



Plastic polymers and social vulnerability: Precious Plastic as a program for sustainable development capable of achieving the pillars of sustainability

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Abstract

The issue of plastic pollution on the planet not only affects the environment but also impacts the three pillars of sustainability, affecting the environment, food production, as well as the health and economy of individuals and communities located geographically close to where the life cycle of these materials occurs, from production to disposal. This text is dedicated to studying the Precious Plastic project as a program capable of combating the social harm caused by the production and disposal of synthetic polymers. To do this, it uses the concept of Maslow's Hierarchy of Needs and investigates how the organization and distribution of various elements of the project's network can contribute to meeting the motivational needs of Maslow's hierarchy, thus combating situations of social vulnerability.

Keywords: SDG's; Precious Plastic; Maslow's Pyramid; Sustainability; Social Design

1. Introduction

The omnipresent presence of synthetic polymers, commonly known as plastics, in contemporary society is undeniable. These versatile and moldable materials are found in all sectors of the economy, from simple plastic bags to sophisticated electronic devices. Their proliferation can be attributed to the intrinsic characteristics of plastics, such as low density, chemical resistance, electrical and thermal insulation, as well as the ability to be molded into various shapes, colors, and textures (LIMA, 2006).

However, as plastics gained prominence in the industry, their significant presence began to pose complex and multifaceted challenges, particularly concerning their relationship with the Sustainable Development Goals (SDGs) established by the United Nations. The massive production and inadequate management of plastic waste have generated adverse impacts that

span a wide range of SDGs, affecting environmental, economic, and social aspects (GEYER, JAMBECK & LAW, 2017; UNEP, 2021).

In this context, this article aims to comprehensively analyze how plastic pollution relates to the UN SDGs. Through an approach that encompasses impacts from the foundation of human needs represented by Maslow's Hierarchy of Needs to the global goals of sustainable development, we will explore the complex interactions between the environmental challenges posed by plastics and human aspirations for progress and well-being. Additionally, we will examine how initiatives such as the "Precious Plastic" program (UNEP, 2021) play a crucial role in mitigating the effects of plastic pollution, thus contributing to the achievement of the SDGs and the improvement of the quality of life for communities worldwide.

To facilitate the understanding of these connections, we will present a concise framework of the challenges of plastic pollution in relation to each of the SDGs, thereby outlining the critical importance of addressing this issue comprehensively and urgently in pursuit of a sustainable future.

2. Plastic Numbers

According to Geyer, Jambeck, and Law (2017), it is estimated that 8.3 billion tons of plastics were produced between 1950 and 2017, with only 10% of this amount being recycled, and another 30% still in use within society, while the remaining material is discarded in landfills and disposed of in the environment. Figure 1 graphically illustrates this information regarding the global accumulation of plastic waste.

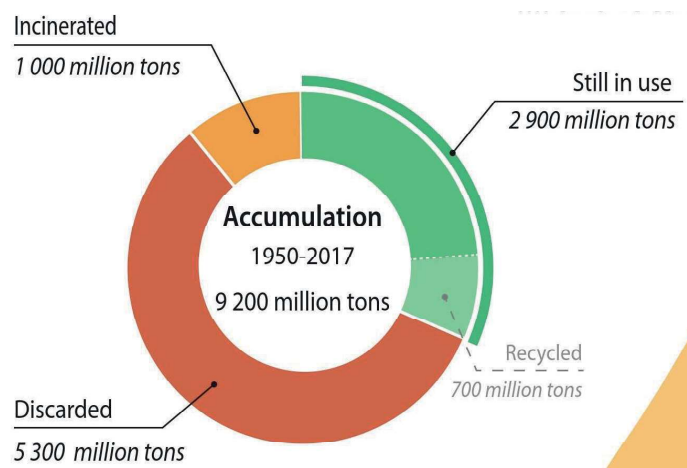


Figure 1 - Global Plastic Accumulation. Source: Adapted and translated from UNEP 2021

According to UNEP (2021), there is approximately 1.3 tons of plastic for every person alive on Earth. Faced with these alarming numbers, it is possible to glimpse some of the impacts that plastics generate, with the majority of them related to the final phase of this material's life cycle. However, plastic poses sustainability issues throughout its entire life

cycle, negatively and equally concerningly affecting the environmental, economic, and, especially, the social pillars.

Concerned about this issue, the United Nations, through UNEP, has developed a framework titled "Challenges Posed by Plastic Pollution to Achieve the SDGs," in which 17 objectives for Sustainable Development of Nations directly and indirectly combat the social impacts caused by the production, use, and disposal of plastics.

Table 1. Challenges Posed by Plastic Pollution in Achieving SDGs	
No Poverty	Plastic pollution threatens the livelihoods of those who rely on marine resources for their work. Plastics can enter waterways, causing flooding. Tourism and fishing in marginalized coastal areas are affected.
Zero Hunger	Microplastics can impact fishing (reducing income) and contaminate seafood on which people depend for sustenance.
Good Health and Well-being	From extraction, refining, and transportation of fuel to plastic raw material production, the health of populations living near these facilities is affected. Moreover, this infrastructure is often located in communities with less political or economic power to influence, prevent, or oppose it during the planning stages. Parents of children exposed to plastic pollution suffer significant psychological stress and anxiety.
Quality Education	Students located in communities surrounded by extraction/refinery/production/waste burning sites are more susceptible to adverse health impacts, exacerbating educational disparities.
Gender Equality	Garbage collection is considered female work in some places, making women more exposed to waste and sanitation-related issues. Women's specific biology can lead to gender-specific and vulnerability to viruses and bacteria, especially during menstruation, pregnancy, and breastfeeding.
Clean Water And Sanitation	From fuel extraction to production, use, and disposal, plastics can pollute water sources, aggregating contaminants and obstructing/interrupting sanitation infrastructure.
Clean Energy	Government subsidies drive plastic production and fossil fuel extraction through highly polluting extractive methods. Plastic production often wouldn't be economically viable, possibly hindering research and development of cleaner energies.
Decent Work and Economic Growth	Employment opportunities along the plastic production (extraction to use) may pose health risks to workers due to exposure to toxic substances. Existing infrastructure can hinder the development of other industries that consider risks to their own facilities. The development of circular economies and recycling infrastructure could create more jobs; however, lack of political will and funding prevents this sector from developing adequately, and these jobs could help combat unemployment among vulnerable groups.
Industry, Innovation and Infrastructure	Subsidies, corporate funding, and investments drive plastic production and extraction as if they were through highly polluting extractive methods that would not be commercially viable without these incentives, possibly hindering the development of cleaner energies.
Reduced Inequalities	Many countries in the Global North export their plastic waste to poorer countries in the Global South for disposal. Waste disposal methods (incineration, etc.) affect the health and quality of life of people in receiving countries, while waste exporters avoid health impacts and receive environmental praise at the expense of others.

	Petrochemical and waste management facilities, such as incinerators and landfills, are disproportionately built in low-income communities, further exacerbating social disparities with environmental degradation, health costs, and wasted public investments.
Sustainable Cities and communities	The commodification of public resources (such as water) by the plastics industry hinders the development of local infrastructure. Often, the substitution of drinking water in their industrial processes leads local governments to compromise water supply for communities. Inadequate regulations, penalties, and restrictions for oil spills and the ineffectiveness/lack of plans to deal with them in emergencies result in additional risks and potentially inadequate responses. Additionally, the burden of navigating complex and confusing recycling systems is placed on individual consumers.
Responsible consumption and production	Os plásticos, desde a extração e fornecimento de materiais até a produção e descarte de resíduos podem ser uma indústria problemática, em alguns casos mercantilizando recursos naturais para obter lucro (água engarrafada impedido o desenvolvimento de infraestrutura pública).
Climate Action	Plastics, from material extraction and supply to production and waste disposal, can be a problematic industry, in some cases, commoditizing natural resources for profit (bottled water impeding public infrastructure development). Plastic production influences climate change through the emission of greenhouse gases related to oil extraction, material transport, plastic disposal, and incineration.
Life below water	Plastic pollution threatens marine wildlife (suffocation, ingestion, entanglement, and threatened reproduction) and aggregates contaminants through bioaccumulation. From extraction, CO2 threatens all marine life with ocean acidification.
Life on land	More than 50% of all microplastics remain on land and comprise nearly all (95%) of global plastic waste production. Although the number of studies on plastic impacts on soils is limited, there is emerging evidence that microplastics affect the reproduction, growth, and mortality of earthworms.
Peace, Justice and Strong Institutions	The differential exposure of vulnerable communities to health risks due to plastics threatens strong institutions, dominates justice, and promotes instability through protests and water insecurity.
Partnerships for the goals	This problem presents an opportunity to create equitable and fair collaboration opportunities to address the issues posed by plastic pollution. For example, some suggest that an international instrument addressing the entire classic life cycle on a global scale could help mitigate the problem and strengthen the voices of affected countries.

Fonte: UNEP (2021)

3. Research Goals

The objective of this research is to conduct a comprehensive analysis of the impacts of plastic pollution, especially in the context of the Sustainable Development Goals (SDGs) outlined by the United Nations, with a focus on its interaction with fundamental human needs, as represented by the theoretical framework of Maslow's Hierarchy of Needs (MASLOW, 1943; MCLEOD, 2018). This study aims to identify and understand how plastic pollution affects the layers of Maslow's Hierarchy, ranging from physiological needs to self-actualization and transcendence (CAVALCANTI ET AL., 2019).

Furthermore, this research seeks to investigate how initiatives like the "Precious Plastic" program (UNEP, 2021) can contribute to mitigating the negative impacts of plastic pollution, thereby promoting the achievement of the SDGs and human well-being at various levels



(SDGs 1, 2, 3, 4, 7, 9, 11, 12, 15, 16, UNEP, 2021). The primary purpose is to provide a comprehensive insight into the implications of plastic pollution regarding human needs and sustainable development, contributing to a deeper understanding of this global challenge and potential solutions (GEYER, JAMBECK, AND LAW, 2017).

4. Methodological Procedures

4.1. Data Collection and Reference Sources

To address the complexity of plastic pollution and its impact on human needs, this research relies on an interdisciplinary analysis that incorporates information from reliable sources. Relevant data and information will be obtained through a literature review, including academic journal articles and documents provided by the United Nations (UN) and its programs related to environmental preservation.

4.2 Analysis of the Relationship with Maslow's Hierarchy

The research will follow a structured method in two stages:

4.2.1. Mapping SDG Challenges onto Maslow's Hierarchy

In this initial stage, we will map the challenges presented in Table 1 onto Maslow's Hierarchy. We will analyze how these challenges impact the social and personal development of individuals and communities, hindering the fulfillment of the fundamental needs represented in Maslow's Hierarchy.

4.2.2. Assessment of Precious Plastic Program Benefits

In the second stage, we will focus on assessing the benefits of the Precious Plastic program in relation to achieving the needs represented in Maslow's Hierarchy.

4.3 Comparison between Synthesis Table 1 and Synthesis Table 2

In this third stage, we will conduct a comparative analysis between Synthesis Table 1, which highlights the challenges of plastic pollution in relation to the Sustainable Development Goals (SDGs), and Synthesis Table 2, which focuses on the benefits of the Precious Plastic program in relation to Maslow's Hierarchy.

4.3.1 Identification of Correspondences

We will identify correspondences and relationships between the challenges presented in Synthesis Table 1 and the benefits highlighted in Synthesis Table 2.

4.3.2 Analysis and Discussion

After data collection and analysis, we will conduct an in-depth analysis of the findings to identify patterns, correlations, and insights related to plastic pollution challenges, human needs, and the benefits of the Precious Plastic program. This will enable us to build a more comprehensive understanding of the relationship between plastic pollution, sustainable development, and human needs.

5. Data Collection and Reference Sources

5.1 Maslow's Hierarchy Concept

Maslow's Hierarchy, originally conceived with five levels, represents a framework that describes the hierarchy of human needs and the process of intrinsic motivation to fulfill them. According to Abraham Maslow (1943), individuals typically seek to satisfy the needs at the base of the pyramid before aspiring to the higher layers. Later, the theory was refined and expanded to include eight levels, recognizing the idea that needs can be pursued simultaneously (MCLEOD, 2018).

The eight tiers of Maslow's Hierarchy can be understood as categories of needs that motivate individuals to pursue goals that make them feel "fulfilled." These goals can be classified into two categories: Deficiency Needs (D-needs) and Growth Needs (G-needs), as per McLeod (2018). Deficiency Needs are situated at the bottom of the pyramid and are related to fundamental requirements for survival and physical and mental well-being. Growth Needs occupy the upper half of the pyramid and pertain to personal growth and development, including the achievement of goals for oneself and society.

Here are the eight identified and named levels of Maslow's Hierarchy:

1. Base 1 - Physiological Needs: These fundamental needs include food, water, shelter, and rest, which are crucial for life maintenance.
2. Base 2 - Safety Needs: This level involves the pursuit of physical, economic, and emotional security, providing a sense of stability and the ability to plan for the future.
3. Base 3 - Belongingness Needs: At this stage, individuals seek interpersonal connections and relationships with others, whether at work, in emotional expression, or in exchanging ideas.
4. Base 4 - Esteem Needs: Esteem needs involve the pursuit of self-esteem, respect from others, and recognition. Individuals desire to be valued and have confidence in themselves.
5. Base 5 - Cognitive Needs: This tier reflects the pursuit of knowledge, learning, and understanding. Cognitive needs are related to intellectual curiosity and intellectual development.
6. Base 6 - Aesthetic Needs: It involves the appreciation of beauty, creativity, and harmony. People seek the experience of pleasing visual and aesthetic stimuli.
7. Base 7 - Self-Actualization: At this level, individuals aspire to reach their full potential by developing their talents and skills and seek personal satisfaction in their achievements.
8. Base 8 - Transcendence: The quest to transcend the self and engage in spiritual experiences or contribute to the well-being of others is a characteristic of the need for transcendence.

It is important to note that the fulfillment of these needs does not occur in a vacuum and is influenced by various contextual factors such as culture, society, and environment. However, the foundational base of the pyramid, physiological needs, plays a critical role as



an individual's survival depends on its satisfaction. When physiological needs are not met, other needs become secondary in comparison to the pursuit of survival (MASLOW, 1943).

5.2 Precious Plastic and Its Initiatives in Brazil

Initiated in 2012 in the city of Eindhoven, in the southern Netherlands, the Precious Plastic project is a global initiative that addresses the issue of plastic waste. Its main objective is plastic recycling, preventing it from being discarded in landfills and the environment. The project believes that the participation of people from different backgrounds and ages is essential to combat this problem, promoting the reuse and recycling of materials.

Precious Plastic has developed open-source machines for shredding, extruding, injecting, and compressing plastic waste. These machines are affordable and can be built by anyone, thanks to the assembly files available for free on their website. They are divided into three categories: Basic Machines, ideal for beginners; Pro Machines, for commercial use; and Community, shared by the global community, all modular and subject to improvements.

In Brazil, several initiatives have been inspired by Precious Plastic, contributing to the spread of this philosophy. We highlight some of them:

5.3.1 MudaLab

MudaLab is a social enterprise that uses social, ancestral, and digital technologies to promote social transformation. Their focus is on democratizing technologies to promote community inclusion in vulnerable areas. They adapt low-cost technologies, open knowledge, and collaborative methodologies to meet local social and environmental needs.

5.3.2 Precious Plastic Cotia Brasil

This initiative in Cotia, São Paulo, focuses on manufacturing plastic recycling equipment adapted to the Brazilian reality. They produce compact shredders, cold presses, extruders, and hot presses, aiming to generate income for small entrepreneurs and recycling cooperatives, thus contributing to social inclusion and sustainable development.

5.3.3 Precious Plastic UFPE

The Federal University of Pernambuco (UFPE) is part of the global Precious Plastic network and promotes plastic recycling on its campus. They provide machines and collection points and involve the academic community in seeking environmental and social solutions. Their goal is to foster the circular economy and raise awareness of the environmental impacts of plastic.

5.3.4 Likso

Located in Porto Alegre, Likso focuses on environmental education through plastic recycling. In addition to workshops, courses, and lectures, they produce decorative and utility objects from recycled plastic, promoting the circular economy and encouraging sustainable practices regarding plastic.

These Brazilian initiatives, inspired by Precious Plastic, not only contribute to environmental preservation but also have a significant impact on communities, generating income, promoting environmental awareness, and fostering social inclusion. To assess their social impacts more deeply, this text will use concepts from Maslow's Hierarchy, which are relevant for evaluating the objectives and goals of these projects.

6. Mapping of SDG Challenges in Maslow's Hierarchy

Based on the data collected, the first Synthesis Table can be created, which will relate the bases of Maslow's Hierarchy to the SDG and the challenges that plastic pollution brings to both meeting human needs and Sustainable Development.

Summary Table 1 - Relationship between Maslow's Hierarchy, SDGs, and Challenges posed by Plastic Pollution		
Base of Maslow's Hierarchy	Sustainable Development Goals (SDGs)	Challenges of Plastic Pollution
Base 1 - Physiological Needs	SDG 1: Poverty Eradication	The accumulation of plastics in the oceans affects fishing, a source of food for impoverished populations.
	SDG 2: Zero Hunger	Microplastics can impact the quality of marine food, threatening food security.
	SDG 3: Health and Well-being	Exposure to plastic pollution can have implications for human health, impairing well-being.
Base 2 - Safety Needs	SDG 16: Peace, Justice, and Strong Institutions	Inadequate plastic waste management can lead to conflicts and legal issues.
Base 3 - Belongingness Needs	SDG 11: Sustainable Cities and Communities	Plastic pollution in cities affects the quality of life and community cohesion.
Base 4 - Esteem Needs	SDG 4: Quality Education	Plastic pollution can have a negative impact on education in affected communities.
Base 5 - Necessidades Cognitivas	SDG 9: Industry, Innovation, and Infrastructure	Research and innovation are necessary to address plastic pollution effectively.
Base 6 - Aesthetic Needs	SDG 12: Responsible Consumption and Production	The aesthetic of the environment is compromised by the presence of plastic waste.
Base 7 - Self-Actualization	SDG 7: Affordable and Clean Energy	Plastic production is linked to resource extraction and carbon emissions.
Base 8 - Transcendence	SDG 15: Life on Land	Plastic pollution threatens wildlife and terrestrial biodiversity.

Source: Authors

Summary Table highlighting how the Precious Plastic program contributes to fulfilling needs in the Maslow's Hierarchy and aligns with the United Nations Sustainable Development Goals (SDGs):

Summary Table 2 - Relationship between Maslow's Hierarchy, Precious Plastic, and alignment with UN proposed SDGs		
Base of Maslow's Hierarchy	Benefits of the Precious Plastic Program	Alignment with UN SDGs
Base 1 - Physiological Needs	Provides a solution for plastic waste management, reducing environmental pollution and health risks.	SDG 12 (Responsible Consumption and Production): Reduces pollution and promotes responsible consumption.
Base 2 - Safety Needs	Contributes to job opportunities and income generation, promoting financial security for those involved.	SDG 8 (Decent Work and Economic Growth): Generates decent jobs and promotes economic growth.
Base 3 - Belongingness Needs	Encourages the formation of local recycling communities, promoting affiliation and collaboration among participants.	SDG 11 (Sustainable Cities and Communities): Fosters the development of sustainable communities.
Base 4 - Esteem Needs	Values the efforts of participants and communities, promoting self-esteem and recognition for the work done.	SDG 4 (Quality Education): Promotes learning and education for personal development.
Base 5 - Necessidades Cognitivas	Provides open knowledge and access to technology, encouraging learning and the pursuit of knowledge.	SDG 4 (Quality Education): Facilitates access to knowledge.
Base 6 - Aesthetic Needs	Stimulates creativity by transforming plastic waste into aesthetic and functional objects.	SDG 12 (Responsible Consumption and Production): Promotes sustainable design and creativity.
Base 7 - Self-Actualization	Facilitates personal fulfillment by allowing individuals to develop their skills and contribute to society.	SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth): Empowers individuals and engages them in the community.

Source: Authors

This analysis highlights how the Precious Plastic program not only addresses environmental issues but also promotes significant social benefits, aligning with various United Nations Sustainable Development Goals (SDGs). It addresses a wide range of needs in Maslow's Hierarchy of Needs, demonstrating its positive impact at both the individual and community levels.

7. Identifying Correspondences between Synthesis Tables 1 and 2

Now, correspondences will be identified between the challenges presented in Synthesis Table 1, which highlights the challenges of plastic pollution in relation to Maslow's Hierarchy of Needs and the Sustainable Development Goals (SDGs), and the benefits highlighted in Synthesis Table 2, which focuses on the benefits of the Precious Plastic program in relation to Maslow's Hierarchy of Needs.



Correspondence between Base 1 - Physiological Needs and SDG 3 (Good Health and Well-being): In Synthesis Table 1, Base 1 of Maslow's Hierarchy of Needs, related to physiological needs, is linked to SDG 3, which focuses on health and well-being. Plastic pollution can adversely affect human health, as mentioned in the challenges of plastic pollution. In Synthesis Table 2, the Precious Plastic program contributes to the satisfaction of physiological needs by reducing plastic pollution and its health impacts, aligning with SDG 3.

Correspondence between Base 2 - Safety Needs and SDG 16 (Peace, Justice, and Strong Institutions): Base 2 of Maslow's Hierarchy of Needs, related to safety needs, is associated with SDG 16, which focuses on peace, justice, and strong institutions. Inadequate plastic waste management can lead to conflicts and legal issues, as indicated in the challenges of plastic pollution. The Precious Plastic program contributes to financial security, aligning with SDG 8 (Decent Work and Economic Growth), and indirectly to the prevention of conflicts related to plastic pollution.

Correspondence between Base 3 - Belongingness and SDG 11 (Sustainable Cities and Communities): Base 3 of Maslow's Hierarchy of Needs, related to the need for affiliation, is related to SDG 11, which addresses sustainable cities and communities. Plastic pollution in cities can affect quality of life and community cohesion, as mentioned in the challenges of plastic pollution. The Precious Plastic program promotes the formation of local recycling communities, contributing to affiliation and collaboration among participants, aligning with SDG 11.

Correspondence between Base 4 - Esteem Needs and SDG 4 (Quality Education): Base 4 of Maslow's Hierarchy of Needs, related to esteem needs, is linked to SDG 4, which focuses on quality education. Plastic pollution can negatively impact education in affected communities, as indicated in the challenges of plastic pollution. The Precious Plastic program values the efforts of participants and communities, promoting self-esteem and recognition for the work done, aligning with SDG 4.

Correspondence between Base 5 - Cognitive Needs and SDG 4 (Quality Education): Base 5 of Maslow's Hierarchy of Needs, related to cognitive needs, is also related to SDG 4, which focuses on quality education. The Precious Plastic program provides open knowledge and access to technology, encouraging learning and the pursuit of knowledge, which aligns with SDG 4.

Correspondence between Base 6 - Aesthetic Needs and SDG 12 (Responsible Consumption and Production): Base 6 of Maslow's Hierarchy of Needs, related to aesthetic needs, is related to SDG 12, which focuses on responsible consumption and production. The Precious Plastic program stimulates creativity by transforming plastic waste into aesthetic and functional objects, promoting sustainable design and creativity, aligning with SDG 12.

Correspondence between Base 7 - Self-Actualization and SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth): Base 7 of Maslow's Hierarchy of Needs, related to self-actualization, is related to SDG 4 (quality education) and SDG 8 (decent work and economic growth). The Precious Plastic program facilitates personal achievement by

allowing individuals to develop their skills and contribute to society, aligning with SDG 4 and SDG 8.

Correspondence between Base 8 - Transcendence and SDG 13 (Climate Action) and SDG 15 (Life on Land): Base 8 of Maslow's Hierarchy of Needs, related to transcendence, is related to SDG 13 (climate action) and SDG 15 (life on land). The Precious Plastic program encourages transcendence by promoting environmental awareness and contributing to the well-being of others, aligning with SDG 13 and SDG 15.

This analysis identifies correspondences between plastic pollution challenges, human needs in Maslow's Hierarchy of Needs, and the United Nations Sustainable Development Goals (SDGs), demonstrating how the Precious Plastic program addresses and contributes to meeting these needs and objectives in an integrated and sustainable manner. Based on this information, a third synthesis table can be created that brings together all the information and interconnections between Maslow's hierarchy, the UN SDGs, and the actions of Precious Plastic.

Summary Table 3 - Relationship between Maslow's Hierarchy, SDGs, Challenges of Plastic Pollution, and Mitigating Capacity of the Precious Plastic Program			
Base of Maslow's Hierarchy	Sustainable Development Goals (SDGs)	Challenges of Plastic Pollution in Relation to Maslow's Hierarchy of Needs and the SDGs	Benefits of the Precious Plastic Program in Relation to Maslow's Hierarchy of Needs and the SDGs
Base 1 - Physiological Needs	SDG 3: Good Health and Well-being	Health impacts due to plastic pollution.	Reduction of plastic pollution and health risks through plastic waste management.
	SDG 1: No Poverty	Threat to fishing, a food source for vulnerable populations.	
	SDG 2: Zero Hunger	Microplastics affect marine food, threatening food security.	
Base 2 - Safety Needs	SDG 16: Peace, Justice, and Strong Institutions	Conflicts due to improper plastic waste management.	Creation of job opportunities and financial security through the Precious Plastic program.
Base 3 - Belongingness Needs	SDG 11: Sustainable Cities and Communities	Plastic pollution in cities affects quality of life and community cohesion.	Stimulation of the formation of local recycling communities, promoting affiliation and the development of sustainable communities.
Base 4 - Esteem Needs	SDG 4: Quality Education	Negative impact on education in communities affected by plastic pollution.	Recognition of the efforts of participants and promotion of self-esteem through the Precious Plastic program.
Base 5 - Necessidades Cognitivas	SDG 4: Quality Education	Reduced access to knowledge due to plastic pollution.	Provision of open knowledge and access to technology by the Precious Plastic program.

Base 6 - Aesthetic Needs	SDG 12: Responsible Consumption and Production	Damage to the environment's aesthetics due to the presence of plastic waste.	Stimulation of creativity and sustainable design through the Precious Plastic program.
Base 7 - Self-Actualization	SDG 4: Quality Education		Empowerment and community engagement through education and work.
	SDG 8: Decent Work and Economic Growth		Facilitation of personal fulfillment and skills development through the Precious Plastic program.
Base 8 - Transcendence	SDG 13: Climate Action		Generation of decent jobs and promotion of economic growth.
			Contribution to environmental protection and action against climate change.
			Promotion of transcendence through environmental awareness and contribution to the well-being of society, aligning with SDGs 13 and 15 (Life on Land).

Source: Authors

8. Conclusions and Future Contributions

Through the analysis of the synthesis frameworks developed in the text based on the collected data and in-depth analysis that allowed us to identify patterns, correlations, and valuable insights related to the challenges of plastic pollution, human needs, and the benefits of the Precious Plastic program, we can conclude that the presented objectives have been achieved and can be summarized and explained in the following topics:

Holistic Integration: Synthesis Framework 1 highlights the interconnection between plastic pollution, the Sustainable Development Goals (SDGs), and human needs in Maslow's Hierarchy. This emphasizes the importance of addressing plastic pollution comprehensively, recognizing that it affects various dimensions of human life.

Multidimensionality of Plastic Pollution: The analysis emphasizes that plastic pollution is not only an environmental problem (as evidenced by its connection to SDG 15 - Life on Land) but also impacts areas such as poverty, hunger, health, education, and community cohesion, reflecting its complexity.

Multisectoral Approach: Synthesis Framework 1 reveals how plastic pollution transcends disciplinary boundaries, requiring a response that spans sectors such as the environment, health, education, economics, and justice.

Contributions of Precious Plastic: Synthesis Framework 2 demonstrates how the Precious Plastic program specifically addresses human needs and contributes to the achievement of relevant SDGs. It primarily operates in waste management, job creation, community



building, and education. Its synergy with the SDGs is noteworthy, as the Precious Plastic program aligns with several SDGs, including SDG 12 (Responsible Consumption and Production), SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities and Communities), and others. This highlights its ability to promote sustainable development in various ways.

Community Empowerment: Precious Plastic not only addresses environmental issues but also promotes the participation and empowerment of local communities. This aligns with the need for affiliation and self-actualization in Maslow's Hierarchy.

Innovation and Education: The program provides access to knowledge and technology, encouraging cognitive needs and promoting quality education.

Environmental Awareness: By stimulating transcendence and environmental awareness, Precious Plastic contributes to mitigating challenges related to plastic pollution and climate change.

This analysis underscores the importance of a comprehensive and complex approach that is necessary to address plastic pollution, considering both its environmental impacts and its implications for fundamental human needs. The key insight we gained was the relevance of the Precious Plastic program, which emerges as a standout example of how practical solutions can be directed to address the complex and interconnected challenges that humanity faces. This characteristic further emphasizes the need for collaboration across various fields of knowledge and data exchange in the pursuit of solutions. For a sustainable future, it is crucial to recognize and address these challenges in an integrated manner, considering the various dimensions of human development.

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