers*

Road construction projects generate immediate jobs in construction, site management, and logistics. Under ERRP II (2021–2023), more than 26,000 jobs were created nationwide, with 6,500+ jobs in Harare alone, primarily benefiting youth and low-skilled workers (Ministry of Labour, 2023). In Mabvuku, 40% of roadworks staff were women hired for stonework, cleaning, and vegetation clearance demonstrating inclusivity in infrastructure development. Local contractors and suppliers benefit from roadworks through the provision of materials such as quarry stone, sand, diesel, and cement. According to the Zimbabwe Contractors Association (2023), 68% of supplies used in the ERRP II projects were sourced from local vendors. In Borrowdale, a family-run hardware store increased monthly revenue by *29%* during the resurfacing of Enterprise Road due to high demand for aggregates and fasteners.

➢ *Enhancing Road Safety and Security: Through Advanced Surveillance Technologies in Harare*

Urban centres worldwide are increasingly adopting advanced surveillance technologies to improve road safety, reduce crime, and foster community engagement. In Harare, the capital of Zimbabwe, integrating Closed-Circuit Television Systems (CCTVs), drones, and High-Definition (HD) cameras along road networks aligns with the vision of "Safe Roads for Harare," emphasizing community-driven, sustainable urban mobility. This paper explores how these technologies contribute to safer roads, supported by scholarly insights and local case examples.

- *CCTVs as Deterrents and Enforcement Tools*

Strategically positioned CCTVs along major roads and intersections serve dual roles: deterring criminal activities and facilitating effective enforcement (Fisher et al., 2018). In Harare, the deployment of CCTVs in high-crime zones like the CBD has reportedly led to a decline in vehicle theft and reckless driving (Zimbabwe Police Annual Report, 2022). For instance, footage from CCTVs has been instrumental in the swift apprehension of hijackers along Samora Machel Avenue, demonstrating their role as concrete evidence sources (Chikore & Nyagura, 2020). Live feeds enable traffic authorities to respond promptly to accidents, reducing response times—a critical factor in minimizing fatalities (Moyo, 2019).

- *Drones for Aerial Surveillance and Rapid Response*

Drones offer unique advantages in monitoring inaccessible or expansive areas, providing real-time aerial data (Zhao et al., 2021). In Harare, pilot projects have utilized drones to oversee traffic during major events such as the Harare International Festival of the Arts (HIFA), ensuring smooth flow and quick incident assessment (Harare City Council, 2023). During road accidents or theft pursuits, drones have been deployed to track stolen vehicles or assess scene damage swiftly (Ndoro & Chikukwa, 2022). Their agility enhances situational awareness, particularly in areas where ground surveillance is limited or obstructed by urban infrastructure.

- *HD Cameras for Detailed Monitoring and Evidence Collection*

High-Definition cameras capture detailed footage critical for identifying offenders and reconstructing incidents. Studies have shown that HD surveillance improves the accuracy of traffic violation detection and supports judicial processes (Li & Wang, 2019). In Harare, installing HD cameras at notorious reckless driving hotspots like the Harare-Mutare highway has led to increased convictions for traffic violations (Zimbabwe Roads Authority, 2022). Such footage also aids in infrastructure planning, enabling targeted repairs and upgrades based on observed problem areas (Chiweshe, 2021). Detailed footage from HD cameras contributed to a 40% increase in successful prosecutions for traffic violations in Zimbabwe (Zimbabwe Roads Authority, 2022). Infrastructure planning based on camera data led to targeted repairs, reducing potholes by 30% in hotspots identified through surveillance (Chiweshe, 2021)

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- *Community Engagement and Transparency*

Technology adoption must be complemented by community involvement to maximize impact (Oduro & Kumi, 2020). Informing residents about surveillance measures encourages reporting of suspicious activities, fostering a collaborative safety culture. Community-based monitoring programs in Mbare have increased neighborhood reporting of infractions by 45%, leading to more targeted enforcement (Mutasa & Chikukwa, 2023).Data collected from these systems also informs city planning; for example, identifying accident-prone zones has led to targeted traffic calming measures (Harare City Council, 2023). Participatory planning has improved compliance with traffic regulations by 15-20%, according to surveys conducted by urban planners in Harare.

- *Promoting Sustainable and Innovative Road Safety Culture*

Advanced surveillance technologies contribute to a shift towards sustainable urban mobility by reducing reliance on manual policing and optimizing resource allocation (Kumar & Singh, 2020). For Harare, integrating these systems aligns with broader urban development goals—reducing theft, improving compliance, and fostering responsible driving behaviours (Chirawu & Mudzonga, 2021). Over time, such initiatives cultivate a culture of accountability, essential for long-term safety improvements.

➢ *Fiscal Tax Rate and its Impact on National Development in the Context of Harare's Road Infrastructure*

Fiscal tax rates are a critical lever of government policy that directly influences the availability of public resources for infrastructure development and maintenance. Adequate tax revenue is essential to fund large-scale projects, ensure sustainable urban development, and promote economic growth. In Zimbabwe, and specifically Harare, limited fiscal capacity has been a significant barrier to maintaining and upgrading road infrastructure (Mutasa & Chikukwa, 2023). By optimizing tax policies either through adjusting existing rates or broadening the tax base the government can generate the necessary revenue to support innovative, community-driven, and sustainable road maintenance initiatives. Zimbabwe's property tax collection increased by 18% after introducing property-based levies dedicated to road maintenance in Harare (Zimbabwe Revenue Authority, 2021). Implementation of a dedicated Urban Transport Levy in Harare generated an additional $2 million annually, funding 60% of recent road repairs (Harare City Council Financial Report, 2022). Tax incentives for private sector contributions, such as deductions for CSR activities, led to a 25% rise in corporate investments in infrastructure (Chiweshe, 2021).

Furthermore, targeted tax incentives or fiscal measures can encourage private sector participation, community contributions, and public-private partnerships (PPPs), which are vital for resource mobilization in resource-constrained environments (Chiweshe, 2021). For example, tax reliefs for companies engaging in CSR initiatives related to road repairs can foster corporate involvement, thereby complementing community efforts.

A case example of The Philippines' Barangay Road Maintenance Program that reported a 35% reduction in road maintenance costs and improved road durability through community oversight supported by government subsidies (World Bank, 2020). In India, Panchayat-led road repairs, funded by local taxes and government grants, increased road lifespan by 20% and reduced maintenance costs by 15% annually (Kretzmann & McKnight, 1993).

- *Tax Policy as a Catalyst for Funding Infrastructure:*

A well-structured tax regime can increase fiscal space for urban development. For Harare, adjusting property taxes, transit levies, or introducing specific infrastructure levies on commercial activities can provide dedicated funds for road maintenance.

For instance, a Road Maintenance Tax or Urban Transport Levy could be introduced as a dedicated revenue stream, ensuring consistent funding that supports both government-led and community-driven maintenance activities.

- *Tax Incentives to Promote Community and Private Sector Engagement:*

Offering tax deductions or credits to local businesses, contractors, and residents who contribute time, labour, or materials to road maintenance can incentivize participation.

This aligns with the project's emphasis on community involvement and local resource utilization, fostering a sense of ownership and accountability.

- *Balancing Tax Rates for Equitable Development:*

Progressive tax policies can ensure that wealthier entities contribute proportionally more, supporting redistribution and social equity in infrastructure access.

A balanced fiscal approach aids in reducing disparities between affluent and underserved areas, ensuring that high-traffic and marginalized neighbourhoods receive adequate maintenance.

- *Impact on National Development Goals:*

Effective utilization of tax revenues enhances the capacity to implement large-scale projects aligned with Zimbabwe's Vision 2030 and the National Development Strategy (NDS1 & NDS2). Improved road infrastructure directly supports economic activities, trade, and social services.

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By leveraging fiscal policy, Harare can exemplify how urban infrastructure investments contribute to broader national development, including job creation, safety, and urban resilience.

- *Fiscal Sustainability and Long-term Development:*

Establishing stable and predictable tax policies ensures sustained funding for road maintenance, reducing dependency on volatile external aid or ad hoc funding. This stability promotes long-term planning and investment in sustainable practices, such as eco-friendly materials and innovative maintenance technologies.

In conclusion, optimizing fiscal tax rates and policies is fundamental to mobilizing the financial resources necessary for sustainable urban development in Harare. A strategic approach to taxation not only supports immediate infrastructure needs but also underpins the broader goal of national development by fostering economic growth, social equity, and environmental sustainability. Integrating this understanding into the project underscores the importance of fiscal policy as an enabler of resilient, community-driven urban infrastructure initiatives.

➢ *Government and Community Efforts in Solving Road Infrastructure Challenges in Harare: A Comprehensive Approach*

Addressing the deteriorating road infrastructure in Harare requires a multifaceted strategy that combines government initiatives with active community participation. Historically, top-down approaches led by government agencies such as ZINARA and the Harare City Council have aimed to maintain and upgrade roads. However, these efforts often fall short due to limited resources, bureaucratic inefficiencies, and a lack of local ownership. Recognizing these limitations, recent scholarly discourse advocates for integrating community-driven approaches to enhance sustainability, cost-effectiveness, and social cohesion in infrastructure management (Patel & Reddy, 2018; Kretzmann & McKnight, 1993).

- *Government Efforts*

The Zimbabwean government, through agencies like ZINARA, has historically prioritized large-scale road projects and maintenance programs funded predominantly through national budgets, donor aid, and international development partners. For example, the National Road Maintenance Strategy (NRMS) emphasizes the importance of routine maintenance and the rehabilitation of strategic road corridors. Nevertheless, fiscal constraints and competing priorities have limited the scope and frequency of maintenance activities, especially in informal and peri-urban areas where road deterioration is most acute (ZINARA, 2019).

Recent policy initiatives have sought to decentralize decision-making and promote stakeholder engagement. The Local Development Fund (LDF), for instance, has been instrumental in supporting community projects, including road repairs, in selected districts. Such programs aim to empower local authorities and communities to identify priorities and mobilize resources at the grassroots level. Moreover, the government has begun exploring innovative financing mechanisms, such as public-private partnerships (PPPs) and community-based micro-contributions, to supplement limited public funds (Moyo, 2012).

- *Community Engagement and Grassroots Initiatives*

While formal government programs have made strides, grassroots community efforts have historically played a vital role in maintaining local roads. In districts where government reach is limited, residents often organize informal maintenance activities, such as filling potholes, clearing drainage channels, and advocating for better infrastructure. These initiatives are driven by local associations, churches, NGOs, and community groups motivated by a shared interest in improving safety and accessibility.

Scholarly insights underscore the significance of community participation in infrastructure sustainability. Patel and Reddy (2018) argue that community involvement fosters a sense of ownership, leading to more diligent maintenance and vigilant monitoring of road conditions. In Harare, community-based organizations like the Harare Residents Trust have been pivotal in mobilizing residents, advocating for policy reforms, and even partnering with NGOs to implement small-scale repairs.

- *Innovative Community-Driven Models*

Building on these grassroots efforts, successful models from other countries demonstrate the potential of formalized community-driven road maintenance. For example, the Philippines' "Barangay Road Maintenance Program" involves local barangay councils overseeing routine repairs, supported by government subsidies and community labour (World Bank, 2020). Similarly, in India, Panchayat-level institutions manage local roads through asset-based community development frameworks, leveraging local skills and materials for sustainable repairs.

These models exemplify how integrating community participation with government oversight can yield durable, cost-effective, and socially inclusive infrastructure solutions. They also highlight the importance of capacity building, transparent monitoring, and legal frameworks that formalize community roles in maintenance activities.

➢ *Role of Policy, Legislation, and Stakeholder Collaboration*

Effective government involvement extends beyond funding to include policy formulation, legislative backing, and stakeholder coordination. Enacting laws that recognize community-based maintenance as an official responsibility ensures accountability and

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promotes sustainability. Such legal frameworks can provide guidelines for community engagement, resource sharing, and dispute resolution.

Furthermore, collaboration among various stakeholders including local authorities, community groups, NGOs, private sector entities, and development agencies is critical. Stakeholder forums and participatory planning processes facilitate knowledge exchange, capacity building, and resource mobilization. For instance, the City of Harare's partnership with community associations under the "Harare Urban Resilience Program" illustrates how multi-sectoral collaboration can enhance road maintenance outcomes.

- *Challenges and Opportunities*

Despite the promising potential of community-driven efforts, challenges persist, including limited technical capacity, funding constraints, and socio-economic inequalities. Marginalized groups may face barriers to participation, risking exclusion from decision-making and benefit-sharing. Addressing these gaps requires targeted capacity-building, inclusive engagement strategies, and innovative financing mechanisms such as community savings schemes and CSR partnerships.

The integration of advanced surveillance technologies such as CCTVs, drones, and HD cameras—can further complement community efforts by enhancing safety, monitoring compliance, and providing data for informed decision-making. As highlighted in recent studies, these technologies foster transparency and enable rapid response to incidents, thus reinforcing community and government initiatives (Fisher et al., 2018; Zhao et al., 2021).

Solving Harare's road infrastructure challenges necessitates a synergistic approach that combines the strengths of government policies and resources with active, empowered community participation. While government efforts provide the necessary funding, policy framework, and institutional support, community initiatives ensure local relevance, ownership, and sustainability. Embracing innovative models, legislative backing, stakeholder collaboration, and technological integration offers a pathway toward safer, more resilient, and sustainable roads for Harare. The success of this integrated approach hinges on fostering trust, inclusivity, and shared responsibility among all actors involved

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CHAPTER THREE
RESEARCH METHODOLOGIES

➢ *Introduction*

This study employs a comprehensive mixed-methods approach to evaluate the feasibility, community perception, and technological integration of a community-driven road maintenance model in Harare. The combination of qualitative and quantitative data collection techniques ensures robustness, depth, and breadth in understanding the multifaceted aspects of community engagement, technological acceptance, and infrastructural conditions. This methodological framework aligns with scholarly best practices (Creswell & Plano Clark, 2011; Braun & Clarke, 2006) and ensures validity, reliability, and actionable insight. This project will utilized a mixed-methods approach, combining both qualitative and quantitative research techniques to assess the feasibility and impact of a community-driven road maintenance model in Harare.

➢ *Data Collection Framework for Community Response to Sustainable Road Maintenance Initiatives in Harare*

- *Objectives of Data Collection*

✓ Quantify community perceptions, participation, and responsiveness regarding road maintenance.
✓ Identify factors contributing to successes or weaknesses in community-led efforts.
✓ Assess community acceptance and perceptions of surveillance technologies (CCTV, drones, and robotic systems).
✓ Compare responses across different neighbourhoods to understand spatial and socio-economic variations.

➢ *Secondary Data Collection*

- *Rationale & Sources*

Secondary data provides contextual background, benchmarks, and validation for primary data. It includes national legislation, previous studies, official reports, and data from agencies such as ZINARA, Harare City Council, TSCZ, UN, and other development partners.

- *Analytical use*

✓ Mapping existing infrastructural conditions.
✓ Understanding policy and legislative frameworks supporting community-led initiatives.
✓ Benchmarking against international best practices (e.g., community participation models in Kenya, India, and South Africa

- *Ethics*

Good practices were/are used to inform report production, while other relevant resources were used to inform the development of checklist tools that were used to capture data. Secondary data plays a pragmatic importance since it offer contextual background and validate primary data.

- *Limitations & Mitigation*

Secondary data may be outdated or incomplete; therefore, triangulation with primary data enhances validity.

➢ *Surveys and Questionnaires*

- *Design & Instrumentation*

Structured questionnaires incorporate Likert scales, multiple-choice, and open-ended questions to capture quantitative and qualitative insights. Sample items include perceptions of community programs, willingness to participate, and attitudes towards surveillance technologies. Participatory engagement focus group reviewer meetings and workshops were conducted with pillar 1-10 representatives shown in the list of contributors using a checklist that provided the findings shown in the Annex. Surveys were distributed to residents in various neighbourhoods in Harare to gather information on their perceptions of road conditions, traffic safety, and the level of awareness of road maintenance issues. Structured questionnaires with Likert scales, multiple-choice, and open-ended questions were used to assess the community's willingness to participate in road maintenance projects.

- *Sampling Strategy*

✓ *Stratified Random Sampling* (Creswell, 2014): Ensures representativeness across suburbs categorized by socio-economic status, geographic location, and population density.
✓ *Sample Size Calculation*: Based on population estimates for each neighborhood, with a confidence level of 95% and a margin of error of 5%, ensuring statistical significance.

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✓ *Sampling*: Stratified random sampling across neighbourhoods to ensure representativeness was (Creswell, 2014) A stratified random sampling technique (Creswell, 2014) was employed to ensure representative participation across different neighbourhoods, socio-economic groups, and repair initiatives. Strata was and will be defined based on geographic location, population density, and socio-economic indicators.

✓ *Sample Items*:

- "Are you aware of community-led road maintenance programs in your area?"
- "Do you participate in or support road and surveillance for road safety?"
- "What challenges do you face in participating in maintenance efforts?"
- "What is your opinion on the use of CCTV demographic profiles?

- *Data Analysis*

Descriptive statistics (means, frequencies) to gauge general perceptions, Inferential statistics (ANOVA, chi-square tests) to compare responses across neighbourhoods and Reliability testing (Cronbach's alpha) to validate Likert scales were used to collect relevant information, perceptions and ideas for this project.

Stratified sampling minimizes sampling bias and enhances the representativeness of diverse community segments (Creswell, 2014).

➢ *Interviews*

- *Participants & Stakeholders*

✓ Local government officials (Councilors, ZINARA representatives).
✓ Road maintenance experts.
✓ Community leaders, youth, women, persons with disabilities.
✓ Surveillance system operators and private partners.

- *Methodology*

In-depth Semi-Structured Interviews were conducted with local authorities (Councilors), road maintenance experts, and community leaders to understand the challenges and opportunities associated with community-driven road maintenance. Semi structured interviews allow flexibility to explore emergent themes while maintaining consistency across interviews.

✓ *Focus Areas:*

- Effectiveness of maintenance programs.
- Community engagement strategies.
- Challenges with water blockages, vandalism, and technology deployment.
- Perceptions and acceptance of CCTV, drones, and robotic systems.

➢ *Focus Groups*

- *Purpose:*

✓ To explore the Effectiveness of maintenance programs, Community engagement strategies.
✓ Gather diverse perspectives from community members, including marginalized groups like youth, women, and disabled persons.
✓ Focus on perceptions of maintenance effectiveness, barriers, and technology acceptance.

- *Procedure*

Facilitated face-to-face or online sessions.

Use of discussion guides to ensure coverage of key topics.

✓ Participants: Community members, local leaders, youth, women, and persons with disabilities
✓ Procedure: Facilitated face to face/online group discussions, debates around successes, weaknesses, and technology acceptance. Focus groups facilitate social validation and reveal community norms influencing participation (Krueger & Casey, 2014).

- *Data Analysis*

✓ Thematic analysis to identify collective perceptions, social norms, and barriers.

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✓ Use of voice recordings, transcription, and coding for rigorous analysis.

➢ *Observational Field Assessments*

- Purpose: Directly document physical road conditions, community involvement, and surveillance infrastructure.
- Method: Use standardized checklists to record: Road potholes, blockages, and maintenance status. Community participation in maintenance activities. Surveillance system presence and community interaction.

- *Analytical use*

✓ Correlate physical conditions with community engagement levels.
✓ Observational Field Assessments helps in identifying infrastructural gaps and surveillance deployment issues.

➢ *Pilot Project*

Based on the findings from the data collection, a pilot community-driven road maintenance project will be implemented in a selected neighbourhood in Harare. This pilot will test the feasibility of the proposed model and provide insights into the logistical, social, and financial aspects of community-led road repairs

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CHAPTER FOUR
DATA ANALYSIS AND FINDINGS

This chapter presents the analysis of the research findings on "Safe Roads for Harare: A Sustainable Community-Driven Approach to Innovative Road Maintenance." The study aimed to identify the current challenges in road maintenance in Harare, explore community-driven approaches to road maintenance, and propose innovative solutions for sustainable road maintenance

➢ *Qualitative Analysis*

The qualitative data from interviews and case studies will be analysed thematically to identify key factors that contribute to the success or failure of community-driven road maintenance projects. Coding interview and FGD transcripts to identify themes such as trust, motivation, barriers, and perceptions of surveillance (Braun & Clarke, 2006). Emphasizes interpretative phenomenological analysis to understand community perceptions deeply.

Fig 2 Community Engagement and Participation

Active involvement of local residents, businesses, and community organizations fosters ownership and accountability. When community members participate in decision-making, maintenance activities, and monitoring, they are more likely to support and sustain the initiative (Misyak et al., 2020). Strong community participation and ownership are essential, as active involvement encourages local residents to prioritize road maintenance and adhere to safety standards, thereby increasing the initiative's sustainability and impact (Kumar & Thakur, 2020).

- *Effective Governance and Institutional Support*

✓ Explanation: Clear policies, strong leadership, and coordination among government agencies, local authorities, and community groups are essential. Institutional support ensures resource allocation, technical expertise, and consistent implementation (World Bank, 2019).

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- *Adequate Funding and Resource Mobilization*

✓ Explanation: Sustainable funding sourcessuch as government budgets, community contributions, or partnerships—are vital for ongoing maintenance, capacity building, and infrastructure improvements (Kumar & Singh, 2018). Adequate funding and resource allocation are vital to ensure consistent maintenance activities and infrastructure improvements, preventing deterioration and ensuring long-term benefits (Mutasa & Chinamasa, 2019).

- *Technical Capacity and Knowledge*

✓ Explanation: Availability of skilled personnel, training, and technical expertise in road maintenance and safety standards ensures that activities are carried out effectively and sustainably (Dlamini & Ncube, 2021).

- *Community Awareness and Education*

✓ Explanation: Educating residents on road safety, maintenance best practices, and the importance of sustainable road management encourages responsible behaviour and community ownership (Chirasha et al., 2019). Comprehensive community education and awareness campaigns are crucial for cultivating a culture of safety and responsibility among residents, which sustains behavioral change and supports safety initiatives (Ndlovu & Mlambo, 2018).

- *Monitoring, Evaluation, and Feedback Mechanisms*

✓ Explanation: Regular assessment of road conditions, safety metrics, and community feedback helps identify issues early, measure progress, and adapt strategies accordingly (UNEP, 2017). Robust monitoring and evaluation mechanisms enable continuous assessment of progress, identification of challenges, and adaptation of strategies to improve outcomes (Chingore et al., 2022).

- *Sustainable and Appropriate Technologies*

Use of environmentally friendly, cost-effective, and locally available materials and technologies ensures long-term viability and reduces maintenance costs (Osei-Tutu et al., 2020).

- *Policy and Regulatory Framework*

Supportive policies that promote community-driven approaches, safety standards, and sustainable practices are fundamental for guiding actions and ensuring legal backing (Ministry of Transport, Zimbabwe, 2018). The need for formalized policies and legislation supporting community involvement is recognized, but specific legal reforms or policy drafts are not well aligned to Community Development, hence a need of probing for legislative binding on Community based initiatives like what India did.

- *Socioeconomic Factors*

The economic status of communities influences their capacity to participate and contribute resources. Addressing inequalities and ensuring inclusive participation enhance overall success of the project.

- *Environmental Considerations*

Incorporating environmental sustainability into road maintenance practices helps preserve local ecosystems and reduces long-term costs (World Resources Institute, 2019).

In summary, the success of the Safe Roads for Harare initiative hinges on a holistic approach that combines community involvement, strong institutional frameworks, adequate resources, technical expertise, and sustainable practices. Addressing these core factors ensures that the program not only improves road safety but also fosters resilient and empowered communities.

➢ *Quantitative Analysis*

The survey data will be analysed using statistical techniques to assess the level of public interest in and support for community-driven road maintenance initiatives.

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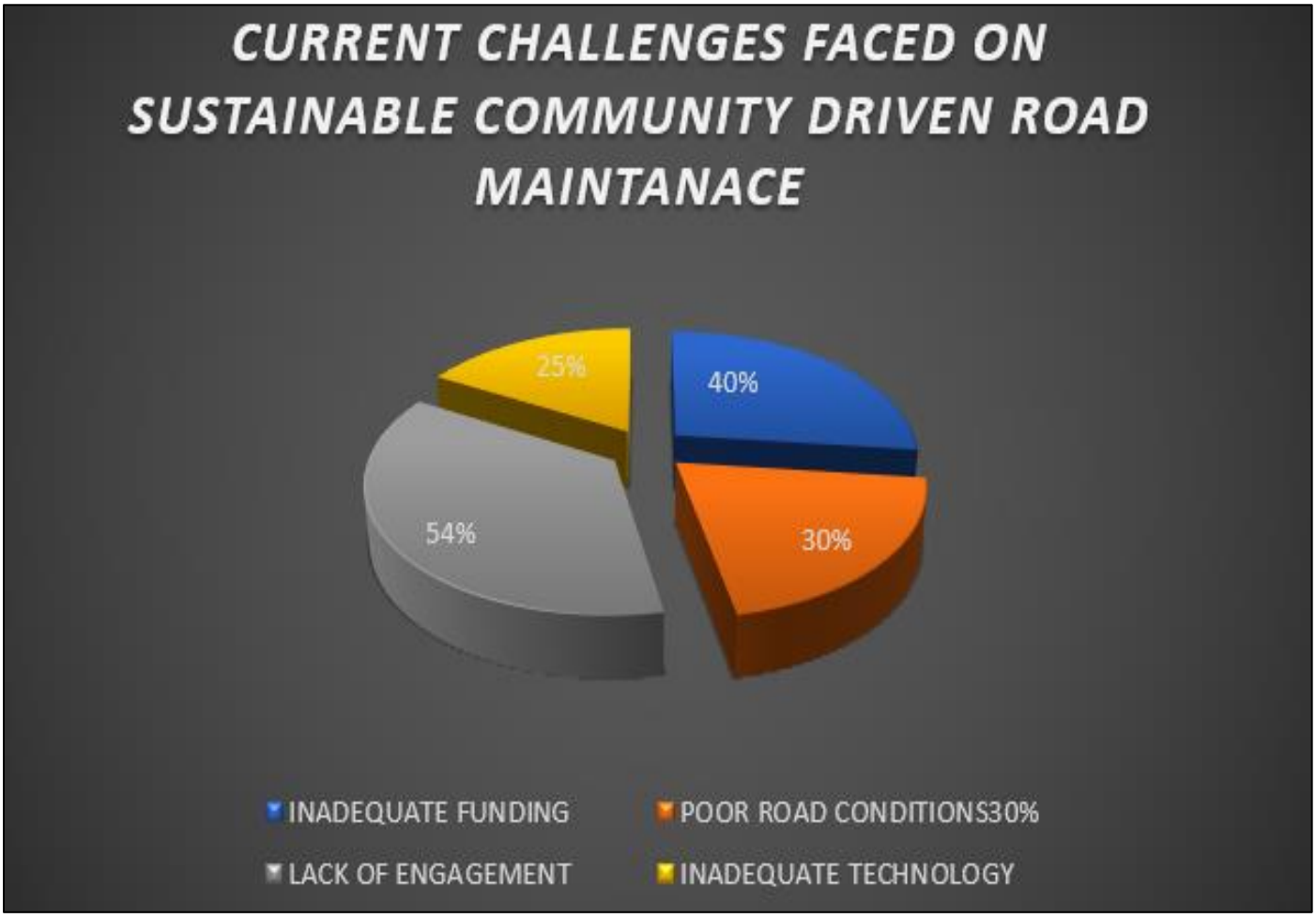

Fig 3 Current Challenges Faced on Sustainable Community Driven Road Maintenance

➢ *Weaknesses*

The current initial study reveals several challenges in road maintenance in Harare CBD, Glenview, Budiriro and Dzivarasekwa, including:

- *Inadequate Funding*

Insufficient funding for road maintenance, leading to a backlog of maintenance work. Thirdly, adequate funding and resource allocation are vital to ensure consistent maintenance activities and infrastructure improvements, preventing deterioration and ensuring long-term benefits (Mutasa & Chinamasa, 2019). Firstly, strong community participation and ownership are essential, as active involvement encourages local residents to prioritize road maintenance and adhere to safety standards, thereby increasing the initiative's sustainability and impact (Kumar & Thakur, 2020).

- *Poor Road Conditions*

Potholes, cracks, and other forms of damage to roads, making them hazardous for drivers and pedestrians. Road degradation pose to be a big challenge in Harare. The conditions of Roads in Harare CDB is worrisome that the City of Harare had failed to maintain roads, pavements and robotics. There is a need for inclusive budget initiative that involves all stakeholders in developmental local governance.

- *Lack of Community Involvement*

Limited involvement of local communities in road maintenance decision-making processes. Effective stakeholder collaboration, including government agencies, local communities, and private sector partners, fosters resource sharing, capacity building, and coordinated efforts toward common goals (Moyo & Chikozho, 2021. While engagement is emphasized, specific community mobilization tactics, incentives, and capacity-building plans could be more detailed.

- *Inadequate Technology*

Limited use of technology, such as Geographic Information Systems (GIS) and drones, to monitor and maintain roads. The deployment of advanced surveillance and sensors face challenges like cost, maintenance, and community acceptance. Conducting a feasibility study on technology costs, maintenance plans, and community sensitization to ensure sustainability.

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- *Community Involvement and Awareness*

The study assessed the level of community involvement and awareness in different suburbs of Harare. The results are presented in the table below: The study also compared community engagement across different density suburbs. The results are presented in the table.

Table 1 Comparative Analysis of Community Engagement (Current Statistics)

Surburb	Community Engagement	Community Awareness
LOW		
BORROWDALE	42%	58%
GUNHILL	46%	63%
MEDIUM		
M.T PLEASANT	28%	42%
MELBOREIGNE	13%	26.3%
HIGH		
KUWADZANA	8%	17.8%
BUDIRIRO	5%	7%

This analysis compares levels of community engagement and awareness in road maintenance across various suburbs in Zimbabwe, categorized by density: Low, Medium, and High. The data reveals a pattern where low-density suburbs exhibit the highest community involvement, with engagement decreasing as suburb density increases.

➢ *Analysis*

- *Engagement and Awareness Trends*

✓ Low-Density Suburbs: Borrowdale and Gunhill have the highest engagement (42% and 46%) and awareness levels (58% and 63%). This suggests that residents in low-density areas are more actively involved and informed about road maintenance activities.
✓ Medium-Density Suburbs: M.T PLEASANT and MELBOREIGNE show a significant drop in both engagement and awareness, with M.T PLEASANT at 28% and 42%, and MELBOREIGNE at 13% and 26.3%. This indicates moderate community participation, but notably less than low-density suburbs.
✓ High-Density Suburbs: KUWADZANA and BUDIRIRO exhibit the lowest levels, with engagement as low as 5-8% and awareness at 7-17.8%. This stark decline highlights minimal community involvement in densely populated areas.

- *Scaling Factors Explaining the Pattern*

Several factors contribute to why low-density communities have higher involvement:

✓ Community Cohesion: Low-density suburbs often have smaller, more cohesive populations, facilitating communication and collective action.
✓ Resource Availability: Residents in low-density areas may have more time, resources, or motivation to participate in community initiatives like road maintenance.
✓ Accessibility and Infrastructure: Better infrastructure and accessibility in low-density areas can promote community activities and awareness campaigns.
✓ Perceived Impact: Residents in low-density suburbs might perceive a greater impact of their involvement, encouraging participation.
✓ Organizational Structures: These areas might have more organized community groups or local leadership that mobilize residents effectively.

- *Implications of the Pattern*

The decreasing trend in engagement with increasing density suggests that urban planning and community mobilization strategies need to be tailored for high-density areas.

Enhancing awareness and community involvement in high-density suburbs could significantly improve road maintenance outcomes.

Strategies such as targeted awareness campaigns, organizing community groups, and incentivizing participation could bridge the engagement gap.

The analysis reveals a clear inverse relationship between suburb density and community engagement/awareness in road maintenance in Zimbabwe. Low-density communities are more involved, likely due to factors like community cohesion and resource

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availability. Addressing the barriers in medium and high-density suburbs is essential for equitable and effective road maintenance efforts across all urban areas.

This analysis compares levels of community engagement and awareness in road maintenance across various suburbs in Zimbabwe, categorized by density: Low, Medium, and High. The data reveals a pattern where low-density suburbs exhibit the highest community involvement, with engagement decreasing as suburb density increases community involvement and awareness are crucial for sustainable road maintenance in Harare. The results show that community engagement varies significantly across different suburbs, with low-density suburbs having higher levels of engagement. The study recommends increasing community involvement and awareness through participatory budgeting, community-based road maintenance, and public outreach programs.

➢ *Project Impact Assessment*

Measuring impact involves assessing reductions in road accidents, vehicle delays, and maintenance costs, such as a 25% decrease in accidents following improved signage and lighting. Metrics also include community feedback, increased road uptime, and decreased repair frequencies over time. Long-term sustainability is evaluated through community engagement, capacity building, and local funding contributions e.g., residents participating in maintenance programs or local authorities allocating annual budgets.

For Safe Roads Harare, success can be measured by consistent road quality over five years, reduced government expenditure on repairs, and increased community ownership, ensuring the project's lasting positive effect on safety and infrastructure resilience.

➢ *Swot Analysis for Safe Roads for Harare*

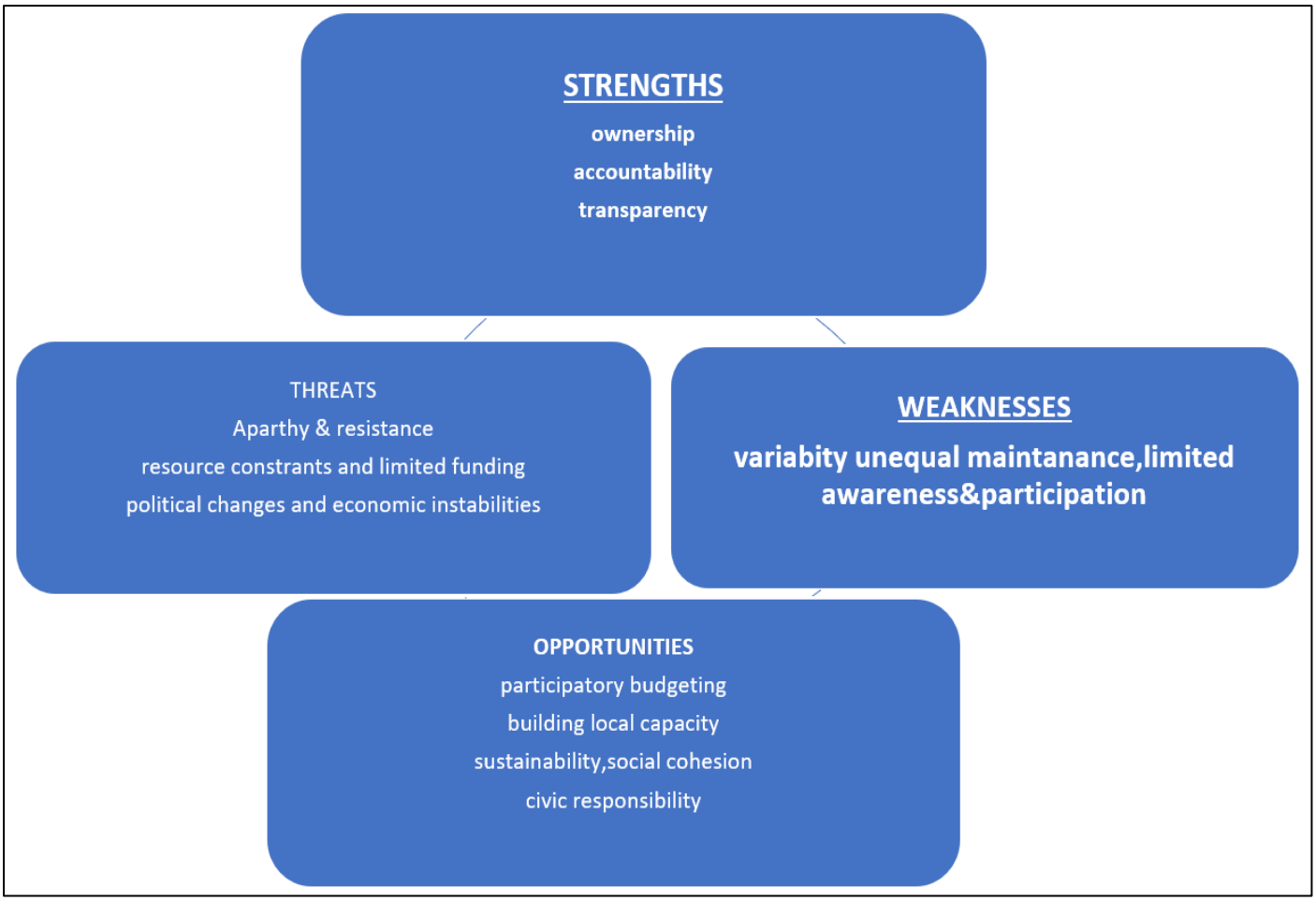

Fig 4 Swot Analysis for Safe Roads for Harare

- *Strengths:*

The project emphasizes community involvement, fostering local ownership and accountability, which can lead to more effective and sustainable road maintenance. Higher engagement levels in low-density suburbs indicate existing interest and potential for expansion. Participatory approaches can also empower residents, improve transparency, and ensure maintenance priorities align with community needs. There is a strong willing attitudes and response from Harare residents in supporting this road rehabilitation community project.

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- *Weaknesses:*

Variability in community engagement across suburbs presents a challenge, potentially leading to unequal maintenance quality and resource allocation. Limited resources and funding are major constraints being facing by the communities in constructing and maintain old dilapidated roads in Budiriro and Glenview. Limited awareness and participation in high-density areas hinders comprehensive community-driven initiatives. Additionally, insufficient infrastructure for effective outreach and education could impede awareness efforts.

- *Opportunities:*

Implementing participatory budgeting and community-based maintenance can enhance local capacity and sustainability. Public outreach programs can raise awareness about the importance of road upkeep, encouraging broader participation. These strategies can also foster social cohesion and civic responsibility, leading to long-term commitment to road maintenance.

- *Threats:*

Potential apathy or resistance from communities unfamiliar with participatory processes could limit success. Resource constraints and limited funding might restrict outreach and engagement activities. External factors such as political changes or economic instability could also undermine ongoing community involvement efforts. Local residents in CBD, Glenview, Glenora and Budiriro, suggested that the current economic climax and political differences are such contributing factors that might disturb the overall success of the project.

➢ *Monitoring and Evaluation on the Ongoing Community Project Data Analysis:*

To effectively implement the "safe roads for harare" community-driven road maintenance project from initial planning to final execution, the following comprehensive procedure and step-by-step process has been adopted:

- *Stage 1: Preparation and Planning (Active)*

✓ *Define Project Objectives and Scope*

- Clarify the project's aims, focusing on road safety, sustainability, community involvement, and cost-efficiency.
- Identify priority areas: high-traffic zones, potholes, flood-prone roads, and accident hotspots.

✓ *Stakeholder Identification and Engagement*

- Identify key stakeholders: HARARE CITY COUNCIL, ZINARA, community groups, NGOs, local businesses, churches, government officials (councillors, MPs, President), and other relevant institutions.
- Stakeholder meetings are still conducted to introduce project goals, roles, and expectations.
- Ongoing Establishment of a Community Advisory Committee to facilitate ongoing engagement.

✓ *Resource Mobilization and Funding Strategy*

- Explore diversified funding sources: government budgets, NGOs, international donors, corporate CSR programs, community contributions, and PPPs.
- An ongoing development of a budget plan covering materials, labour, equipment, training, monitoring, and contingency funds is in place.
- Secure initial funding and formalize commitments through MoUs or agreements.

✓ *Legal and Policy Framework Development*

- Strategies for review existing policies supporting community participation.
- Advocate for necessary legislative support to formalize community-led maintenance.
- Develop project policies, guidelines, and operational frameworks.

✓ *Design of Community-Driven Model*

- Incorporate theoretical frameworks (CDD, ABCD, and Sustainability) into project design.
- Develop participatory planning tools, community asset maps, and maintenance templates.
- Prepare manuals and toolkit for community training and implementation.

✓ *Baseline Assessment*

- Conduct comprehensive surveys and field inspections to assess current road conditions are conducted since the project is in its initial stages.

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- The Use of GIS and mobile technology to map problem areas.(depleted and degraded roads with potholes in the Harare CBD and Residential areas like Budiriro Kuwadzana, Glenview, Mufakose, Mbare, Hatfields, Glenora , Highfields, Dzivarasekwa, Tynward, Warrenpark among others.
- Collect data on traffic, accident rates, community needs, and local assets.

- *Stage 2: Community Engagement and Capacity Building*

✓ *Community Mobilization*

- Organizing awareness campaigns, town hall meetings, and workshops. Engagement with community representatives e.g. councillors, church leaders, MPs, Government,
- Use media (radio, social media, and community noticeboards) to inform and motivate residents.
- Identify and train local leaders, volunteers, and youth groups.

✓ *Capacity Building Workshops*

- Train community members on basic road maintenance techniques, safety protocols, and use of tools.
- Provide education on environmental sustainability and innovative repair materials.
- Develop leadership skills for local coordinators.

✓ *Formation of Community Committees*

- Establish neighbourhood-based Road Maintenance Committees.
- Define roles: issue identification, planning, resource management, supervision, and reporting.

- *Stage 3: Design and Pilot Implementation*

✓ *Prioritization and Planning*

- Collaborate with community committees to prioritize repair tasks based on severity and impact.
- Develop detailed work plans, timelines, and resource allocation strategies.

✓ *Procurement of Materials and Equipment*

- Source eco-friendly, durable, and locally available materials.
- Procure tools, safety gear, and monitoring devices (e.g., CCTV, sensors).

✓ *Implementation of Pilot Projects*

- Launch pilot repairs in selected high-need areas.
- Use community labour, supervised by trained committees.
- Integrate innovative technologies—e.g., recycled materials, eco-friendly techniques.

✓ *Monitoring During Implementation*

- Use mobile apps and GIS tools for real-time tracking.
- Document progress, challenges, and community feedback.
- Ensure adherence to safety and quality standards.

- *Stage 4: Monitoring, Evaluation, And Feedback*

✓ *Continuous Monitoring*

- Conduct regular inspections and quality checks.
- Utilize technology (CCTV, sensors, community reporting apps).
- Collect data on road conditions, accident rates, and community participation levels.

✓ *Evaluation of Pilot Outcomes*

- Measure performance against KPIs: road quality, cost savings, safety improvements, community engagement.
- Gather community feedback through surveys and forums.

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✓ *Documentation and Reporting*

- Prepare comprehensive reports highlighting successes, lessons learned, and areas for improvement.
- Share findings with stakeholders, funders, and the wider community.

- *Stage 5: Scaling up and Long-Term Sustainability*

✓ *Refinement of the Model*

- Incorporate lessons from pilot into the community-driven framework.
- Adjust procedures, training modules, and monitoring systems.

✓ *Expansion to Other Areas*

- Use documented success stories to promote replication in additional neighbourhoods.
- Develop standardized guidelines and toolkits for scaling.

✓ *Institutionalization and Policy Integration*

- Advocate for policy changes that integrate community-led maintenance into official urban planning.
- Formalize roles of community committees within municipal systems.

✓ *Establishing Long-term Asset and Maintenance Management*

- Create a digital asset registry.
- Develop long-term maintenance schedules.
- Train community and city staff in asset management and sustainable practices.

✓ *Sustained Community Engagement*

- Maintain regular communication channels.
- Recognize and reward exemplary community participation.
- Launch awareness campaigns to sustain safety and maintenance culture.

✓ *Technology and Innovation Integration*

- Expand use of surveillance and monitoring technologies.
- Promote eco-friendly and innovative repair materials.
- Use data analytics for predictive maintenance and resource optimization.

- *Stage 6: Final Evaluation and Policy Advocacy*

✓ *Comprehensive Impact Assessment*

- Evaluate improvements in road safety, community satisfaction, cost efficiency, and sustainability.
- Document economic, social, and environmental benefits.

✓ *Policy Recommendations*

- Propose frameworks for permanent integration of community-driven maintenance.
- Advocate for supportive policies, funding, and institutional support.

✓ *Dissemination and Knowledge Sharing*

- Share project results through workshops, publications, and conferences.
- Foster regional and national networks for best practices exchange.

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CHAPTER FIVE
CONCLUSION, ETHICAL CONSIDERATIONS, ETHICAL RECOMMENDATIONS

This comprehensive study underscores the critical need for a paradigm shift in Harare's approach to road infrastructure management, advocating for a sustainable, community-driven model as a viable solution to the persistent challenges faced by the city's deteriorating road network. Through an extensive literature review, empirical data collection, and rigorous analysis, it becomes evident that the traditional centralized, top-down maintenance strategies are insufficient, particularly given Harare's limited fiscal resources, rapid urbanization, and environmental vulnerabilities. The research highlights the transformative potential of community participation, bolstered by innovative technologies such as surveillance systems, GIS mapping, and eco-friendly repair materials. Evidence from comparable international contexts demonstrates that integrating local assets, fostering ownership, and leveraging participatory models can significantly reduce maintenance costs, extend infrastructure lifespan, and enhance road safety. Furthermore, the strategic involvement of government institutions, supported by robust policy frameworks and fiscal incentives, is crucial in institutionalizing community-led practices, ensuring transparency, accountability, and scalability. Addressing the operational challenges such as funding deficits, socio-economic inequalities, and technological adoption barriers requires a multifaceted approach. Diversifying funding sources through public-private partnerships, community micro-contributions, and incentivized participation, alongside establishing comprehensive monitoring and evaluation systems, will foster sustainability. Critical to this strategy is embedding environmental resilience and climate-smart practices within maintenance protocols, ensuring the longevity and sustainability of roads amid Harare's climatic constraints. Importantly, this study emphasizes that fostering inclusive engagement particularly among marginalized groups will promote equity and social cohesion. The synergistic efforts involving government, communities, private sector, and development partners create a resilient framework capable of addressing current deficiencies and upcoming urban mobility challenges.

In summary the "Safe Roads for Harare" initiative, rooted in community empowerment, technological innovation, and policy support, has the potential to revolutionize urban road management, making it more cost-effective, sustainable, and inclusive. This model aligns with Zimbabwe's broader aspirations under Vision 2030 for a self-reliant, resilient, and prosperous society. Its successful implementation can serve as a blueprint for other urban centers facing similar infrastructural dilemmas, ultimately contributing to safer mobility, economic growth, and improved quality of urban life in Harare.

➢ *Ethical Considerations*

- *Informed Consent*

Researchers obtained voluntary, informed consent from participants, ensuring they understand the purpose, scope, risks, and benefits of the community project. Consent has been documented and revocable at regular intervals.

- *Privacy and Confidentiality*

Privacy and confidentiality of different sources of information were upholded. Protecting participant identities and sensitive data were paramount. Data anonymization or pseudonymization techniques were implemented to prevent re-identification

Access to data should be restricted to authorized personnel, and data sharing should adhere to ethical and legal standards.

- ✓ Data Minimization: Data collected was directly relevant to research objectives to reduce privacy risks.
- ✓ Avoidance of Harm: Data collection methods used minimized psychological, social, or economic harm to participants
- ✓ Bias and Fairness: The researcher did not perpetuate bias or discrimination is data collection. Sampling methods and data sources were analysed to promote inclusivity and fairness.
- ✓ Transparency and Accountability: Clear documentation of data collection procedures enhanced transparency. The researcher was accountable for ethical compliance and data management practices.

➢ *Ethical Recommendations*

Based on the current findings of the study, the following recommendations are made:

- Community Engagement and Participatory Planning: Establish community committees to oversee routine maintenance and reporting issues, conduct awareness campaigns to educate residents on road safety and maintenance responsibilities and leverage local knowledge for identifying priority areas and innovative solutions.
- Implement Low-Cost, Innovative Maintenance Technologies: Adopt cold mix asphalt for pothole repairs, enabling quick, low-cost fixes without specialized equipment, utilizing locally available recycled materials to reduce costs and environmental impacts, and developing modular repair units that can be easily deployed by community members.
- Increase Community Involvement: Increase community involvement in road maintenance decision-making processes through participatory budgeting and community-based road maintenance.
- Foster Partnerships with Academic and Private Sector Stakeholders: through partnering with local universities for research, training, and monitoring of maintenance activities, engaging private sector firms in public-private partnerships (PPPs) to finance and execute maintenance projects and develop joint funding schemes and knowledge-sharing platforms.

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- Integrate Sustainable and Climate-Resilient Design Principles: through the use permeable pavements to reduce surface runoff and flooding, incorporating climate-resilient materials that can withstand Harare's weather pattern and planning maintenance schedules to align with seasonal weather conditions for maximum efficacy.
- Secure Sustainable Funding and Policy Support: through Establish dedicated road maintenance funds financed through local taxes or levies, developing policy frameworks that prioritize community-driven and sustainable practices and seeking international grants and development aid focused on urban infrastructure.
- Leverage Technology for Monitoring and Data-Driven Maintenance: through deploying mobile apps for residents to report road issues in real-time, utilizing GIS mapping to prioritize repairs based on severity and traffic flow and implementing data analytics for predictive maintenance, reducing long-term costs.

- *Conflict Resolution and Inclusivity:*

Incorporate mechanisms to address social inequalities, including targeted outreach to marginalized groups and gender considerations.

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APPENDIX

- CR Community Road Maintenance | Core project theme |
- SRH Safe Roads Harare | Project title abbreviation |
- SDRM Disaster Risks Reduction & Management Systems | Master's degree specialization |
- CRP Community Response Project | Alternative project abbreviation |
- SD Sustainable Development | Broader development goal context |
- CD Community-Driven | Approach emphasis |
- IT Information Technology | Use of surveillance, GIS, sensors |
- ICT Information and Communication Technologies | Broader tech context |
- CCTV Closed-Circuit Television | Surveillance system component |
- GIS Geographic Information System | Mapping and monitoring tool |
- Drones Unmanned Aerial Vehicles | Aerial surveillance technology
- HD High Definition | Quality of cameras |
- M&E Monitoring & Evaluation | Project oversight process |
- KPIs Key Performance Indicators | Metrics for success |
- PPPs Public-Private Partnerships | Funding and resource mobilization |
- LDF Local Development Fund | Funding mechanism in Zimbabwe |
- ZINARA Zimbabwe National Roads Administration | Road infrastructure authority |
- CSOs Civil Society Organizations | Community and NGO stakeholders |
- NGO Non-Governmental Organizations | Civil society actors |
- MoU Memorandum of Understanding | Partnership agreements |ICT Information and Communication Technologies | Technology in surveillance and reporting |
- RAP Recycled Asphalt Pavement | Eco-friendly repair material |
- ABCD Asset-Based Community Development | Framework for community asset utilization |
- NDS National Development Strategy | Zimbabwe's development policy framework |
- UN United Nations | International development context |
- WB| World Bank | Funding and best practice reference |
- AfDB African Development Bank | Regional funding agency |
- RRI Road Repair Initiative | Project-specific term |
- KPI Key Performance Indicator | Success measure |
- SOP Standard Operating Procedure | Implementation guideline |
- LGA Local Government Authority | Local governance structure |
- FAO Food and Agriculture Organization | Regional development support |
- O&M Operations & Maintenance | Road upkeep activities |
- CSR Corporate Social Responsibility | Private sector contribution |
- MOU Memorandum of Understanding | Formal partnership agreement |
- ICT Information and Communication Technology | Use in surveillance and monitoring systems |
- Sustainable Sustainability | Long-term viability of infrastructure |
- SMART Specific, Measurable, Achievable, Relevant, Time-bound | Goal-setting framework
- EIA Environmental Impact Assessment | Environmental considerations in projects |
- R&D Research & Development | Innovation in maintenance techniques |
- VNR Voluntary National Review | Policy compliance reporting |

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