The Challenges of Citizen Participation in the Development of Citizen-centered Smart Cities: Lessons Learnt from two European initiatives

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Abstract. Citizens have become the forefront of every urban transformation in the pursuit of more citizen-centered cities. The involvement of residents in any smart city initiative is key for establishing resilient and inclusive smart cities that cater to the needs of the entire community. Thus, the representative participation of citizens in any transformation process becomes a pillar for acquiring the necessary information. Nevertheless, some barriers arise that prevent a successful participatory process when developing smart cities. These barriers become a challenge to develop truly citizen-centered and inclusive smart cities. This paper analyses two European initiatives, DROP and URBANAGE, where specific actions have been taken to overcome these barriers. Utilizing engagement methodologies, cocreation processes have been systematically implemented to organically integrate citizens into the strategic design framework. Although targeting different citizen groups and objectives, both projects encounter common challenges in achieving citizen participation and awareness. Lastly, the paper highlights five main lessons learnt and proposes several guidelines to help overcome these barriers in other participatory processes.

Keywords: participation, engagement, human-centered design, case study.

1 Introduction

A proper urban development can be achieved through the development of smart cities [1]. The concept of smart cities has significantly gained in importance and relevance, as urbanization and population shift are expected to increase considerably by the year 2050 [2]. However, the origins of this concept remain somewhat ambiguous. Some authors trace it back to the Smart Growth Movement that emerged in the late 1990's [3], [4]. Other authors identify its roots in the earlier "cybernetically planned cities" of the 1960's or in proposals for networked or computable cities within urban development plans from the 1980's onwards [5], [6].

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Regardless of their origins, smart cities are characterized by their innovative performance across various domains: governance, mobility, economy, environment and lifestyle [7]. Most of the definitions of smart cities in scientific literature revolve around the use of Information and Communication Technologies (ICTs). The dependence on technology, however, leads to a digital society with the emergent issue of the digital divide, as smart city citizens are often assumed to have a high understanding of technology [8]. Nevertheless, while often associated with digital technologies, such as sensor data collection [9], the "smart" aspects of smart cities also encompass attitudes related to awareness and self-sufficiency [10]. Therefore, a more human-centered characterization of smart cities is increasingly gaining strength [2] that emphasizes the importance of the social dimension of cities and places the citizens in the center of smart cities [11].

This focus on social well-being is a core objective of citizen-centered cities. Citizen-centered cities focus on improving the quality of life, wellbeing and satisfaction in urban contexts by creating them for and with the citizens that live in or transit them[11]. Conceiving citizen-centered cities can be achieved through citizen participation initiatives. Citizen participation processes bring several benefits to the citizens, the city and the corresponding authorities, highlighting: multi-directional approach to problem solving [12], [13], [14], community empowerment [15], social cohesion [15], [16], resilient communities [15], [16], awareness [17], [18], increased accountability [15], [18], inclusivity and diversity [19], [20] and innovative ideas [14].

However, like any complex process, the application of citizen participation initiatives can face several barriers, both internal and external, that can undermine its successful implementation. In this case, seven barriers can be: representativeness [21], [22], political interference [23], power relations [23], [24], time constrains [22], limited resources [22], technology [12] and expertise gap [18].

2 Barriers for successful citizen participation in smart city development

This section outlines the main barriers identified in scientific literature that undermine a participatory process in smart city development.

i. **Representativeness**. Ensuring that participation to be truly representative of the entire community can be difficult [22], [23]. The subset has to be representative of the relevant population, important interests have to be included, participants have to possess enough information to make good judgements and have to be accountable for those that do not participate [21].
ii. **Expertise gap.** Citizens often lack the expertise in urban planning, architecture, and design, making it challenging for them to fully grasp the technical aspects of regeneration projects. Many critical views defend that citizens do not have the expertise to contribute to the process [18].

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iii. **Political interference**. Politicians or special interest groups may manipulate or co-opt the participation process for their own agendas, undermining the genuine involvement of residents. According to Wamsler et al. [23], the main issue is that citizen participation in the least of priorities of the corresponding authorities and, therefore, there is not a systematic way to collect peoples' needs and wishes. Thus, this will end in the lack of supporting policies, regulations and planning tools for participation.

iv. **Power structures**. Complex bureaucratic processes and regulations can deter citizen participation. A lack of transparency can frustrate community members. Moreover, the existing institutional structures and power relations lead to a lack of trust and accountability due to pre-existing conflicts [20], [23], [24]. By the same token, capturing citizens needs and the local context is often too expensive and fails due to lack of personnel [22].

v. **Time constraints** are also a relevant barrier for citizen participation. Participating in urban regeneration initiatives can be time-consuming, and many residents may have other commitments, such as work and family, that limit their availability [22].

vi. **Limited resources**. Communities may lack the financial or technical resources needed to actively participate in the regeneration process. This can create disparities in participation between affluent and disadvantaged neighborhoods. Maas et al. [22] highlight that involving citizens in the design process takes a huge amount of time and resources in order to establish a meaningful relationship with the community.

vii. **Technology**. Technology and "technology first" mindset that has built upon the smart city context. Authorities believe that implementing existing technology will be cheaper than designing solutions from scratch and together with the citizens [22] . However, within this context, another limitation is the difficulties facing the collection and processing of the correct data from citizens [12].

3 Methodology

This section describes the methodology applied to the collection and analysis of the data in both case studies. It followed a Descriptive-Analytical Method, where both cases have been studied independently and then analyzed to understand the participatory process in each case (see **Fig. 1**). When applying this method in the case study analysis it generates a detailed and exhaustive description of the cases, while allowing understanding of the context and the particular characteristics of the case deeper [25]. In this case, it has added special value in the identification of challenges between the two phenomena to assess the validity of the methodology in different cases.

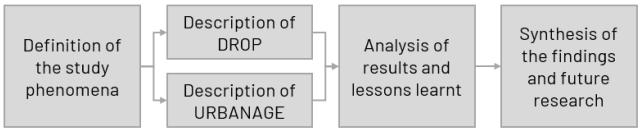

Fig. 1. Steps of the Descriptive-Analytical Method in this study

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This paper analyses two Europe based case studies that have applied the same principles in order to overcome the barriers of participation and enhance citizen engagement in participatory initiatives. It outlines the actions taken and the lessons learnt from both initiatives.

4 Results and discussion

This section describes both case studies analyzed in this paper and outlines the actions taken in both of them as well as the results obtained.

4.1 Definition of the study phenomena

Both case studies have been selected due to the methodology used in order to overcome the barriers of citizen participation in the development of inclusive and smart cities. The methodology applied in the two case studies has its origin in the Human-Centered Design (HCD) principles. The concept of HCD has its roots in Design Thinking [26]. It was popularized in the 1990s as an approach to foster innovation in business strategies through the development of user-driven products and services [27]. The principal goal of HCD is to develop solutions that cater to the needs of its users while maintaining its feasibility in the market, concluding with solutions that are feasible, meaningful and effective, addressing the needs of its users. It divides every step into a divergent and convergent sub-step, where activities are approach through a human-centered approach while balancing them with real-world limitations such as time and resources [28].

It is an approach that places a primary emphasis on ensuring that whatever is being designed, whether it's a product, service, or system, effectively meets the needs and preferences of its intended users. Its standards follow the international norm ISO 9241-210, which defines 5 main principles a process must follow in order to be human-centered (see **Fig. 2**).

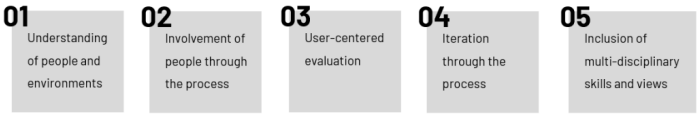

Fig. 2. Main principles of HCD

Hence, it relies on techniques that facilitate communication, interaction, empathy and engagement with the individuals involved in a process [29]. Through the use of these methods, designers strive to attain a deeper understanding of users' needs, desires and experiences, often uncovering aspects that users may not initially recognize or express. Within HCD approaches, the designer's role is to have an integrated vision, making it inclusive and finding a way to gather users from different backgrounds [30]. Thus, the role of the user or, in this case, the citizen, increments as the successful implementation of this approach concludes in citizen-centered cities with truly transformative

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governments [31]. The principles of HCD have been adapted to the specific objectives of each case study.

4.2 Case study 1: drOp

The first case study analyzed in this paper was the Horizon EU project drOp: "Digitally enabled social district renovation processes for age-friendly environments driving social innovation and local economic development". The core ambition of drOp is the development of an integrated renovation methodology (IRM) aiming to transform social housing districts into inclusive smart neighborhoods. To achieve this goal, drOp employs a human-centered approach and incorporates cutting-edge technologies to generate growth. The model developed in this study is being tested in a case study in the Santa Ana neighborhood in Ermua (Spain) and followed by in two other European municipalities: Elva (Estonia) and Matera (Italy).

Within this context, three main action lines have been developed to overcome the barriers of citizen participation through a human centered design approach: (i) communication of the participatory process, (ii) definition of a collaboration structure and (iii) co-creation sessions.

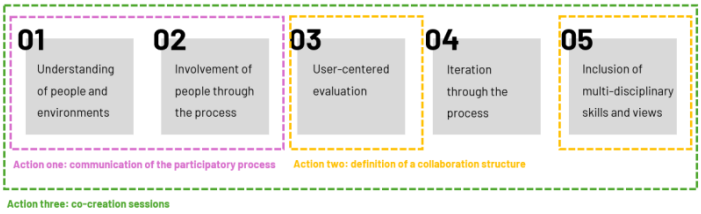

Fig. 3. How every drOp action reflects in the principles of HCD

Each of these actions addresses different principles of the human centered design approach (see **Fig. 3**) in order to overcome the identified barriers:

- Action one: Communication of the participatory process. This action is directly tied with the HCD principles 1 and 2 as it helps to better **understand the people** living in the neighborhood and their environment and also ensures the **involvement of people through the process**.
- Action two: Definition of a collaboration structure. This action focuses on the HCD principles 3 and 5 by putting the **evaluation activities** in the hands of the residents and **integrating multi-disciplinary skills and views** into the team.
- Action three: Co-creation sessions. The last action covers all five HCD principles, as co-creation sessions are the basis of the entire process and involve citizens and other stakeholders to achieve different objectives.

Action one: communication of the participatory process. The first action focuses on techniques to facilitate both communication with involved citizens and their

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understanding of the process and its potential outcomes. To do so diagrams, visuals and illustrations were developed to show the process and possible results of the project to the participants. Participants are experts of their own experience but not necessarily experts in the topic in hand. They take part in a process to help planners, designers or authorities understand the day-to-day life of the neighborhood and the needs they may have around it. Therefore, it is in the hands of the planners or designers to make the process as inclusive as possible by not using a mere technical language.

The project's progress and key decisions were communicated to the community through a series of infographics (see **Fig. 4**). These visuals were shared with residents via mailed pamphlets and displayed at the neighborhood office, ensuring that the community remained informed and engaged throughout the process. This approach also helped minimize the expertise gap mentioned beforehand, as visual representations made it easier to understand the more complex technical aspects.

Fig. 4. Information pamphlets through the process

For the understanding of the possible outcomes of the process, some images were created with the help of Artificial Intelligence (AI), where the neighborhood was visualized in several possible future scenarios, depending on the different actions taken during the development of the project. These images showed the actual neighborhood but with different features such as greener spaces, more social encounters, enhanced economic development or smart dwellings (see **Fig. 5**). Having pictures of their actual neighborhood but with a few adjustments has helped in understanding better the possible outcomes of the project from the outset of it.

Fig. 5. Images of the neighborhood created with AI

Action two: definition of a collaboration structure. The second action line relies on the definition of a work structure for the project, encompassing community members, key stakeholders, project team members and the council. This structure, defined as a

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Local Task Force (LTF), describes a three leveled structure defining different standards of implication for each level. The LFT represents a coalition of relevant stakeholders working collaboratively to address the challenges presented by the community and reach a consensus on the decisions at hand. Thus, it entails the distribution of the decision-making authority and responsibilities among different stakeholder groups. It functions as a local hub that guides the bottom-up initiatives, divided into three main levels: a coordination structure, an executive commission and an extended commission.

Fig. 6. Structure of the Local Task Force

Action three: co-creation sessions. The third and last action line was the design and development of the co-creation sessions in the identification and the co-design of the projects to develop in the neighborhood. Several sessions were conducted, where both citizens and relevant stakeholders took part (see **Fig. 7**). These sessions were designed following the principles of HCD, where they main focus relied in the understanding of residents and their environment. This was made by facilitating bidirectional conversation spaces where participants could express their feelings and opinions. Thus, they were designed in a quite open-ended format, so that they were easy to adapt to the needs and desires of the participants. The residents were involved through the entire process and were the ones that evaluated and prioritized the projects to be co-designed based on the needs of the community. They were held in the neighborhood to ease the participation and ensure accessibility to all residents.

Fig. 7. Overview of some of the co-creation sessions

In some cases, digital tools were used to conduct the sessions, where the facilitators would use an app to manage all the data citizens were sharing. These tools were used by the facilitating team, with the inputs of the residents, so that they would only need to focus on sharing their problems and needs. This way the time of both the actual

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session and the processing of the data afterward were reduced significantly and efficiency, overall, enhanced.

4.3 Case study 2: URBANAGE

The second case study examined in this paper is URBANAGE, a Horizon 2020 project titled "Enhanced URBAN planning for AGE-friendly cities through disruptive technologies." This initiative aims to assist urban planners and policymakers in leveraging new technologies for more inclusive and evidence-based decision-making. URBANAGE promotes the creation of age-friendly cities by implementing a new decision-support ecosystem, co-developed by key stakeholders (public servants) and end-users (older adults). This ecosystem, designed with a deep understanding of users' needs, has been tested through pilot use cases in three European local planning systems: Helsinki, Santander, and Flanders.

The URBANAGE project was conceived to assess the potential benefits, risks and impact of implementing a long-term sustainable framework to support evidence-based decision-making processes in the field of urban planning for age-friendly cities. This framework has been developed through an inclusive co-creation strategy with relevant end users (public servants and older adults).

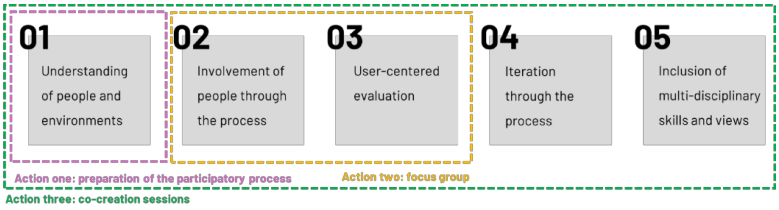

Fig. 8. How every URBANAGE action reflects in the principles of HCD

The methodology employed to facilitate citizen participation following the human-centered principles in the URBANAGE project encompassed the following stages:

- Action one: Preparation of the participatory process. This action is directly tied with the HCD principle 1 as it helps to better **understand the people** living in the neighborhood and their environment.
- Action two: Focus group. This action focuses on the HCD principles 2 and 3 by **involving** citizens and other stakeholders together **through the process** and by putting the **evaluation activities** in the hands of the residents.
- Action three: Co-creation sessions. The last action covers all five HCD principles, as co-creation sessions are the basis of the entire process and involve citizens and other stakeholders to achieve different objectives.

Action one: preparation of the participatory process. This action line serves as the foundation for conducting focus group and co-creation activities with end-users. This

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activity necessitates a comprehensive understanding of the stakeholders who can influence and contribute to a project such as URBANAGE. It is also crucial to identify whose interests should be considered during the development and implementation of policies or urban plans. Detailed stakeholder mapping will facilitate pilot sites in pinpointing the key actors essential to URBANAGE activities.

URBANAGE aimed to engage two distinct groups: older adults and civil servants. To ensure inclusiveness in the URBANAGE approach, participants had to represent the diversity of ageing populations in terms of age, gender, ability, and digital literacy. Additionally, older adults from various social classes, races, and ethnicities have to be included when relevant [32]. When engaging civil servants, "The Global Age-Friendly Cities: A Guide" delineates eight distinct domains that a city must consider to be deemed age-friendly. Civil servants involved should encompass all domains identified as falling under the urban environment's jurisdiction at the city level. Specifically, those with urban planning competencies should focus on outdoor environments, housing, and transport and mobility. Conversely, public servants from departments traditionally responsible for interactions with older citizens, such as social services, should also be included. Although these departments may not be directly involved in city planning, their actions in other fields can influence urban planning, and they possess valuable knowledge about the older citizen demographic. Additionally, departments responsible for citizen participation, communication, and information should be actively engaged.

Action two: focus groups. The primary objective of focus groups is to elucidate and identify the motivations, challenges, and barriers that influence the participation and engagement of older adults in the pilot areas. The focus group activities aim to identify effective mechanisms to motivate older adults to engage in citizen participation by examining the factors that encourage or hinder their motivation and understanding their perceptions of digital technology in these activities. Additionally, it explores how gamification techniques can be utilized to enhance their engagement, and which specific techniques are perceived as motivational by older adults in this context.

Three focus groups were conducted, one per pilot site (Flanders (Ghent), Santander, and Helsinki). The comprehensive process encompassed literature research, designing the methodology and protocol, conducting train-the-trainer sessions with pilot sites, executing the focus groups, and analyzing the collected data.

Fig. 9. Overview of one of the focus groups

Action three: co-creation sessions. The co-creation activities aim to uncover the challenges that older citizens encounter in urban environments. This gathered information will help refine the use-case definitions and establish the user requirements from civil

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servants. Additionally, it will guide the development of solutions, such as data sources, visualizations, simulation models, and AI, necessary to address these challenges effectively.

Fig. 10. Summary of the co-creation sessions

The objective of the cocreation session 1 (CC1) was to ascertain the user requirements of older citizens concerning the development of an accessible and age-friendly urban environment. Through the implementation of a co-creation workshop format, a structured dialogue was facilitated between the moderator and older citizens. Specifically, the workshop aimed to elucidate the challenges, needs, desires, and opportunities experienced by older citizens to derive comprehensive insights.

The second co-creation workshop (CC2) focused on civil servants in URBANAGE pilot cities. Its main goals were to validate the requirements from CC1, assess their feasibility, and gather information on relevant initiatives and departments. The workshop introduced the URBANAGE project and its pilot objectives, mapped existing age-friendly initiatives, challenges, and collaborations, and identified key actors. It also addressed challenges civil servants face in age-friendly projects, assessed collaborations between city departments, and validated user requirements from CC1, while identifying technical constraints and challenges for implementation.

The goal of co-creation session 3 (CC3) was to combine the insights from earlier sessions with older adults and public servants. CC3 brought these groups together to validate and negotiate user requirements from CC1, incorporating the feedback from public servants and findings from CC2. The session helped prioritize these requirements based on their importance and feasibility, while also identifying technical challenges related to implementation. Additionally, older adults were consulted on their preferred ways to give input and receive information, with site-specific adaptations considered to validate current solutions and communication methods.

Fig. 11. Overview of the co-creation sessions

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5 Conclusions

The overall methodology of both case studies is different but they both share the common principles of HCD. They both approach the process with emphasizing in the people that are affected by the issue at hand and put a special focus in understanding their needs from the very outset of the project and involving residents in every step of the process. This ensures that the process will be better adapted to the people that takes part in it, enhancing the participatory process and generating more tailored solutions to the current issues of the city. There is still significant progress to be made in fully addressing the barriers identified in the literature. However, this paper highlights the main lessons learnt in the development of the two mentioned participatory processes and proposes several guidelines as a reference guide for practitioners who want to design truly citizen-centered smart cities tackling the barriers for successful citizen participation.

Lesson 1: Create a structure that endorses long time and multi-level engagement. The development of smart cities often involves lengthy and exhausting participatory processes for citizens. For these processes to be effective, the structure must be consistent and transparent, providing clear support and adequate resources. A common challenge is that citizens, driven by previous unsuccessful participatory experiences, may lose motivation, leading to inconsistent participation or dropping out altogether. To address this main challenge, it is crucial to establish a structure that clearly outlines the decision-making process and provides the necessary resources to support meaningful involvement. Furthermore, individuals should have the autonomy to decide if, and to what extent, they wish to participate in this structure as they should be free to choose whether they want to engage and how.

This structure helps endure the above mention barriers of representativeness [21], [22], [23], power structures [20], [22], [23], [24] and political interference [23] as it co-creates a clear framework among all the interested parties defining how the involvement of each stakeholder is going to be and how the decision-making process is going to be held.

Lesson 2: Offer engagement activities that cater to the needs of the entire community. Citizens are a heterogeneous group, so the process needs to adapt in order to cater to the needs of the community. It is imperative to create an offer of participatory choices and activities that allow citizens to contribute to different commitment levels. Accordingly, some participatory processes can get too lengthy and overload participants with too many activities. Thus, it is recommendable to use one gathering to discuss different topics, without the need to generate one workshop per issue and adapt it to the people that will take part in it. This way citizens will feel more willing to participate and it will be a better use of time and resources.

By following these actions, the barrier of time constrains and limited resources [22] can be revised. The offering of the activities mentioned will help in the management of time and resources into more practical and efficient participatory activities.

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Lesson 3: Promote self-efficacy and capability. When engaging with citizens, and especially older residents, it is essential to build their confidence in their ability to make a meaningful contribution to their community. When citizens see concrete and visible results they gain a sense of accomplishment, reinforcing their belief in their capability to make a difference. These visible outcomes not only motivate them to continue contributing but also inspire others in the community to take part as this tangible recognition serves as an extra layer of motivation, fostering a community spirit that encourages continued participation. However, communication must be tailored to ensure inclusivity, avoiding overly technical or bureaucratic language that may alienate or confuse participants. Instead, adopt clear, visible, and relatable methods of communication that resonate with the community.

This overcomes the abovementioned barrier of expertise gap [18] and representativeness [21], [22], [23] as it promotes the capableness of the citizens by using an inclusive language and making the process visible for all.

Lesson 4: Technology as an enabler of the process instead of the actual outcome. Technology needs to be a tool that helps enhance the experience without creating a digital divide. Therefore, the integration of new technologies in citizen engagement requires a thoughtful approach, especially for individuals who are less digitally savvy. It is essential to clearly communicate the added value of technology, explaining why it is preferable over traditional methods, and highlighting its practical benefits to avoid skepticism. Transparency about the motivations behind adopting new technologies can help build trust and acceptance among participants. Additionally, a dual-track policy that includes both digital and non-digital alternatives ensures inclusivity, preventing the exclusion of those who are unwilling or unable to adopt new technological tools.

This contributes to minimizing the barrier of technology [12], [22] as it helps cope with the “technology first” mindset that usually builds upon smart cities and places a more meaningful emphasis on the people that need to use the technology rather than the technology itself.

Lesson 5: Be transparent and communicate the real impact of their decisions. Citizens will contribute to the improvement of their neighborhoods and cities, under the condition that the cause is clear, and they feel they can have an impact. If the real impact of their contribution is not made explicit and sustained, then they will lose trust in the process and, overall, stop their engagement. Therefore, a communication campaign through the process is key to bolstering their motivation towards the project and sense of usefulness. Additionally, communication needs to be clear and continuous, with a non-technical language so that the community feels included and valued. Lastly, it is important to leave some room for feedback with every communication so that residents can share their input in order to ensure longer and more meaningful engagement.

This can contribute to reducing the expertise gap [18] by informing residents of the overall process and by using adequate language to do so. Also, by leaving space for feedback, there is a great chance to get input for more community members, increasing the representativeness [21], [22], [23]. Lastly, with a clear communication of the progress and the decisions of the process, the power structures [20], [22], [23], [24] will

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became clearer, reducing the mistrust citizens may have against the decision-making organs.

These insights represent the primary lessons learned throughout both processes; however, a more comprehensive understanding would benefit from a detailed evaluation of both the process and its outcomes.

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