

## Article

# The Zero Waste University Program in Mexico: A Model for Grassroots Innovations in Sustainability

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**Abstract:** Grassroots innovations for sustainability can take various forms, including novel models for comprehensive waste management. This article examines the contributions of the University Solid Waste Management Program with a Zero Waste approach, a grassroots innovation established by the community of a university campus associated with a non-governmental organization. The program was developed in Cuernavaca, Mexico, in a political and economic context marked by unsustainable and inequitable practices, but with a long history of social struggle for the construction of alternatives. In analytical terms, we study the formation and mutual influence of the sustainability niches of both organizations from the perspective of strategic niche management theory, as well as the benefits resulting from such development.

**Keywords:** grassroots innovations; university sustainability; waste management

## 1. Introduction

Two billion metric tons of urban solid waste are generated annually on Earth [1]. A third are managed insecurely, especially in poor countries where in spite of economic resources for the operation of waste management being able to represent up to 20% of municipal budgets, low coverage rates of collection, recovery, and final disposal are still common [2]. Latin America and the Caribbean generates 10% of global solid waste, but 40 million people do not have a collection service and a third of the waste generated is disposed of in open dumps. Improper waste disposal damages the environment because it pollutes the soil and groundwater and emits contaminant gases in the atmosphere [3,4], causing health risks. This situation will worsen in the future, as the estimated generation of waste in 2050 will reach 3.40 billion tons per year [2]. Thus, waste management is one of the priority aspects of the World Agenda for Sustainable Development. Various initiatives have emerged with important benefits, mainly in the recovery and transformation of waste in countries of the Global South, and some show innovative examples of grassroots participation and have contributed to the making of public policies and the improvement of management systems [5].

The objective of this article is to examine the contributions of a university solid waste management program with a zero waste approach that emerged as a grassroots innovation established in the community of students, workers, and academics of a university campus, in association with a non-governmental organization (NGO). Such contributions will be analyzed from the perspective of the strategic niche management literature, applied to the development of sustainability niches. This theoretical framework is accompanied by a novel methodological approach, based on participatory action research that the authors conducted while simultaneously occupying the position of program coordinators.

We try to explore interesting answers to the following questions: How and why can grassroots innovation contribute to sustainability in the university campus? By which means can a particular

grassroots innovation in the university, the Zero Waste Program (ZWP), develop an innovative niche with clear practical and learning benefits? The main contribution of this article is the analysis of a grassroots innovation and the identification of its contributions to a policy sector, based on highlighting its aspects of social innovation (rather than technological). We recognize the role of the community of a university campus in the design and implementation of an innovation in waste management, which represents a transition from governance to sustainability. This role of the university, with the emphasis on its social dimension, has not been previously studied from the perspective of innovation for sustainability.

The structure of the paper is as follows. Section 2 presents the theoretical perspective and the analytical model with which the empirical case is studied. In Section 3, we describe the methodological procedures undertaken for the empirical research. In Section 4, a description of the case study is presented. In Section 5, the results of the investigation are reported: the ZWP is characterized as a grassroots innovation, and the correspondence between this innovation and the formation of a sustainability niche is exposed. Consequences on leadership, organizational practices, and the learning process are analyzed. In Section 6, these results are analyzed and discussed. Finally, the last section provides a main conclusion: the program challenges the status quo of social and technical practices structured under waste management regimes that persist to be environmentally insufficient and socially inequitable. The fact that it does so within the National University of Mexico (UNAM), the largest university in the world, is especially significant.

## 2. Theoretical Framework: Linking the Niche with the Grassroots Innovations for Evaluating the Zero Waste University Program

### 2.1. Grassroots Innovations

In sustainable development, we do not all walk the same path or do it in the same way. The practices oriented towards sustainability are different according to the scale, the geography, and the sector (public, private, social) from which they arise. Even though the theory of innovation niches has preferably focused on sustainability innovations under the logic of the market economy, an alternative theoretical approach has developed at the margin for the analysis of community actions under the term grassroots innovations (GI). GI seeks to “describe the networks of activists and organizations that generate new bottom-up solutions for sustainable development; solutions that respond to the local situation and to the interests and values of the communities involved” [6]. That is, in grassroots innovation, communities have control over the processes and results involved [7,8].

This article analyzes the actions of the university community regarding waste management on campus as a GI. What does this mean in theoretical terms? Our work relates to the larger debate on how innovations provide towards sustainability, and also, by focusing on a university grassroots program, points towards a redefinition of what is public and what is understood by the provision of services.

Studies on GI began two decades ago. A consensus has not been reached on their definition, although progress has been made on the characteristics they should exhibit. One of their main characteristics is their social origin. GI are generated by civil society, result from social experiments of innovative technologies, values, and institutions [6], and are derived from the knowledge, experience, and skills of communities and individuals that solve local problems, often on the fringes of formal educational, research, and industrial institutions [9].

GI emphasize social, cultural, and ethical values that differ from conventional innovations [10], and in this sense, usually operate outside or at the margins of state or commercial interests [11]. They also pose different kinds of sustainable organization, such as informal community groups, social enterprises, voluntary associations, and co-ops [12].

A second characteristic is their orientation to and from the local. GI have knowledge and experience about which innovations are appropriate for their localities, and from this position, mobilize significant resources [5]. They support the creation of local niches through the incubation of sociotechnical

innovation against conventional values, technologies, and actors [13] and build a bottom-up approach to sustainability [14,15].

For some authors, the differences with conventional innovation are explained by the fact that GI arises from dissenting voices and movements, which demand a different vision and innovative practice from the dominant innovations. Therefore, the operations of GI challenge the status quo of technologies, practices, and values; they promote new forms of organization and provision systems [16] and they oppose existing legal, regulatory, and institutional elements in their operational contexts [17].

Seyfang and Longhurst [18] argue that GI differ from conventional innovation to the extent that their driving force is a social need and ideological commitment and they do not pursue profit. Thus, the protected space for these GI is created by values and culture. They argue that GI are established in communal property structures, and depend on volunteer work, grants, or mutual exchange.

## 2.2. Niche Literature

Theoretical approaches to GI are framed in a more general literature on transitions and innovations. Research on sociotechnical transitions towards sustainability [12–19] addresses how technological innovations can spread and alter existing sociotechnical systems from the successful expansion of an experimental niche [20]. From this literature, GI have been linked to niche theory and to the transition from niche to regime [21].

The literature on sustainable innovation indicates that improvements in production and consumption systems require innovation at the scale of “socio-technical regimes” [22], which refer to a complex configuration of instruments, institutions, and agents that reproduce technological practices, and implies a collective social process in which the various social actors negotiate innovation [23]. To respond to sustainable development, the regime needs to articulate changes in its internal and external elements, a coupling that can arise from a niche practice.

A niche is defined as “a discrete application domain ... where actors are prepared to work with specific functionalities, accept initial problems such as higher costs and are willing to invest in improvements of new technologies and the development of new markets” [19]. Although, as we pointed out above, this definition is linked to the market economy and is presented in terms of strategic combinations typical of game theory, it highlights two important elements: it opens a door for the transformation of regimes and emphasizes “collective effort” [24].

This approach raises useful resources for the analysis of sustainability innovations. It narrows the gaze to a niche and recognizes that GI generate a set of technological and organizational transformations that are functional and thus, have innovative potential. However, it should not be assumed that niches generate the changes per se [19], since they depend on contingencies and processes that are beyond their control [22]. When evaluating the learning derived from the niche, attention should not be restricted to aspects of performance, or “first order”; instead, it is necessary to examine the lessons of “second order”, relative to the alternative sociocultural values that sustain it as well as affect its diffusion [19]. That is, the intrinsic and extrinsic benefits of the niche must be distinguished. Among the former, it is necessary to distinguish those that allow appreciation of the dimensions of sustainability and the social and economic compensations that the niche reports in relation to the ideologies that motivated it. Among the latter, it is necessary to identify the transformation potentialities generated by the niche beyond the micro level that contribute critically to regime change [6].

The theory of the niche in the social economy understands that GI are functional for the development of niches because they generate processes such as the formation of networks, learning, capacity development, empowerment, and protection of the niche innovations [25]. In the right regime, niches support the diffusion of innovative sociotechnical practices [20] built and mobilized by GI at the local level. In other words, GI represent transformative initiatives within the operating framework of a niche that, if properly articulated, is capable of replicating them and converting them into conventional elements within a regime.

A suitable analytical framework for evaluating the contributions of sustainability niches is Strategic Niche Management (SNM), which seeks to actively create and nurture sustainable innovation development niches to trigger broader systemic transitions [20]. This is achieved by focusing attention on radical and unproven technologies for local development [26] and explaining the dynamics of sociotechnical-based innovations [12]. The SNM approach looks at how sustainability experiments improve the performance and diffusion of potentially transformative innovations through the creation of visions and expectations, networks, and social learning [19,24]. Strategic development of the niche arises from experiments undertaken by local networks that are capable of generating replicable lessons at that scale. Followed by an intermediation process, in which these lessons are translated and negotiated to build generic rules for a broader niche network, these lessons could become inputs for new experimentations and make the niche transform the prevailing regimes or become a viable competitor [27].

Criticisms of SNM question the lack of recognition that success in developing a niche depends on vision, leadership, and formal and informal association with different actors at different scales [28]. Recent emphasis has been put on the absence of analysis on the formation and dynamics of power that goes through the entire process of niche development and the need for political support [29]. Our analysis reflects this criticism, as we recognize the role that a committed university authority and the formation of an academic administrative leadership should play, without prejudice to the active roles played by the local university community and the participant NGO in the development of innovations and experiments capable of solving their own problems [30].

Our case study will show how the sociotechnical experiment undertaken has become a sustainability niche that allows a solution to the problem of waste management on the campus, and will exemplify the way in which GI accumulate learnings, disseminate best practices, and challenge the existing regime. To do this, we propose three phases of analysis. The first determines to what extent the campus ZWP is a GI, based on characterizing its social and local origins and its organizational form. The second explores the correspondence between this sociotechnical innovation and the development of a sustainable innovation niche, by identifying the processes of networks, learning, and dissemination of the ZWP. The third raises the evaluation of the internal and external benefits of this innovation niche.

### 3. Methodological Procedures

Data were obtained during 2019 through an interdisciplinary participatory action research (PAR). This research is part of a broader advocacy project, started in 2015 and coordinated by the authors since then, whose purpose is to establish and institutionalize a solid waste management program at the Morelos campus of UNAM. Professors, students, staff, workers, and officials from the university campus and an NGO have participated in the project as providers and users of the services generated, and as agents of change. In general, PAR aims to understand complex and problematic processes in order to influence and transform them. An emancipatory orientation is followed insofar as it seeks, through mutual learning, to strengthen the capacities of the social groups involved that will generate social changes [31]. PAR is about stakeholders “developing goals and methods, participating in data collection and analysis, and implementing the results in a way that will increase critical awareness and promote changes in the lives of those involved—changes that are in the direction and the control of the participating group or community” [32].

In the experience described here, members of the university community worked outside the channels of conventional authority, but coordinated with it, in the solution of a previously identified problematic situation: the management of solid waste generated on campus. The result was a long-term collaborative approach aimed at designing practical solutions and institutional transformations. The data were compiled in a period of four years (2015–2019) from the abundant notes collected day by day by the authors during the planning and execution of the program activities, as well as through in-depth interviews with numerous representatives of the other stakeholders, which were recorded, transcribed, and analyzed with the software ATLAS.ti.

#### 4. Case Study Description

This section contains the background of the case study. We focus on the problems that affect the management of urban solid waste in Mexico and the difficulties faced by waste collectors. The emergence of the ZWP is located as a solution to this problem and describes the first steps of ZWP within the university campus.

##### *The ZWP as a Grassroots Innovation*

In Mexico, the amount of solid waste generated amounts to just over 120,000 t/day. The percentage of national collection coverage is 83.9% and approximately 16% of the waste remains in the environment without control [33]. Reuse and recycling activities do not exceed 10% and fall on the work of more than 28 thousand informal waste pickers [34]. These workers make up the first link in the recycling chain and carry out their activity in dangerous, unhealthy conditions, without recognition or labor rights, with long working hours, and under constant uncertainty on the access to the waste on which their income depends [35]. Unlike other Latin American countries, such as Colombia, Ecuador, Argentina, Brazil, and Chile, which have made progress in the socioproductive integration of waste pickers, Mexico shows a delay in the construction of an inclusive public action.

This deplorable and dramatic situation, together with the low levels of efficiency and effectiveness with which the service operates, shows that in Mexico, the waste management regime is not sufficient to comply with (ambitious) Mexican laws and international commitments. This anticipates the urgent need for restructuring the sector, in which GI could play an important role. This is where the contribution of universities is undeniable, firstly because universities are great generators of waste and are therefore, obliged by law to establish programs for the management of their own waste, and secondly, because by proposing and deploying innovative solutions within the campus, they may offer a living model of sustainability to society. Due to its size, academic importance, and influence, the contribution of the National Autonomous University of Mexico may be crucial.

Currently, the ZWP is the instrument with which the Morelos campus of the UNAM tries to comply with Mexican laws, meets the demanding university ethics in waste management, and tries to transform waste management. We argue that the ZWP should be considered as a GI insofar as it represents a sociotechnical experiment relevant to the local context, and was constructed on the knowledge, experiences, and skill basis of the university population, and on a community ethos different from that of the conventional waste industry.

While the antecedents of the program go back to the beginning of the millennium [36], the ZWP formally began in 2015 with a diagnosis aimed at designing the objective of the program and proposing a concrete solution relevant to the campus. Such diagnosis was conducted independently but in coordination with the university authority, and volunteer members from all sectors of the university community participated: staff, workers, students, and professors. The diagnosis made it possible to identify and characterize a set of obstacles to overcome (for example, that the municipal government of Cuernavaca did not offer a differentiated collection service or possibilities to value the collected waste) and also to address certain opportunities (such as the existence in Cuernavaca of several low-scale collection centers accredited by the environmental authority, various associations and companies that offered collection services, and private enterprises where these materials were bought and sold). More importantly, it showed the urgent need for the university to deepen its commitment to the environment, dignify and modernize the campus waste management system, and recover waste by-products to incorporate them into recycling chains.

As a consequence of the ZWP, there have been various transformations in the daily practices and institutions of the campus. After a long process of deliberation and shared planning, integral waste management was implemented on four processes and practices: the separation of waste at source, selective collection, temporary collection, and final disposal (which includes the on-site composting of food waste). Additionally, several association models were established to guarantee the adequate transfer and reduction of final waste disposal: for non-recoverable waste (20%), the municipal collection



service continued to be used; for organic waste resulting from pruning green areas (50%), an agreement was signed with the University Composting Center of the Autonomous University of the State of Morelos (UAEM); for recoverable waste (30%), both organic and inorganic, local composting was set up for food residues, and a collaboration was established with the NGO “We Recycle” (WR).

WR is a non-profit civil association, founded in 2014 with the aim of promoting an ecological conscience and a culture of cleaning and separation of recyclable solid waste, and to create jobs that help preserve the environment [37]. In 2016, it had five low-scale collection centers in the city and provided the collection service of recoverable waste to condominiums, restaurants, and shopping centers. Although the operation of each collection center is autonomous, the sale of the by-products is consolidated, which has allowed them to generate sources of employment for some workers, including some waste pickers.

## 5. Results

### 5.1. The ZWP as a Grassroots Innovation

Is the ZWP a GI? We further substantiate our answer by considering three aspects of the program: the formal organization of the innovation niche and its substantive content, the local origin of the niche, and the social origin of the niche.

Regarding the organizational form, it is important to point out that although universities are hegemonic institutions in innovation processes, they do not usually experience their innovative proposals in themselves, or establish symbiotic collaborations with non-conventional actors. Nor do they recognize other forms of knowledge production or build outside the imperative of innovation for competitiveness. The collaboration between “Zero Waste” and “We Recycle” cements a shared learning structure to solve a problem. This relationship is based not on the operation of a new service provision modality, but on mutual exchange and trust among parties which have established themselves as a coherent community with their own founding principles.

Indeed, although formally, WR functions as a service provider for the UNAM and receives wages in return, in substance, the agreement functions as a symbiotic innovation niche. Consequently, WR has decided to profoundly transform its operating model. For example, it has incorporated into its operating model the corrective separation of waste erroneously segregated by university users, weighs the by-products of the collected waste, delivers a monthly report of the amount of recovered waste, sends the products to recycling chains of certified local or regional businesses, and returns the proceeds of such sale to campus. For UNAM, this relationship has made it possible to build and maintain an updated data system on the magnitude and composition of waste, to evaluate the performance of the ZWP and plan its progress, to identify the traceability of waste, and to take advantage of the skills of the association’s workers, who have extensive experience in materials and the recycling market.

Regarding its local origin, ZWP has a history that goes back at least the decade prior to its implementation. In 2005, many researchers and students from the Morelos campus of UNAM, including the authors, participated in a large project aimed at the ecological restoration of the hydrographic basin, which included the development of a sustainable waste management program for various neighborhoods of Cuernavaca. This process recovered a popular tradition of waste management with several decades of existence [36]. UNAM’s technical-scientific knowledge was also important during the resistance struggle that various local communities undertook against a poorly conceived sanitary landfill that the local government tried to impose on them during 2006–2009. The ZWP was able to retrieve all these accumulated experiences and situated knowledge, and used it to propose an inclusive sociotechnical solution that recovered tangible and intangible resources developed regionally, which were also significant to the local context.

Finally, regarding its social origin, the ZWP emphasizes the social, cultural, and ethical values of the communities involved, where the university expresses its values by proposing an innovation from a leadership position for the benefit of society, and WR serves its mission and vision and provides

sustenance to its associates. Through this articulation, the association attends to a socioenvironmental need and not to obtain profits, technical efficiency per se, or commercialization; at the same time, it is in opposition to the practices, technologies, and rules of the conventional system in which it operates: waste management at the same university.

In summary, due to its social and local origin and organizational substance, we can affirm that the ZWP is a GI, since with the knowledge, ideas, and accumulated local university and social capacities, an innovative solution for an environmental management problem typical of the university campus was constructed.

### 5.2. *The ZWP as an Innovative Niche*

To what extent does the transformative power of this GI contribute to the transition to sustainability in the university? In this section, we identify the elements developed by the ZWP and their contribution to the development of sustainable innovation niches from the perspective of strategic niche management.

The ZWP is a local solution for waste management with practical viability. Its support structure brings together three types of elements:

1. Operational elements. These concern both technical aspects of waste (its characteristics, methods of collection, and presentation for the recycling market) and logistical aspects of the program (space organization, devices, and infrastructures, as well as collection services within and from the campus).
2. Internal and external organizational elements. Among the first are administrative issues related to the coordination of the collection service, its frequency, the delivery of reports, the way in which the officials responsible for the program are informed, and how decisions are made in this regard. The second has to do with the dynamism of the recycling market, the supply and demand of by-products, their prices, technological innovations, and the expansion derived from these forces towards the use of new waste.
3. Educational elements. They concern dissemination activities and mutual and collective training on the processes and practices associated with the program in relation to the dynamism of the waste sector.

Based on this support structure, we believe that the ZWP has facilitated the sustainable development of an innovation niche. Three aspects should be discussed.

#### 5.2.1. Networking

Part of the strength achieved by ZWP depends on the construction of networks internal and external to the campus. Internally, ZWP is the first initiative in UNAM that establishes, independently and in a complementary way to the university's authority structure, permanent bridges between academics and staff for the resolution of a problem not well posed in a relevant field of incidence (the management of university garbage). At the core of those responsible for the program are academics and campus staff, for whom this horizontal and unprecedented collaboration has facilitated the exchange of knowledge and experiences between two fundamental but previously weakly articulated sectors. Likewise, this construction of networks helped to institutionalize learning and standardize practices.

Externally, the collaboration with WR, who are inserted in local and regional networks of the recyclables market, has been fundamental to learn the dynamism and functioning of such market and orient internal practices towards it. Collaboration with other entrepreneurs, indirect and mediated by WR, has stimulated the expansion of the program towards other waste products and opened a hybrid path for university sustainability. Additionally, it has cemented an unconventional way of institutionalization between two worlds marked, on the one hand, by criticism and on the other, by interdependence. The ZWP challenges a waste regime dominated by an oligopoly with deep structural flaws and routines and practices adjusted to these flaws, and at the same time, articulates with some entrepreneurs to open new paths and advance in the performance of innovation.

Construction of networks, with complex complementary skills, has facilitated meaningful learning. This is knowledge that relates the extensive practical experience of WR with the knowledge acquired during the research, teaching, and university social bonding processes, which needs filtering. Directly applied in the practices of reducing and separating waste in the university, such filtered knowledge has shaped a change of reasoning, attitudes, and affects in those university members who participate, which are now able to communicate them to the rest of the university community.

### 5.2.2. Learning

Although it would seem that learning within a university campus is a natural process, the experience with the ZWP showed that some conditions are necessary for its development. It was necessary to build a recurring and performance-based training plan for the entire university community (staff, workers, professors, researchers, and students) in order to disseminate information, incorporate practices, and develop skills to reduce and separate waste correctly. Once this learning was incorporated into the community, new sustainable practices emerged spontaneously not only on the issue of waste, but in other aspects of campus environmental management, such as water and energy.

Learning has been a continuous and variable process. On the one hand, this is because the process of selective separation of solid waste must respond dynamically to fluctuations and changes in the market, with new knowledge and practices. For example, it is necessary to continuously adjust the original separation and collection scheme as new products or recycling processes are incorporated, or new environmental regulation occurs. This generates a permanent learning process between the campus and WR, and between them and the recycling intermediaries. On the other hand, those responsible for the program must develop a habit of continuous learning regarding the entire waste management process, as they are forced to continuously experiment with, among other aspects, new ways of reducing waste generation and evaluating program performance. Thus, multiple spaces for creativity are formed.

### 5.2.3. Expectations

The ZWP represents a niche practice that attempts to solve the contradictions of the waste regime. By proposing itself as a locally rooted action that generates changes in behavior within a community, it promptly establishes a prototype of socioenvironmental change that responds to the needs of sustainability. It is socially acceptable, environmentally sustainable, and economically viable.

This sustainability niche has attracted attention and general interest, as it is a flexible proposal capable of adapting and spreading. In 2019, for example, there were more than five guided visits to the campus for external observers interested in learning about the operation of the ZWP, and three diagnostic visits were made to two federal public administration agencies and an association of foresters from northern Mexico willing to implement such an initiative.

Within the campus, the observation and practice of this experience of sustainability have led to deep reflection and interest, and many members have approached WR to receive the collection service in their homes.

## 5.3. Niche's Internal and External Benefits

The theory of niches points out the importance of not restricting evaluation to its technical aspects, but needs to be broader. Next, we identify both the internal benefits of ZWP and the external benefits of its diffusion.

### 5.3.1. Internal Benefits

The program has generated various benefits for the campus. From October 2016 to March 2020, all organic wastes were composted and more than 27 tons of recoverable waste went into recycling processes, thus avoiding their disposal in landfills. In addition, the ZWP has extended the proper handling and transfer of some waste that is difficult to recycle locally or needs special handling.



Regarding social progress, the program has allowed important improvements in working conditions, both for campus workers and for WR workers, who now carry out their activities in orderly, clean, and safe collection centers and in facilities where proper hygiene conditions are maintained. Thus, vulnerability to risk exposure has decreased. For impoverished informal workers, who receive and trade waste in some phase of the commercial chain, the program has reportedly provided an increase in expected income, a decrease in uncertainty in access to waste, and the possibility of obtaining high-quality recyclable materials and in sufficient quantities. This has improved their ability to negotiate more favorable prices and marketing conditions vis-à-vis large intermediaries and recyclers.

Finally, the collaboration with UNAM has improved the recognition of this profession and its contributions to the common good. Rather than considering recovery as an activity located outside proper waste management, the ZWP redefines it as a central action, whose practice endows those who carry it out with the dignity of environmental operators.

### 5.3.2. Diffusion Benefits

Considering the ZWP as an innovation niche shows how it is possible to transform the provision of the collection service of waste. This bottom-up proposal must be judged with evaluation metrics other than efficiency and effectiveness in terms of a market economy, since it is based on the values promoted and mobilized by a community with knowledge and located resources, where optimal performance and sustainability are the product of a collective effort.

While it is true that the ZWP does not pursue an objective beyond the micro level, it somehow proposes a sociotechnical device that allows us to reflect on the great and urgent transformations required by the waste regime in Mexico.

## 6. Discussion

This article has shown that an approach to GI from the perspective of innovation niches allows progress in the conceptualization of sustainable development. Such contribution has been relatively neglected, as it is thought of as part of a marginalized agenda.

The main contribution of the Zero Waste Program is to challenge the status quo of social and technical practices structured under waste management regimes that are environmentally insufficient and socially inequitable. The fact that it does so within the largest university in the world is especially significant.

The development of practices in context triggers a comparative and dialogical process between what is lived and experienced locally and what prevails in the national waste management regime. Additionally, it provokes the broadest reflection on what would work in a broader context characterized by the insufficiency of the regime and labor informality, and leads us to question what practices make sense for the management of waste both in the rest of UNAM and in Mexico.

In addition, grassroots innovation places at the center of attention the way of making science available and socially relevant to address a local problem. The experience of the ZWP contributes to cognitive justice, as the university community admits that there are many ways to produce knowledge and experiences and that all are useful to define situated solutions.

This exercise, by demonstrating the validity of collaborating with non-conventional actors and organizations, reveals that the only way to advance towards sustainability is collective and involves reconnecting actors, institutions, and technologies.

## 7. Conclusions

We have analyzed the potential of a grassroots innovation to contribute towards sustainable development. The Zero Waste Program was characterized as a grassroots innovation and as an innovation niche, and its potential to be disseminated beyond the niche itself was exposed.

Our findings suggest that commitment and trust between the actors involved in a grassroots innovation are essential for its success. We identify two important elements: the recognition of new components of identity in the participating organizations and the formation of a sense of shared community built around a collective purpose.

In theoretical terms, our proposal to analyze the Zero Waste Program as a grassroots innovation under the light of SNM theory reveals the potential of the program as an engine of change for the waste regime in Mexico. The successful experience of managing solid urban waste with the Zero Waste Program refers to a tangible, plausible, efficient experience that responds to local needs.

A set of more refined theoretical tools remains to be developed in future research to understand the contribution of university communities in the transition towards sustainability, especially when they are articulated in unconventional ways with other actors.

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