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Citizen assemblies: a sortition-based way to improve modern democratic systems

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Abstract:

Since several decades modern democracies have been showing clear signals of decline in the representativeness of people needs. Recent research literature suggests that the random selection of citizens to participate in legislative or advisory assemblies – also known as sortition – can enhance the efficiency and representativeness of democratic systems. In recent years several studies demonstrated, through agent-based modeling, that including randomly selected legislators in parliament can reduce inefficiencies caused by party discipline and strategic voting, thereby improving overall decision-making outcomes [1,2]. Sortition can serve as a valuable corrective to the growing democratic deficit in representative systems by introducing diversity, reducing polarization, and increasing public trust. At the same time, several practical experiences around the world have provided a strong support for incorporating sortition-based citizen assemblies as a complement to electoral democracy [3]. In this paper we present an overview of these new deliberative tools for improving modern democracies and try to support their efficacy with numerical simulations.

Keywords: citizen assemblies, sortition, democracy, agent based models

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1. Introduction

In recent years, democratic institutions across the globe face a legitimacy crisis, driven by increasing polarization, low voter turnout, and entrenched political elites. Sortition—random selection of

average citizens for policy deliberation—has reemerged as a potent tool to address these deficits. This paper investigates the theoretical underpinnings of sortition, reviews cutting-edge mechanisms, examines real-world applications and their outcomes.

Some years ago, two of us proposed as a way to improve the efficiency of a Parliament the possibility to introduce a certain number of politicians sorted by lot [1,2]. This number depends on the force of the majority party or coalition. In this paper we first review the recent application of citizen assemblies with participants chosen by lot around the world and then we will briefly recap the main ingredients of our schematic model presenting new numerical simulations which support also the possibility to improve democracy also by introducing citizen assemblies. In fact this solution as proven by the many real applications is much more feasible to adopt since it does not imply any change of the constitution law.

2. Case Studies of Sortition in Practice

The growing interest in democratic innovation has led, in recent decades, to the development of practices that aim to strengthen the direct involvement of citizens in public decision-making processes. Among these, citizens' assemblies and deliberative processes are key tools capable of promoting inclusive participation, the legitimacy of collective choices and social cohesion. Empirical experience shows that these mechanisms are adaptable to different levels of government and multiple issues, highlighting their low sensitivity to the decision-making scale and considerable institutional flexibility [3-5].

In this section we briefly analyse several significant experiences of deliberative democracy at different levels of governance: local, urban, national, supranational and global. Subsequently, the characteristic features of the scalability and replicability of the deliberative model are discussed, with particular attention to the dimensions of representativeness, regulation and institutional innovation capacity.

2.1 Bulzi Futura: bottom-up innovation in small municipalities

The first case we address is the project **Bulzi Futura** of **Bulzi**, a small rural municipality close to Sassari in Sardinia (Italy). The project Bulzi Futura is a paradigmatic example of *bottom-up* democratic innovation which was started in 2022 [6]. In response to depopulation, ageing and marginalisation, a group of local associations promoted a **Citizens' Assembly** to involve citizens in

formulating strategic recommendations for the revitalisation of the town. The project, supported by a broad coalition of civil society and institutions, involved the random selection of participants through a *double-stage lottery* [7], emphasising the representativeness of different social groups and focusing on those typically less involved in public life.

The deliberative process unfolded in several stages – listening to experts, facilitated discussion, definition of priorities and recommendations – culminating in the institutional adoption of the proposals that emerged. Key objectives included improving access to digital services, promoting rural development, creating energy communities, cultural vitality and strengthening public services at the territorial level. The society-driven bottom-up nature of this initiative distinguishes it from other more common experiences promoted directly by public administrations.

2.2 Bologna: urban deliberative democracy and climate transition

The second case we present here is that of the city of **Bologna** which introduced in 2023 the first Citizens' Climate Assembly in Italy [8], positioning itself as an advanced laboratory of **urban deliberative democracy** linked to issues of environmental justice. Driven by movements such as Fridays for Future and Extinction Rebellion, as well as by the Municipality and the Urban Innovation Foundation, the assembly was structured around the local declaration of a climate emergency.

Through a sophisticated stratified lottery procedure, citizens, students living away from home and city users were selected, alongside the participation of stakeholders and representatives of collective interests. The process, rigorously structured in phases of information, training, listening, discussion and voting, led to the definition of six macro-recommendations, 24 proposals and 127 actions. The topics addressed were building redevelopment, energy transition, water management, urban agriculture, sustainable mobility and participatory governance [8].

A particularly significant result has been the institutionalisation of the mechanism: citizens' assemblies are now provided for in the municipal statute, with obligations for the administration to provide reasoned responses and monitoring committees to oversee the implementation of the recommendations.

2.3 Convention Citoyenne pour le Climat: deliberation and national policies

Between 2019 and 2020, France launched one of the most impressive national experiments with the *Convention Citoyenne pour le Climat* [9]. Promoted by President Macron in response to the social tensions triggered by the ecological transition, the Convention saw the random and stratified selection

of 150 citizens, representative in terms of age, gender, education level and profession, with the mandate to formulate proposals to reduce emissions by 40% by 2030.

The work, which lasted seven months, produced 149 proposals organised by theme, including responsible consumption, sustainable production, mobility, building renovation, agriculture, fishing, biodiversity and environmental governance. Some proposals included calls for constitutional changes and the establishment of control mechanisms, such as the Defender of the Environment. Legislative implementation has had mixed results: many recommendations have been incorporated into state strategies and new laws, although their formal enforceability remained limited [10] by the current legal framework.

2.4 Belgium's Permanent Citizens' Assemblies

Belgium's German-speaking community (Ostbelgien) pioneered the world's first fully institutionalized, permanent system of deliberative citizen participation, known as the "Ostbelgien Model." Since early 2019, this model has introduced two interconnected bodies: the Bürgerrat (Citizens' Council) and the Bürgerversammlungen (Citizens' Assemblies), creating a robust structure for ongoing citizen involvement in public decision-making[11]. The Citizens' Council (Bürgerrat) is a standing body of 24 people, selected by lottery for 18-month terms, with staggered replacements every six months. Members are chosen to reflect the regional population's diversity in terms of age, gender, education, and residence. Importantly, all inhabitants aged 16 and over are eligible for selection, not only Belgian nationals.

The main functions of the Council are to set the agenda for public debate and to determine the topics to be considered by Citizens' Assemblies. It does not itself issue recommendations, but organizes, monitors, and supports the deliberative process. When a topic is chosen, a time-limited Citizens' Assembly of 25–50 members is convened, also by lottery. These panels meet typically over three weekends within several months to research, debate, and formulate policy recommendations. After deliberation, the Assembly's recommendations go directly to the regional parliament and government, which are obligated to respond publicly, explaining if and how the proposals will be adopted or, if rejected, providing clear reasons. This process builds both transparency and accountability into the system.

Inspired by Ostbelgien's experience, both Brussels and Wallonia have expanded permanent deliberative models:

- In Brussels, the regional government created the world's first permanent Citizens' Assembly on Climate in 2023.
- Wallonia and Brussels have established mixed deliberative committees comprised of both MPs and randomly selected citizens. These structures enable collective debate on policy issues, with agenda items proposed either by citizens (via signature collection) or by elected representatives. The use of these panels has become a recurring part of parliamentary procedure since 2019 in Brussels and February 2023 in Wallonia [11].

2.5 Conference on the Future of Europe and European Citizens' Panels: deliberation at the supranational level

The *Conference on the Future of Europe* (CoFoE) [12], promoted by the highest EU institutions between 2020 and 2022, was the largest deliberative exercise ever undertaken at supranational level. Involving 800 citizens selected by lottery and representativeness from all 27 Member States in four thematic panels, as well as open digital platforms, the CoFoE addressed challenges such as the green and digital transition, governance models, social rights, security, migration and foreign policy.

The sampling procedures, based on a double-stage lottery and multivariate stratification (gender, age, education, origin), aimed to ensure maximum diversity of perspectives. The panels worked in parallel and in interaction with a Plenary that brought together citizens, institutional representatives and civil society. The result was 49 proposals comprising 325 operational measures. Emerging themes included strengthening citizens' assemblies, reforming the EU decision-making process, regular citizen participation in decisions of European importance and the introduction of systematic feedback mechanisms on proposals put forward by citizens. CoFoE was then followed by a new and stable deliberative tool integrating the European citizens into the institutional decision-making process: the European Citizens' Panels. Since the end of the Conference, 11 panels have been held on different topics (Food, Energy, Hatred, etc...) [13].

Finally in early 2025, the European Commission organized a panel of 150 randomly selected citizens from all 27 EU member states to deliberate the long-term EU budget [14]. Over three weekends, this demographically representative group produced 23 comprehensive recommendations that prioritized sustainable investment, fair taxation, digital resilience, social cohesion, and environmental stewardship. The panel's results will inform the EU's next multiannual financial framework, proposed for adoption from January 2028 [14].

2.6 Global Assembly for COP26: global deliberation on the climate crisis

At the global level, the *Global Assembly for COP26* in 2021 [15] was a pioneering attempt at multi-level deliberative democracy on climate governance. Promoted by an international network of civil society organisations and research centres, the Global Assembly involved 100 citizens randomly selected from 100 countries according to criteria of geographical density, inclusion and diversity (age, gender, income, literacy, position on climate change).

Structured in several phases of information, training, deliberation and presentation, the assembly produced a 7-point Declaration focused on the implementation of the Paris Agreement, the principle of equity, the extension of participation, the promotion of environmental rights and climate justice, systemic education and the commitment to a just energy transition. Although limited in terms of direct impact, this experience represented a significant step forward in defining global participatory standards and methodologies.

2.7 Characteristics of the scalability and replicability of deliberative practices

Let us examine in this chapter some important features of the practice of citizens' assemblies.

a) Low sensitivity to scale and sample size

A recurring element in all the experiences considered is the **low sensitivity to the scale of application** of the deliberative model. Deliberative processes based on representative sampling techniques allow for sufficient diversity of viewpoints to be included even in relatively small panels, without statistical significance becoming a central constraint. The aim is not to capture the opinions of the population, but to stimulate informed discussions capable of generating authoritative proposals for the institution in question. Consequently, the size of the panel is determined by requirements of representativeness and logistical sustainability, not by arithmetic precision.

b) Adaptability to heterogeneous institutional frameworks

A second important feature is **the institutional adaptability** of deliberative processes, which can be replicated both in regulated contexts (such as in Bologna or in the CoFoE) and in more informal and spontaneous situations, where the political will for innovation and openness determines the activation of the processes. The absence of mandatory rules by statute or law favours the spread of flexible practices, although regulation – when present – helps to strengthen the protection of participation rights and ensure the continuity and impact of results.

c) Thematic innovation and methodological maturity

The thematic flexibility of deliberative practices appears to be one of the main strengths of the model: the experiences ranging from urban planning to health, or the environment, welfare and energy, demonstrate considerable adaptability to issues of greater complexity and collective impact. Methodological evolution has led to the refinement of selection tools (stratified lottery, double-stage lottery), stages and guarantee mechanisms (facilitators, monitoring committees, reasoned responses from institutions), helping to produce credible and authoritative results.

d) Critical issues: binding force, implementation and institutionalisation

Despite the consolidation of deliberative practices, some critical issues have emerged. The implementation of recommendations made by assemblies does not always translate into binding decisions, especially at the national and international levels, where the impact is sometimes limited to formal acknowledgement by institutions. In contrast, the local context shows a greater propensity to fully integrate recommendations into political and administrative processes. The ongoing disciplinary debate focuses on the need to promote specific regulations for the institutionalisation of deliberative democracy, while ensuring operational flexibility and the protection of participation rights.

4. A model for citizen assemblies

In this section, building on our previous works on mathematical models for improving parliamentary efficiency [1,2], we extend the investigation of sortition to the context of citizens' assemblies. In earlier studies, we showed – through both agent-based simulations and analytical approaches – that the introduction of a fraction of randomly selected independent legislators into a Parliament dominated by two parties or coalitions can significantly enhance its average efficiency, defined as the product of the percentage of accepted proposals and their average social welfare. These results, consistent with the historical use of sortition in Athenian democracy and with the general benefits of randomness observed in physical and social systems, highlighted the existence of an “efficiency golden rule,” i.e., an optimal proportion of independent members maximizing collective outcomes. In the previous paragraphs, we have presented real-world deliberative innovations, such as local and national citizens' assemblies, where randomly selected citizens deliberate alongside elected representatives, providing evidence of their adaptability, legitimacy, and scalability across different

institutional settings. Motivated by these empirical developments, we present here a new computational model in which citizens' assemblies are explicitly integrated into the parliamentary framework. Our goal is to reproduce, through agent-based simulations, an ideal context in which participants drawn by lot in the assemblies formulate proposals that, after deliberation, are submitted to the Parliament together with those of the traditional parties. The efficiency of the Legislature is then assessed, as in our previous works, by evaluating the trade-off between the quantity of approved acts and the quality of their collective benefit. This allows us to compare the performance of purely representative institutions with hybrid deliberative-representative systems and to test under which conditions the inclusion of citizens' assemblies can outperform the efficiency of standard parliamentary configurations.

In order to introduce our simulation framework, let us briefly recall the dynamics of the parliamentary model originally introduced in Ref. [1]. In that approach, as shown in Fig.1 (a), each legislator is represented as a point in a two-dimensional metrical space inspired by Cipolla's diagram, where the horizontal coordinate $x \in [-1,1]$ measures the degree of personal interest and the vertical coordinate $y \in [-1,1]$ represents the expected social gain of the legislator's proposals. Parties (or coalitions) are modeled as clusters of legislators (red and green points) distributed within "circles of tolerance" around a central point (x_p, y_p) , with radius r accounting for internal heterogeneity. On the other hand, independent legislators, randomly extracted from an opportune sortition list, are represented by isolated (black) points uniformly distributed along the diagram. During each legislature, legislators propose acts located at their coordinates in the Cipolla plane, while the voting procedure is governed by acceptance windows, see Fig.1 (b): party members always support proposals from their own group (party discipline), whereas independent legislators vote individually according to their position. A proposal will be accepted only if it reach 50% + 1 of votes. The efficiency of a legislature L with N_a proposals is defined as:

$$E(L) = N_{\%acc}(L) \cdot Y(L) \quad (1)$$

i.e. as the product of the percentage of accepted proposals $N_{\%acc}(L) = (N_{acc}/N_a) \cdot 100$ and their average social welfare $Y(L) = N_{acc}^{-1} \sum_{m=1}^{N_{acc}} y(a_m)$, and is finally averaged over many legislatures to remove contingent fluctuations.

As anticipated, simulation results demonstrated that introducing an appropriate fraction of randomly selected members can enhance parliamentary efficiency by increasing the collective social welfare generated by its acts. According to the analytical "golden rule" obtained in Ref. [1], the optimal share of independent members would strictly depend on the relative size of both Majority and Minority

parties determined by the elections and the peak value of average efficiency gain was always included in the range 12-18 (arbitrary units).

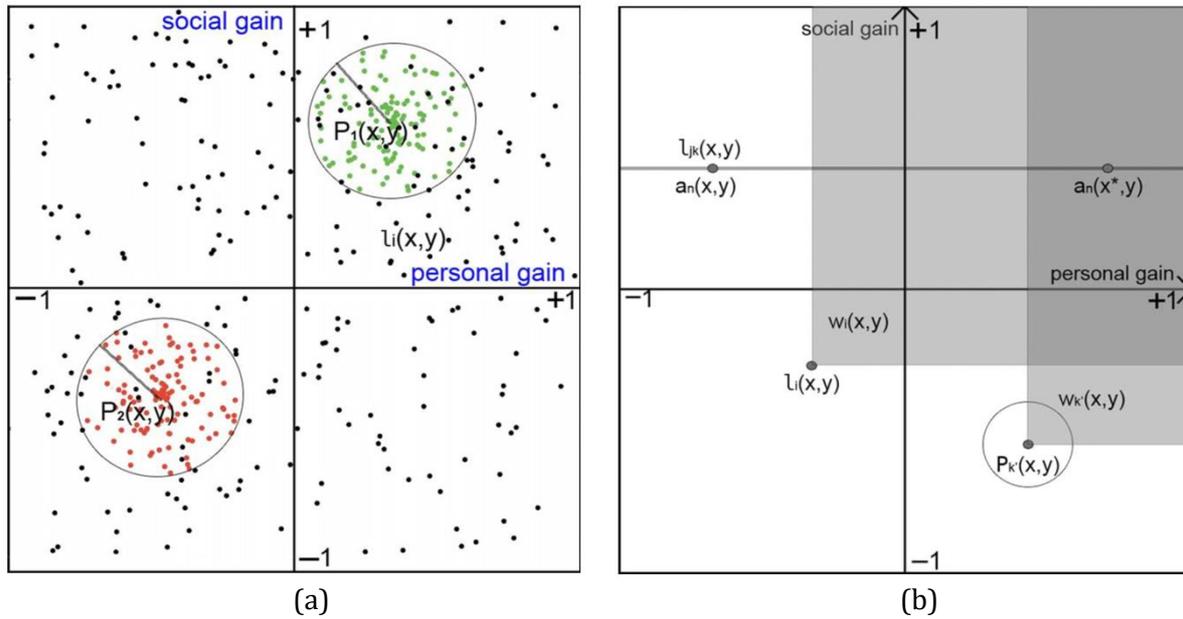
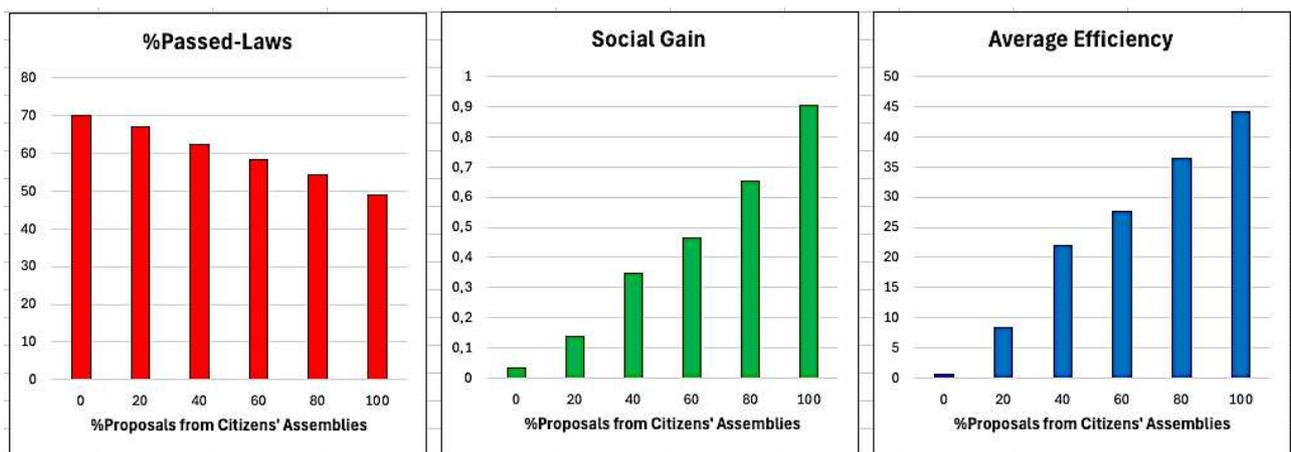


Figure 1. (a) Cipolla diagram. The Parliament consists of $N = 500$ members: black points represent N_{ind} independent legislators, while green and red points refer to the remaining members, belonging to the two Parties P_1 and P_2 . We report also the circles of tolerance of the two Parties, with equal radius $r = 0.3$. **(b) An example of voting process.** The two gray areas in Cipolla diagram indicate the acceptance windows of an independent legislator $l_i(x, y)$ and of a Party P_k . Given the proposal $a_n(x, y)$, advanced by a legislator $l_{jk}(x, y)$ belonging to the Party P_k , a new “voting point” $a_n(x^*, y)$ has been randomly extracted over the (gray) line $y = y(a_n)$ and compared with the two acceptance windows. Since the voting point falls within the window $w_i(x, y)$ of l_i , this legislator will vote the corresponding act. The same proposal would be voted also by all the members l_{jk} of the Party P_k , since it also falls within the window $w_k(x, y)$. See Ref. [1] for more details about the voting mechanism.

To adapt this framework to the case of citizens’ assemblies, we eliminate the independent legislators as member of Parliament and introduce a new category of randomly selected participants who, unlike independent ones, are grouped in an external deliberative body – the citizens’ assembly –, with its own internal discussion and collective decision-making. All the N legislators of Parliament will be grouped, as usual, in two parties with, for example, 60% of seats for the Majority and 40% for the Minority. Both the members of the two parties (red and green points, within their respective circles) and the N_{cit} citizens of the assembly (free black points) can be again reported in the same Cipolla diagram, as that shown in Fig.1(a). However, in this case they represent two distinct components (inside and outside of the Parliament) performing two distinct voting processes. In this study we fix $N = 500$ and $N_{cit} = 150$ and we imagine that, during a legislature L , a certain percentage P_{cit} of the $N_a = 1000$ proposals voted by the Parliament would be previously proposed and voted by the members of the citizens’ assembly, with the same algorithm adopted for independent legislators in

Ref. [1]. More in detail, the assembly will vote repeatedly the proposals coming from its members until one of them will be accepted by $50\% + 1$ of voters. Then, the accepted proposal will be passed to the Parliament for the new voting process. According to the analogous beneficial mechanism producing the increase in collective social welfare for the independent component of the mixed Parliament in Ref. [1], also in this case we expect that the proposals coming from the citizens' assembly result to show an high level of social gain. Thus, when confirmed also by the traditional parliamentary vote, they will presumably contribute to raise the global efficiency calculated again with equation (1).

Such a virtuous mechanism is clearly visible in the simulation results, averaged over 100 legislatures each with a different distribution of parties in the Cipolla diagram. Notice that, on the contrary, the position of the members of citizens' assemblies has to be randomly modified for each discussed proposals within each legislature, since we need to model the fact that in real world the composition of the assembly changes with new citizens drawn by lot for the discussion of each new topic. As shown in the three panels of Fig.2, the increase in the average social gain (b), due to the increasing percentage P_{cit} of proposals coming from the citizens' assembly, is not sufficiently counterbalanced by the decrease of the average percentage of passed laws (a), thus the average efficiency of the hybrid system "citizens' assembly + traditional Parliament" (c) rapidly increases and already for $P_{cit} \approx 40\%$ overcomes the maximum efficiency gain obtained with the mixed Parliament analyzed in Ref. [1].



(a)

(b)

(c)

Figure 2. Numerical results, averaged over 100 legislatures. Thanks to the pre-processing of proposals coming from the citizens' assembly, the average social gain (b) is growing faster than the percentage of laws passed by parliament is decreasing (a), so that their product - i.e. the average efficiency of the hybrid system "citizens' assembly + parliament" (c) - constantly increases.

5. Conclusions

Summarizing, sortition and citizen assemblies offer a promising path toward reinvigorating democratic governance since the inclusion of citizens' assemblies can substantially improve the efficiency of the legislative process. In particular, our numerical experiments show that when assemblies contribute even a moderate share of the proposals voted by the Parliament, the overall efficiency rapidly increases and soon surpasses the maximum values achievable by any mixed configuration of parties and independents alone. Beyond a certain threshold – around 40% of assembly-driven proposals in our simulations – the efficiency of the hybrid system consistently outperforms that of mixed parliaments analyzed previously [1], indicating that, deliberative processes based on sortition can provide both a corrective to the distortions of party politics and a mechanism to enhance the social value of legislative output. These findings strengthen the case for embedding citizens' assemblies as permanent institutions within representative democracies, allowing randomness and deliberation to complement electoral competition in the pursuit of collective welfare.

Taken together, the numerical simulations here presented and the empirical evidence from recent deliberative experiences previously discussed point in the same direction. Local initiatives, such as the Bulzi assembly in Sardinia, national processes like the French Convention Citoyenne pour le Climat, supranational experiments in the Conference on the Future of Europe, and even the global assembly convened for COP26, all demonstrate the scalability, adaptability, and legitimacy of citizens' assemblies as institutional innovations. At the same time, our model provides a quantitative counterpart to these experiences, showing, under controlled conditions, how the random selection and deliberation of citizens can enhance legislative efficiency by balancing inclusiveness with collective rationality. Although real assemblies face challenges of implementation, binding force, and institutionalization, our findings suggest that their integration into representative democracies could significantly improve both the quality of decision-making and the trust of citizens in political institutions. In this sense, simulations and practice converge in highlighting citizens' assemblies not as episodic experiments, but as promising structural complements to traditional representative mechanisms able to innovate and improve our democracies. Future research should focus on institutional integration, cost-benefit analysis, and cross-context comparative studies.

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