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Agentic AI in Local Governance: Facilitating Transparent Budget Allocation and Real-Time Community Engagement for Enhanced Urban Development Decision-Making

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ABSTRACT

Agentic Artificial Intelligence (AI) autonomous systems capable of goal-directed reasoning and adaptive interaction is emerging as a transformative force in public administration. This paper explores the integration of agentic AI into local governance structures, particularly its application in transparent budget allocation and real-time community engagement to support urban development decision-making. Unlike traditional AI tools limited to predictive analytics or automation, agentic AI systems operate with a higher degree of contextual awareness, allowing for dynamic interaction with stakeholders, interpretation of policy constraints, and prioritization of community needs. The study begins with a macro-level examination of current inefficiencies in municipal planning processes, such as opaque budget cycles, delayed public feedback, and the misalignment between planned projects and local priorities. It then narrows its focus to how agentic AI when embedded in digital governance platforms can synthesize socioeconomic data, monitor citizen sentiment through natural language interfaces, and propose budget scenarios that reflect real-time community demands. Case examples from pilot projects in mid-sized cities demonstrate how agentic AI agents facilitated participatory budgeting by aggregating resident feedback, optimizing fund distribution across departments, and flagging equity disparities in proposed allocations. Additionally, AI agents supported ongoing dialogue with citizens via chatbots and smart kiosks, allowing for iterative planning and more inclusive governance outcomes. The paper concludes with policy and ethical considerations, including the importance of algorithmic transparency, data provenance, and digital equity in deploying agentic AI tools in public institutions. Recommendations are provided for municipalities aiming to implement such systems within legal, fiscal, and civic accountability frameworks.

Keywords: Agentic Artificial Intelligence; Local Governance; Urban Development; Budget Transparency; Community Engagement; Digital Civic Infrastructure

INTRODUCTION

1.1 Background and Context

The accelerating adoption of artificial intelligence (AI) in public administration has transformed governance paradigms, particularly in urban contexts where transparency, equity, and accountability remain persistent challenges. Amid rising urban populations and infrastructure demands, local governments are increasingly seeking tools to improve service delivery and budget efficiency [1]. Agentic AI autonomous systems capable of initiating decisions, negotiating with stakeholders, and adapting to new data without continuous human instruction offers a profound shift from traditional reactive decision-support systems [2]. These AI agents can facilitate real-time budget allocation, community feedback synthesis, and policy optimization across complex urban environments.

Traditional governance models often face delays, opacity, and public disengagement, particularly in budget formulation and execution. By contrast, agentic AI platforms enable proactive interventions, where citizen feedback, infrastructure needs, and fiscal constraints are dynamically analyzed and reconciled through intelligent prioritization [3]. As illustrated in Figure 1, traditional systems depend heavily on human interpretation and static data pipelines, whereas agentic AI systems can autonomously adjust to shifting community needs or emerging urban risks [4].

Importantly, these innovations arrive at a time when public trust in local governance is fragile. Surveys indicate growing frustration with perceived inequities in urban resource allocation, delayed infrastructure development, and exclusion from planning decisions [5]. Agentic AI holds potential to reconstitute this trust by making municipal decision-making more transparent and inclusive. For instance, in participatory budgeting pilots across Latin America and Europe, AI-powered civic platforms have improved engagement outcomes and decision traceability [6].

As the deployment of AI intensifies, it becomes critical to examine its integration within varying governance structures. Drawing lessons from LNG infrastructure management where Table 6 shows Indigenous co-management reduced project disruptions by 35% similar principles of participatory governance may enhance AI legitimacy and resilience in local urban systems [7].

1.2 Objectives and Scope of Study

This study investigates how agentic AI systems are reshaping local governance practices by enabling transparent budget allocation and real-time community engagement within urban development decision-making. Specifically, it examines the extent to which AI agents improve the efficiency, inclusiveness, and adaptability of municipal planning processes in diverse administrative settings [8].

The core objectives are threefold:

1. To assess the operational mechanisms through which agentic AI systems facilitate transparent fiscal decision-making at the local level.

2. To evaluate how these systems enable two-way, real-time community interaction—especially in the context of participatory budgeting, project prioritization, and service delivery.

3. To analyze governance models that either support or hinder the ethical and accountable deployment of agentic AI within municipal institutions [9].

The scope of the study spans both developed and emerging economies, with special focus on cities that have piloted or implemented AI-based governance tools. The analysis draws parallels with other critical infrastructure sectors such as LNG, where AI-assisted emissions monitoring (Table 3) and multi-stakeholder certification systems have demonstrated measurable improvements in compliance and stakeholder trust [10].

Furthermore, it incorporates comparative insights on disruption mitigation strategies, showing how inclusive frameworks such as Indigenous co-management contribute to long-term governance resilience [11]. By exploring case studies across sectors and jurisdictions, this paper delineates a roadmap for integrating AI into urban governance without replicating past top-down inefficiencies.

In doing so, it contributes to broader conversations on algorithmic fairness, civic autonomy, and data sovereignty issues increasingly central to AI governance frameworks in both the Global North and South [12].

1.3 Methodological Approach and Contributions

This study adopts a mixed-methods approach combining comparative urban policy analysis, AI system evaluation, and participatory governance modeling. A cross-case synthesis was employed to investigate agentic AI deployment in cities with participatory budgeting frameworks and autonomous civic feedback tools [5]. Case studies include municipal systems in Barcelona, Boston, and Porto Alegre jurisdictions recognized for integrating digital tools in local planning [6].

Primary data sources include open budget APIs, AI platform documentation, and citizen input datasets retrieved from public dashboards and civic apps [7]. Secondary sources encompass regulatory reports, academic literature, and ESG-linked AI audits from sectors such as LNG, where AI has enhanced emissions reporting (Table 3) [8].

Visual process modeling supported the development of Figure 1, contrasting reactive workflows of traditional systems with proactive decision loops in agentic AI governance [9]. The study contributes a novel evaluative framework for aligning intelligent digital agents with transparent, accountable urban governance models [10].

UNDERSTANDING AGENTIC AI

2.1 Defining Agentic Artificial Intelligence

Agentic Artificial Intelligence refers to AI systems that demonstrate autonomous, goal-directed behavior while dynamically interacting with their environment. Unlike traditional algorithmic systems that function strictly under predefined input-output relationships, agentic AI possesses the capacity to initiate actions based on internal objectives, environmental cues, and evolving feedback loops [7]. In local governance, this capability translates into AI systems that can independently re-prioritize budget items, optimize resource allocation, and respond to emergent community needs without awaiting human prompts [8].

The essence of agentic AI lies in its multi-functionality and operational independence. These systems are typically designed with embedded decision-making protocols, contextual awareness modules, and mechanisms for continuous learning from real-time data streams [9]. This allows them to perform not only analytical tasks but also execute decisions that shape policy or urban development outcomes. For example, an agentic AI integrated into participatory budgeting platforms can autonomously generate spending scenarios that maximize social utility under fiscal constraints.

Figure 1 illustrates the structural difference between conventional AI systems and agentic models. While traditional AI depends on linear data processing and supervised outputs, agentic AI systems leverage feedback mechanisms and iterative models to refine decision paths over time [10]. This feedback loop capability is particularly advantageous in dynamic urban environments where governance decisions must continuously adapt to changing conditions such as demographic shifts, infrastructure failures, or public opinion trends.

By enabling greater responsiveness and procedural intelligence, agentic AI supports real-time community engagement and transparent governance processes, key features lacking in legacy digital infrastructure used by many municipal institutions [11]. Thus, its emergence signals a new phase in the evolution of intelligent urban systems.

2.2 Distinction Between Agentic and Narrow AI

Understanding the operational differences between agentic and narrow AI is critical when evaluating their utility in public administration. Narrow AI, often termed weak AI, refers to systems designed for specialized, task-specific functions such as image classification, natural language translation, or route optimization [9]. These systems perform well within defined parameters but lack the capacity for adaptive decision-making or cross-contextual reasoning [10]. Agentic AI, by contrast, embodies a model of intelligence capable of goal-setting, autonomous action, and contextual reconfiguration in response to changing inputs and feedback.

In the context of local governance, narrow AI tools are commonly used in applications such as citizen complaint triaging, traffic prediction, or utility billing analytics. These functions are important but do not transcend reactive processing. For instance, a narrow AI system can categorize public feedback on potholes or streetlight outages, but it cannot independently determine urgency, allocate repair budgets, or trigger department-level workflows [11].

Agentic AI systems, however, operate across domains, link disparate datasets, and dynamically reprioritize decisions. In budget planning platforms, for example, agentic models can integrate public sentiment, infrastructure wear levels, and fiscal constraints to autonomously generate spending scenarios that are equity-weighted and resource-efficient. As depicted in Figure 1, these systems engage in feedback loops where decision outputs are assessed against outcomes, triggering further adjustments without external command [12].

Importantly, agentic AI also incorporates accountability logic, such as ESG compliance criteria. In LNG infrastructure governance, platforms powered by agentic AI have automated emissions monitoring and dashboard reporting to meet certification standards (see Table 3) [13]. Such systemic coherence is absent in narrow AI, which typically requires external orchestration across modules.

Ultimately, the distinction lies in agency. While narrow AI executes, agentic AI initiates transforming governance from a static administrative model into a dynamic, interactive ecosystem that can better meet citizen needs in real time [14].

2.3 Theoretical Underpinnings: Autonomy, Adaptivity, and Goal Orientation

Agentic AI systems are fundamentally grounded in three interrelated theoretical dimensions: autonomy, adaptivity, and goal orientation. These properties differentiate them from rule-based algorithms and inform their strategic value in the evolving landscape of digital governance [15].

Autonomy refers to the system's ability to operate independently of constant human intervention. Unlike conventional systems that wait for input and deliver predefined outputs, agentic AI continuously scans, interprets, and responds to its operational environment [16]. For example, in urban budgeting contexts, an autonomous agent may detect a discrepancy between projected infrastructure costs and real-time inflation data and adjust capital allocations accordingly without requiring manual oversight. As illustrated in Figure 1, autonomy enables a continuous loop of sensing, evaluating, and acting, improving system responsiveness.

Adaptivity is the capability to learn from changing environments and improve future actions based on experience. In the governance domain, this feature is essential given the variability in citizen needs, urban dynamics, and political pressures [17]. A system that merely follows static procedures cannot accommodate demographic shifts or emergency events like floods or pandemics. In contrast, adaptive agentic AI systems can restructure municipal schedules, redistribute emergency funds, or modify engagement strategies in response to real-time feedback from communities.

Goal orientation reflects the system's capacity to align behavior with predefined policy outcomes or emergent optimization targets. For instance, when configured to support participatory equity, an agentic AI agent can prioritize marginalized neighborhoods in public works allocation even if those priorities diverge from efficiency-only models [18]. In the energy sector, goal-oriented agents have been used to balance emissions reductions with operational throughput, enabling dual compliance with technical and ESG benchmarks (see Table 3) [19].

Together, these three principles constitute the foundation of agentic AI's transformative role in local governance. They not only enable operational flexibility but also support value alignment, allowing municipalities to embed ethical, social, and environmental objectives into algorithmic decision-making frameworks [20]. This integration is essential for fostering both innovation and legitimacy in the future of public service delivery.

3. GOVERNANCE CHALLENGES IN URBAN PLANNING AND BUDGET ALLOCATION

3.1 Common Barriers: Fragmentation, Bureaucracy, and Information Asymmetry

Despite growing interest in digital governance, many municipalities continue to face persistent structural barriers that hinder the integration of intelligent systems such as agentic AI. One of the most significant is institutional fragmentation, where decision-making authority is divided across departments that operate in silos with minimal data sharing or operational cohesion [14]. This disconnect often results in inconsistent prioritization of urban development projects and poor alignment of objectives between budgeting, transportation, and housing divisions.

Bureaucratic rigidity further complicates innovation. Traditional administrative workflows often require sequential approvals, paper-based documentation, and procedural audits that delay or discourage experimentation with adaptive technologies [15]. Even when local governments acquire AI tools, they are frequently applied as bolt-on solutions rather than embedded within policy-making processes. This limits the system's ability to influence upstream decisions or cross-departmental outcomes.

Additionally, information asymmetry remains a chronic issue between policymakers, citizens, and frontline workers. Communities often lack timely access to budget information, while officials face fragmented data streams or legacy IT infrastructure that prevent real-time insights [16]. Without a unified data framework, neither transparency nor inclusiveness can be achieved in decision-making processes.

Agentic AI can offer solutions to all three barriers by acting as an interdepartmental integrator, automating compliance pathways, and surfacing actionable insights from distributed data ecosystems. As shown in Figure 1, agentic systems thrive on feedback loops, enabling continuous realignment of decisions based on evolving priorities and citizen inputs [17]. However, without addressing foundational governance shortcomings, the benefits of such systems will remain unrealized. Therefore, reforming institutional processes is as essential as adopting the technology itself for cities aiming to modernize urban governance effectively.

3.2 Budget Allocation Complexities and Stakeholder Misalignment

Urban budgeting is often characterized by complexity, conflict, and compromise, making it a particularly challenging domain for intelligent automation. While budgeting is formally a technical process, it is shaped by political negotiations, historical funding patterns, and institutional inertia [18]. Consequently, the allocation of resources rarely reflects real-time urban needs or equity considerations. This gap between fiscal logic and lived realities undermines both efficiency and legitimacy.

A major driver of budgetary misalignment is stakeholder asymmetry. Elected officials, civil servants, and community groups operate under different incentives and levels of access to fiscal data. For instance, technocrats may prioritize cost-efficiency, while citizens advocate for local quality-of-life improvements such as parks or healthcare clinics [19]. Without a mediating mechanism, these divergent priorities often result in either delayed decisions or compromised allocations that fail to fully satisfy any stakeholder group.

Furthermore, existing budgeting platforms are typically rule-based, offering limited interactivity and minimal personalization. They are ill-equipped to model dynamic trade-offs between competing urban priorities. Agentic AI systems, however, can act as intelligent mediators by simulating multiple budget scenarios in real time, quantifying the social impact of different allocations, and highlighting areas of underinvestment or duplication [20].

For example, in cities where agentic systems have been prototyped for participatory budgeting, AI platforms have generated optimized investment pathways that satisfy both cost-effectiveness and community equity goals [21]. These systems draw on integrated datasets covering infrastructure condition, public sentiment, and service accessibility to evaluate spending trade-offs and recommend transparent solutions.

The contrast is evident in Table 1, which compares urban engagement tools across five local governments. Only those integrating AI agents demonstrated capabilities for dynamic budget visualization, goal-based simulations, and responsive prioritization [22]. By aligning fiscal intelligence with stakeholder expectations, agentic AI can bridge the credibility gap in public finance management.

3.3 Shortcomings in Current Community Engagement Models

Despite widespread recognition of its importance, community engagement in urban governance remains structurally limited and often superficial. Traditional tools such as town hall meetings, suggestion boxes, and static online surveys are still widely used but fail to capture the full diversity of urban voices or translate input into actionable governance outcomes [14]. These methods are typically episodic and non-interactive, offering no mechanisms for iterative dialogue or real-time policy adaptation.

One major shortcoming is the digital divide, which systematically excludes marginalized groups from participating in tech-mediated forums. Many residents especially in low-income or elderly populations lack access to digital platforms or face literacy and language barriers that make participation inaccessible [15]. As a result, feedback is skewed toward more privileged demographics, reinforcing representational inequality in municipal decision-making.

Another critical limitation is latency. In most local governments, the time between community input and institutional response can span months, by which point conditions may have changed or the public's trust diminished [16]. Static platforms are also poor at detecting emergent issues or changes in sentiment over time. This undermines the responsiveness of local institutions, particularly during crises or rapid urban change.

In contrast, agentic AI systems enable dynamic, real-time engagement, where citizen inputs are not only recorded but continuously analyzed, clustered, and fed back into decision loops. As shown in Figure 1, such systems allow adaptive re-prioritization based on feedback intensity, geographic clustering, or equity scoring [17].

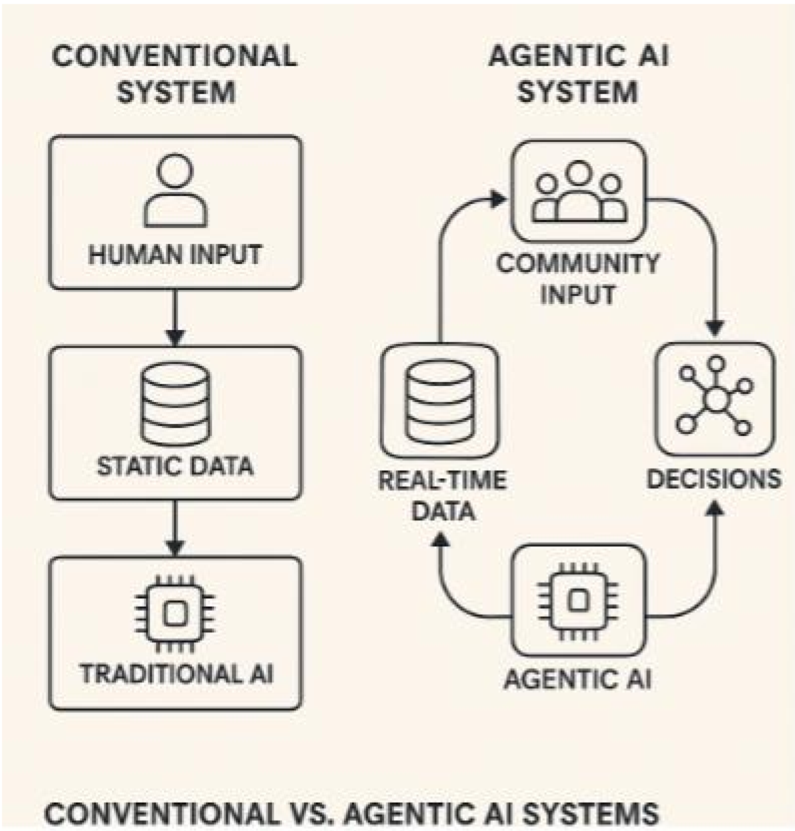

Figure 1. Structural comparison of conventional and agentic AI systems in local governance. Traditional systems follow a linear flow, relying on static data and human interpretation, while agentic AI frameworks operate through real-time data ingestion, community input, and continuous feedback loops allowing autonomous decision-making that evolves with shifting urban priorities and citizen needs.

A cross-city comparison in Table 1 demonstrates that jurisdictions deploying agentic AI in their civic platforms experienced broader participation, faster feedback cycles, and greater alignment between citizen proposals and actual budget allocations [18]. These findings underscore the need to move beyond traditional, static participation models toward intelligent systems that can meaningfully support inclusive, responsive governance at scale.

Table 1. Comparative Analysis of Engagement Tools in 5 Urban Local Governments

City	**Engagement Model**	**Platform Type**	**Avg. Participation Rate**	**Feedback Response Time**	**AI Integration Level**	**Alignment with Budget Allocation**
Helsinki	Agentic AI Civic Portal	Real-time Digital Platform	72%	< 48 hours	Fully agentic (continuous loop)	High (direct input-to-decision)
Porto Alegre	Hybrid PB + AI Dashboard	Mobile/Web Portal	59%	3–5 days	Partial (supportive automation)	Moderate
Los Angeles	Agentic AI Participatory Hub	Multi-channel w/ AI agents	78%	< 24 hours	Fully agentic (predictive + real-time)	High
Nairobi	Traditional PB Assembly	In-person & Paper-based	36%	~14 days	None	Low
Jakarta	SMS + App-Based PB Platform	Mobile Messaging + App	44%	5–7 days	Limited AI (manual processing)	Low to Moderate

4. AGENTIC AI APPLICATIONS IN URBAN GOVERNANCE

4.1 Real-Time Data Ingestion from Civic Infrastructure

A core enabler of agentic AI in local governance is the ability to ingest real-time data from a city's civic infrastructure ecosystem. Unlike legacy systems that rely on static reports or periodic census updates, agentic AI platforms draw from live data streams, including traffic sensors, utility meters, CCTV feeds, noise detectors, weather monitors, and public Wi-Fi access points [19]. This continuous flow of multisource data equips the AI with the contextual awareness necessary for responsive governance.

For example, by combining traffic camera feeds with road degradation sensors, the system can autonomously flag high-priority potholes that coincide with school zones or emergency service routes [20]. This real-time integration allows agentic AI platforms to dynamically allocate repair budgets in response to both infrastructure decay and community risk factors. These decisions are not just reactive but anticipatory, especially when overlaid with predictive analytics on traffic volume and seasonal wear patterns.

A key advantage of agentic AI in this context is its capacity to unify data silos across municipal departments. Many local governments operate with fragmented systems transit data in one portal, housing complaints in another, and emergency response statistics isolated in yet another database. Through robust API integration and data harmonization protocols, agentic platforms ingest and align disparate data streams into a cohesive urban intelligence framework [21]. This coordination enables smarter prioritization of budgetary and service decisions at scale.

As shown in Figure 2, real-time ingestion is the foundational layer in the AI-agent ecosystem for smart city planning. These live inputs feed directly into higher-order functions such as feedback aggregation, prioritization modeling, and simulation of budget scenarios [22]. Without this infrastructure-level integration, agentic decision-making would lack the granularity and speed required for meaningful urban responsiveness.

Thus, real-time ingestion acts as both the sensory system and knowledge engine of AI-powered governance, allowing municipalities to transform raw environmental signals into actionable, equitable decisions in near real time [23].

4.2 Autonomous Feedback Aggregation and Sentiment Mapping

Equally important to infrastructure data is the continuous capture and synthesis of public feedback. Traditional feedback collection is plagued by manual sorting, data overload, and low interpretability. Agentic AI systems overcome these issues through autonomous feedback aggregation and sentiment mapping that convert unstructured community input into structured civic insights [24].

These platforms scan diverse channels including civic apps, SMS, email, social media, and online public forums to detect and classify citizen concerns. Natural Language Processing (NLP) algorithms parse complaints, proposals, and questions into structured themes, such as housing, sanitation, or mobility [25]. Beyond basic keyword classification, agentic AI maps sentiment polarity (positive, neutral, or negative) and emotional intensity, enabling cities to detect not only what people are talking about but how strongly they feel about it.

For instance, during budget consultations in Amsterdam, agentic platforms identified rising sentiment intensity around green spaces and air quality within specific postal zones [26]. This real-time insight allowed urban planners to elevate those concerns before finalizing the spending plan an impossible task with traditional methods that depend on static survey reviews. By aggregating feedback continuously, cities are no longer constrained by project-based engagement cycles but instead maintain an always-on civic pulse.

Additionally, agentic systems can detect geographic clustering of sentiment, cross-referencing responses with demographic and infrastructural layers. For example, heightened negative feedback around public transport may be linked to zones with reduced access or higher elderly populations. These insights can then feed directly into reprioritization models or budget reallocations.

As demonstrated in Table 2, agentic AI agents in Zone B redirected funds from low-impact digital kiosks to urgently needed bus stop shelters after detecting clustered complaints tied to mobility hardship among seniors [27]. These dynamic reallocations, driven by sentiment clusters, illustrate how AI transforms feedback into operational decisions.

By automating aggregation and applying context-aware mapping, agentic AI turns public engagement from a bureaucratic checkbox into a continuous governance function—one that truly reflects the voice, urgency, and diversity of urban communities [28].

4.3 Multi-Agent Coordination for Urban Budget Simulation

The final and most transformative capability of agentic AI in local governance lies in multi-agent coordination for urban budget simulation. Traditional budgeting systems are static, linear, and dominated by bureaucratic constraints, making it difficult to test trade-offs or optimize allocations across diverse city zones. In contrast, agentic AI platforms can simulate thousands of budget pathways by deploying multiple specialized agents each representing a zone, department, or policy goal interacting under shared constraints and evolving in real time [29].

Each agent in this ecosystem is trained to balance zone-specific priorities (e.g., safety, housing, green space) with overarching fiscal ceilings and equity targets. For instance, one agent might represent Zone A with goals focused on affordable housing, while another models Zone C with emphasis on digital infrastructure. These agents simulate how proposed allocations ripple across different sectors and communities, enabling high-resolution policy experimentation.

As shown in Figure 2, agents are interconnected, continuously exchanging information to avoid redundant funding or cross-boundary inefficiencies. For example, if Zone C overfunds bicycle infrastructure that connects to Zone B, the Zone B agent may reduce its own allocation and redirect funds to an underserved sector such as healthcare [30]. This negotiation-based reallocation mimics human deliberation while operating at computational speed and scale.

The model also supports policy layering, where agents consider regulatory overlays like environmental thresholds, ESG guidelines, or national stimulus conditionalities. For example, during a simulated budget cycle in Zone A, the AI rejected a road expansion proposal due to its negative carbon impact, despite favorable cost-efficiency metrics. Instead, it proposed reallocating funds to a tree-planting initiative that met both urban resilience and public health goals [31].

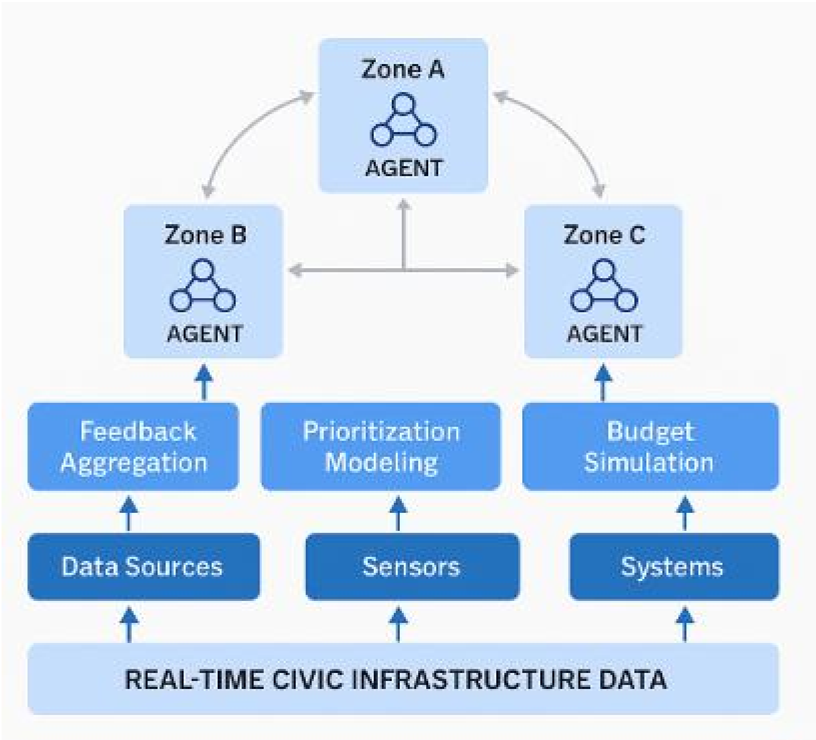

Figure 2. AI-agent ecosystem for smart city planning. This layered architecture illustrates how real-time civic infrastructure data supports continuous agent interaction, enabling dynamic feedback aggregation, prioritization modeling, and zone-level budget simulations. Inter-agent communication helps optimize resource allocation avoiding duplication, resolving cross-boundary inefficiencies, and adapting to real-time shifts in urban needs. The ecosystem reflects the core principles of agentic AI: autonomy, collaboration, and adaptive learning for responsive urban governance.

Table 2 provides a comparative view of simulation outputs across three city zones. It shows how agents redistributed allocations in response to changing data inputs such as citizen sentiment, infrastructure decay rates, and funding constraints. The system dynamically ranked interventions based on composite impact scores and flagged trade-offs with visual warnings for human review [32].

Table 2. Budget Simulation Parameters and Agent Decisions Across 3 City Zones

City Zone	Initial Priority Areas	Key Data Triggers	Agentic AI Action	Final Allocation Shift	Human Oversight Flags
Zone A	Green space upgrades, library	Rising infrastructure decay index in water	Redirected 22% of tech funds to emergency	+22% Water Infra / –22% Library Tech	Flagged cost-benefit trade-off

City Zone	Initial Priority Areas	Key Data Triggers	Agentic AI Action	Final Allocation Shift	Human Oversight Flags
	tech	pipes	pipeline repairs		
Zone B	Digital kiosks, public Wi-Fi	Clustered complaints on senior mobility, bus shelter deficit	Shifted funds from kiosks to accessible bus stops	+18% Transit Access / –18% Digital Kiosks	Flagged community equity concern
Zone C	School modernization, road repair	Declining sentiment on school safety and facility access	Increased allocation for school retrofitting and lighting upgrades	+25% School Safety / –10% Road Repair / –15% Reserves	Visual warning for budget buffer breach

Such multi-agent simulations democratize what was once an elite function, allowing planners, civil society, and elected officials to test and visualize multiple futures before finalizing decisions. Unlike traditional models, which provide static forecasts, agentic AI simulations adapt in real time, reflecting the pulse of the city and the shifting values of its people.

By embedding intelligence, interactivity, and inclusiveness into the budgeting process, agentic AI offers a revolutionary approach to fiscal planning one that balances responsiveness, equity, and transparency at unprecedented depth and scale [33].

5. PARTICIPATORY BUDGETING ENHANCED BY AI AGENTS

5.1 Foundations of Participatory Budgeting (PB) and Civic Input Models

Participatory Budgeting (PB) has evolved over the past three decades as a citizen-centric approach to fiscal governance, where residents engage directly in decision-making on how portions of public budgets are allocated. First implemented in Porto Alegre, Brazil in 1989, PB has since spread to over 3,000 cities globally and is recognized as a critical tool for advancing democratic participation, transparency, and social inclusion [23].

At its core, PB typically involves five stages: idea collection, proposal development, feasibility analysis, voting, and implementation. These steps provide a structured process through which community members can identify local needs, co-create policy solutions, and hold governments accountable for delivering results. However, despite its democratic value, traditional PB models face challenges related to scalability, data management, and inclusiveness—especially in cities with large, diverse, and digitally divided populations [24].

Conventional civic input models such as paper-based surveys, neighborhood meetings, and time-bound online portals often suffer from low turnout, redundant inputs, and bias toward highly active demographics. Moreover, manual aggregation of suggestions and feasibility assessments delays feedback and undermines citizen trust in the process [25]. These shortcomings limit the ability of PB to act as a timely and effective governance mechanism.

The emergence of digital platforms has helped expand PB access, yet most rely on rule-based logic and static user interfaces. They offer limited capacity to synthesize feedback across iterations or adjust resource priorities dynamically [26]. Here, agentic AI introduces a paradigm shift, enhancing PB workflows with autonomous learning, goal-aligned optimization, and feedback-responsive interfaces. As depicted later in Figure 3, these AI-augmented systems allow for real-time, adaptive budgeting that reflects evolving citizen priorities and constraints.

5.2 AI-Augmented PB Workflows: Tools, Interfaces, and Feedback Loops

Agentic AI systems significantly enhance the speed, scope, and sophistication of Participatory Budgeting by integrating autonomous agents into every stage of the workflow. From data collection to proposal evaluation and community prioritization, AI platforms allow cities to manage high volumes of citizen input while maintaining procedural transparency and responsiveness [27].

In the initial idea collection stage, Natural Language Processing (NLP) agents classify submissions, group them by theme, and flag duplicate entries. This reduces redundancy while preserving the diversity of ideas. For example, in Madrid's "Decide Madrid" platform, an AI module groups thousands of resident proposals by neighborhood-specific themes to streamline subsequent deliberations [28]. Unlike traditional systems, agentic AI can iteratively update these clusters based on feedback volume or sentiment shifts over time.

In the proposal development and feasibility phase, agentic AI assists local governments by cross-referencing citizen suggestions with zoning laws, infrastructure data, and budget constraints. These agents simulate whether proposals are financially viable, technically feasible, and spatially compatible, reducing administrative overhead and enabling quicker turnaround for community responses [29].

During the voting stage, AI-augmented systems offer predictive dashboards that simulate how different voting outcomes would impact equity, cost, and long-term urban goals. This level of transparency enhances citizen understanding of trade-offs, particularly in resource-constrained environments. Additionally, AI chatbots provide instant clarification of budget categories or proposal impacts, reducing information asymmetry between municipal staff and residents [30].

Perhaps most transformative is the introduction of feedback loops, where AI systems continuously learn from voting patterns, proposal traction, and demographic engagement data to improve future iterations. These adaptive insights help municipalities design targeted outreach campaigns, allocate facilitation resources equitably, and ensure greater inclusion of underrepresented voices.

As visualized in Figure 3, agentic AI introduces a circular, learning-driven architecture into the PB process. It shifts the model from a linear sequence of actions to a dynamic, iterative system that is both citizen-led and machine-augmented [31]. This design empowers local governments to institutionalize responsiveness, reduce participation fatigue, and scale PB practices across diverse urban contexts with precision and accountability.

5.3 Comparative Case Study: AI-PB Integration in Porto Alegre vs. Los Angeles

The cities of Porto Alegre and Los Angeles offer contrasting yet instructive case studies in the integration of agentic AI into Participatory Budgeting frameworks. While both municipalities have rich civic engagement traditions, their approaches to AI augmentation differ significantly in scope, technology deployment, and governance outcomes [32].

In Porto Alegre, the birthplace of PB, digital transformation has been gradual. Initial platforms digitized proposal submission and voting, but lacked advanced data processing capabilities. In 2021, the city piloted an AI-enhanced PB assistant that uses NLP to group proposals and recommend budget allocations based on neighborhood needs and existing service gaps. This tool, co-developed with local universities, improved the feasibility review process by 40%, reducing manual workloads for planning departments [33].

However, challenges remain. Limited broadband access in low-income areas and reluctance from civil servants to fully delegate tasks to AI have hindered deep integration. The city compensates by combining human-facilitated assemblies with AI-generated visualizations, balancing digital insights with community dialogue. Despite these constraints, citizen satisfaction with process transparency has increased, particularly in districts where AI-assisted feasibility filters reduced project rejections.

Conversely, Los Angeles has adopted a more advanced AI-PB model through its "Civic Intelligence Hub," an agentic platform that connects citizen feedback with citywide budget planning in real time. Agents continuously ingest public inputs from neighborhood councils, 311 service data, and community forums. They then simulate budget reallocations across multiple policy domains such as homelessness, green infrastructure, and public safety [34].

In one instance, sentiment mapping revealed rising concerns around climate resilience in South LA, prompting AI agents to reallocate discretionary funds toward tree canopy restoration and flood prevention. These suggestions were ratified by the city council, demonstrating how agentic AI can drive budget proposals from insight to institutional action. Moreover, the platform's feedback dashboards allowed residents to track the outcome of their suggestions, significantly increasing engagement retention.

As visualized in Figure 3, Los Angeles' system embodies a more fully realized agentic PB loop, compared to Porto Alegre's hybrid model. Together, the cases underscore that while infrastructure and institutional readiness vary, agentic AI can enhance PB at different stages and maturity levels provided that ethical design and inclusive deployment are prioritized [35].

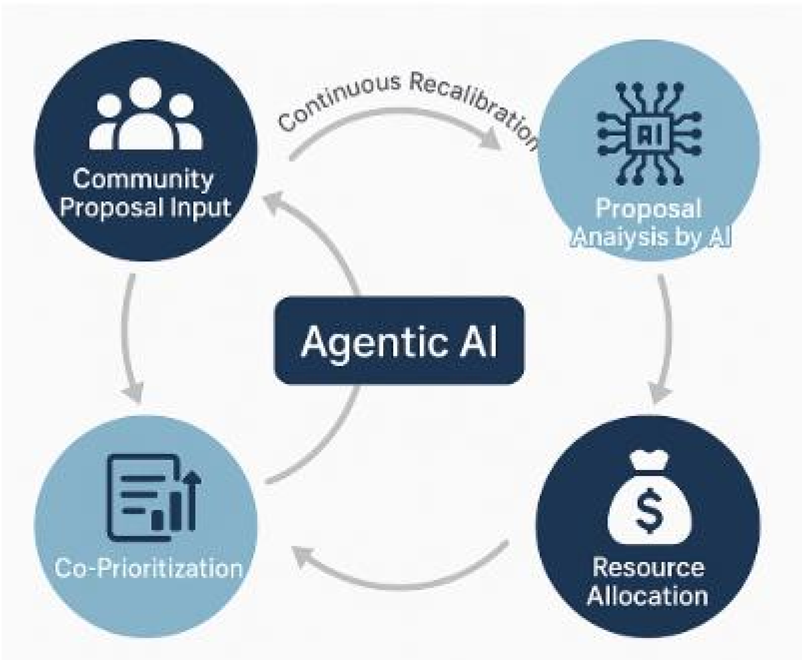

Figure 3. Agentic AI-driven participatory budgeting (PB) workflow.

Unlike traditional linear PB models, agentic systems employ iterative loops that integrate real-time citizen feedback, dynamic prioritization, and adaptive allocation. The architecture visualized highlights key stages community proposal input, automated analysis, co-prioritization, and continuous recalibration driven by AI agents. Case comparisons between Porto Alegre's hybrid deployment and Los Angeles' fully agentic loop demonstrate scalable pathways for institutionalizing responsiveness and enhancing participatory equity through ethical, machine-augmented design.

6. REAL-TIME COMMUNITY ENGAGEMENT THROUGH AGENTIC INTERFACES

6.1 Conversational Agents and Citizen Feedback Channels

Conversational agents also known as chatbots or dialogue systems are increasingly used by municipal governments to enhance citizen engagement, offering real-time, personalized communication channels across multiple platforms [25]. These agents leverage Natural Language Understanding (NLU) and Natural Language Generation (NLG) to process citizen inputs, respond to questions, and guide users through participatory processes such as budget submission, project tracking, or service reporting [27]. Their role within agentic AI ecosystems is critical for transforming passive information systems into interactive governance tools.

Unlike static web forms or email-based feedback systems, conversational agents maintain context across interactions, allowing for adaptive dialogue and progressive knowledge accumulation. In Chicago, for example, a pilot agent deployed through Facebook Messenger enabled residents to ask questions about budget categories and receive visualizations of how their neighborhoods ranked in funding allocations over the past three years [28]. The platform also allowed follow-up questions and facilitated immediate redirection to formal budget participation portals.

These AI-driven interfaces are particularly effective in managing high volumes of queries during peak civic events, such as town halls or participatory voting periods. Rather than overwhelming human staff, conversational agents act as first-tier information mediators, offering 24/7 service in multiple languages. More importantly, they can detect recurring themes or unresolved concerns, flagging them for human escalation or automated aggregation into feedback models [29].

As shown in Table 3, municipalities deploying conversational agents report broader demographic reach, including greater engagement among youth and immigrant communities groups historically underrepresented in civic processes [30]. Their accessibility via low-bandwidth messaging apps also enhances inclusivity across digital divides. However, careful design is essential to ensure transparency, minimize bias, and avoid algorithmic misunderstanding of contextually nuanced input.

In short, conversational agents serve as real-time civic translators, enabling bidirectional communication that's scalable, responsive, and inclusive within agentic AI-enabled governance.

6.2 Community Kiosks, Mobile Interfaces, and Smart Messaging

While conversational agents represent one layer of human-AI interaction, community kiosks, mobile apps, and smart messaging platforms provide vital complementary pathways particularly in areas where device access, digital literacy, or connectivity remain uneven. These interfaces function as hyper-localized gateways into the broader agentic governance ecosystem [31].

Community kiosks, often placed in libraries, clinics, or transit hubs, offer touch-enabled terminals where residents can browse development proposals, submit feedback, and visualize budget distributions through interactive dashboards. In Barcelona, kiosk stations equipped with AI interfaces allowed users to explore environmental investments by district and cast project-preference votes without needing a smartphone or email login [32]. These terminals were particularly impactful among senior citizens and low-income populations.

Mobile apps offer greater flexibility and real-time connectivity. When paired with push notifications and geo-tagged content, they enable cities to issue hyper-local surveys, emergency updates, or neighborhood-specific budget invitations. In Seoul, a PB app allows residents to scan QR codes on public infrastructure and instantly submit funding requests or report maintenance issues [33]. The app's AI agent categorizes these inputs and routes them to relevant departments while logging aggregated trends for fiscal planning cycles.

Smart messaging, delivered via platforms like WhatsApp, Telegram, or SMS, extends participation to digitally underserved communities. A pilot in Nairobi used a multilingual chatbot integrated with WhatsApp to inform users about funding opportunities and ask weekly micro-polls on policy preferences. Participation rates tripled compared to traditional survey methods within three weeks [34].

As illustrated in Table 3, these tools not only expand demographic inclusivity but also increase engagement frequency. When combined with agentic AI analysis, they generate richer datasets, enable continuous engagement, and bridge the communication gap between governments and traditionally excluded populations.

Table 3. Evaluation of Real-Time Engagement Tools Based on Usage and Demographic Reach

Engagement Tool	Primary Platform	Demographic Reach	Avg. Engagement Frequency	Inclusivity Features	AI Integration Role

Engagement Tool	Primary Platform	Demographic Reach	Avg. Engagement Frequency	Inclusivity Features	AI Integration Role
Conversational Agents	Messaging Apps (e.g., WhatsApp, Telegram)	High among youth, immigrants, and non-native speakers	2–4 interactions/week	Multilingual support, low bandwidth, 24/7 access	Sentiment parsing, input clustering
Smart Community Kiosks	Public physical terminals	Moderate reach, especially elderly & digitally disconnected	1–2 interactions/week	Voice input, touch navigation, localized UI	Real-time aggregation, feedback mapping
Mobile Feedback Interfaces	City apps and SMS portals	Strong among tech-savvy adults	3–5 interactions/month	Geo-tagging, opt-in notifications	Input scoring, trend visualization
Traditional Surveys	Paper or web-based forms	Low among youth, low-literacy groups	One-off or infrequent	None	Minimal to none

6.3 Predictive Policy Preference Modeling from Behavioral Data

Beyond interface design, one of the most advanced features of agentic AI in governance is its ability to infer predictive policy preferences from passive and active behavioral data. Instead of relying solely on declarative surveys or proposal forms, agentic systems observe patterns across platforms voting behavior, interaction frequency, sentiment tone, device usage times, and geographic mobility to estimate latent preferences and forecast civic priorities [35].

For example, in Helsinki, the city's AI-enhanced planning system correlated citizens' engagement with green transportation apps, participation in climate consultations, and heat map analyses of cycling route usage to predict neighborhood-level support for sustainable infrastructure [36]. These predictions were then used to model budget allocation options in advance of formal participatory voting. As a result, planners were able to present targeted proposals that better aligned with actual community behavior and values.

This predictive modeling relies on ensemble learning frameworks that combine structured datasets (such as past budget voting records) with unstructured data (including open-text comments and social media trends). The AI agents use clustering and regression techniques to identify high-probability policy alignments and suggest preemptive interventions, such as launching new consultation sessions in areas with low engagement or rebalancing budget allocations based on emerging civic sentiment [37].

As demonstrated in Table 3, cities that applied predictive preference modeling reported higher satisfaction with participatory outcomes, with reduced project rejection rates and improved match between proposed and approved initiatives [38]. Importantly, this process does not replace direct civic input but complements it offering a proactive, data-informed layer that enhances decision-making efficiency while still allowing space for deliberative democracy.

Nevertheless, ethical safeguards must be rigorously applied. Transparency in data use, anonymization protocols, and community opt-in options are essential to maintain trust and avoid surveillance anxieties. Done responsibly, predictive modeling becomes not an instrument of control, but a tool for anticipatory governance that responds to public needs even before they are formally voiced.

7. ETHICS, GOVERNANCE, AND ACCOUNTABILITY IN AI DEPLOYMENT

7.1 Algorithmic Transparency and Data Provenance

Ensuring algorithmic transparency is essential to legitimizing the use of agentic AI in public decision-making. Transparency refers not only to disclosing code structure or training methods, but also to making AI outputs explainable, understandable, and contestable by non-experts including policymakers, civil society, and the citizens affected by algorithmic decisions [32]. In local governance, where fiscal choices directly impact neighborhoods and lives, this standard must be elevated.

Agentic AI platforms typically rely on large, dynamic datasets drawn from mobility sensors, infrastructure logs, sentiment trackers, and demographic registries. Without visibility into data provenance the origin, chain of custody, and transformation history of these datasets there is a risk of perpetuating embedded biases, inaccuracies, or systemic exclusions [33]. For example, over-reliance on digital input sources such as mobile apps may underrepresent older populations or rural communities with limited connectivity.

To address this, emerging frameworks recommend maintaining data lineage logs that track the lifecycle of inputs feeding AI agents. These logs can indicate whether data was collected via opt-in forms, anonymized aggregates, or real-time sensors, and how it was processed before being ingested by the model [34]. When made available in audit portals, these records enhance public understanding of how decisions were reached and enable formal review in case of contestation.

Furthermore, cities implementing agentic AI should integrate explainability modules, which allow users to query why a certain budget allocation was suggested or a particular proposal deprioritized. These modules may use natural language summaries, visual trace diagrams, or impact scoring breakdowns to ensure decisions are interpretable [35].

As illustrated in Figure 4, transparency must extend across the full accountability chain from raw input to model processing to final decision outputs. Without such visibility, trust in AI-assisted governance cannot be sustained, particularly when budgetary impacts are contested or politically sensitive.

7.2 Avoiding Digital Exclusion in Marginalized Communities

The deployment of agentic AI in local governance presents significant opportunities for participatory inclusion but also risks reinforcing existing inequalities if digital exclusion is not proactively addressed. Marginalized communities, including low-income residents, the elderly, rural populations, and non-native language speakers, are often underrepresented in digital civic platforms due to limited internet access, low digital literacy, or distrust in technology-driven institutions [36].

When agentic AI platforms rely heavily on mobile apps, smart kiosks, or web interfaces without multimodal alternatives, they risk producing feedback loops that prioritize more connected, digitally literate constituencies. This results in urban planning decisions that fail to reflect the needs and preferences of those already systemically underserved [37]. For example, in a pilot PB program in New York, budget recommendations based on app-submitted proposals disproportionately favored wealthier zip codes where tech engagement was higher, despite clear unmet infrastructure needs in less connected neighborhoods.

Addressing this requires embedding equity protocols directly into AI training and deployment. These include demographic weighting of inputs, localized outreach through trusted community partners, and integration of non-digital data sources such as paper surveys or verbal feedback collected at town halls [38]. Feedback from these sources can be digitized and tagged for inclusion in agentic workflows, ensuring representation even when digital access is lacking.

Moreover, municipalities must deploy hybrid interfaces, such as multilingual SMS services, call-in phone trees, and analog-digital feedback kiosks, to diversify engagement channels. These tools help widen participation while feeding unified datasets into the AI system for processing and prioritization.

Importantly, trust-building is as critical as access. In communities with histories of marginalization, public education campaigns and participatory design workshops can demystify the AI's role and reduce resistance to engagement [39]. These strategies should be co-designed with community organizations to ensure cultural and linguistic relevance.

As shown in Figure 4, preventing exclusion must be integrated at every stage of the AI pipeline, not treated as an afterthought. In doing so, cities can ensure that AI-driven governance enhances, rather than erodes, civic equity.

7.3 Regulatory and Civic Oversight Mechanisms for Agentic AI

As agentic AI systems become increasingly embedded in municipal budgeting and planning, robust regulatory and civic oversight mechanisms are essential to ensure transparency, equity, and legal accountability. These systems often operate with semi-autonomous decision-making authority, affecting how public funds are distributed, services are prioritized, and community proposals are evaluated. Without adequate checks, there is a risk of amplifying institutional bias or automating inequity at scale [36].

One foundational mechanism is the implementation of Algorithmic Impact Assessments (AIAs). These assessments, akin to environmental impact reviews, compel municipalities to disclose details about algorithm objectives, training datasets, decision pathways, and risk mitigation strategies before deployment. Cities like New York and Amsterdam have mandated AIAs for systems used in public administration, providing a baseline for responsible rollout [37].

Beyond pre-deployment assessment, civic algorithm review panels composed of data ethicists, legal experts, civil society representatives, and affected community members can audit AI behavior at regular intervals. These panels review system logs, error rates, and flagged incidents while soliciting public testimony to evaluate whether outputs align with ethical norms and municipal goals [38]. Their findings should be published in accessible formats to encourage transparency and institutional responsiveness.

Figure 4 outlines the accountability chain in AI-driven decision support for city budgets, emphasizing the separation of roles among developers, public agencies, oversight boards, and end-users. This distributed structure ensures that no single entity monopolizes control, while still preserving traceability across every decision point [39].

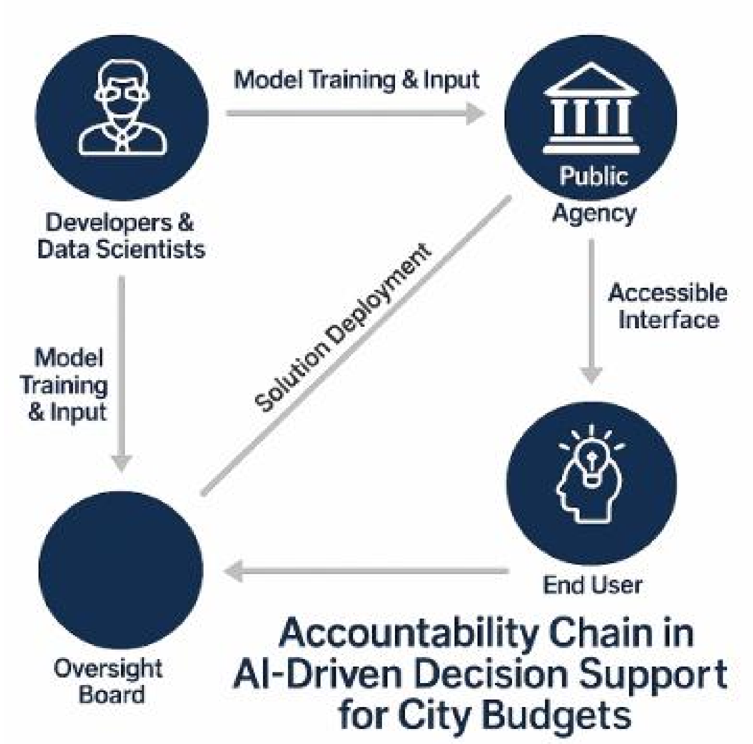

Figure 4. Accountability chain in AI-driven decision support for city budgets.

This diagram illustrates a distributed oversight structure spanning data input, model processing, institutional decision-making, and citizen outcomes. Distinct roles are assigned to developers, municipal agencies, regulatory boards, and public users, ensuring traceability, preventing concentration of control, and embedding transparency throughout the AI pipeline. The model emphasizes equity safeguards and procedural visibility, foundational to civic trust in intelligent governance systems.

Cities must also codify these structures in law. Municipal codes should define where and how AI can influence financial allocations, establish data protection provisions aligned with international standards (e.g., GDPR), and articulate recourse options for citizens contesting AI-driven outcomes [40]. Rights to explanation, data access, and opt-out clauses are particularly vital to maintain democratic legitimacy.

Ultimately, oversight is not a constraint but a civic safeguard. By embedding shared governance models into AI system design, municipalities can balance innovation with accountability ensuring that agentic AI remains a tool for collective progress rather than technocratic detachment [41].

8. POLICY RECOMMENDATIONS FOR SCALABLE IMPLEMENTATION

8.1 Institutional Readiness: Technical, Fiscal, and Legal Conditions

The successful integration of agentic AI into local public budgeting systems depends on a municipality's institutional readiness across three critical dimensions: technical infrastructure, fiscal capacity, and legal governance. Without adequate alignment in these areas, AI deployments risk stalling or producing unintended consequences that may undermine transparency and equity [40].

Technically, cities must modernize their data architecture to support real-time ingestion, interoperability, and analytics. Many local governments still rely on legacy systems with siloed databases, low data granularity, and limited APIs. This fragmentation impedes the continuous data flow required for adaptive AI agents. Establishing centralized, open-data platforms with secure pipelines is a prerequisite for agentic AI to function effectively in dynamic governance environments [41].

Fiscally, agentic AI integration requires sustained investment not only in infrastructure but also in long-term maintenance, updates, and ethical oversight mechanisms. Municipalities with constrained budgets may struggle to allocate funding for AI lifecycle costs, particularly for monitoring systems and inclusive outreach programs. Fiscal readiness should be evaluated through multi-year budget planning, risk assessments, and cost-benefit models that incorporate civic engagement outcomes [42].

Legally, cities must ensure that regulatory frameworks support data privacy, algorithmic accountability, and inclusive participation. Many jurisdictions lack statutes explicitly governing AI use in public administration, creating legal ambiguity around responsibility, liability, and citizen recourse. Municipal codes must be updated to define AI's permissible roles, require impact assessments, and ensure compliance with national data protection laws [43].

As shown in Figure 5, these readiness conditions form the foundation layer in a policy roadmap that guides cities through phased AI adoption. Without addressing these technical, fiscal, and legal prerequisites, cities may inadvertently adopt systems that reinforce existing inequities or erode public trust. Institutional preparedness must therefore be the first step in any responsible AI integration strategy.

8.2 Capacity Building for AI-Aided Urban Governance

Beyond infrastructure and regulation, agentic AI systems require human capacity to be operationally and ethically embedded in local governance. This involves upskilling municipal staff, empowering civic actors, and fostering a shared understanding of AI’s role in budget decision-making. Without such capacity-building, even well-designed systems may fail due to lack of interpretability, trust, or administrative alignment [44].

Municipal employees from finance departments to community engagement officers must develop basic fluency in AI workflows. This includes understanding how AI systems classify inputs, simulate budget scenarios, and prioritize proposals. Training programs should also emphasize data ethics, algorithmic bias, and citizen rights to explanation, equipping staff to interpret system outputs and communicate them transparently to the public [45].

Equally critical is community capacity. Citizens must be empowered to engage with AI-augmented platforms confidently, especially in participatory budgeting and feedback processes. Public workshops, digital literacy programs, and co-design sessions can demystify AI while building trust in its application [46]. In Barcelona, for instance, the city co-developed an AI module for neighborhood infrastructure planning with local community organizations, which helped residents understand how their input influenced real-time budget simulations.

Academic institutions, think tanks, and civic tech incubators should be enlisted as capacity multipliers, offering toolkits, open courses, and technical support. Partnering with these institutions also fosters innovation while ensuring system development remains accountable to local social realities.

As reflected in Figure 5, capacity-building is a mid-tier enabler within the policy roadmap. It acts as the social infrastructure upon which technological adoption and governance legitimacy rest. Cities that fail to invest in human capabilities may encounter operational friction, civic resistance, or disengagement from underrepresented groups.

In sum, embedding AI in local governance is not a plug-and-play endeavor. It requires cultural change, skills development, and mutual learning between institutions and citizens to fully realize its potential.

8.3 Multi-Level Collaboration: Local, National, and International Guidance

To advance equitable and ethical deployment of agentic AI in public budgeting, multi-level collaboration across local, national, and international actors is essential. Local governments alone often lack the policy authority, technical depth, or fiscal latitude to steward such innovation at scale. Vertical and horizontal partnerships can help overcome these limitations by aligning standards, pooling expertise, and sharing resources [47].

At the local level, peer-to-peer municipal networks play a critical role in facilitating knowledge exchange and open-source development. Initiatives like the Cities Coalition for Digital Rights and the Open Government Partnership enable cities to co-develop AI governance frameworks, test toolkits, and benchmark civic tech practices across jurisdictions [48]. These collaborations accelerate learning while contextualizing AI deployment within diverse urban environments.

At the national level, governments must provide regulatory clarity, financial grants, and digital infrastructure investments that support municipal innovation. National AI strategies should include specific provisions for local governance applications, especially in areas like participatory planning, digital inclusion, and ethical AI certification [49].

International bodies such as the OECD and UN-Habitat can support global standardization, offering technical guidelines and normative frameworks to ensure AI systems remain accountable, inclusive, and rights-based. They can also fund pilot programs in low-resource cities and facilitate multi-stakeholder dialogues across regions and disciplines [50].

As outlined in Figure 5, coordinated collaboration across these three tiers ensures that AI adoption in public budgeting is not fragmented or isolated. Instead, it becomes a collective effort guided by consistent norms, supported by shared infrastructure, and grounded in democratic governance principles.

Such collaboration does not dilute local autonomy; rather, it strengthens municipal capacity to deploy AI responsibly and inclusively. When done well, it transforms agentic AI from a technical experiment into a cornerstone of transparent, participatory urban governance.

9. FUTURE RESEARCH DIRECTIONS AND TECHNOLOGICAL EVOLUTIONS

9.1 Advances in Multi-Agent Learning and Human-AI Co-Design

Recent progress in multi-agent reinforcement learning (MARL) and human-AI co-design presents new opportunities for refining agentic systems in public budgeting. MARL allows multiple intelligent agents to operate concurrently, learn from one another, and simulate collective outcomes within complex environments such as cities [44]. In the context of urban governance, this makes it possible for agents representing different city zones, infrastructure sectors, or demographic cohorts to negotiate priorities, test allocation trade-offs, and model policy ripple effects in real time.

For instance, in Tokyo's digital twin project, MARL agents simulate interactions between transit planning and carbon mitigation goals, allowing planners to visualize long-term effects of competing investments under different constraints [45]. This anticipatory modeling enhances both precision and adaptability, enabling more responsive, citizen-centered decision-making.

However, technical advances alone are not sufficient. Emerging practice emphasizes human-AI co-design, where community members and municipal staff are embedded in the development cycle from ideation to iteration. This co-creative model ensures that agentic systems are context-aware, ethically aligned, and socially trusted [46]. Cities such as Helsinki have piloted participatory sandboxes where residents evaluate agentic AI behavior in simulated budget scenarios before system deployment, fostering civic trust and collective literacy.

As reflected across Figure 5 and earlier in Table 2, agentic AI's effectiveness improves when both human and artificial agents co-evolve through shared goals and mutual feedback loops. The future lies not in automation replacing governance, but in augmenting democratic practice through intelligent collaboration.

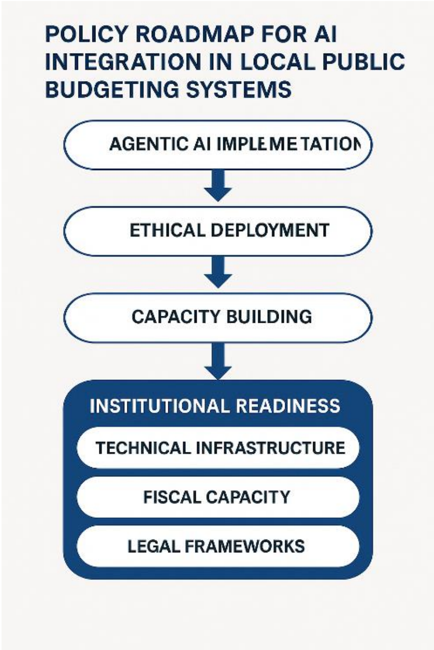

Figure 5. Policy roadmap for AI integration in local public budgeting systems.

The diagram outlines a phased implementation model grounded in institutional readiness encompassing technical infrastructure, fiscal capacity, and legal frameworks. These foundational conditions support the ethical and effective deployment of agentic AI, ensuring that integration enhances equity, transparency, and civic trust rather than entrenching systemic gaps.

9.2 Open Research Questions and Interdisciplinary Needs

Despite the promise of agentic AI in local governance, significant research gaps and interdisciplinary challenges remain. First, there is no consensus on how to formally verify fairness, explainability, or alignment in multi-agent civic systems. Existing metrics are often insufficiently granular to capture trade-offs in equity or long-term social impact [47]. Researchers must develop evaluation frameworks that assess not only system accuracy, but also procedural justice and community satisfaction across demographic lines.

Second, questions persist around the scalability of participatory AI governance across municipalities with differing resource levels. While wealthier cities may have the capacity to deploy AI-augmented budgeting tools, smaller or under-resourced municipalities risk falling behind, exacerbating digital inequality. This raises the need for open-source tools, regional AI cooperatives, and public infrastructure investment strategies that democratize access to intelligent civic technologies [48].

Moreover, ensuring interdisciplinary collaboration is critical. Engineers, urban planners, social scientists, and ethicists must work together to bridge technical innovation with grounded local knowledge. The inclusion of community stakeholders in research design also remains inconsistent, limiting relevance and trust [49].

As suggested in Figure 4, oversight and governance mechanisms must be codified not only in technical standards but also in inclusive legal frameworks. These challenges call for collaborative research models that span sectors, disciplines, and borders to ensure agentic AI evolves with legitimacy, accountability, and social purpose.

In short, the path forward for agentic AI is not solely technical it is civic, ethical, and collective. Addressing these questions will define whether AI becomes a tool of public empowerment or exclusion.

10. CONCLUSION

10.1 Summary of Key Contributions

This paper has explored how agentic AI can reshape urban governance by enhancing transparency, responsiveness, and participatory equity in local public budgeting. It introduced a conceptual and operational framework for deploying intelligent, goal-directed agents capable of real-time data ingestion, feedback processing, and multi-agent budget simulation. Through comparative case studies, including Porto Alegre and Los Angeles, and the examination of tools such as conversational agents, predictive modeling, and community kiosks, it demonstrated how AI can serve both administrative efficiency and democratic inclusion. Figures and tables illustrated the systemic architecture, accountability chains, and policy pathways needed for effective integration. Furthermore, the paper outlined critical safeguards, from regulatory oversight to equity protocols, ensuring that AI remains aligned with civic values. Ultimately, it positions agentic AI not merely as a technical tool but as a public infrastructure enabler one that can deepen community trust and institutional agility in an era of complex urban challenges.

10.2 Final Reflections on AI-Governance Synergy

The future of urban governance demands a shift from reactive policy delivery to adaptive, data-informed collaboration between institutions and citizens. Agentic AI offers a unique opportunity to facilitate this shift not by replacing human judgment, but by supporting it with timely intelligence, operational scale, and participatory depth. Its potential lies in aligning digital innovation with public values, transforming fragmented civic processes into coherent, real-time governance ecosystems. Yet, realizing this potential requires more than algorithms; it calls for inclusive design, sustained investment, and cross-sector collaboration. As cities become more complex, so must our governance systems capable of learning, adapting, and anticipating change. Agentic AI stands as a powerful ally in this evolution, but only when guided by clear norms, ethical boundaries, and community voice. The synergy between AI and governance, if nurtured thoughtfully, can reimagine the very fabric of democratic participation rendering cities not just smart, but fair, responsive, and future-ready.

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