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Exploring case-based platforms: AI-powered meta-analysis of participatory design and planning practices

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Abstract

Case-based platforms, such as Participedia, PartScout, Co-Cities, and LATINNO, are increasingly recognized as inclusive, cumulative, and informative tools for designing collaborative and participatory actions. These platforms are equipped with social technologies, crowdsourcing applications, and human-computer interactions, which facilitate the dissemination, analysis, and exchange of participatory design and planning (PD&P) experiences that address chronic public problems related to shared interests and values. However, exploring the ever-increasing, interdisciplinary, and extensive scope of PD&P cases to gain insights is challenging for researchers and practitioners, thereby making it essential to develop effective strategies. Despite participatory practices being inherently collective, there is little discussion of how to leverage collective intelligence (CI) into participatory research. We claim, accordingly, that the systematic use of CI will enrich our understanding of the diverse realm of PD&P. We have approached case-based platforms through the lens of CI, as an umbrella term bridging various concepts encompassing cooperative, bottom-up, citizen-led, collaborative, and grassroots actions. This study aims to conduct a meta-analysis to reveal cross-case patterns, specifically probing contextual, methodological, and actor-related dimensions, within a dataset comprising 2,439 cases. The research design is grounded in the case survey method, further enhanced by integrating AI-based clustering, mapping, and semantic analysis. The findings point to the promising performance of the proposed method in revealing diversified and highly interconnected PD&P patterns. Despite its limitations, this preliminary study provides valuable insights through the CI genome, contributing to a comprehensive understanding of PD&P landscapes and stimulating new research questions.

Keywords

Case survey, Clustering, Collective intelligence, Participatory practices, Self-organizing maps.

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1. Introduction

Participatory design and planning (PD&P) roots lie in the ideals of participatory democracy, where decision-making is highly decentralised, transparent, and inclusive. Moreover, the PD&P process and outcomes can be enhanced by leveraging techno-social networks of collective intelligence (CI or wisdom of the crowd). Both interconnected and long-standing concepts can be traced back as far as Plato's Republic, which emphasized principles such as 'freedom of speech, assembly, voting, and equal representation' (Sanoff, 2010), and Aristotle's Politics, which advocated for the idea that 'many heads are better than one' (Dortheimer, 2022).

Of late, PD&P is applied to urban planning, architecture, geography, policy, and education as well as to the fields of industrial and information technology, often in intersection with design anthropology (Luck, 2018; Sanoff, 2022). In a broader sense, it is a process of engaging a pluralistic community to co-design tools, products, environments, types of experiences, and social institutions (Simonsen & Robertson, 2013; DiSalvo et al., 2017). This is hardly surprising, having a multitude of definitions, considering the rhizomatic connections with a wide range of disciplines, domains, and communities. In the background of this study, existing literature has been scanned to outline core values and an evolutionary framework through the main trajectories.

Furthermore, PD&P approaches have matured and evolved to a versatile concept at the interdisciplinary level, influenced by feminist, activist, maker, ecocentric, and democratic movements. Participatory action research (PAR) proposes a new paradigm as 'research by the people', based on the premise that user groups possess an expertise equal to, but different from, that of experts (Sanoff, 2000). Replacing the defunct notion of the expert, Latour (2004) explicitly stressed that people as co-researchers in the new division of labour. In parallel, Latourian actor-network theory (ANT) suggests ontological, methodological, and epistemological turns to rethinking PD&P, which refers to the actor networks of humans and non-humans, the mapping controversies in public, and the role of the designer and planner to that of a cartographer—an agnostic Prometheus (Storni, 2015). By expanding the definition of who or what participates (Rice, 2017), it is possible to include non-human actants, such as objects, artefacts, and devices in the participatory process (Björgvinsson et al., 2012).

Strengthening voices against technocracy and top-down governance, PD&P has been instrumental in upholding fundamental democratic and sustainability principles outlined in the Aarhus Convention and UN Sustainable Development Goal 11, leading the way for a sustainable city and community. Specifically, the Scottish charrette (Kennedy, 2017), Brazilian participatory budgeting (Sintomer et al., 2008), North American and Western European universities' architectural design (Summers, 1979) and planning (Thornton, 1971) games, and many others are promising strategies for democratic innovation and collaboration. Diversified PD&P approaches are being applied across a wide range of practices under a bewildering variety of concepts: cooperative, collaborative, bottom-up, citizen-led, community-based, and grassroots (see glossary Alarcón et al., 2022). Positing that all these relevant interpretations are inherently collective, the systematic use of CI will enrich the understanding of the diverse realm of participation.

PD&P covers areas of action, including co-housing, children's involvement, participatory archaeology, responsible tourism, and so forth. By approaching PD&P interventions as contributing to the constitution of the public (Dantec and DiSalvo, 2013), we focused on public space as the scope of this study. It is also connected to another research on revealing citizen perspectives on participatory processes for public space across three capital cities, representing developed, less developed, and underdeveloped countries (Heyik et al., 2024). Given the wide range of subjects and scales of applications in PD&P, there exists a substantial body of literature that refers to the public

space. More recently, socio-material dimensions of public spaces have become the central issue of the pandemic period.

Such agonistic (Mouffe, 2007) spaces point to heterogeneity, controversy, and uncertainty as consequences of collective actions. It is important to reconsider ideas about 'the common' and the practical, tangible spatial public sphere—for instance, activities in a square and the informal relationships between users that shape the arrangement of benches for seating (Sennett, 2013)—in contrast to the theoretical and formal approach taken by public institutions in organizing the city and the democratic state, as argued by Habermas (1974). These ideas of the public are not opposed to each other but rather complement each other, especially in a democratic city where the public sphere must strive to create 'the common' in both concrete terms, in real space (streets, squares, community gardens, etc.), and conceptual terms, in institutional space (norms, laws, bureaucratic organization, etc.).

Indeed, according to Sennett (2013), when the practical and the institutional spheres are separated, both lose their potentialities. Therefore, with respect to the common goods that are protected or produced, PD&P should promote, enhance, and above all, interconnect the physical and institutional domains of the public sphere to enable both collective and individual emancipation of citizenship. Ascher's (2018) principles of new urbanism also confirm the engagement of multiple actors and levels in the co-production processes of a contextually sensitive framework considering multifunctional solutions, complexity, variety, and the multisensory dimensions and, where applicable, the quality of public spaces in the two mentioned spheres. Stavrides (2016) distinguishes common space by transforming public space, initially designated by a specific authority, into shared and democratic space through collective forms of appropriation by those who participate in the commoning processes. In particular, community-based long-term PD&P allows for increasing social capital and thereby promoting a sense of community (and extension of common goods).

The rise of PD&P practices along with the rhizomatic trajectories intensified around the chronic, urgent, and wicked public issues followed by an increase in published case studies. More and more, PD&P approaches are being applied in both community- and government-driven cases. Accordingly, non-governmental organizations, institutions, and civic movements have developed peer-to-peer (P2P) case-based platforms utilizing social technologies and crowdsourcing applications. These platforms play a pivotal role in addressing complex public issues by facilitating collaboration, knowledge sharing, learning, and co-creation of participatory approaches. Policymakers, designers, civic initiatives and (co-)researchers can leverage these platforms to share their experiences, disseminate sustainable solutions for chronic issues, identify success factors, and establish benchmarks for participatory and collective actions. The insights gained from these platforms can help the designing of tailored PD&P settings in problem-solving and decision-making processes as well as support mutual learning. However, there is a growing challenge in extracting insights from a large number of shared PD&P experiences, necessitating the development of innovative methods to analyse this extensive (grey) literature dominated by peer-reviewed and crowdsourced cases. Several studies have employed meta-analyses to map the PD&P landscapes, each focusing on different areas of action, but with the shared goal of enhancing understanding and generating new inquiries (Yin & Yates, 1974; Beierle & Cayford, 2002; Tuhkala et al., 2018; Newig et al., 2019; Seve et al., 2022).

This paper focuses on seven case-based platforms: Participedia (Frid-Jimenez et al., 2020), LATINNO (Pogrebinschi, 2017), PartScout (Newig & Michael, 2022), Co-Cities (Iaione et al., 2019), User-Centric Cities Repository (Mitta et al., 2023), OECD (2020), and UN-Habitat Database (UN-Habitat, 2018), to examine their characteristics and test the applicability of the proposed semi-automatic analysis. The

study was conducted to address the following research questions (RQs), which frame our discussion:

1. To what extent does the AI-powered meta-analysis method assist researchers and practitioners in mapping case-dominated landscapes?
2. What types of CI patterns emerge from idiographic richness to nomothetic generality in PD&P, based on contextual, actor-related, and methodological dimensions?
3. How does the utilization of both peer-reviewed and crowdsourced case-based platforms affect the case quality and publication bias for meta-analysis?

These RQs serve a threefold interconnected purpose: development of a novel method to leverage meta-analysis, revealing cross-case CI patterns within the diversified PD&P landscape, and examining meanings of emerging case-based platforms for meta-analysis.

2. Conceptual background

2.1. Participatory design and planning

Over the past half-century, there have been several contemporary trajectories of PD&P across disciplines and communities. Breaking with the user-centred design approach (user as subject) in the 1970s, Scandinavian countries started leading the PD approach (user as a partner) based on the empowerment of users in designing information technology (IT) as part of workplace democracy movements (Sanders & Stappers, 2008; Ehn, 2008; Björgvinsson et al., 2012; Simonsen & Robertson, 2013; Halskov & Hansen, 2015; Smith et al., 2017). For more than a decade, PD of IT enlarged and diversified its main focus, thereby it is renewed to improve the quality of life in a broader sense (Andersen et al., 2015; Poderi and Dittrich, 2018). Accordingly, emerging social technologies present opportunities for fostering democratic innovations, inclusive decision-making mechanisms, and robust collaborations in various areas of action, often intersecting with planning.

The other interconnected trajectory of PD&P emerged in the 1960s civil rights movements and community consciousness in American society (Arnstein, 1969; Fagence, 1977; Sanoff, 2000). Godschalk (1971) highlights the lack of innovative ability within American public institutions, attributing it to the insensitivity of local governments and the absence of a decision-making mechanism to effectively address rapid social change. Hence, he defined the role of the planner as a 'change agent' to find a way to re-orient traditional processes toward more participatory and innovative behaviour. In this sense, Davidoff's (1965) advocacy model aimed to stimulate consideration of future conditions by all groups in society as well as the adversary nature of pluralistic planning. Influenced by advocacy planning, community design centres were established in both the United States and the United Kingdom to provide design and planning services (Skeffington, 1969; Sanoff, 2010). Today, one of the most well-known concepts of PD&P is that of wider participation in urban and regional planning (Cross, 1972). Emphasizing transparency and inclusivity, participatory processes are crucial for restoring community trust in community-based planning, as opposed to top-down policies (Laurian, 2009).

In parallel, however, PD&P faces practical difficulties and impediments, in both developed and less developed countries (Potter, 2011). Fagence (1977) metaphorically described PD&P as 'a double-edged sword', necessitating planners' receptivity and citizens' active participation in the process. On the other hand, Arnstein (1969) confirms the practical difficulties by adroitly likening PD&P to 'eating spinach', an idea that no one is against in principle. Moreover, there are other metaphors such as the 'Achilles heel' of planning (Benveniste, 1989), and the 'cornerstone' of democracy to managing commons (Day, 1997; Harvey, 2012). Indeed, PD&P is often employed by authorities as a unilateral tool for gathering data from citizens, informing them about processes, and obtaining merely legitimacy and accountability, rather than truly empowering or collaborating with citizens.

Putting these key attributes together reveals both the challenges and potential benefits of PD&P in governance and policy science, encompassing both sceptical and optimistic perspectives.

Design Research Society's conference, held in Manchester, is themed Design Participation (Cross, 1972), covering topics such as user interests, self-organizing environments, responsive architecture, and computer-aided participatory design methods. The current special issues on PD&P, almost half a century after this grounding conference, reflect a continuity along the architectural trajectory and evolution with the emerging new strategies to enrich engagement settings in an inclusive manner (Sanoff, 2007; Luck, 2018). Luck (2018), particularly, presents the history of architectural PD in three stages the rise of PD (mid-1960s-), the resilient middle years (mid1980s-) and renewed interests (mid-2000s-) in the UK and US.

There is renewed interest in how to enrich PD&P in pedagogic practices and experimentation in new areas of contestation (Luck, 2018). In particular, technologically mediated PD&P has created new forms of engagement in distributed spaces (Smith et al., 2017). Klosterman's (1997) early manifestation emphasizes the integration of ICT in planning as a collective design to enhance public understanding of complex issues, including the social, fiscal, and environmental impacts of alternative development proposals. Negroponte (1976) has also envisioned users as designers in shaping their living (responsive) environments, through the mediating machine. Previously impossible advanced settings for massive participation and augmented interactions are now feasible with the opportunities of technology. Vardouli (2015) offers an extensive overview for theorizing technological mediation, through a parallel reading of both the past visions of the models from the Design Participation conference and the recent developments. DiSalvo et al. (2017) underscore the substantial interventions by the 'Digital Bauhaus' over the last decade, which have tended to prioritize collective aspects rather than purely digital ones.

2.2. Collective intelligence

Collective intelligence (CI) refers to "the capacity of human collectives to engage in intellectual cooperation to create, innovate and invent" (Lévy, 2010). The key factors concisely used to introduce CI is that the wholeness is greater than the sum of the parts in collaboration, as well as interconnectedness (Atlee, 2014), social co-creativity (Fischer, 2005), and mutual sensitivity (Mulgan, 2018). Engelbart (1962) addresses the value of people's problem-solving capability as the most important resource possessed by society. Indeed, the need for CI is primarily linked to the presence of controversial, urgent and complex issues that require effective and decisive collaboration (Hiltz & Turoff, 1993). In particular, CI is associated with benefits such as understanding the root causes of problems, enhancing awareness, exchanging experiences, adapting, making more informed and inclusive decisions, strengthening the legitimacy of decisions, providing greater accountability, and enabling civic monitoring (Peach, et al., 2019; Ryan et al., 2020). These approaches have been widely embraced by institutions and self-organized communities in both developed and underdeveloped countries.

The 2023 Venice Architecture Biennale, themed 'The Laboratory of the Future,' highlights the effective utilization of CI through interactive means. Notable pavilions utilized CI strategies, such as South Korea's interactive game, "2086: Together How?", which engaged participants in addressing climate issues collectively, Singapore's emphasis on measurement and calibration for sustainable urban planning, and Canada's collective action for cohousing. These examples underscore the role of CI in diagnosing environmental problems, fostering awareness, facilitating learning, and promoting collaborative action in tackling climate challenges and chronic problems. The earthquake in Turkey-Syria in 2023 has introduced a recent example of leveraging CI in crisis. Various critical crowdsourcing platforms, such as hotosm.org, deprem.io, depremenkaz.xyz, afetharita, yakinimibul.net, and deprem.basarsoft,

played pivotal roles in emergency response efforts by facilitating coordination, connecting affected individuals, providing aid, and offering psychological support. The effective utilization of these CI tools is crucial in managing this regional crisis, where seamless coordination is paramount.

In the PD&P literature, DiSalvo et al. (2017) claim that CI is mostly an untapped resource to advance the participatory process and outcomes, while Sanoff (2007) defines it as a favourable outcome. Sendra (2024) emphasizes that co-design must involve collective thinking as a whole and should aim to achieve moments of CI. In relation to the trajectory of technological mediation in PD&P, many recent studies focus on the techno-social networks enriched through CI approaches. Hight and Perry (2006) define CI in design through its potential to restructure and transform separate design practices and disciplines into these networks. Briscoe and Hadilou (2013) further explore CI as an analytical simulation tool for crowdsourced data and social interaction. According to Paulini et al. (2011), CI supports design communication through asynchronous discussions and scales up design participation through an open invitation to the world. Dortheimer (2022) suggests three types of CI within design crowdsourcing systems: discussive, synthetic, and evaluative, which are based on techno-social networks.

Focusing on urgent and complex problems of cities through SDGs, EU-supported projects developed CI models and platforms, such as CIPTEC (Collective Innovation for Public Transport in European Cities), C3PO (Collaborative City Co-design Platform), Cities4People, U_CODE (Urban Collective Design Environment), UrbanData2Decide, urbanAPI (Urban Planning Tools and Intelligence for Integrated Urban Governance), and CAPS (Collective Awareness Platforms for Sustainability including CAP4Access, COMRADES, OPEN4CITIZENS, SOCRATIC, Impact4you, and Catalyst) ecosystem (Bellini et al., 2016). While U_CODE (Urban Collective Design Environment) creates a co-design platform for massive PD&P (Stelzle et al., 2017), CAPS consist of multiple interconnected projects contributing to the field of PD&P. These innovative approaches, as a fraction of current literature, bring together technology, data, and people (Peach et al., 2019) to address chronic public issues within various contexts. Additionally, there are digital CI applications effectively using gaming, mapping, and crowdsourcing strategies such as Veus, Habla, CommunitAR, Qua-Kit, Arturo, SenseCityVity, CityScope, Coastsnap, CivicAI, BlockByBlock, and SuperBarrio within the field of PD&P.

From a pedagogical perspective, CI has been used in collaborative learning (Tenório et al., 2021). Recent applications, such as Sketchdrive at TU Delft Faculty of Architecture (Ouwerkerk, 2018), GEO-VEM at KU Leuven University (Pak & Verbeke, 2014), EquiCity developed by Genesis Lab (Azadi & Nourian, 2021), Hybrid Ideation Space (HIS) in collaboration with Berkeley University and Montréal University (Dorta et al., 2011), Architasker at Tel Aviv University (Dortheimer et al., 2020), and CityWiki and Douyocity at the University of Granada, among others, have deepened our understanding of both the potential advantages and limitations associated with incorporating CI into PD&P education.

We intended to bring together PD&P and CI to create a robust space of inquiry for extracted cases across the fields of democratic innovations, planning, and design. By reading the PD&P trajectories through the CI, common matters of concern among the interconnected fields can be revealed, thus creating a fertile ground for an analytical framework.

3. Method

The research design consists of two main parts: firstly, the identification of case-based platforms to create an extensive and reliable dataset (data collection), and secondly, the application of the AI-powered model to derive insights from the dataset (data analysis).

For the model, we aim to enhance the case survey method (meta-analysis) (Larsson, 1993; Newig et al., 2019) to uncover statistical patterns across

numerous cases. Lucas (1974b) provided an early example of applying the case survey method to citizen participation cases (n:51). Yin and Yates (1974) also utilized this method to assess various case studies (n:215 / 118 variables) related to urban decentralization. Beierle & Cayford (2002) employed it to measure the success of 239 cases of public participation in the United States. In a broader context, Larsson (1993) reviewed eight case surveys conducted between 1974-1989. More recently, Newig and Fritsch (2009) evaluated the applicability of this method in political science. The proposed model consists of the four basic procedures of case survey, leveraged by the integration of AI-powered self-organizing maps (SOMs) (Figure 1):

1. Select relevant case studies for public space from a comprehensive dataset, defining the scope for PD&P cases.
2. Design a coding scheme according to the CI genome for the systematic conversion of qualitative case descriptions into qualified variables.
3. Code the cases by two raters and extract common variables from resources based on attributes of the CI genome.
4. Analyse the coded variables to uncover meaningful relationships within the dataset, map site-specific and cross-regional characteristics, and cluster multidimensional data to establish nomothetic generality in the PD&P landscape.

Overall, we utilized Cytoscape, Knime, Power BI, and Viscovery tools to enhance the capacity of our model to address conventional limitations of case surveys for a large number of cases. Additionally, for the second step, we employed the CI genome, incorporating a triple-scale coding scheme, to systematically map distinctions for contextual, actor-related, and methodological dimensions (Figure 1).

3.1. Data collection

The seven case-based platforms identified as valuable resources for testing the semi-automatic model in our research. We have attempted to cover the range of disciplines, domains, and communities in which PD&P is applied through diversified approaches: democratic innovations (Participedia-DB1 and LATINNO-DB2), decision-making mechanisms (Partscout-DB3 and OECD-DB4), collaborative city-making (Co-Cities-DB5), collaborative actions (UN Habitat-DB6), and user-centric public services (UserCentriCities-DB7). Each platform/database offers comprehensive perspectives on the research area. Some of them have emerged as integral components of a broader CI ecosystem and are interconnected, as seen in the collaboration between Co-Cities and LATINNO.

User interaction within these platforms involves various activities, such as comparing cases to gain insights into PD&P contexts, processes, results, and impacts (DB5). This allows researchers, practitioners, and decision-makers to understand similarities and differences

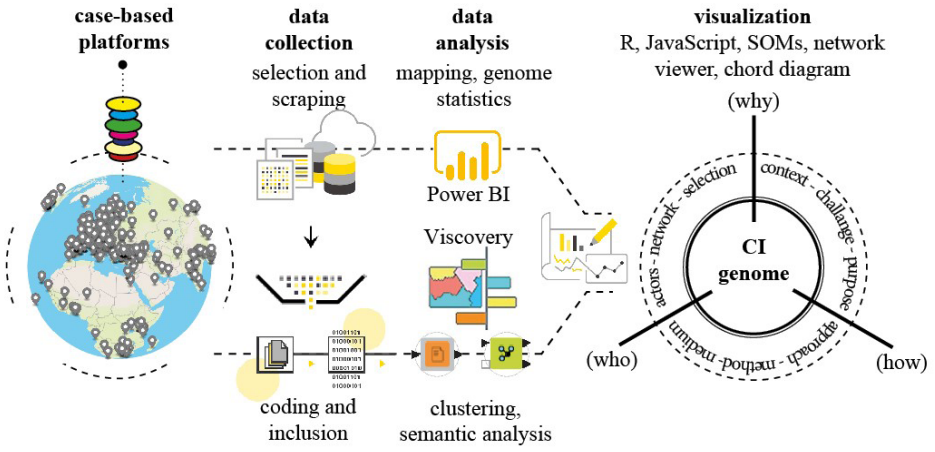

Figure 1. *Methodological framework*

among cases. Based on crowdsourcing applications, users can also contribute by adding new (and editing existing) case studies, ensuring continuous dataset diversity, expansion, and up-to-date information (DB1). The platforms offer search keywords and filtering options based on criteria such as geographical location, method, involved actors, period, participation type, or context, enabling users to quickly find relevant case studies (DB2). Additionally, these platforms facilitate discussions and P2P information exchange, fostering collaboration and learning among stakeholders involved in PD&P practices. They also recognize and award best practices within the field, thereby encouraging competitive collaboration (DB3).

The diverse structures and approaches of these platforms ensure the diversity of the dataset, thereby providing a comprehensive and multifaceted dataset for meta-analysis. To identify distinctions and common variables used to present cases, we have created networks between the structures of the seven platforms (Figure 2). This network facilitates the refinement of the coding scheme for the subsequent data analysis phase. Indeed, the networks created here are similar to those intended for thousands of case mapping. Both aim to make visible existing relationships between matters of concern and actors.

The structural network (Figure 2) provides valuable insights into the interconnectedness and relationships between different components within the platforms, highlighting their functionalities and alignment with various promises. However, one clear observation here is that DB1, 2, and 5 have well-organized attributes, DB4 has a survey-based detailed structure, and DB3, 6, and 7 have a more flexible format. Particularly, several attributes such as description, context, method, organization, and impact are common variables across the seven platforms. Similarly, the commonalities regarding the detailed networks with sub-attributes such as areas of action, types of methods, and actors involved are essential for cross-case analysis.

The selection is based on several reasons: the diversified structures of the platforms, mitigating the bias in case selection with various sources, achieving a heterogeneous worldwide distribution beyond the geographic north, and having a sufficiently large number of cases for rigorously testing the proposed model. However, many other platforms exist, each serving different purposes: Co-Governance Case Databank, which shares successful public policies, organizations, and collaborations (Douglas et al., 2020); CitizenScience.gov, which supports citizen science across the U.S.; CivicWise

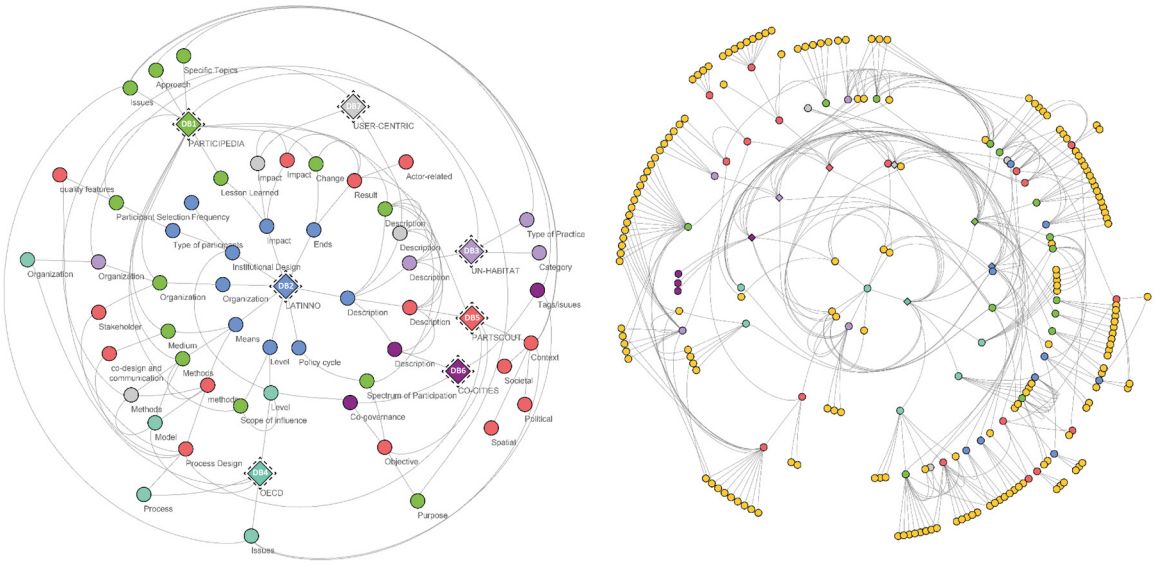

Figure 2. *Networks between the structures of the platforms: general (on the right) and detailed (on the left) graphics (visualized using Cytoscape).*

Table 1. *Extracted and included cases.*

ID	Database (Filters)	Cases / Filtered count
DB1	Participedia (Issues: environment; planning and development; arts, culture, and recreation; identity and diversity; transportation)	2,254 / 1,018
DB2	Latinno - Innovations for Democracy in Latin America (Issue: urban planning and local development)	3,744 / 614
DB3	UN-Habitat Urban Best Practice Database (Type: community-based organization)	4,625 / 240
DB4	OECD Database of Deliberative Processes and Institutions (Issue: urban planning, public services, public spending, citizen engagement, transportation, strategic planning)	574 / 230
DB5	Participation Case Scout (Fields of action: urban spatial planning, sustainability, coastal zone managenent, land use)	305 / 202
DB6	Co-Cities Dataset (Terms: collaborative city-making, co-governance)	399 / 99
DB7	User-Centric Cities	36 / 36
	Total	**2,439**
	Inclusion Criteria	**DB1 / Included**
IC1	Removing duplicate cases and checking languages	-
IC2	Availability of the description or/and abstract	1018 / 874
IC3	Screening the contextual relevance with the public space	874 / 476
IC4	Sufficient information for coding scheme	476 / 418
	Total	**418**

(Civic Innovation for Territory Making), which promotes citizen engagement; Supermind.design (Augmented CI Database), which synergizes human and AI-powered machines; TROPICO (Transforming into Open, Innovative, and Collaborative Governments) (Rackwitz et al., 2020); and platforms like Crowdlaw, COLDIGIT, and People Powered, which include ICT-based tools. These platforms enrich the landscape of participatory design and planning (PD&P), contributing to the dissemination of various approaches and collective experiences. While not included in this research, they offer intriguing avenues for further exploration.

The inclusion of these seven platforms in the meta-analysis aimed to capture maximum diversity for case selection. The selection criteria have long been argued to be an important part of the reliability of the findings. The criteria should be rigorous (Yin & Heald, 1975), based on the RQs (Larsson, 1993), explicit, and consistently applied (Lucas, 1974a). Using the existing filters on each platform related to the public space (PS), we extracted 2,439 case studies from the seven databases (Table 1).

For cases from DB2, DB3, and DB6, web scraping using Xpath in Knime was employed for data extraction. And the filtered data of cases from DB1, DB4, DB5, and DB7, was downloaded using the available export options, conducted within the timeframe of December 10-16, 2022.

3.2. Data analysis

The applied filters provide a comprehensive dataset of PD&P cases related to public space and pave the way for potential future investigations in other relevant domains. Initially, the dataset was examined using semantic and mapping analysis. For clustering, it was further refined using four explicit inclusion criteria (Table 1), encompassing 418 case studies from DB1. Clustering analysis was conducted using AI-based Self-Organizing Maps (SOMs, also known as Kohonen maps) in the Viscovery software to simplify complexity and reveal meaningful relationships.

SOMs offer a more straightforward approach for clustering multi-dimensional mixed data without the need for extensive preprocessing, such as principal component analysis (PCA), which is an alternative clustering method. The SOMs represent a significant advancement in competitive learning, where not only the best-matching cell is activated but also its topographical neighbours in the network participate in tuning to the same input. This process enables the SOMs to identify and represent similar patterns in the original data space, explicitly designed for handling mixed data (Ritter & Kohonen, 1989). One advantage of SOM clustering is its ability to handle mixed data types. Our dataset contains both numerical and categorical variables.

The CI genome (Figure 3) is a simplification, but it helps to construct a primary coding scheme for dataset analysis and incorporates triple-scale parameters derived from shared variables within the platforms' structures (Figure 2). The coding scheme, focusing on the contextual dimension, encompasses the case study goals, themes, specific sub-themes addressed during participatory processes, and the purposes of harnessing CI in these cases. Regarding the methodological dimension, it covers the employed participatory approaches, the level of par-

ticipation, the medium used for participation, participant methods, and the frequency and duration of participatory practices. Lastly, for the actor-related dimension, the analysis delves into the participants involved in the case studies, selection criteria for the participatory process, and organizing entities responsible for the PD&P practices. This triple-scale CI framework, namely the coding scheme, facilitates a systematic cross-case evaluation.

In addition to the CI genome, the dataset includes essential information such as start and end dates, number of participants, references for detailed information about the process, location data of the activities, descriptions or summaries, key outputs, the approximate area of the public space addressed, the allocated budget for the process, and its funding source. Each case was coded by two researchers based on the coding scheme.

4. Results

We present the findings of the semantic, mapping, and clustering analysis of the case dataset. The semantic analysis provides a general understanding and refinement of variables, while mapping and clustering enable further exploration through the identified variables. To conduct these analyses, several computational tools were employed together (Figure 1).

4.1. Semantic analysis

In addition to categorical and numerical values, the dataset also contains descriptions (summary/abstracts) of the case studies. Keywords are identified through semantic analysis based on these descriptions within the coding scheme. In Knime software, a keyword search component is used for semantic analysis. To determine whether there are differentiations across the platforms, the analysis was conducted for the entire dataset (total of 2439 case studies) and specifically

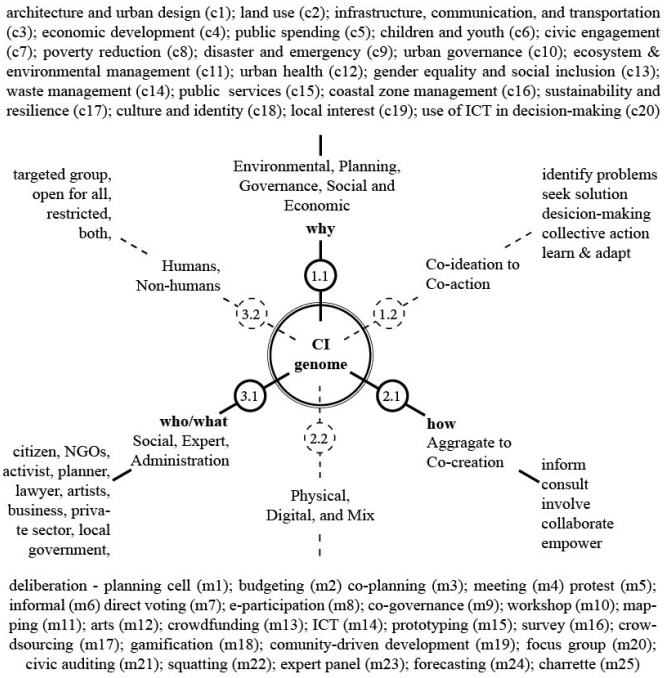

Figure 3. *Coding scheme.*

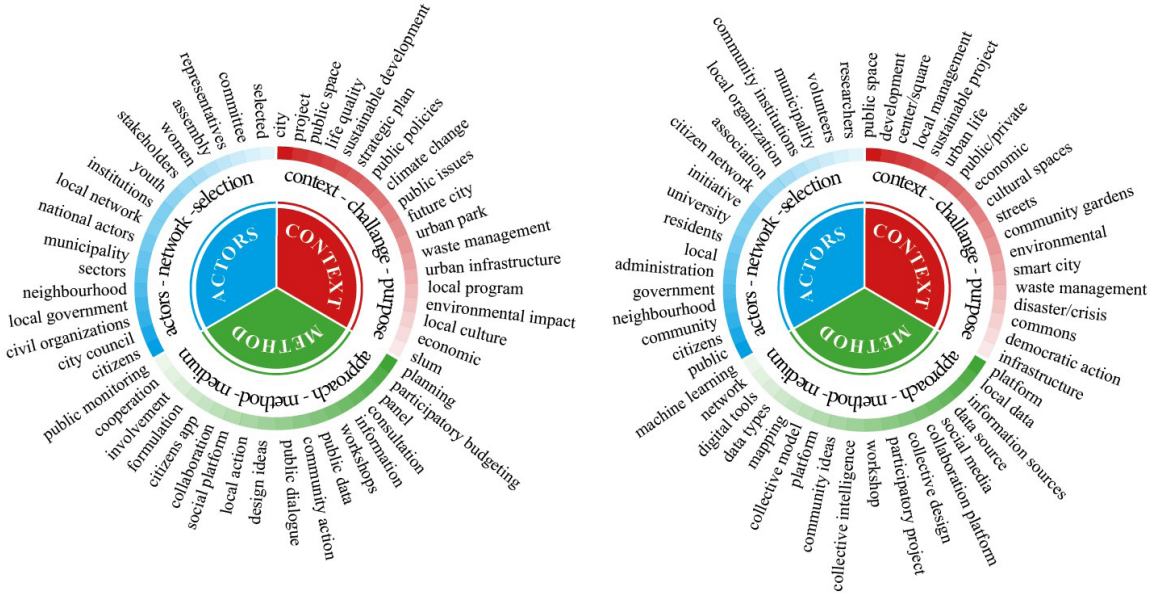

Figure 4. *Semantic keyword frequencies (overall-left and DB6-right).*

for Co-Cities (DB6) and Supermind. design (included) based on the coding scheme.

In the results of the semantic analysis with Latent Dirichlet Allocation (LDA) topic modelling (Figure 4), keywords have been identified within the framework of the coding scheme, and a gradient colour scale has been used for the co-occurrence rate of keywords. In both graphics, there is a similarity in the keywords related to the contextual and actor-related dimensions, while there is significant differentiation in the methodological dimension. Semantic findings for each platform have been examined not only using LDA outputs but also through Cytoscape networks to generate these graphics.

The semantic analysis provides a practical way to identify the critical issues and ensure consistency within the dataset before the coding phase. Furthermore, the statistical co-occurrence rates promote various inquiries, such as comparing platforms' approaches, included and excluded cases, different time intervals, geographic regions, political cultures and so forth. However, the findings offer broad generalizations, necessitating further stratified analysis and parallel readings for more detailed and reliable results.

4.2. Mapping

Mapping case distributions show different scopes of the platforms from European to globally connected networks. The mapping results primarily show the geographical diversity and heterogeneity of the dataset with the worldwide distribution (Figure 5).

Further analysis focuses on exploring areas of action based on the coding scheme. Specific contexts and methods can be examined in their geographical distribution. In this sense, the existing dataset can provide several insights, such as concentration zones for coastal management (c16), adoption of Scottish charrette (m25), and Brazilian participatory budgeting (m2) methods across different geographies and communities. On the other hand, enhancing the diversity of the case dataset is

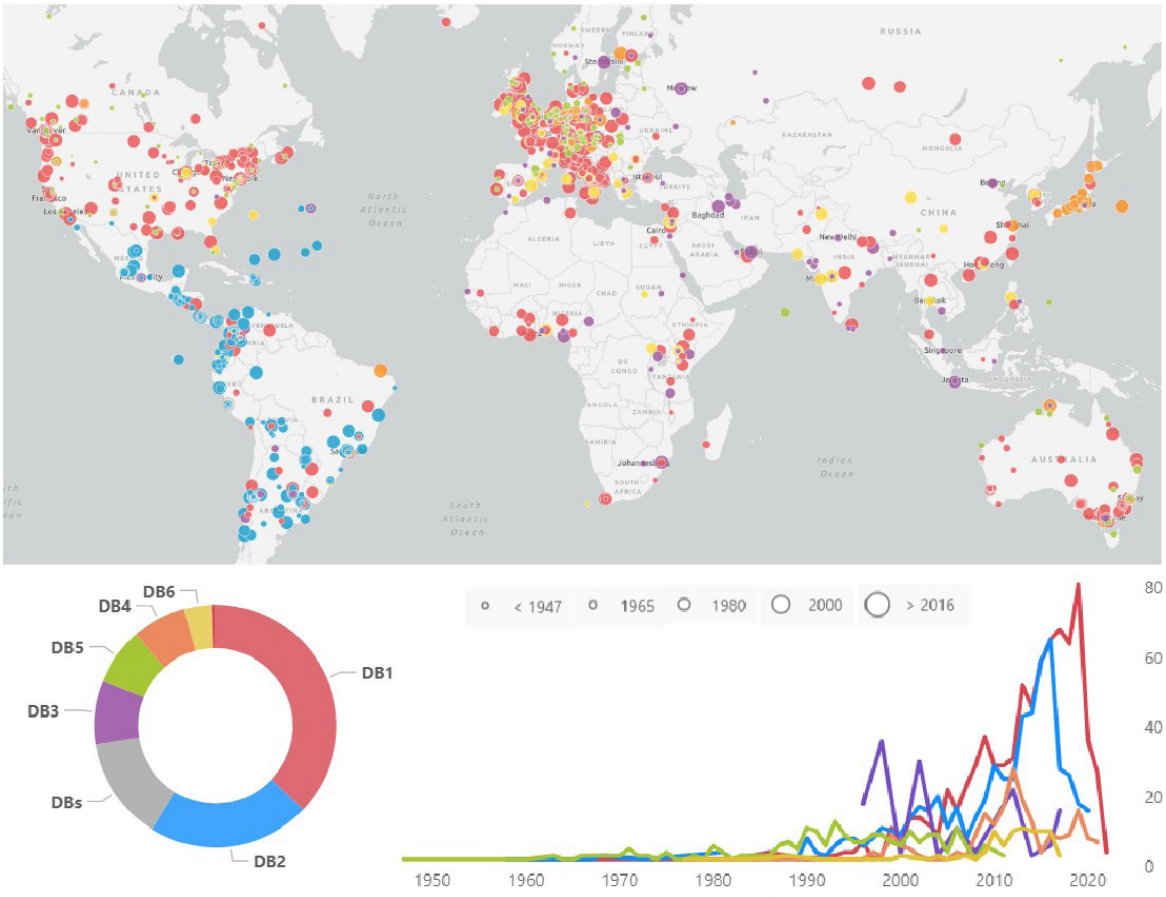

Figure 5. *Geographical and chronological distribution according to DBs.*

fundamental to increasing reliability and uncovering more comprehensive insights.

Despite the inclusion of seven platforms to increase diversity, Europe and the geographic north still dominated the mapping result. Potter (2011) stressed that PD&P is as vital in less developed countries as it is in Western communities, although in a somewhat modified form. This map (Figure 5) highlights the socio-political differences between communities, whether they lack a welfare state or embrace social democracy, both of which use PD&P for the common good and a better society (Luck, 2018). The contrasting characteristics throughout communities, such as those in India and China, imply that PD&P can accommodate diversity in a wide variety of political and cultural contexts. The recent PD Conference (2022) linked 16 distinct locations, spanning from Kenya to Helsinki, and from Sibu to Morelia. Halskov and Hansen's (2015) review also verifies the worldwide expansion of participatory practices (2002-2012) over the last decade. Indeed, mapping the diversified PD&P landscape could facilitate new explorations while also promoting a better understanding of cross-regional comparisons.

In addition to regional distributions, the dataset is also examined chronologically in mapping. Also, a numerical line graph has been created based on the start dates of the filtered examples from the DBs (Figure 5). By evaluating geographical and chronological analyses together, it is possible to draw better insights from the map.

The Power BI dashboards enable the visualization of multiple variables together based on specific queries, such as 'cases in Spain related to PD&P workshops (m10) on sustainability and resilience (c17) after the 2008 economic crisis,' and 'chronological graphics and actors involved in cases related to the conservational or political squatting (m22).

The scopes of the platforms can also be explored chronologically, there-

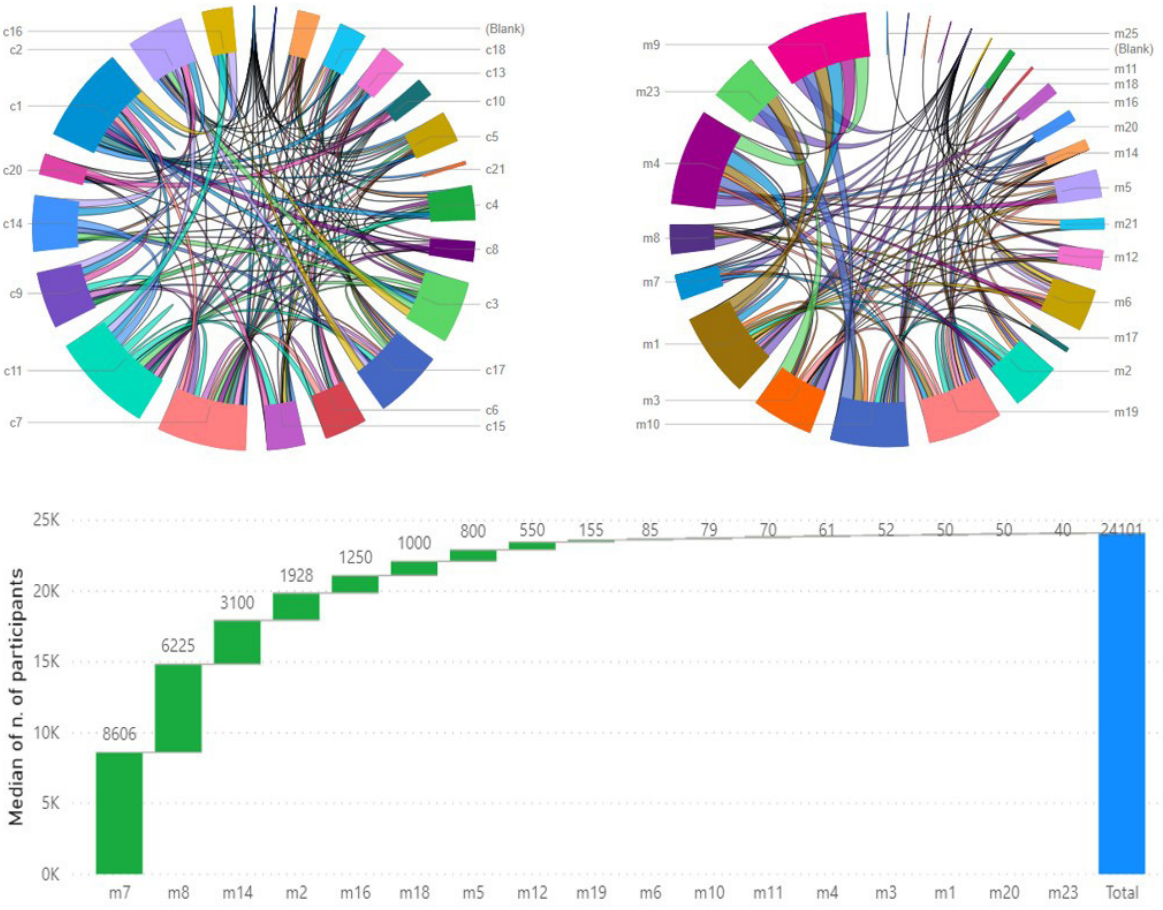

Figure 6. *Chord diagram for contexts and the number of participants by the employed method.*

by reflecting regional or specific networks. DB7 is a Horizon 2020 project, whereas DB5 dates back to the 1960s, DB4 to the 1980s, and DB2 to 1990, each defining its respective scope. Most platforms feature case studies that span from the 1960s to the 2020s, with the highest frequency observed in the 21st century. This can be attributed to the platforms' expansion in scope and enriched content through crowdsourcing, aligning with their establishment during this timeframe.

However, adding historical cases into the platform's structure is more challenging compared to sharing recent PD&P practices and focusing on current issues. Notably, the platforms exhibit heterogeneous distributions across different years: DB1 peaks in 2010-2020, DB2 in the mid-2010s, DB4 in 2005-2010, DB6 in the 2010s, DB3 in 1995-2005, and DB5 in the 1990s and 2000s. Given these variations, considering these platforms together provides a geographically and chronologically more advanced dataset.

Additionally, chord diagrams are utilized to explore the relationships between different genome variables within the dataset, particularly focusing on the co-occurrence of context pairs and employed methods in the same case (Figure 6). The first diagram reveals a strong association among approximately 20 contexts, with certain pairs like c11-c16 and c10-c20 displaying highly interconnected relationships. In contrast, the relationships among 25 methods are weaker, with some methods dominating while others are rarely used together. Notably, methods such as m19 (community-driven development), m10 (workshop), m1 (planning cell), and m2 (participatory budgeting) exhibit higher interconnectedness in the chord diagram, whereas methods like m9 (co-governance), m23 (expert panel), m3 (co-planning), m20 (focus group), and m21 (civic auditing) have relatively lower co-occurrence with other methods. Certain method pairs, such as m10-m23 and m4-m5, display highly interconnected relationships. Conversely, other methods (m16, m11, m25, m18, and m17) have significantly lower occurrence rates within the dataset.

Moreover, when compared to the more heterogeneous and similar usage rates observed in the context diagram, the distribution of methods like m9, m4, m1, m10, and m19 corresponds to a substantial part of their usage within the dataset.

To further elaborate on this (Figure 6), another variable is examined: the number of participants based on the employed method. In digitally supported methods, such as voting (m7-8606), e-participation (m8-6225), ICT (m14-3100), budgeting (m2-1928), survey (m16-1250), gamification (m18-1000), protest (m5-800), and arts (m12-550), the medians of participant numbers significantly differ from other methods. However, the relationships between variables aren't as clear as participant numbers. Thus, clustering is needed to interpret and evaluate all variables together, especially in such a large number of cases.

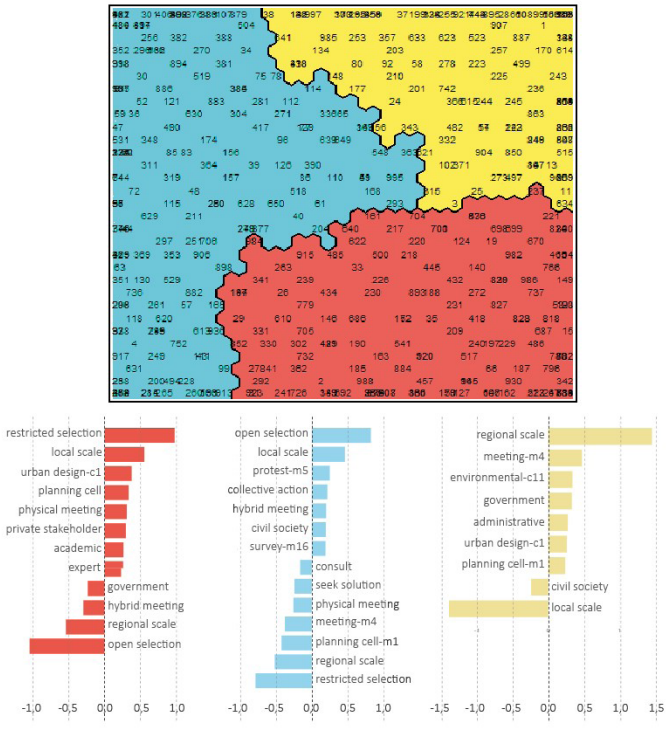

Figure 7. *SOM results in 3 clusters (the code of each case study is identified in black font).*

4.3. Clustering

When selecting the clustering method, emphasis was placed on ensuring that the results are intuitively interpretable and that variables/attributes can be easily prioritized. In Viscovery software, the feature maps facilitate a

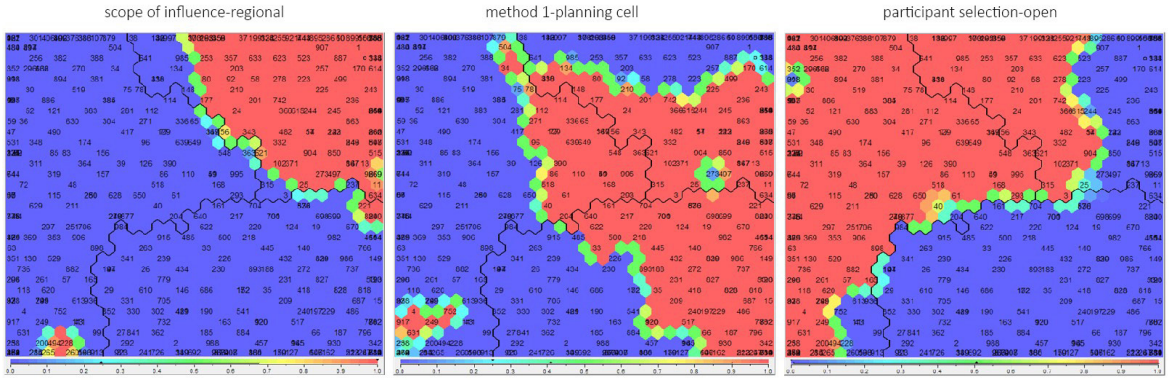

Figure 8. *Distribution of the individual values include 'm1=planning cell', participant selection 'open', the scope of influence 'regional' along the 3-sample SOMs.*

better understanding of relationships and spatial organization between clusters. When examining the values in the 3-cluster SOM results, it can be observed that, 11 variables exhibit significant impact (values > 0.2) on the cyan cluster. These variables include 'restricted' and 'open' in the participant selection, 'regional' and 'local' in the scope of influence, and 'm1' and 'm5' in employed methods. Furthermore, the fundamental characteristic features within each of the three clusters (polarized as - and +) can be examined based on the effects of the variables (Figure 7). The polarized representations describe the negative and positive relationship between neighbouring neurons in the feature map. The resulting feature map exhibits a topological organization of the data, where similar cases are typically located in close proximity to each other. The SOM model was constructed using 114 attributes and 916 neurons, with a significance level of 95% indicating the confidence level of the obtained clusters. The 916 neurons represent the competitive learning nodes used in the SOM algorithm, providing a visual representation of the clustering results.

Moreover, the clustering results can be further analysed for individual variables based on the distribution of values along the SOM. For instance, the 'regional' variables related to the scope of influence exhibit distinct boundaries within the yellow cluster, indicating a strong association with this particular cluster. Similarly, the 'open' variable within the participant selection is well-defined within both the yellow and cyan clusters, implying a shared impact on these two clusters. Furthermore, the 'm1' variable within the methods category is observed to have a uniform distribution across all three cluster regions, suggesting consistent effects (Figure 8).

In the 5-sample SOM clustering, notable changes emerge (Figure 9). The number of variables with a significant impact on the clusters increases compared to previous analyses. Addi-

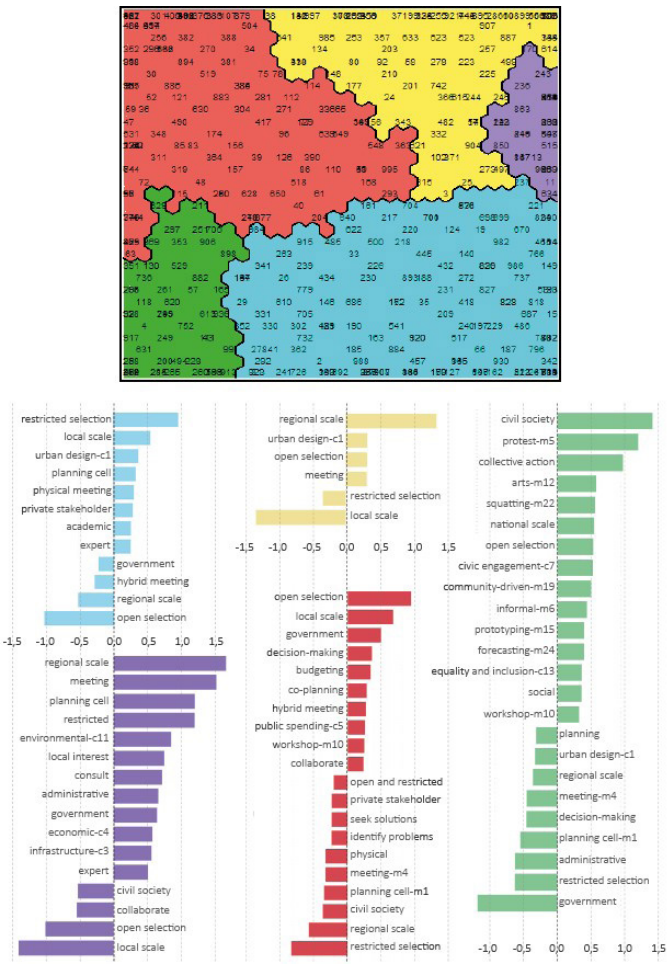

Figure 9. *SOM results in 5 clusters.*

tionally, two new and relatively smaller samples differentiate from the formerly cyan and yellow clusters. Upon closer examination, the 'government' and 'civil society' variables in the type of organization define the green cluster, while 'methods' and 'targeted groups' influence the violet cluster.

5. Discussion

The research conducted a comprehensive analysis of seven case-based platforms employing a semi-automatic model. By applying semantic, mapping, and clustering methods respectively, the study offers a novel approach to discovering the landscape of PD&P. The ensuing discussions focus on the potentials and limitations of the proposed model (RQ1), the emergence of CI patterns from idiographic richness to nomothetic generality in PD&P (RQ2), and the significance of utilization of both peer-reviewed and crowdsourced case-based platforms for meta-analysis (RQ3). The initial discussion has focused on the performance of AI-powered meta-analysis for mapping PD&P cases in a practical and interpretable manner.

5.1. Reflections on methodology

Navigating and evaluating ever-increasing PD&P cases can be frustrating for (co-)researchers. In this sense, case surveys bridge the gap between nomothetic approaches and idiographic case studies by quantifying primarily qualitative cases to enable statistically testing cross-case patterns (Newig & Fritsch, 2009; Larsson, 1993). However, this approach, while powerful, is also limited. Issues such as criteria in case selection, publication or rater biases, and restricted reports or resource data due to space limitations, can threaten validity. Furthermore, the quality and quantity of case studies and the potential loss of idiographic information due to coding simplification pose significant challenges (Larsson, 1993; Jager et al., 2021).

In our research, we have addressed these limitations through the following methodological developments:

1. Utilizing multiple sources for data collection through seven case-based platforms.
2. Employing a comprehensive coding scheme with the triple CI genome.
3. Incorporating semantic, mapping, and clustering techniques as a practical and robust approach to address a large number of cases.
4. Including multiple raters and data triangulation to minimize information loss.

Additionally, Larsson (1993) suggests further developments to mitigate limitations, such as:

5. Stratified case selection using sampling parameters and bias analysis.
6. Author-coded cases provide access to additional primary data.

In particular, the heterogeneity of platform structures posed challenges, resulting in missing or incomplete essential information required for the coding scheme. And, some cases presented tacit or unclear expressions, that make accurate coding challenging. To overcome these issues, we employed web-scraping tools for data collection and simplified the CI genome to facilitate network analysis of the chosen platforms. In particular, the combination of semantic, mapping, and cluster analysis offered a robust and stratified model. To effectively test the proposed model in the fertile and complex field of PD&P, we integrated various computational tools:

- Conducted web-scraping for data collection and semantic analysis in Knime.
- Established network structures of semantic results and case platforms to refine variables in Cytoscape.
- Examined variables using chord diagrams and mapping tools in Power BI.
- Created interpretable representations of the dataset through clustering in Viscovery.

Indeed, the strength of the model lies in addressing the limitations of the case survey method. Lucas comparatively analysed aggregative approaches, including both case surveys and cluster methods, considering their strengths and weaknesses. "No one approach or variation is always the best, and they can in fact be used in combination to strengthen the aggregation process" (Lucas, 1974a). Previous studies have utilized hierarchical clustering (Jager

et al., 2021) and prototype-based k-means clustering (Tuhkala et al., 2018) to analyse different variables in participatory decision-making and education-related PD studies. Each clustering technique has specific advantages and can yield different outcomes depending on the context in which it is applied. Our study employs an innovative approach by leveraging the potential of case surveys, probing the why, how, and who dimensions within CI genomes. Specifically, we selected an AI-based clustering technique as an aggregative method for in-depth exploration of intricate patterns across PD&P practices.

We also utilized kernel methods in conjunction with 3D scatterplots for clustering, serving as an alternative technique to compare the performance of SOMs. Kernel Principal Component Analysis (KPCA) uses a kernel function to transfer input data into a higher-dimensional feature space (Xu & Franti, 2004), where non-linear relationships are retained. However, kernel-based clustering provides results in less interpretable cluster boundaries due to the necessity of defining appropriate kernels and data preprocessing.

Building on these arguments, the proposed semi-automatic model has significant potential in the field of PD&P and is adaptable to other case-dominated landscapes. Therefore, incorporating more data sources and testing alternative clustering techniques could provide a deeper understanding of advanced methodology.

5.2. From idiographic richness to nomothetic generality in PD&P

The diversity of the dataset is ensured by the variety of case-based platforms, providing a broader perspective for the discussion. Accordingly, the dataset presents a colourful spectrum, from designing ICT-based decision-making, to ubiquitous interactive spaces, to planning future actions, to community gardens. We have mapped out the network of the interconnected PD&P practices and their diversified landscapes, which we could pretend represent forms of CI patterns. The findings offer valuable yet broad insights into the evolutionary trajectories and diversified landscape of PD&P.

- The cases addressed public space with practical (79.7%) and theoretical (50.6%) aspects, often intersecting with planning (48.8%) and social contexts (16.5%). This emphasizes that PD&P covers both the practical and institutional aspects of public space.
- In total, 41.5% of the case studies prioritized decision-making objectives, while 6.8% indicated collective action. The clustering results also show a contrast between decision-making and collective action variables in the green cluster. Due to the practical and discursive nature of these objectives, they generally do not align with the dataset.
- Statistically, the distribution of adopted approaches is as follows: inform (3.1%), consult (39.4%), involve (28.9%), collaborate (22.8%), and empower (5.7%). The clustering results indicate significant contrasting effects between collaboration and consultation variables within the violet cluster. Consequently, the emerging approaches are primarily characterized by participants' levels of empowerment and the presence of unilateral/distributed relationships.
- The findings also emphasize the active role of both human and non-human actors in shaping the PD&P process. In digitally supported methods, such as m7, m8, m14, m2, m16, m18, m5, and m12, the number of participants is significantly higher than in other methods. However, the medium of participation is primarily based on face-to-face (64.4%) or hybrid settings (28.9%).
- The type of organization significantly influences clustering results, with a contrasting effect between civil society and government in several clusters. In this sense, the distinctions between community-driven (bottom-up) and data-driven (top-down) cases are significant. Within the case dataset, these two approaches can be located at oppo-

site ends of the spectrum, cautioning against disempowerment and non-participatory processes.

When collectively assessed, these findings reveal meaningful or independent relationships. While some variables, like frequency, show no impact on overall clustering results, others consistently influence the outcome, such as participant selection and the scale of issues. We aimed to test the proposed meta-analysis method without bias towards any specific variables. Hence, we didn't focus on a particular hypothesis to confirm or refute regarding the nomothetic generality of our results. However, meaningful relationships among these variables could prompt new inquiries. Our method, as tested, can be effectively utilized with its adaptable modules for networking, mapping, and clustering cases.

5.3. Harnessing peer-reviewed and crowdsourced platforms in meta-analysis

One notable aspect of the study is its methodological advancements, while another is its comprehensive coverage of diverse platforms. Some case-based platforms facilitate new case submissions through features like "quick submit" (Participedia) and "send us a case" (LATINNO), whereas others consist of peer-reviewed (scientifically reliable) cases and do not accept new submissions (e.g., Partscout). The geographical distribution of cases across different regions underscores the platforms' varied scopes of interest. Additionally, the chronological analysis reveals peak points for case numbers during the 21st century, possibly reflecting the expansion of platform scopes and the increasing potential of crowdsourcing.

Overall, these open-access, P2P, cumulative, and crowdsourcing platforms offer a broader perspective, enabling users to compare cases and understand diverse PD&P contexts, processes, and impacts. They foster collaboration, and mutual learning, and recognize success factors. Indeed, most of these platforms are examples of CI, created collaboratively through social technologies. While these platforms demonstrate numerous positive effects, they also raise concerns about disruptive consequences associated with publication bias in crowdsourcing.

Hess et al. (2015) emphasized that the reliability of meta-analysis findings is positively correlated with the size of the sample and scientifically reliable case studies. Newig et al. (2023) conducted a meta-analysis with and without grey literature, observing stable results. Jager et al. (2021) argued that including cases from grey literature possibly enhances dataset validity but raises concerns about the reliability and density of information. We deliberately diversified the dataset with peer-reviewed and crowdsourced cases to mitigate publication bias and obtain a comprehensive understanding of the researched field. The findings remain inconclusive as we did not conduct the analysis without the inclusion of grey literature or solely with it. However, the methodological advancements made, particularly the network and semantic analysis conducted prior to the coding stage, can strengthen this case selection.

Moreover, certain platforms feature selected practices under categories like "best practices," "promising," and "award winners," (e.g., UN-Habitat). In general, these approaches can be classified into crowdsourcing, research-oriented, and competitive categories. Indeed, the slogans of these platforms reflect their primary functions, such as "Explore, contribute and teach" (Participedia), "Innovations for Democracy in Latin America" (LATINNO), and "Get inspired for your own projects!" (Partscout).

The network and mapping analysis revealed the distinct characteristics of each case-based platform, indicating the diverse functionalities and structures. However, it also brought to light potential opportunities for collaboration and knowledge exchange among these platforms. By fostering connections among them, stakeholders can access shared practices, strategies, and key factors—whether unreliable, unsuccessful, or unofficial—from various perspectives. Such collaboration has the potential to cultivate a more robust collective intelligence ecosystem for PD&P and related concepts.

6. Conclusion

The study has effectively conducted a semi-automatic meta-analysis of seven peer-reviewed and crowdsourced platforms, utilizing semantic, mapping, and clustering techniques and computational tools. The research outcomes have illustrated the considerable potential of the AI-powered method in efficiently uncovering cross-case patterns.

In conclusion, this research presents a robust and adaptable methodology for analysing ever-increasing case studies in the field of PD&P. Page's review (2003) on case surveys method for participatory decision-making is notable in stressing both the affordances and limitations: 'Such a method will only ever give a sketch because it is seeking to make broad generalizations... it provides a crucial map of ideas and a provocative set of future research questions". Despite the encountered limitations, our preliminary study has provided valuable insights from idiographic richness to nomothetic generality in PD&P. By addressing reported challenges and focusing further on specific inquiries, the findings of this study contribute to a broader understanding of the PD&P landscape. The increasingly emerging case-based platforms and the development of CI ecosystems can offer valuable resources for practitioners and researchers engaged in participatory research, fostering the co-creation of sustainable, inclusive, and resilient strategies. However, given the extensive case-dominated (grey) literature, the proposed method and inclusiveness of the research scope are valuable but not sufficient.

The contextual, methodological, and actor-related insights can inform the designing of co-creation settings and the implementation of truly participatory and proactive PD&P processes. To deepen this impact, future research can address detailed questions by leveraging the proposed method in experimentations in new areas of contestation. Recently, we've attempted to integrate our findings with our ongoing research on citizens' willingness, trust, and lack of interest in PD&P settings across capital cities of developed, developing, and least developed countries. The future objective is to compare preliminary insights derived from the published case studies with citizens' reflections interviewed on the streets.

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