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Parra, C.; Rohaut, C.; Maeckelbergh, M.; Issarny, V.; Holston, J.

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Cristhian Parra, Christelle Rohaut, Marianne Maeckelbergh, Valerie Issarny,  
James Holston

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# Expanding the Design Space of ICT for Participatory Budgeting

Full paper

Cristhian Parra  
Social Apps Lab (at) CITRIS,  
University of California, Berkeley  
United States & INRIA, Paris, France  
cdparra@berkeley.edu

Christelle Rohaut  
Social Apps Lab (at) CITRIS,  
University of California, Berkeley  
United States  
christelle.rohaut@live.fr

Marianne Maeckelbergh  
Department of Anthropology  
Leiden University  
Netherlands  
MMaeckelbergh@fsw.leidenuniv.nl

Valerie Issarny  
Inria, Paris  
France  
valerie.issarny@inria.fr

James Holston  
Department of Anthropology  
University of California, Berkeley  
United States  
jholston@berkeley.edu

## ABSTRACT

This paper analyzes existing practices and supporting technologies for Participatory Budgeting (PB), with a special focus on US-related initiatives, as a mean to understand the current and future design space of ICT for participatory democracy. We suggest new design opportunities for ICT to facilitate citizen collaboration in the PB process, and by extension, to reflect on how these technologies could better foster deliberative decision-making at a scale that is both small and large.

## CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing** → **Collaborative and social computing theory, concepts and paradigms** → Computer supported cooperative work

## KEYWORDS

Participatory Democracy; Participatory Budgeting; Citizen Engagement; User Studies; Information and Communication

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## 1 INTRODUCTION

This paper assesses the expanding design space of ICT for democratic participation by analyzing one case, that of ICT for Participatory Budgeting (PB). The latter is an allocation process now used in thousands of cities worldwide in which residents develop proposals for a predetermined portion of the annual budget and vote on the ones they want the city to implement. We analyze the US experience of PB and digital tools currently in use to suggest design opportunities for ICT to facilitate collaboration in PB processes, and by extension, to reflect on how these technologies could better foster participatory democracy. We focus especially on two problems that have been central in history and debates of democracy, those of decision-making and scale.

The ancient Athenians understood democratic citizenship as direct participation in all aspects of the business of rule: not just in an occasional vote but in the everyday activities of juries, councils, and assemblies. Thus, Aristotle [6] argued that “the citizen in this strict sense is best defined as a man who shares in the administration of justice and in the holding of office” (1275a§6). When he went on to declare, famously, that “citizens in the common sense of the term are all who share in the civic life of ruling and being ruled in turn” (1283b§12), he was referring not only to the legislative function of citizenship – to making and obeying the laws – but also and as fundamentally to the executive – to direct an unmediated decision-making as office holders in the execution of government and the administration of justice and in turn to submission to the decisions of other office holders. As a consultant to Greek city-states, Aristotle also argued that this kind of direct democratic citizenship could only or best be achieved in small-scale communities, in which people knew each other and could deliberate face to face as a means of evaluating moral character and building trust.

Since then, countless theorists of democracy have linked definitions of citizenship to conditions of scale. Most consider that the Athenian model of direct, participatory citizenship is no longer possible given the new scales of empires and nations. While they

express nostalgia for the Athenian, they are, so to speak, resigned to the Roman; namely, to a citizenship that, given the massive numbers of people to be ruled, is representative, passive, and hierarchical – referring, in other words, to a legal status of someone protected by the law who has delegated legislative and executive decision-making to professionals, rather than to an active status of someone who makes and executes the laws [5]. The overwhelming consensus in literature is that, as Buchanan and Tullock put it, “direct democracy becomes too costly in other than very small political units when more than a few isolated issues must be considered” [4].

In the last decade, however, citizens have massively rebelled against the Roman model that would seem inevitably to result from this conclusion. They express their rebellion, paradoxically, both passively and actively. There is an abiding sense that people are tired of representative, vertical, hierarchical democracy and, as a result, engage in democratic processes only occasionally if at all, mistrust their representatives, and feel disempowered and left out [20]. At the same time, the desire to create more active citizenries is unmistakably evident, as people worldwide organize experiments in direct and participatory democracy [9]. We have only to mention the Occupy movements in countless cities around the world, with their emphasis on leaderlessness and horizontal decision-making [1], in addition to PB as one of participatory democracy’s most successful recent experiments. Both kinds of experiments emphasize giving participants a direct say in decision-making processes and overcoming the supposed constraints of hierarchy, representation, and scale to do so. Both engage the potentialities of new digital communication technologies to restructure democratic participation in these key aspects, among others. Certainly, research and design of ICT for governance is not new – terms like e-government exist since the mid 1990s [11] – but their emphasis has typically been on improving the delivery of government services. Recently, however, there is a growing number of ICT [17] that focuses on the active engagement of citizens in both consultative and deliberative processes. The expanding body of empirical research on the operation and institutionalization of PB [9] makes it an ideal instance for an exploration of our research questions: (RQ1) what are some of the areas for improvement in the democratic decision-making process of participatory budgeting, (RQ2) which ICT are currently being used in existing PB processes, and (RQ3) how can we create a design space that facilitates deliberative decision-making at a scale that is both small and large?

By placing our research focus primarily on the democratic process of PB as a whole, and only secondarily on how citizens are using ICT in PB, we are able to identify areas for ICT design that would otherwise go unnoticed. What we discovered is that despite efforts to create various channels for citizen participation, a power imbalance persists between citizens, budget delegates and city staff. We argue that ICT could be used not only to create better communication between citizens and city officials, but also to facilitate communication and group formation among citizens so that they can pool their power and resources when interacting with people in positions of relative power. In what follows we

first explore the PB process and our findings as to the functioning of direct democracy in PB, before we turn to the exploration of the current state of ICT in PB. Finally, we conclude by bringing the two halves of the paper together to think about what an ideal design space for a directly democratic PB might look like.

## 2 PARTICIPATORY BUDGETING

Participatory Budgeting (PB) started in 1989 in the city of Porto Alegre, following the end of the military dictatorship in Brazil [9]. It was conceived as a way to enable “a process of direct, voluntary and universal democracy, where the people can debate and decide on public budgets and policy” by which a citizen becomes a “permanent protagonist of public administration” [8]. Since then, it has spread to the world [15], from 13 to 200 cities in Brazil [2], and at least 1000 cities worldwide [3][13]. In the US, PB started in 2009 in Chicago and by 2014 had spread to more than 20 cities, some of which have multiple PB processes sponsored by various kinds of communities such as districts, neighborhood and schools [18]. While the process features diverse organizations, stages and methods, it generally follows an annual cycle of the following stages [10]:

- **Idea collection:** Citizens brainstorm ideas in a variety of settings (face to face meetings, online forums, etc.).
- **Proposal development:** Groups of either elected or volunteer citizens categorize and develop ideas into proposals with help from experts and city staff.
- **Vote:** After project proposals are finalized, citizens vote to decide which projects to fund.
- **Implementation:** The city executes winning projects.

Porto Alegre’s PB process organizes Idea Collection in regional and thematic assemblies, where citizens debate budget priorities and elect representatives for next steps [9]. Combining proposal development and voting, elected representatives collaborate as part of the Participatory Budget Council (COP for its Portuguese initials) to decide on the distribution of investment funds across the city. The decision of the COP is then presented to the mayor’s office, which implements the winning projects. The COP remains involved to monitor implementation. When adopted by other countries, the original model changed in many ways. In Lisbon, Portugal, proposals are collected at decentralized assemblies and later receive technical evaluation by municipal services. This process produces a list of provisional projects that are subject to a period of feedback by citizens, followed by voting [12]. In Paris, collected ideas also go through a technical assessment by the city to create a shorter list of feasible ideas. However, they are followed by collaborative workshops where the city helps proposers to develop selected projects or merge them with similar ones. After this collaboration, citizens vote<sup>1</sup>.

In the US the PB process is usually led by a Steering Committee [19], comprised of city staff, representatives of local community organizations, and other volunteer citizens. Together they plan and facilitate the PB process, starting by determining the

<sup>1</sup><https://blog.bulbintown.com/participatory-budgeting-paris/>

rules, dates, and methods to be used. Additionally, Budget Delegates Committees that are formed by citizens who are either selected within the Idea Collection assemblies or recruited as volunteers, develop ideas into proposals by categorizing, filtering, merging, and refining ideas in close collaboration with city staff. A third actor in the US is the Participatory Budgeting Project, a national non-profit that offers consulting and training on best practices to cities, organizations, and citizens.

Despite their differences, PB processes share a core component of political values, such as being strongly driven by principles of equity and social justice. Unlike many processes of political participation, low-income residents constitute a large proportion of the participants, and cities take active steps to include them. In 2002, in Porto Alegre, around 20 percent of elected citizens on budget forums, and 15 percent of the COP were low-income residents. In 2014, in Long Beach, CA, a third of the residents who attended neighborhood assemblies were from lower-income households (below \$49,000) [18]. Most PB processes in the US allow residents to vote who are otherwise ineligible to participate in general elections because of age or immigration status, which potentially makes PB a much more inclusive democratic assembly of the city.

### 3 THE US EXPERIENCE OF PB

To assess ICT needs for supporting participatory democracy, we start our analysis by looking at how participatory democracy is functioning and where there are limitations in the democratic process (RQ1). This section examines the experience of PB in the US as a proxy to this broader question, based on findings from a large-scale study by Public Agenda [21] complemented by our own interviews with participants in Long Beach and Vallejo, where we are currently conducting field research and piloting a platform that we have designed with the insights we report in this article. Our methodology combines content analysis of both previous research (e.g., technical reports, research articles, etc.), and interviews to key stakeholders of the process.

#### 3.1 Data Sources

In North America to date, more than 50 sites<sup>2</sup> have initiated a PB campaign over the past two years, either at the district level (85% of all cases) or citywide [21]. Public Agenda's study is based on surveys and observations of PB processes across the US and Canada, conducted by local evaluation teams during the 2014-2015 cycles. The study reports on findings related to 15 metrics about the impact of participatory budgeting in the civic and political life of city residents. The report also covers the cities of Long Beach and Vallejo, our field research focus. Both these cities have gone through several cycles of PB: Vallejo is about to launch its 4th citywide cycle and Long Beach has completed its 5th PB process in multiple districts. Our interest in these cities responds to two main criteria: first, Vallejo is the first city wide

process in the US, and second, Long Beach has a strong focus on inclusion of low income residents. Our research focuses on the broader question of direct democracy at the level of the city, with an emphasis on social justice and inclusion of all residents.

#### 3.2 Interviews

We interviewed 16 people (4 in Vallejo, and 12 in Long Beach) including city officials (referred as CO), budget delegates (referred as BD), voters (V), and NGOs/researchers (R). We interviewed the city staff in their field offices, and residents during the voting week for the current PB cycle in Long Beach. On average, interviews lasted 40 minutes and they are semi-structured based on two pre-tested 12-item questionnaires<sup>3</sup>. In summary, our semi-structured interview asked participants what they felt might be different in their community after PB, the extent to which PB has helped to bridge the gap between residents and local government, and technical questions about the process. We asked about their degree of involvement in the community before, during, and after the PB process as well as the retention rate (participation from one PB cycle to the next). We further asked how influential they felt and whether they would like to be more engaged in their community in the future. We investigated whether participating in PB forged new social relationships, encouraged a sense of belonging in and responsibility for their neighborhood, and motivated engagement in community projects. Finally, we asked residents about the future of PB and what new knowledge they gained around topics of public participation, awareness of community needs, and the practical implementation of municipal projects (understanding the administrative process). The following is a summarized analysis of our findings so far, based on both the Public Agenda report and our interviews.

#### 3.3 Analysis

Public Agenda [21, pg. 22] reported that, in communities that had PB, only 0.16% of residents participated in neighborhood idea collection assemblies (1 assembly per 24000 with an average of 38 participants). A potential reason for this low participation has to do with reach, as one voter in Long Beach expressed *"not being reached"* (V1) for Idea collection during our interviews. Additionally, some city officials seem to put more emphasis on the voting phase, defining democracy solely through this final phase of the democratic process. As one city official claimed, the process is *"100% democratic"* because *"everyone can vote"*, leaving *"it all to the people"* (CO1). While one researcher expressed that PB *"minimizes the power imbalance between the city and the residents"* because *"it creates dialogue"*, some residents expressed sentiments that imply the opposite. For example, one resident argued that, *"the city sees the citizens as intruders ... they don't want people to tell them what to do. There is still a lack of understanding from the city. The city is not educated enough for PB. [they] sometimes forget to give the*

<sup>2</sup> Sites refer to cities (13 in total), council districts or neighborhoods (40), and other community organizations.

<sup>3</sup> Some questions were extracted from "Key PB Metrics Research Instruments" developed by Public Agenda [14].

*power to the people*" (BD2). The ideal of citizen empowerment is limited by the reality of the power imbalance between residents and city staff, and between residents who take on coordinating roles and those who do not. While this power imbalance might be unavoidable, its impact can be mitigated and minimized through the formation of collectives that support each other. Thinking of ways that ICT can help individuals feel empowered in their communication with city officials and with each other is an exciting opportunity for design.

Interviewees in Long Beach and Vallejo, for example, expressed their hope that technology can extend participation in idea collection. However, the Public Agenda report demonstrates that online idea collection, is already widely used, and that the use of technology in the idea collection phase, so the question of how technology can extend participation cannot be resolved merely by introducing more tools – a deeper analysis of how information and social relations feed into a sense of empowerment is required in thinking about which tools will increase meaningful participation and which might not. The tool used in Long Beach is appreciated for its mapping capabilities and for associating ideas to its writers, but some face technical difficulties as one interviewee pointed that residents often include more than one idea in the same contribution and that it is difficult to group ideas or provide feedback to the author of the original idea, especially when ideas come from a face-to-face assembly. The inability of citizens to easily interact with each other (horizontal interaction) is experienced as a hindrance to the process.

Power imbalances also arise due to the overwhelming workload, which is required for the transformation of ideas into project proposals. In American PB processes the task of developing proposals out of ideas tends to fall on "budget delegates", who either volunteers their time or are elected by participants. In cycle 3 of Vallejo PB, budget delegates accounted for 16% of the participants in the idea collection assemblies and 0.06% of the total population in Vallejo. The Public Agenda report does not specify why so few community members volunteer as budget delegates, but it might be related to the level of commitment and work that this phase requires. Budget delegates in Vallejo, for example, were asked to reduce the total number of proposals by 93% for the final vote, which again requires them to do a substantial amount of research and analysis on ideas and proposals before getting to the final list. Our interviews also revealed that the high level of engagement and heavy workload needed to develop proposals creates an overwhelming experience which leads some to quit, and contributes to distancing residents from the city staff. As a researcher expressed, *"delegates get frustrated because of strained relationships with the city sometimes: they don't have enough time with the city staff who is very busy, and they would like to better know the rules at the very beginning of the process ... There is no in-between, being a delegate is already a high involvement"*.

Some delegates also feel overwhelmed by the task of managing ideas. As one budget delegate expressed, *"too many similar ideas"* are often created. Grouping, merging, and

prioritizing these ideas are additional tasks for budget delegates. By creating a space of decision-making in which only budget delegates have power, the PB process introduces a form of representation that undermines residents' ability to have direct input and decision-making power over proposals. The power inequality introduced into the process in this way is of even greater concern when we consider that evaluation reports have found that the role of budget delegates tends to be filled by a certain type of person - middle-aged, retired, activist [18][21]. One researcher noted that *"some delegates commit only to push for their own projects"*, indicating self-interest as an important motivating factor for the choice to volunteer as a budget delegate. The budget delegates are highly determinate of the entire PB process since they decide which proposals will be voted upon and which not. This disproportionate power did not go unnoticed by either delegates or residents. As one delegate expressed, *"sometimes people are not happy with the decisions; there was some controversy on how to decide which project to put on the ballot"* (BD3), and concludes, *"more people [should be] involved in the decision-making. Only budget delegates decide on which proposal is put on the ballot"*. Another delegate wanted to expand participation not only in terms of the number of people, but also in terms of the stages in which people could be involved, *"it is important to vote on each stage of proposal-making."* (BD4). This tension in the process of developing proposals arises because decisions often remain in the hands of the few who have the time, opportunity, and capacity to promote their ideas, and it is not always clear how those decisions are reached. There seems to be a need more transparency and for all stages where decisions are made to allow for more direct forms of democracy.

The need for more direct participation, however, runs deeper than the transfer of information or more opportunities to vote on proposals. Residents also desire more dialogue with city staff. Part of this desire is created by the promise of direct democracy embedded in the PB process. In cycle 4 in New York City [24], both Council staff and delegate committee facilitators reported low levels of direct interaction between budget delegates and city agencies outside of the initial agency briefings for delegates. At first sight, our interviews may seem to contradict these findings: a steering committee member describes the democratic value of the PB process as *"it's directly the residents who decide what should be done in their district"* and he believes that *"people have the ability to ask the city for anything, all they have to do is volunteer"* (BD1). However, he later describes the sense he had that the process can sometimes be *"a burden on city staff"* (BD1) implying that the city communicated a sense of being burdened by all these residents asking the city for "anything" - which does not seem like a very welcoming response. While communication might be frequent between budget delegates and city staff, this is not the case between delegates and residents who initially proposed the ideas (except when budget delegates develop their own ideas). Sharing information and expertise between different budget committees is still limited, as pointed out by city staff. These problems may help to account for low participation rates in proposal development and idea collection. In Vallejo, Cycle 3,

2015, 75% reported that their only participation during the process was in the final vote [25].

The key take away from our analysis is that citizen empowerment, a landmark promise of PB, is fundamentally challenged by the inability of PB to address the power imbalances between residents and city officials, and by the creation of further power imbalances between residents themselves, across different stages of the process. Minimizing these imbalances by making the process more transparent, improving information flows, facilitating collaboration across stages and between different types of participants (especially among residents with similar grievances), distributing capacities and reducing workloads all represent unique opportunities for ICT design that, as demonstrated in the next section, have thus far been under-addressed. We now turn to our analysis of existing ICT currently being used in PB in North America (RQ2).

## 4 TECHNOLOGIES FOR PB

ICT have been used in PB processes for collecting ideas, facilitating outreach and voting, and mediating communication between citizens and city officials (RQ2). In this section, we analyze these tools, based on findings from research evaluation reports of PB processes in North America [18][21][24][25][23][22], previous research about ICT for civic engagement [7], and other sources of information such as product websites. While we emphasize the US experience, we also include some tools that have been used elsewhere to offer a greater overview of the current design space of ICT for PB.

### 4.1 Idea Collection

To collect ideas, data reported by [21] shows that 83% of communities doing PB in North America provided online opportunities (e.g., forums, online forms, online maps) for residents to submit project ideas and comment during 2014-2015. OpenPlans' Shareabouts provides an interactive map that includes a form to submit ideas, relating them to specific places in the city<sup>4</sup>, which has been used to collect ideas in NYC<sup>5</sup> and Long Beach<sup>6</sup>. Open Town Hall<sup>7</sup> is another popular platform that cities use to maintain citizen discussion forums on topics relevant to the city administration. Cities create discussion topics, which can include surveys and polls, to which citizens can respond with ideas or comments. The tool automatically provides data analytics. During cycle 3 of PB in Vallejo, CA, ideas were collected and discussed within a topic in the local Open Town Hall instance of the city.<sup>8</sup>

Budget delegates reported that district maps of needs and resources were very helpful for developing ideas and turning them

into projects, particularly to evaluate ideas and align them with community needs and their potential impact. In NYC's cycle 4, they used a project evaluation matrix to assess feasibility and costs throughout the proposal development phase to support this research and evaluation process [24]. Despite their usefulness, both online mapping and evaluation matrices remain rare. Most delegates do not use any specific tool to turn ideas into proposals. Nor is there a specific tool for classifying and winnowing the number of ideas, which is typically done through the use of multiple spreadsheets that circulate back and forth between city employees and budget delegates.

### 4.2 Voting

With regard to voting, only 9% of the 41 communities in the 2014-15 PB cycle in North America offered remote online voting [21], mainly due to a lack of resources to tackle technical issues. Digital voting is mostly limited to in-person voting stations on digital devices. The Stanford Crowdsourced Democracy Team offers a platform for online voting, used in Long Beach, Vallejo and Cambridge<sup>9</sup>. It has been particularly successful in Cambridge's first PB cycle in 2015, where the majority of voters participated by submitting online ballots (around 82%) [23]. An effort remains to be made in terms of translation: paper ballots were proposed in 5 languages (Chinese, English, Haitian, Creole, Portuguese and Spanish) while digital/online ballots only offered 2 languages (English and Spanish).

### 4.3 Communications and Outreach

For outreach purposes, PB uses email, text messages, phone calls, and social media (e.g., Facebook and Twitter) as well as flyers and traditional media (including TV, radio and newspapers) [24]. City officials and local community groups also use newsletters and council websites to inform residents [24]. Chicago increased the number of participants in idea collection by 26% by using "robocalls" [22] and some cities around the world have used purpose-specific platforms such as Textizen, a web platform designed to send, receive, and analyze SMSs to residents of a city. For communication purposes, budget delegates often email city departments for more information throughout the proposal development phase. City websites generally provide a rulebook, but not all delegates consult it. On the PB website, it is sometimes possible to contact PB trainers and advisers or to access useful resources. Within budget committees, delegates generally communicate with each other by email and Google groups. There is no defined channel of communication between community members and budget delegates, and tools specially designed to support communication and collaboration of groups are rarely used (e.g., Slack, Asana, etc.). Some proactive budget delegates follow-up with residents through e-mail.

<sup>4</sup> <http://openplans.org/>

<sup>5</sup> <http://ideas.pbny.org/page/about>

<sup>6</sup> <http://ideas.pblongbeach.org/>

<sup>7</sup> <http://www.peakdemocracy.com/>

<sup>8</sup> [http://www.ci.vallejo.ca.us/living/connect/open\\_city\\_hall](http://www.ci.vallejo.ca.us/living/connect/open_city_hall)

<sup>9</sup> <http://voxpathuli.stanford.edu/>

#### 4.4 Other tools

An interesting area of research and development for PB and citizen participation is gaming [20]. The Big Easy Budget Game<sup>10</sup> was used in New Orleans to collect simulated budgets created by citizens. Similarly, CitizenBudget<sup>11</sup> uses the same approach for budget consultations. @Stake is a game for facilitating idea collection or budget delegate training [29]. In Europe, the Empatia Project<sup>12</sup> is developing Empaville<sup>13</sup>, a role playing game to facilitate idea collection assemblies. These games can be useful as part of the training of budget delegates or to facilitate parts of the process making them fun.

Other platforms have been developed across the Atlantic, to support European PB processes. BiPart<sup>14</sup> has been used in Italy to support all stages of the process, from idea collection to voting. Partecipare<sup>15</sup> is commonly used in Portugal for voting. Developers of BulbInTown<sup>16</sup>, a local crowdfunding platform, have developed an online engagement tool for the PB cycle in Paris<sup>17</sup>, which is used to collect, discuss, and develop ideas (in what they call co-construction spaces that complement collaboration meetings) and finally to vote.

Previous related research has identified a rich list of ICT tools that may be useful for supporting online participatory democracy [7], such as LiquidFeedback<sup>18</sup>, Loomio<sup>19</sup>, and Nextdoor.com<sup>20</sup> even though they are not specifically designed for PB. However, our general assessment is that there is no existing solution that includes or is capable of integrating all the essential functions we identified. Particularly, there is a need for better support for bottom-up collaborative proposal and decision-making processes that are not necessarily driven by or centered around the government. The way ICT are currently used in PB corroborates this assessment in that different tools support different activities of the process. Their lack of integration makes it hard to maintain the transparency of the entire process because it is difficult to keep track of the development of an idea into a project.

## 5 DISCUSSION: THE DESIGN SPACE OF ICT FOR PB

Most current PB processes emphasize their use of ICT solutions in the stages of idea collection and voting, and existing tools are mostly designed for these stages. Additionally, communication and outreach is generally supported through existing and

traditional channels (e.g., social media, emails, flyers, city websites). Figure 2 is a reflection of the current focus of ICT tools for PB in terms of different spaces of design. We highlight the existing separation between Idea Collection and Voting, because the connection between these two stages remains a challenge, with information going through a multitude of different tools, providing little to no information about the evolution of individual ideas.



**Figure 2. PB design space currently well supported with a wide range of tools**

The PB instances we have studied introduce an interesting array of collaborative and inclusive practices that empower citizens, while also creating layers of verticality and power imbalances within the process that put citizen empowerment at risk. This is the most complex part of PB, which relies heavily on an effective and engaging collaboration among citizens and city officials. As noted in our analysis, the tension in this middle stage of the process is particularly important, where the bulk of the work is to turn ideas into project proposals.

Our analysis suggests ways to address this problem, rendering an interesting tapestry of expanded design spaces to explore in research. In particular, interesting opportunities exist in making collaborative proposal development effective at a larger scale and facilitating the direct participation of those who are usually not active and involved in politics. Key to this problem is the design of an ICT infrastructure (both standard APIs and engaging user applications) to publish data about the process, making it easy for everyone to understand its phases, displaying the evolution of individual ideas, their connection and potential impact to community, and facilitating citizen collaboration, allowing them to pool power by building horizontal community links prior to engaging with city officials.

### 5.1 Existing tools and problems

Our analysis makes it clear that proposal development is a crucial stage for ICT intervention in which resident empowerment should be fostered. Extensive research is required to make coherent arguments for proposals. Residents could use ICT to search and present relevant data for their proposals through visualization tools, as well as support the versioning of proposals. Open data repositories and visualization technologies exist (e.g., Socrata<sup>21</sup>, d3js<sup>22</sup>), but they are difficult to use.

OpenIdeo<sup>23</sup> is probably the most comprehensive example of how to manage and display the evolution of ideas from ideation

<sup>10</sup> <https://bigeasybudgetgame.com/>

<sup>11</sup> <http://www.citizenbudget.com/>

<sup>12</sup> <https://empatia-project.eu/>

<sup>13</sup> <http://empaville.org/>

<sup>14</sup> <http://www.bipart.it/>

<sup>15</sup> <https://partecipare.io/>

<sup>16</sup> <https://www.bulbintown.com/>

<sup>17</sup> <https://budgetparticipatif.paris.fr/bp/>

<sup>18</sup> <http://liquidfeedback.org/>

<sup>19</sup> <https://www.loomio.org/>

<sup>20</sup> <https://nextdoor.com/>

<sup>21</sup> <https://www.socrata.com/>

<sup>22</sup> <https://d3js.org/>

<sup>23</sup> <http://openideo.com/>

to implementation. For idea management, solutions like IdeaScale<sup>24</sup> or UserVoice<sup>25</sup> have worked well for companies and might provide inspiration regarding the problem of organizing thousands of ideas in the context of a PB process. However, none of these are open source and all lack various features essential to PB, such as fully open APIs, collaborative editing, and bottom-up inclusive proposal making [7]. These features are particularly important if we are to support citizen-to-citizen collaboration in the crucial stage of proposal development.

Another problem is that after submitting a final version of a proposal in existing PB processes, additional evaluation by the city could result in the proposal not being included in the final ballot. Delegates are notified about this, but they do not have the opportunity to review and resubmit their proposals before the vote. This results in tensions and the perception of a lack of transparency. Collaborative editors like Google Docs<sup>26</sup> or Etherpad<sup>27</sup> could provide ways to incorporate evaluation and review more easily, but they lack support for democratic consensus on versions and easy integration with city data. They also have a steep learning curve, which can be addressed with well-designed onboarding and help functionalities. Additionally, capacity building and learning would allow more people to gain the skills and have access to the tools to develop proposals. ICT can provide interactive templates, guides and toolkits that are easy to use and follow.

Communication and coordination between citizens and city officials might benefit from tools that are as easy and pervasive as email, but that also integrate all the information and data that flows in the process and facilitate coordination of responsibilities. Integrating software like Slack or Asana might improve the communication and collaboration flows, but any ICT for this purpose has to consider that people use multiple channels for communicating and they are not always open to, or have the possibility of, adopting new means. Integrating multiple channels and finding ways for reaching people where they already are is key to this challenge and service oriented composition might provide the answer [7].

It is also our assessment that most online voting systems do not benefit from (nor facilitate) more complex voting algorithms (e.g., range voting<sup>28</sup>) that might offer improvements like preventing manipulation or supporting better democratic values. Although they might introduce complexity, we argue that with good design they may be useful to further improve PB's fairness and educational dimensions. Some interesting examples to explore are Liquid Feedback's proxy voting, where users can hand off their vote to other trusted members<sup>29</sup>, or Loomio's consensus voting system that requires users to elaborate on their vote and change it as the discussion progresses<sup>30</sup>. Experimenting with

random juries is another avenue of research and design that might be interesting to explore.

## 5.2 The Expanded Design Space of ICT for PB

Figure 3 is a reflection of what we believe is the expanded design space of ICT for PB, emphasizing the new stages of the process that need to be addressed, the need to connect them and the additional spaces that are pervasive to others.



**Figure 3. The expanded PB design space of ICT for PB**

To facilitate the complex process of collaboration and address the many frustrations that arise when the development of ideas is not rendered clear, we suggest that research and design efforts need to be made in connecting all the stages and keeping track of how information evolves along the process. We start by adding to the mix the process of *Preparation and Rulemaking (1)*<sup>31</sup>. The many remarks about residents not knowing or not consulting rules implies an opportunity exist for both improving the process and designing interactive applications to support resident participation in this preliminary phase, which might include citizens deciding on which kind of voting system they want or helping in preparing the process. We then expand *Idea Collection* to include *Idea Management (2)*, understood as the processes of categorizing, prioritizing, merging, and keeping track of how ideas evolve. Further, to connect *Idea Collection* to *Voting*, ICT for *Proposal Development (3)* needs better integration and support for group collaboration, with an emphasis on including functionalities that facilitate *Research* about the needs of the community and the impact of ideas. *Voting* would benefit from a better connection to *Deliberation (4)*, understood as the careful consideration of proposals through discussions that inform the decision of voters. ICT can also provide alternative types of voting. An often-overlooked part of the PB process is *Implementation and Evaluation (5)*. ICT can enable citizens to report and follow up on the actual implementation of the proposals that were selected, or to take non-selected projects to other spaces of collaboration where they could still develop until they find other sources of funding. Citizens also need space for evaluating the process itself. All of these measures would increase the channels through which citizens can transform ideas into reality and thereby expand resident empowerment in the PB process.

Some design spaces represented in Figure 3 are pervasive to all others. PB relies heavily on the realization of face-to-face activities (e.g., idea collection assemblies, collaboration meetings, voting assemblies, etc.). Integrating *Face-to-Face Facilitation (6)* activities into the digital flows of information can be, in its own

<sup>24</sup> <http://www3.ideascale.com/>

<sup>25</sup> <http://www6.uservoice.com/>

<sup>26</sup> <https://docs.google.com/>

<sup>27</sup> <http://etherpad.org/>

<sup>28</sup> <http://rangevoting.org/>

<sup>29</sup> <http://liquidfeedback.org/>

<sup>30</sup> <https://www.loomio.org/>

<sup>31</sup> The number in parenthesis in this and following sections refer to the expanded design spaces we suggest in Figure 3.

rights, a whole area of exciting research and design. In addition, rendering the entire process accessible and engaging requires communication and outreach to be expanded to support transparent, particularly large scale, *Information Access* (6) and better *Communication and Engagement* (7) with citizens, making sure that at all stages ideas and proposals are connected to citizens and communities that generated them or that are impacted by them.

### 5.3 ICT for PB Design Opportunities

ICT can support PB within these expanded design spaces in many ways. We argue that HCI and Social Informatics scholarship should address these spaces with an emphasis on minimizing the key issue of emerging power imbalances and heavy workloads, to improve citizen empowerment.

*Mapping*, for example, has already been proven as useful for idea collection and evaluation purposes. Connecting maps to data, facilitating the creation of interactive community maps to support research or inspire ideas, could be an engaging way of supporting Proposal Development (3), informing Voting (4), contextualizing Implementation (5) and facilitating Face-To-Face assemblies (6). *Open APIs* can improve transparency (7) and be of help during proposal development (2), in combination with easy to use data *Visualization* tools. Particularly, developing data interface standards for Idea, Issues and Proposals can pave the way for more integration of the disparate set of tools that are currently in use. When citizens can easily represent the basis for and benefits of their proposal through the use of maps and visualization they will feel better equipped in their interactions with city officials.

A common problem during idea collection (2) and proposal development (3) is redundancy, which can be partially be addressed by integrating *similarity and recommendation algorithms* in Idea Management (2) to connect similar ideas or people to their interests. Using these algorithms within an idea management dashboard (like the one proposed by [26]) but with a focus on assigning ideas to groups of people for its research, evaluation or development can help alleviate the issue of heavy workloads in proposal development and would create spaces where citizens can pool their collective power to support and develop strong proposals. Better use of *Group or Team Communication Systems* can alleviate the work that interactions between city officials and citizens entail, putting special attention to the integration of multiple channels of communication (8).

Additionally, facilitating collaboration through *Collaborative Editing* with rich *interactive project proposal templates and design toolkits* can help in minimizing the difference in capacities among participants. These tools can in turn integrate *mapping, open APIs and visualization* to facilitate the task of preparing final proposals or improving the rulemaking and preparation phase (1). *Crowdsourcing*, particularly *Crowdfunding*, can offer ways for non-winning projects to live on (5). Another issue is the lack of the resources and time, by cities, to evaluate and carefully estimate the cost of proposals. *Crowdsourcing* this process to volunteer experts can also be an exciting alternative to explore.

*Mobile apps and interactive displays* or kiosks can help to facilitate F2F assemblies (6), either for voting or idea collection, helping to connect the output from these assemblies to the digital flows of information. New algorithms and applications that support *alternative voting systems* represent also an interesting opportunity for voting, which can also be leveraged, in combination with *interactive displays* and *mobile apps*, to support face-to-face (6) consensus making in idea collection (2) assemblies or during proposal development (3).

Finally *games* and *game mechanics* have been used in some cases for facilitating face-to-face interactions (6). We suggest this can also be applied to other parts of the process, with the goal of making the engagement more enjoyable.

## 6 CONCLUSIONS

Our analysis suggested that a key problem to be solved in participatory budgeting is that of minimizing the power imbalances and heavy workloads that arise from the process of developing ideas into full-fledged project proposals. This problem is also reflected on the current design space of technology for PB, which places strong emphasis mainly on idea collection, outreach and voting and does not sufficiently support citizen-to-citizen collaboration.

Key opportunities exist in connecting idea collection to voting, making the entire process and information flows more transparent and engaging. By designing and building ICT that effectively allows citizens to pool their power horizontally, democracy will be revitalized with new ways of strengthening community building and citizen empowerment. Better transparency and idea management might also improve the efficacy of the whole process and alleviate situations of distrust. Altogether, better citizen collaboration through ICT holds too a promise of improving the didactic value of participatory processes like PB.

The proposals we offer in our discussion constitute a set of design directions for ICT to foster democratic assembly at an urban scale through deliberative decision-making and collaborative proposal development. They may be able to re-engage residents in an active determination of their citizenship, addressing the fundamental need of equalizing power imbalances that arise within processes of PB, ensuring its ideals of inclusion and equity are finally met.

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