Public Perception, Knowledge, And Willingness To Adopt Bioplastics: Gaps And Opportunities For A Sustainable Transition In Urban Contexts

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Abstract— Bioplastics are gaining attention as sustainable alternatives to conventional plastics. This study examines public perception and willingness to adopt bioplastics in Bogotá through surveys of 127 participants. Findings show strong support—81% are willing to pay more for bioplastic products and 68% seek training on their proper use. However, only 27% know how to dispose of them correctly, highlighting a gap between intention and knowledge. Applying the Theory of Planned Behavior, the study underscores the need for environmental education, institutional support, and infrastructure to enable meaningful adoption and circular waste management.
Keywords— Bioplastics, Public perception, Environmental awareness, Circular economy, Sustainable behavior, Waste management, Theory of Planned Behavior, Urban sustainability, Environmental education.

I. INTRODUCTION

Plastic pollution continues to be a major environmental issue with consequences that are now visible across ecosystems—on land and in the ocean [1]. The persistent presence of plastic waste in rivers, soils, and urban zones is no longer just a concern of scientists; it is a matter increasingly felt in everyday life. One particularly alarming development is the transformation of plastics into micro- and nanoplastics, now found in tap water, processed foods, and even inside the human body [2]. Scientific evidence links these particles to inflammatory responses, oxidative stress, and hormonal disruptions in both wildlife and humans.

In recent years, bioplastics have emerged as a potential solution. Sourced from renewable feedstocks and often marketed as biodegradable, they represent an effort to reduce the environmental burden of traditional petroleum-based plastics [3]. However, real-world implementation reveals several obstacles. Costs remain high, degradation depends heavily on environmental conditions, and most cities lack systems designed to process these materials correctly [4].

What this tells us is that innovation alone isn't enough. For bioplastics to deliver on their promise, a broader, integrated strategy is needed—one rooted in circular economy principles. This includes clear regulatory standards, traceability mechanisms, and public policy that supports education, infrastructure, and effective recycling practices [5]. Some promising approaches involve the co-treatment of organic waste and bioplastics, showing potential in urban waste management systems that aim to be more holistic [6].

Cities like Bogotá illustrate both the potential and the challenges. The increasing demand for packaged goods has made bioplastics more common in the market, but public understanding of how to use and dispose of them remains limited. Studies show that while consumers express interest in sustainable products, they often lack clear information or access to appropriate disposal methods [7]. As a result, compostable plastics frequently end up in landfills or standard recycling streams, where they lose their environmental value.

Even in Europe—where waste infrastructure is generally more advanced—the same disconnect persists. Biodegradable waste is still not widely separated, and environmental literacy around new materials remains a work in progress [8]. This suggests that the success of bioplastics depends not only on their material properties, but also on alignment between public behavior and system design. When that alignment is missing, the intended sustainability outcomes may not only fail—they may give way to a new kind of pollution [9].

Over recent decades, substantial efforts from scientific research, industry, and public policy have been directed toward advancing bioplastics as a solution to plastic waste. Globally, materials with improved technical properties have been developed, renewable feedstock processes patented, and standards on biodegradability and compostability established. In Colombia, institutions like the University of Cauca have pioneered technological innovations and even launched spin-off companies to produce biodegradable packaging. However, these advancements have primarily focused on technical and production aspects, often overlooking the social dimension—such as public awareness, behavioral change, and the actual capacity of cities to manage these new materials effectively.

In recent decades, bioplastics have emerged as a promising solution to the environmental problems caused by conventional plastics. Their production from renewable sources such as corn, sugarcane, cassava, and even marine algae has enabled the development of biodegradable materials with competitive technical properties, particularly for applications like food packaging [10]. Among these, polylactic acid (PLA) and calcium alginate have been extensively studied for their barrier properties, economic feasibility, and low environmental impact [11].

Globally, the adoption of bioplastics has been supported by increasingly stringent public policies and regulatory frameworks. In the European Union, environmental legislation is encouraging a reflective shift in plastic value chains, responding to mounting pressure from environmentally aware consumers [12]. Nonetheless, both Europe and Latin America continue to face significant challenges in bridging the gap between technical progress and its practical implementation in urban and social contexts.

In Latin America, Colombia stands out as a leader in bioplastic innovation, spearheaded by universities and institutions that have developed processes using agro-industrial residues such as sugarcane bagasse and cassava starch [13]. Despite these technological advancements, various studies emphasize that the social component—including public knowledge, consumer habits, and waste management infrastructure—remains underdeveloped. According to Gallego-Schmid et al., while industrial policies and opportunities exist in the region, fragmented regulatory frameworks and low public awareness hinder the effective implementation of bioplastic-based solutions [14].

From a complementary perspective, Macheca et al. analyze the challenges surrounding plastic waste management in Global South countries, emphasizing that the effectiveness of bioplastics largely relies on public understanding of their proper disposal [15]. Similarly, Gupta et al. argue that successful circularity in lignocellulosic waste systems requires a combination of technological improvements and strong awareness and environmental regulation efforts [16]. This viewpoint is also supported by Gausa and Tucci, who stress that cultural shifts—even at the household level—are essential to reinforce sustainable consumption practices involving biomaterials and eco-friendly packaging [17].

Life Cycle Assessment (LCA) studies have affirmed the environmental advantages of bioplastics over conventional polymers. However, these benefits are heavily contextdependent, influenced by actual use conditions and local waste management infrastructure [18], [19]. Therefore, public policies must extend beyond production incentives and ensure efficient collection and composting systems, as emphasized in Ansar et al.'s review of biodegradable waste and compost production [20].

Lastly, strategies for transitioning to a circular economy in Latin America must acknowledge that the success and acceptance of bioplastics as a sustainable solution are not determined solely by their chemical composition or technical performance. Social, educational, and institutional factors also play a vital role in shaping their real-life application [21].

II. LITERATURE REVIEW

Plastic pollution remains one of the most pressing and complex environmental threats of our time. Over 460 million tons of plastic are produced annually, with a significant portion being improperly managed. This mismanagement results in the accumulation of plastic waste in water bodies, soils, and urban environments, leading to widespread ecological degradation and direct contamination of food and water supplies, with verified impacts on human health such as chronic inflammation, oxidative stress, and endocrine disruption [22], [23].

In urban areas of developing countries like Dhaka, the issue is exacerbated by uncontrolled urban expansion, limited access to differentiated waste collection, and informal recycling systems. Studies show that around 10% of the daily waste generated in Dhaka consists of plastic, and only half of that is effectively recycled [22]. This situation increases public exposure to mismanaged plastic waste and perpetuates health inequalities in vulnerable communities.

From an environmental health perspective, growing evidence has revealed the presence of microplastics and nanoplastics in human tissues, food products, and water supplies. These particles often act as carriers for toxic chemical compounds that, once inside the body, can trigger inflammatory reactions and interfere with metabolic, immune, and reproductive functions [24]. This adds a public health dimension to what has traditionally been viewed as a purely environmental issue.

Faced with this complex challenge, isolated technological fixes are no longer sufficient. What's required is a comprehensive strategy—one that weaves together public health policy, robust environmental regulation, and a rethinking of how we produce and consume. The crisis of plastic pollution calls for a deeper redesign of the systems connecting society, nature, and the economy, with a foundation rooted in environmental justice and shared global responsibility.

In response to these needs, the development of bioplastics has gained momentum over the past few decades. These materials—derived fully or partially from renewable sources like starch, cellulose, polylactic acid (PLA), or marine algae—aim to offer the same functional qualities as conventional plastics, but with lower environmental costs during both production and disposal phases [25]. Among these innovations, PLA stands out as one of the most thoroughly studied biopolymers, particularly in the context of single-use items and food packaging. Despite its reputation as a more sustainable alternative, PLA production is not without drawbacks. The process still demands high energy input, relies on metallic catalysts, and can produce waste by-products during polymerization [3].

Other research avenues have explored the use of marine biomass—including sargassum—to develop biodegradable materials. Bioplastics made from calcium alginate extracted from algae have demonstrated promising physical durability and thermal resistance, as well as good degradation performance under controlled conditions. These properties suggest strong potential for applications in eco-friendly packaging solutions [11].

Nonetheless, a key technological challenge remains: achieving the right balance of mechanical, thermal, and barrier properties to meet the demands of advanced industrial applications. For this reason, researchers are incorporating reinforcements such as lignocellulosic fibers and nanocellulose, and blending bioplastics with biodegradable synthetic polymers to improve final performance [26].

Future projections estimate that global bioplastic production could surpass six million tons annually by 2030—provided favorable conditions like rising petroleum prices, continued technological innovation, and regulatory frameworks that support bio-based production are maintained [10].

The increasing adoption of bioplastics as alternatives to conventional polymers presents considerable challenges in urban contexts, especially concerning end-of-life disposal and integration into existing solid waste systems. Despite being designed as compostable or biodegradable, many bioplastics do not break down effectively in standard landfills or mechanical recycling systems, leading to confusion among both citizens and waste management authorities [7].

One of the key obstacles to effective bioplastics adoption in urban settings is the absence of infrastructure designed to handle these materials. In many cities, industrial composting facilities are scarce, and waste collection systems often fail to distinguish compostable plastics from conventional ones. As a result, materials intended for environmental benefit are frequently treated as ordinary waste—diminishing their ecological value and, in some cases, disrupting existing recycling streams [27].

The situation is further complicated by inconsistencies in product labeling and certification. Even well-meaning consumers are often left confused by packaging that lacks clear information or fails to meet unified standards. This issue is particularly acute in many countries of the Global South, where efforts to promote environmental literacy remain limited and uneven [28].

Economic factors present another layer of complexity. Building the infrastructure and training required to manage bioplastics responsibly comes with significant costs. Without strong public policies, financial incentives, and coordinated investment, municipal systems may continue to prioritize conventional recyclables—leaving bioplastics in a policy and operational limbo [29].

Experts point to the need for integrated, systemic solutions. Aligning the promise of bioplastics with real-world conditions requires more than innovation in materials; it demands circular economy policies, educational outreach, institutional coordination, and a redesign of collection frameworks. Only by addressing these interdependent factors can bioplastics become a truly viable pillar of urban sustainability.

The development of regulatory frameworks supporting the circular economy is widely recognized as essential for the transition toward sustainable materials such as bioplastics. This shift requires public policies to incentivize clean technologies and legal instruments to ensure traceability, standardization, and lifecycle oversight.

In Europe, several initiatives aim to harmonize guidelines for a bioeconomy based on renewable resources. For instance, roadmaps have been created to transition the chemical industry toward low-carbon alternatives, highlighting bioplastics as key components [30].

Researchers also underscore the need for national policies to enforce reliable labeling standards, especially regarding compostability and biodegradability. Without these, consumer trust diminishes and sustainable value chains are hindered [31].

In Latin America, regulatory frameworks are fragmented. In countries like Brazil, strategic dilemmas in the diffusion of bioproduct innovations reveal the need for more cohesive

policies that integrate economic incentives, scientific research, and life cycle evaluation tools [32].
The case of Serbia illustrates institutional challenges in circular economy implementation. Despite national strategies and waste management programs, aligning these with specific regulations on bioplastics and food waste remains difficult [33].
Business opportunities for bioplastics are also limited by a lack of tax incentives and regulatory support for local production. Without these, cost competitiveness with conventional plastics remains a barrier [34]. Ultimately, regulatory frameworks must be designed from a systemic perspective—one that considers social dynamics, public health, and urban environments [35].
Public perception of bioplastics is closely linked to environmental knowledge and prior exposure to sustainability concepts. In Indonesian cities, the intention to adopt eco-friendly practices—such as using biodegradable products—is strongly correlated with individuals' environmental awareness [36]. However, the lack of accessible technical information hinders this intention from translating into consistent behavior. A study in Solo, Indonesia, found that willingness to use reusable bags is influenced not just by economics, but also by perceived usefulness, often shaped by misinformation about plastic waste impacts [37].
The educational dimension is crucial in bridging this gap. Research in Nigeria shows that although there is growing recognition of the need for responsible waste management, institutional strategies for environmental education remain limited. Stronger integration between education policy and local governance is urgently needed—especially in areas with high levels of informal waste handling and where environmental education is absent from school curricula [38].
The COVID-19 pandemic brought to light a striking paradox: while convenience became essential for health and safety, environmental responsibility often took a back seat. In several Indonesian cities, the widespread adoption of food delivery platforms led to a marked increase in single-use plastic waste. Despite the visibility of this impact, many consumers remained unaware of the long-term consequences of their consumption patterns. The absence of robust public information campaigns only widened the gap between individual behavior and broader environmental discourse [39].
Evidence continues to show that sustainable behaviors are shaped not just by personal choice, but by structural factors. In particular, studies indicate a strong correlation between education levels and pro-environmental practices. People with access to higher education tend to engage more in sustainability—not simply because they have greater resources, but because they better understand the systems that underlie environmental issues, and develop stronger ethical frameworks around ecological responsibility [40].

This insight reinforces the urgency of education policies that are not only fact-based, but also sensitive to the cultural and socioeconomic realities of different communities. Education must go beyond awareness to support deeper shifts in attitudes toward consumption, waste, and materials such as bioplastics.
In Colombia, academic institutions are at the forefront of developing technological responses to plastic pollution. A standout example is the work at Universidad del Cauca, where researchers have engineered biodegradable packaging films derived from cassava starch. Using extrusion and compression molding techniques, the team has produced materials with desirable mechanical properties and reliable degradation performance under laboratory conditions [41]. These results highlight the potential of regionally sourced bioplastics to address local waste challenges while generating added value in agricultural economies.

At a broader policy level, countries like Brazil have engaged with circular economy principles to guide sustainable material use. However, implementation has not been straightforward. Analyses point to a persistent gap between regulatory ambition and infrastructural capacity. Without the necessary logistics and coordination, well-intentioned policies often fall short—especially when it comes to ensuring the effective disposal of bioplastics [42].

Meanwhile, several African nations are testing hybrid approaches that combine environmental action with social entrepreneurship. Initiatives in Kenya, Nigeria, and Tanzania—such as Gjenge Makers, Wecyclers, and EcoAct—are transforming plastic waste into durable products or mobilizing communities through incentive-based recycling systems. These models succeed by building on local partnerships between citizens, private actors, and government institutions, demonstrating that meaningful environmental solutions are those grounded in social realities [43].

Together, these experiences point to a shared lesson: new materials like bioplastics are just one part of the puzzle. What truly determines success is the capacity of each territory to coordinate action across policy, education, infrastructure, and citizen engagement. No single solution fits all.

Life Cycle Assessment (LCA) studies support this idea. While polymers like PLA and PHA generally result in lower greenhouse gas emissions during production, their total environmental footprint varies depending on numerous variables: the sustainability of feedstock cultivation, the energy intensity of production processes, and the efficiency of post-consumer waste management systems [3].

Comparisons show that PLA, while more energy-efficient, degrades less easily in natural environments. PHA, on the other hand, is more biodegradable but requires costly microbial fermentation processes. This means there is no one-size-fits-all solution—bioplastics must be selected according to their specific context of use and disposal [3].

Experimental data from Latin America supports this nuanced view. In regions lacking composting or advanced recycling infrastructure, the environmental gains of bioplastics may be limited or even reversed—particularly if materials degrade anaerobically in landfills, releasing methane [44]. In such cases, well-intentioned products risk becoming part of the problem.

However, when production is localized and based on regional biomass, bioplastics can bring additional benefits: valorizing agricultural waste, creating jobs, and reducing dependency on imported polymers. These advantages, though, should be evaluated carefully—case by case—factoring in scale, feedstock availability, and the broader waste management system [45].

III. METHOD

This study adopts a quantitative approach with a descriptive and correlational scope, based on the use of structured surveys to explore citizens' perceptions, knowledge, and attitudes toward the use of bioplastics and their relationship with environmentally sustainable behaviors. This approach has proven effective in examining plastic consumption and disposal dynamics in both urban and rural settings, enabling the identification of sociodemographic patterns and levels of environmental awareness [46], [47].

A. Methodological Design and Theoretical Framework

The research design draws upon the Theory of Planned Behavior (TPB), originally proposed by Ajzen [48], which has been widely applied in studies on recycling, waste separation, and adoption of alternative materials. The TPB includes three key behavioral dimensions: attitude toward the behavior, subjective norms, and perceived behavioral control. These were complemented by an additional variable—environmental knowledge—following recommendations from recent literature [46], [47].

B. Data Collection Instrument

A structured questionnaire consisting of 24 items was developed, divided into four thematic blocks:

1. Sociodemographic characteristics: age, gender, education level, occupation, and place of residence.
2. Plastic use and consumption habits: frequency of use, types of products used, and disposal methods.
3. Knowledge and perception of bioplastics: material identification, understanding of biodegradability, and comparisons with conventional plastics.
4. Willingness to adopt sustainable alternatives: intent to change, perceived barriers, sense of individual responsibility, and willingness to pay.

Most items used five-point Likert scales (from "strongly disagree" to "strongly agree"), supplemented by dichotomous (yes/no) and multiple-choice questions to capture both attitudes and observable behaviors. The questionnaire design was informed by instruments previously validated in urban and community environmental perception studies [49], [47].

C. Validation and Pilot Testing

Before full deployment, the questionnaire underwent a pilot test with 20 participants to assess linguistic clarity, cultural appropriateness, and internal consistency. Cronbach's alpha was then applied to the Likert scales, yielding reliability coefficients of 0.78 for environmental perception and 0.82 for willingness to change, indicating acceptable internal consistency [50].

D. Sampling and Administration

The survey was distributed digitally via online forms, allowing geographic reach across Bogotá and nearby municipalities. A non-probabilistic convenience sampling technique was used, which is appropriate for exploratory research in urban settings and has been documented in similar regional studies [51], [46]. A total of 59 responses were collected for the bioplastics survey and 68 for the polymers survey between April and May 2025.

E. Data Analysis

The data were processed using descriptive and inferential statistical tools. Frequencies, percentages, and means were calculated to characterize the main variables. Pearson's chi-square tests and bivariate correlation analyses were conducted to identify associations between sociodemographic variables and levels of knowledge or behavioral intent, following protocols from urban environmental behavior research [38], [47].

F. Ethical Considerations

The study was conducted in accordance with basic ethical principles, including voluntary participation, anonymity, and confidentiality. All respondents provided digital informed consent prior to completing the questionnaire, and no personal or sensitive data were collected. The ethical design adhered to international standards for research involving individuals in urban contexts [47].

IV. RESULTS

A. Knowledge Level and General Perception

The Bioplastics Survey revealed that 68% of respondents were familiar with the term bioplastics, and 83% regarded them as a viable alternative to conventional plastics. Additionally, 58% described bioplastics as environmentally friendly, indicating a generally favorable perception of their ecological value.

In the Polymers Survey, 87% of participants recognized the term polymer, and 85% correctly identified that standard plastics are polymer-based—suggesting a more established understanding of conventional materials.

Figure 1 illustrates key indicators related to knowledge, perception, and willingness to adopt sustainable alternatives from the Bioplastics Survey. Figure 2 presents the equivalent findings from the Polymers Survey.

B. Willingness to Change and Responsible Use

In the Bioplastics Survey, 81% of respondents indicated a willingness to pay a higher price for bioplastic products, provided their lower environmental impact is substantiated. Furthermore, 64% believed changing their consumption habits to prefer bioplastics would be easy, and 68% valued compostability when making purchasing decisions.

In the Polymers Survey, 91% of respondents said they would sort their plastic waste more thoroughly if there were guarantees of genuine recycling or reuse—reflecting a strong willingness to engage in sustainable practices, conditional on confidence in waste management systems.

C. Perceived Barriers and Institutional Trust

Although attitudes toward bioplastics were generally positive, only 27% of respondents in the Bioplastics Survey knew how to properly dispose of such materials. The same percentage believed that Bogotá currently has sufficient institutional capacity to manage them. This disconnect between intent and practical knowledge emerges as a key barrier to effective adoption.

Similarly, the Polymers Survey found that while 62% claimed to understand the recycling process in Bogotá, only 21% considered the existing system effective. This reflects low institutional trust and underlines the need for stronger public policies, clearer waste traceability, and improved environmental education.

D. Demand for Educational Action

Both surveys emphasized the population's demand for environmental education. In the Bioplastics Survey, 68% expressed interest in training on proper usage and disposal methods. The most requested actions were awareness campaigns (37%) and technical training programs (37%).

Correspondingly, in the Polymers Survey, 50% of participants requested public or corporate informational campaigns, while 32% expressed a desire for targeted training to enhance their waste management practices.

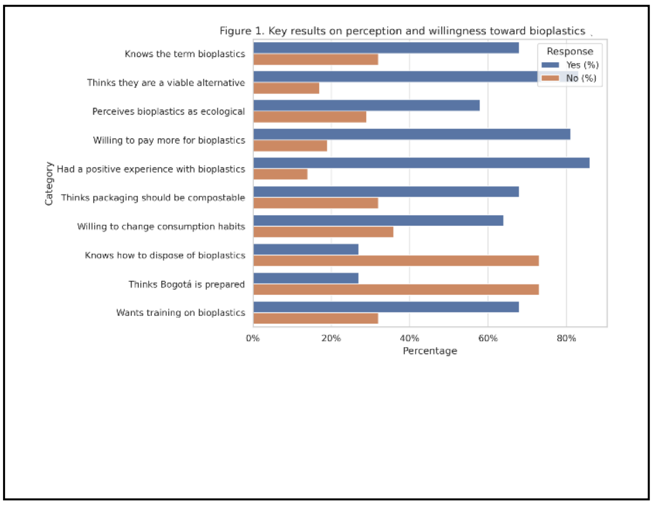

Figure 1. Key findings on perception and willingness to adopt bioplastics.
Source: Own elaboration based on the Bioplastics Survey.

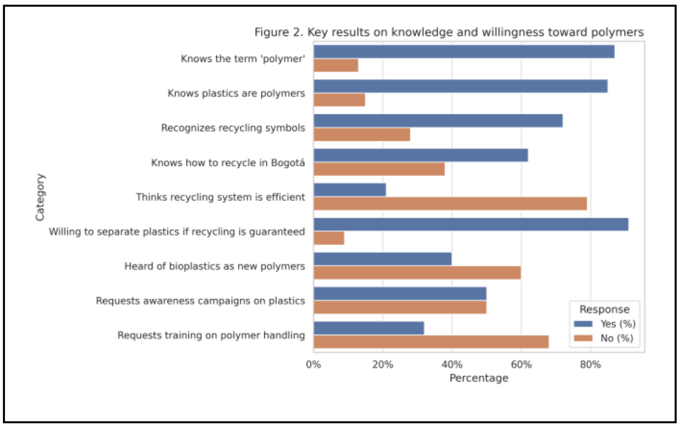

Figure 2. Key findings on knowledge and willingness to engage with polymers.
Source: Own elaboration based on the Polymers Survey.

V. DISCUSIONS

The results of this research reveal a significant public willingness to adopt sustainable alternatives such as bioplastics. A total of 81% of respondents reported being willing to pay a higher price for bioplastic-based products, while 68% expressed interest in receiving training on their use. This finding aligns with international studies highlighting the positive relationship between environmental awareness and behavioral intention toward sustainability [46], [52]. Moreover, these high levels of acceptance provide a strong foundation for designing public policies that facilitate the transition to less polluting materials.

However, this willingness is constrained by a substantial gap in practical knowledge. Only 27% of respondents indicated they knew how to properly dispose of bioplastics, and a similar percentage believed their city was institutionally equipped to manage them. This disconnect between intention and action has been widely documented in the literature. Dilkes-Hoffman et al. argue that limited public understanding of biodegradation processes and disposal infrastructure can negate the environmental potential of bioplastics, even among well-intentioned users [53].

From a psychosocial perspective, these findings can be interpreted through the lens of the Theory of Planned Behavior (TPB), which suggests that behavior is shaped by attitude toward the action, subjective norms, and perceived behavioral control [48]. In this study, attitudes toward bioplastics were generally favorable, and a pro-bioplastics social norm appears to be emerging. However, limited technical knowledge and low confidence in institutional effectiveness reduced perceived control, hindering effective behavior.

A similar pattern emerged in the Polymers Survey, where 91% of participants indicated they would improve their recycling habits if they were confident that materials would be properly recovered. This result is consistent with the work of Fang et al., who emphasize that citizen participation in waste management depends not only on individual motivation but also on trust in the system's effectiveness and access to adequate infrastructure [54].

In the same line, Rentería, Chocoteco, and Mendoza found in Jalisco, Mexico, that willingness to pay for biodegradable products is shaped both by awareness levels and perceptions of the waste management system's functionality [55]. This finding reinforces the need for educational campaigns to go beyond awareness raising and include practical, context-specific training that enables citizens to act effectively within their local environments.

The expressed interest in training—68% in the Bioplastics Survey and 79% in the Polymers Survey—further supports this need. Anokye et al. showed that even in rural contexts with high environmental awareness, such as among secondary school teachers in Ghana, there exists a disconnect between recognizing the problem and integrating it into educational practice. Their study revealed that only 62.5% of teachers occasionally addressed the topic in class, underscoring the need to strengthen sustainability education in formal curricula [56].

Complementarily, the systematic review by Weinrich and Herbes warns that although consumer interest in bioplastics is growing, major knowledge gaps remain regarding their technical properties, compostability conditions, and disposal requirements [52]. Therefore, improving environmental literacy must be a top priority in the implementation of sustainable strategies.

At the structural level, Gallego-Schmid et al. identify regulatory and institutional barriers in Latin America that limit the implementation of circular solutions involving bioplastics. Among the persistent barriers to scaling bioplastics are fragmented regulatory systems, underfunded composting infrastructure, and insufficient coordination between public institutions and private actors [14]. The case of Bogotá exemplifies this regional reality: a population increasingly aware and willing to act, yet constrained by the absence of the structural conditions required to turn intention into impact.

These insights reinforce a critical lesson—bioplastics alone will not deliver a circular economy. Technological advancement must be part of a broader, integrated approach. That includes coherent and evidence-informed policymaking, sustained investment in public awareness and education, the strengthening of institutional capabilities, and genuine spaces for civic participation. Without this kind of systemic alignment, the potential of bioplastics to support sustainable urban transitions will remain largely untapped [46].

VI. CONCLUSIONS

The study reveals a clear public inclination toward bioplastics, widely perceived as a more sustainable alternative to conventional plastics. Many participants expressed not only support for these materials but also a willingness to take concrete action—such as paying more for bioplastic products and improving household waste separation. This positive disposition signals a valuable opening for public policies and urban sustainability initiatives grounded in circular economy principles.

Nonetheless, this favorable attitude coexists with significant practical challenges. While citizens may endorse sustainability in theory, many lack the knowledge or tools to properly dispose of bioplastics. Misunderstandings about biodegradability, the absence of differentiated waste systems, and a general mistrust in institutional efficiency remain major obstacles—especially in complex urban environments like Bogotá, where infrastructure and policy often lag behind innovation.

This tension reflects a broader reality: public support alone is not enough to drive environmental transformation. Lasting change requires systemic coordination across education, governance, regulation, and public engagement. When these dimensions remain disconnected, even strong social interest risks being neutralized by structural limitations.

A notable finding from the study is the high level of interest among citizens in receiving training on bioplastics and sustainability. Rather than being passive recipients of information, people show a genuine desire to engage. This presents an opportunity to design communication and capacity-building strategies that activate public intention and translate it into informed, consistent practice.

Furthermore, this research supports the relevance of applying theoretical models such as the Theory of Planned Behavior [48] to better understand how attitudes, social norms, and perceived behavioral control influence the adoption of sustainable practices. The findings also align with previous studies [19], [43], [51] and recent evidence on behavioral change and waste management [52], [53], emphasizing that technological advancements must be accompanied by cultural and institutional change in order to generate measurable environmental impact.

In sum, the transition to a more sustainable model of consumption and waste management requires a systemic, multisectoral, and evidence-based approach. While bioplastics hold significant promise, their transformative potential can only be realized if they are embedded within an enabling environment that supports their production, use, collection, and end-of-life valorization.

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