



Contesting informality through innovation “from below”: epistemic and political challenges in a waste pickers cooperative from Buenos Aires (Argentina)

Sebastián Carenzo

To cite this article: Sebastián Carenzo (2020) Contesting informality through innovation “from below”: epistemic and political challenges in a waste pickers cooperative from Buenos Aires (Argentina), Tapuya: Latin American Science, Technology and Society, 3:1, 441-471, DOI: [10.1080/25729861.2020.1788775](https://doi.org/10.1080/25729861.2020.1788775)

To link to this article: <https://doi.org/10.1080/25729861.2020.1788775>



© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 08 Sep 2020.



Submit your article to this journal [↗](#)



Article views: 554



View related articles [↗](#)



View Crossmark data [↗](#)



Contesting informality through innovation “from below”: epistemic and political challenges in a waste pickers cooperative from Buenos Aires (Argentina)

Sebastián Carenzo 

Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Instituto de Estudios sobre la Ciencia y la Tecnología – Universidad Nacional de Quilmes (IESCT-UNQ), Buenos Aires, Argentina

ABSTRACT

This paper draws on an ethnographic research to critically analyze the process of formalization of the so-called “informal” recyclers within the Buenos Aires metropolitan area. It claims that their recognition by governmental and nongovernmental agencies has been mostly oriented to crystallize their role as a workforce in the lower shackles of the recycling value chain. In contrast, other valuable contributions of waste pickers, such as the development of a practical pedagogy towards the segregation and recycling of materials, or the design and manufacturing of their own technological devices, have not been yet properly recognized or strengthened in the same way. Therefore, to approach the waste management field by focusing on the innovations dynamic is revealing of to what extent it is shaped by asymmetric power relations, which include epistemic and techno-cognitive dimensions. Drawing on the notion of epistemic (in)justice, this paper provides a critical reflection on the drivers and obstacles that shape innovation skills aimed at waste management, and thus, define which actors are to be legitimated as “innovators” within this field and which are not. Finally, I share some open reflections about some policy guidelines that could help to profit from the rich body of technological experience and knowledge elaborated within waste picker’s grassroots organizations. At the same time, I will highlight the specific contribution of an ethnographic perspective to the study of grassroots innovations.

KEYWORDS

Grassroot innovations; Waste pickers; Epistemic politics; Ethnography; Buenos Aires

PALABRAS CLAVE

Innovaciones de base; Recicladores de base; Política epistémica; Etnografía; Buenos Aires

PALAVRAS-CHAVE

Inovações de base; Catadores de materiais recicláveis; Política epistêmica; Etnografia; Buenos Aires

Contestando a informalidade por meio da inovação “de baixo”: desafios epistêmicos e políticos em uma cooperativa de catadores de lixo de Buenos Aires (Argentina)

RESUMO

Com base em pesquisas etnográficas, este documento analisa criticamente o processo de formalização dos chamados catadores “informais” dentro da área metropolitana de Buenos Aires. Ela afirma que seu reconhecimento por agências governamentais e não-

CONTACT Sebastián Carenzo  sebastian.carenzo@gmail.com

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

governamentais tem sido principalmente orientado para cristalizar seu papel como força de trabalho nos elos inferiores da cadeia de valor da reciclagem. Em contraste, outras contribuições valiosas dos catadores, tais como o desenvolvimento de uma pedagogia prática de segregação e reciclagem adequada de materiais, ou a concepção e fabricação de seus próprios dispositivos tecnológicos, não foram adequadamente reconhecidas ou reforçadas da mesma forma. Portanto, abordar o campo da gestão de resíduos concentrando-se na dinâmica das inovações é revelador da medida em que ela é moldada por relações de poder assimétricas, que incluem dimensões epistêmicas e tecno-cognitivas. Recuperando a noção de (in)justiça epistêmica, este documento oferece uma reflexão crítica sobre os motores e obstáculos que moldam as capacidades de inovação orientadas para a gestão de resíduos e, portanto, define quais atores devem ser legitimados como “inovadores” dentro deste campo e quais não devem. Finalmente, compartilho algumas reflexões abertas sobre algumas diretrizes políticas que poderiam ajudar a aproveitar o rico corpo de experiência e conhecimento tecnológico desenvolvido dentro das organizações de base de catadores de recicláveis. Ao mesmo tempo, observa-se a contribuição específica de uma perspectiva etnográfica para o estudo das inovações de base.

Concurso de informalidad a través de la innovación “desde abajo”: desafíos epistémicos y políticos en una cooperativa de recicladores de Buenos Aires (Argentina)

RESUMEN

Partiendo de una investigación etnográfica este trabajo analiza críticamente el proceso de formalización de los llamados recicladores “informales” dentro del área metropolitana de Buenos Aires. Afirma que su reconocimiento por parte de las agencias gubernamentales y no gubernamentales se ha orientado principalmente a cristalizar su papel como fuerza de trabajo en los eslabones inferiores de la cadena de valor del reciclaje. En contraste, otras valiosas contribuciones de los recicladores, como el desarrollo de una pedagogía práctica acerca de la correcta segregación y el reciclaje de materiales, o el diseño y fabricación de sus propios dispositivos tecnológicos, no han sido debidamente reconocidas o fortalecidas de la misma manera. Por lo tanto, abordar el campo de la gestión de desechos centrándose en la dinámica de las innovaciones, es revelador de hasta qué punto está configurado por relaciones de poder asimétricas, que incluyen dimensiones epistémicas y tecno-cognitivas. Recuperando la noción de (in)justicia epistémica, este documento ofrece una reflexión crítica sobre los motores y obstáculos que conforman las capacidades de innovación orientadas a la gestión de los desechos y, por lo tanto, define qué actores deben ser legitimados como “inovadores” dentro de este campo y cuáles no. Por último, comparto algunas reflexiones abiertas sobre algunas directrices de política que podrían ayudar a aprovechar el rico conjunto de experiencias y conocimientos tecnológicos elaborados en el seno de las organizaciones de base de recicladores. Al mismo tiempo, se señala la contribución específica de una perspectiva etnográfica al estudio de las innovaciones de base.

1. Introduction

This paper draws on ethnographic research developed with members of a waste pickers cooperative located in the metropolitan area of Buenos Aires. This case study allows me to critically analyze the institutionalization of so-called “informal” recyclers in the official waste management system, by focusing on their specific innovation praxis, a dimension which has been little recognized by public agencies, NGOs, and academic scholars devoted to working with this population.

To approach the waste management field by focusing on the innovation dynamic reveals to what extent it is shaped by asymmetric power relations, which include epistemic and techno-cognitive dimensions. Thus, two related analytical questions are formulated. Firstly, which practices and meanings are defining “innovation”? In other words, to what extent is social inclusion being considered? Secondly, who can be socially legitimated as “innovator” within this specific field? That is, which social actors are allowed to claim and profit from technical, financial and legal resources provided by public and private institutions?

These questions gain relevance if we consider that over the last two decades waste pickers cooperatives have achieved key improvements in terms of their working and living conditions, due to their progressive inclusion within municipal waste management public policies and legal frameworks. Simultaneously, this process has contributed to crystallize waste pickers only in terms of an emerging workforce, skilled in collecting and sorting recyclables from waste, at best. Other valuable contributions, such as the development of a practical pedagogy concerning the segregation and recycling of materials, or the design and manufacturing of their own technological devices, have not been yet properly recognized or strengthened in the same way.

A vibrant creative practice takes place within the sheds of the waste pickers cooperatives, even though they are usually framed as an unskilled and alienated population devoted to collect and sort waste as a last resort to make a living. This reductionist gaze not only makes their multiple contributions invisible, but also conceals processes of appropriation and dispossession of those cognitive resources and findings made “from below.”¹ This perspective remarks two key aspects of my approach. On the one hand, it addresses the politics of innovations from a counter-hegemonic perspective, which highlights the creative and experimental praxis developed by so-called popular sectors. On the other hand, my engaged enunciation place is made explicit, continuing a long-term action-research trajectory with waste pickers cooperatives.

Thus, in this paper, I will deepen our understanding of the waste pickers’ creative skills, which have allowed them to design and develop specific technologies of production, processing and organization, over the last 15 years. This includes a wide range of practices, from logistical schemes to recyclables collection in densely populated areas, taxonomies to identify and sort materials, exploration of experimental procedures to reuse or recycle “multi-layered plastics” and other odd materials which cannot be easily sold in the local recyclables market, as is the case with most of the plastic items recovered

¹I prefer to use the term “from below” rather than “from the global South” or other geographic-centered equivalents. In this sense, I follow Pérez-Bustos, Martínez Medina, and Mora-Gómez’s (2018) remarks about avoiding the reductionism of equating place to geography. In contrast, these authors foreground diverse ethnographic STS approaches attentive to how objects and places are folded within onto-epistemic procedures, in terms of a postcolonial symmetry.

from waste. Therefore, I expect to contribute to the analysis of how these grey zones of innovation take shape and perform, including their drives, resistances and antagonisms.

This argument will be deployed in three related parts. Firstly, I will briefly introduce the relation between formalization, valorization and innovation regarding the public and private initiatives which aim to target waste pickers in Buenos Aires. Secondly, I briefly characterize the innovations “from below” perspective, from which I analyze an in-depth case derived from my ethnographic fieldwork within the *Reciclando Sueños* cooperative in Buenos Aires. Thirdly, I provide a discussion on epistemic and political challenges which arise when innovations are driven by waste pickers, who lack the symbolic, economic and technical capital required to socially legitimate these competences. Starting out from the notion of epistemic (in)justice, I draw a critical reflection on the drives and obstacles that shape innovation skills aimed at waste management, and define what is thinkable and (un)thinkable in this field. Finally, I share some open reflections about some policy guidelines that could profit from the rich body of technological experience and knowledge elaborated within waste picker’s grassroots organizations. At the same time, I highlight the specific contribution of an ethnographic perspective to the study of grassroot innovations.

2. On formalization, valorization and innovation in the waste management field in Buenos Aires

Economic valorization has become an unavoidable topic when reflecting about how to deal with waste in contemporary societies. Extended metaphors like “hidden treasure in trash” have provided a powerful narrative that has contributed, explicitly and implicitly, to delineate the scope and borders of the waste management field, defining who, when and how it is legitimate to intervene (Dickerson 1999; Reno 2009; Scotford 2007).

In fact, three key ideas have configured our dominant imaginary about waste valorization through innovation, driving a powerful narrative which I have called the “holy trinity” of waste valorization. Firstly, profitability, given that recycling as such is considered an inherent way of making money by valuing the discarded materials, even in developing countries (Ferronato et al. 2019a; Scheinberg 2012). Secondly, the extensiveness of recyclability is also taken for granted, as it is considered that almost all discarded things could be recycled and valorized somehow, as the zero-waste vision proposes (Lehmann 2011). The third idea-force that completes the argument is related to innovation, by assuming that techno-cognitive knowledge and skills should provide new technologies to realize the waste valorization potential (Brouillat and Oltra 2012; Papachristos 2014).

In countries from the Global South this narrative has been key to reinforce the role of entrepreneurs and technologists in identifying new niches in the recycling market (Kowszyk and Maher 2018; Oyake-Ombis, van Vliet, and Mol 2015; Pereira de Carvalho and Barbieri 2012) and by greening the outdated solid waste management systems run by local governments (Potdar et al. 2016; Scheinberg 2011). However, waste pickers’ roles within those innovations dynamics get limited to a mere instrumental participation, providing a trained workforce in collecting and sorting activities to feed the new recycling flows (Rateau 2017; Rebehy et al. 2017; Wilson, Velis, and Cheeseman 2006).

The situation of waste management and recycling in the Buenos Aires Metropolitan Area (BAMA) is no exception to this trend, even though the waste pickers’

sector² has achieved increasing formalization by leveraging its social and political recognition (Gutiérrez 2020; Perelman 2010; Schamber and Suárez 2012).³ Those achievements are undoubtedly related to the strength of their organizational capabilities, materialized in the 2012 constitution of the National Federation of Waste Pickers (Federación Argentina de Cartoneros, Carreros y Recicladores – FACCyR), which gathers more than 110 national cooperatives (O'Hare and Sorroche 2019). This second-level organization, linked with a wider trade union of an informal workers' movement called Workers Union of the Popular Economy (UTEPA), demands their right to be recognized as providers of a social and environmental service based in the collection and sorting of recyclables. In this way, they request a co-management model for waste in local jurisdictions, which in Argentina are responsible for providing this service to their citizens. They thus propose the inclusion of waste pickers cooperatives in the municipal systems.⁴ At the same time, the FACCyR has also held public opinion campaigns to stand against waste management initiatives that may harm the waste picker situation, for example, the implementation of incineration plants or "intelligent" containers in the public space to prevent waste picking.⁵

This grassroots-based institutional work has been key to raise social awareness of the contributions of waste pickers to society and the environment. However, one of the key challenges for the local waste picker movement remains to achieve greater recognition of the multiple tasks they perform on a daily basis, which go beyond collecting and sorting. On the contrary, they include high-value techno-cognitive skills involved in training citizens in sorting at the source, building machines to grind and extrude plastics or developing processes to reuse materials and manufacture new goods, among others (Carenzo 2011, 2014, 2017).

This way, when attending meetings with government officials and NGO technicians to figure out ways to improve the working and living conditions of waste pickers, three related ideas invariably raised. Firstly, that the main objective should focus on increasing the productivity of waste pickers' work. Secondly, that this could be done by fostering technological innovation to raise its value and performance. Thirdly, that innovations are materialized in artifacts that should be provided to waste pickers following traditional "experts" to "adoptants" technological transfer models.

In what follows, I will provide two empirical references of how the 'holy trinity' narrative shapes the innovation dynamics for waste pickers within the narrow limits of market-driven goals and formal institutions. On the one hand, I will discuss a traditional top-down approach for public policy, focused on artifact transfer designed and built by private firms. On the other hand, I analyze the pros and cons of an inclusive innovation

²Waste picker population in BAMA involves around 75,000 people (of which almost 20% is formalized into working cooperatives), which recovers up to 15% recyclable materials from the 17,000 daily tons of waste produced in this region (FACCyR 2018).

³Two examples describe the extent to which current "inclusive recycling" policies have addressed this population. Firstly, since 2010, 4500 waste pickers of 12 recognized cooperatives in the Buenos Aires City receive a monthly income in recognition for the environmental service they provide. This payment represents as much as a third of their total income, and also includes the provision of sheds, uniforms and tools in order to ameliorate their working conditions (Paiva 2013). Secondly, since 2013, environmental authorities of the Buenos Aires province have updated the legal framework in order to allow more than 30 waste picker cooperatives to provide differentiated collection to large generators of commercial and industrial waste, charging them for the service of treatment of the recyclable waste (Sarandón and Schamber 2019).

⁴<https://faccyr.org.ar/programa-argentina-recicla/>.

⁵<https://faccyr.org.ar/protesta-contrala-instalacion-de-contenedores-de-residuos-antipobres/>.

perspective which explores the potential of social-based initiatives to address the waste pickers' needs through ICTs and a low-tech approach.

2.1. Mainstream innovation put at work: the classification plants

A paradigmatic example of Schumpeterian innovation applied to the field of waste management in low-income countries is given by the implementation of the so-called "Classification Plants" as part of the deployment of ISWM initiatives (Lethbridge 2017; Memon 2010; Vergara, Damgaard, and Gomez 2016). This dispositif is based on an elevated conveyor belt where garbage is deposited and then run. The belt is flanked by operators dedicated to manually capturing different types of recyclable materials. What is not recovered falls at the end of the tape into a deposit for final disposal. The materials recovered by each worker are thrown into hanging bags, and then pressed into bales for later sale.

Classification Plants have been designed and built by private metallurgical industries and financed by governmental ISWM programs, in order to be located in dumpsites or sanitary landfills to reduce the volume of waste to dispose (Gutberlet and Baeder 2008). In most of the cases they are managed by informal waste pickers who used to work at dumpsites or landfills, who were encouraged to constitute working cooperatives. In this sense, Classification Plants have become key dispositifs of formalization of the waste picker population (Aparcana 2017; Ferronato et al. 2019b).

In Argentina, the Classification Plant model was driven by the National Strategy of Integrated Solid Waste Management (ENGIRSU).⁶ This initiative was launched in 2006 by the Secretary of Sustainable Development and Environment of Argentina (SAyDS) as part of a wider regional program led by the World Bank. With the implementation of Classification Plants, the ENGIRSU sought to achieve the "social reinsertion of informal workers of Municipal Solid Waste" (SAyDS 2011). To date, more than 74 plants have been built in municipalities throughout the country and within the Buenos Aires metropolitan area over 25 plants are under operation (CEAMSE 2018; GGBA 2017).

Even though Classification Plants involve very simple technologies, they are frequently framed as significant innovations by governmental and non-governmental actors involved in their development. As Cross (2016) has pointed out, this could be related to two complementary reasons. First, because they express an attempt to solve the oversaturation of existing landfills by minimizing the volume of waste to bury. In practical terms, the Plants function as one of the few institutionalized passages devoted to recovering and recycling practices within the existing waste management circuit. Second, it also evidences a clear trend towards the ordering and regulation of informal recycling by spatially concentrating these activities (in sheds rather than in curbsides and streets), while also promoting associative work to guarantee the daily operation of the plants (by formalizing this population into cooperatives).

The Classification Plants appear to represent the perfect innovative solution according to the holy trinity framework sketched above, being also consistent with the profitability and extensiveness guidelines. In relation to the first, they are devices explicitly designed to extract the economic value of waste by speeding the sorting process. This increases the productivity of waste picker work allowing them to process a larger volume of waste

⁶<https://www.argentina.gob.ar/ambiente/preservacion-control/gestionresiduos/estrategianacional>.

per day. As for the second, because Plants work mainly with non-segregated waste, it is possible (in theory) to recover materials from as much domestic waste streams as possible.

However, at the same time, a number of criticisms can be expressed towards the Classification Plants model, which focus on the shortcomings derived from a top-down and linear innovation transfer model, fostered by market principles and developed under highly formalized institutional environments.

First, in terms of a top-down asymmetry established between developers and users, the Plants involve a Taylorist mechanization of the informal sorting procedures previously developed by waste pickers; designed, however, by external experts (engineers, designers and architects) and built by large metalworking manufacture companies (as DEISA S.A.⁷), to finally be implemented by passive users (waste pickers).

Second, innovations are framed as driven by profit instead of being prompted by social and environmental problem-solving dynamics. In this sense, the Classification Plants are oriented to maximize the efficiency of picking and sorting valuable recyclables. But they are not providing solutions to those discarded materials that are again rejected by waste pickers, as they cannot be sold as recyclables and are dumped in landfills. One could also reconsider if the best action is driving innovation towards the extensive treatment of all the waste streams (extensiveness) or to focus innovations on finding solutions that target those still non-recyclable materials.

Third, as I have stated before (Carenzo 2016), the Classification Plants can hardly be recognized as inclusive devices. Their implementation was not accompanied by the enforcement of differentiated collection programs. In consequence, their staff has to deal on a daily basis with mixed waste, including rotten food, used personal hygiene items, among other dangerous and revolting items, such as, murder-victim bodies (Perelman 2019).

2.2. And what about inclusive innovations?

Tackling social inclusion goals has also been a driver for innovation in the waste management field. Escaping the Schumpeterian innovation model, other scholars have proposed a more comprehensive view of innovation processes related to waste management by addressing key social and cultural issues. For example, by developing a community-based integrated waste management program in Kerala (Guidi 2013); providing services to private large generators of waste (Martinez 2010) or by implementing differentiated recyclable collection in dense urban areas (Chakrabarti 2016; Souza, Brasileiro, and Schmidt 2014; Vernis 2014).

In fact, critical approaches to the mainstream innovation model have stressed its gaps in addressing the needs of poor and vulnerable social groups (Srinivas and Sutz 2008); its role in reinforcing social and economic inequalities (Fressoli et al. 2014; Smith, Fressoli, and Thomas 2014); or its dependence on formal institutional environments (Papaioannou 2014). In order to deal with these shortcomings, an alternative framing for innovation has been drawn up over the last decade, which recovers historical antecedents such as

⁷DEISA is a large scale metallurgical manufacturer devoted to provide machinery for agriculture and logistics. However, since the implementation of ISWM at a national level it has reconverted its core business to provide waste management infrastructure to local governments in the country. More info: <http://www.desarrollosindustriales.com/index.php/es/>.

the 1970s movement of appropriate technologies, while updating its objectives and methodologies by including, for example, the use of cutting-edge technologies (ICTs) or the significant involvement of the private sector and global innovation value chains for the poor (Heeks, Foster, and Nugroho 2014)

Inclusive innovation (which includes frugal, grassroots and below-the-radar innovations) seems to provide some key assets not only for approaching the informal waste picker needs, but also to somehow include them in the innovation processes (Heeks et al. 2013). The significance of stepping outside the mainstream innovation model, developed within an omnipresent and extensive regulatory and fiscal framework, is highlighted when considering that informality is far from representing a marginal phenomenon in the Global South. In Latin America and the Caribbean, it accounts for 35% of GDP on average (Vuletin 2008) and reaches 55% of its workforce around 140 million people (Herranz 2018). The informal recycling sector in this region involves about 1.5% of its total population (estimated in 650 million people), who make a living from the collection, classification and sale of recyclable materials captured in different solid waste streams (PAHO-AIDIS-BID 2010; Red LACRE 2016). The relevance of fostering innovations to target informal waste pickers' needs and demands becomes clearer when taking into account that informal recyclers collect between 10–30% of the recyclable materials from waste streams that would have otherwise ended in landfill or open dumps (Chukwunonye, Fazakerley, and Roberts 2013; Dias 2016).

As in most of Global South cities, Buenos Aires has also identified innovations aiming to foster inclusive recycling within the municipal waste management systems. Professionals and techies, as well as CBOs and NGOs, gather in contests, labs, and workshops in order to come up with simple and affordable solutions for collection logistics, building carts or machinery, or to handcraft goods from recovered recyclables (Baillie and Feinblatt 2010; Constantino 2014; Galimberti and Cimadevilla 2016).

Initiatives of this kind also match the holy trinity perspective, as their overarching goal is to add value to the work of waste pickers and include new waste streams. In this sense, the asymmetries and inequalities of the waste management system are not challenged but considered a given fact, and then innovation dynamics are mobilized to counterbalance their negative effects by providing specific technological solutions to leverage their collecting and sorting practices (Carenzo 2011). Two short examples will illustrate and contextualize this.

A 2006 public policy was launched by the National Ministry of Science and Technology (MINCyT) to foster social innovations in a wide range of topics. Entitled National Contest of Innovations (INNOVAR), the initiative offers cash prizes in different categories, and promotes the prize-winning innovations in the mass-media, professional councils and industrial and commercial chambers in order to link with potential private developers. Through more than ten editions, several proposals were specifically designed to be adopted by waste pickers, including a manual grinder for PET bottles, lighting screens manufactured with textile and plastic discards, and a grinding machine for glass containers (MINCyT 2015).

Another contest promoted by two NGOs (AVINA and Socialab), "Social Innovation for Urban Recuperators," looked to "reward innovative ideas and projects that impact on the productivity of the recycling chain, in order to generate higher levels of material recovery, to improve waste pickers' work environments, and to reach positive environmental

impacts.”⁸ A bursary was awarded at the “Green Inventing” seminar held in São Paulo (Brazil) in which winners would receive expert advice and be connected to potential financiers. Two young undergraduate techies won the prize by presenting “Yo reciclo” (I recycle), an app aimed at fostering “direct communication, without intermediaries, between neighbors and waste picker’s cooperatives, to strengthen the bond, to generate community, and to promote the household sorting to optimize door-to-door collection.”⁹ Inscribed in a win-win scheme, the app could connect neighbors willing to separate recyclables at home, with cooperatives willing to recover those materials. At the same time, the app would organize all daily orders on a specific road map designed to optimize the collection logistics of each cooperative.

Undoubtedly, both initiatives involved attractive inclusive innovations, aimed at ameliorate the working conditions of waste pickers. However, at the same time, they showed some shortcomings linked to the holy trinity perspective. First, even when they were specifically designed to be adopted by waste pickers, none of them were incorporated into the cooperatives’ daily routine. Nevertheless, the innovations were vibrantly displayed within their sponsors websites and social media.¹⁰ A gap therefore appeared between the projected designs and the problems and priorities defined and characterized by the waste pickers themselves. Second, the waste pickers were not part of the designing process, but they were recruited to test the innovations developed by professionals. Again, their skills and knowledges were not taken into account, as the development of the innovations prioritized a top-down model which still reinforced the role of professional experts in detriment of a more collaborative approach.

Up to this point, I have reviewed some innovations that were institutionally legitimized as such: technological devices developed by accredited professionals (engineers, industrial designers, programmers, R&D scholar teams, among others), whose cultural, economic and political capital allow them to intervene in institutional spaces for the promotion of innovations (from public agencies to NGOs). Their development ends up reinforcing the “experts/practitioners” dichotomy, where the former is defined by its abstract rational techno-cognitive skills, while the latter is recognized by its practical abilities, at best (Thomas et al. 2013).

The next section invites us to explore innovations dynamics the other way around, that is by tracking initiatives that usually remain below the radar, not having been driven by professionals, but by the waste pickers themselves.

3. Innovation “from below” among waste pickers in Buenos Aires

Beyond formal and institutionalized innovations (both, mainstream and inclusive) devoted to waste management, one can trace the existence of a vibrant creative world of innovations made “from below.” I am referring to technologies of product, process and organization that emerge from the waste pickers to address their needs and to work out

⁸More info: <https://comprometidos.sociallab.com/challenges/recuperadores-urbanos>.

⁹More info: <https://ar.sociallab.com/challenges/recuperadores-urbanos/idea/18737>.

¹⁰Some examples from the Innovar contest: <https://issuu.com/innovar/docs/cat-innovar2013>; <https://mia.gob.ar/convocatorias/innovar> Some examples of the Avina + Socialab contest: <https://www.youtube.com/watch?v=Bh-0sNRsvk&list=UUSuMmsZ1WgKleQgrF8s800g&index=20>; <https://ar.sociallab.com/challenges/recuperadores-urbanos/idea/18737>.

problem-solution dynamics, defined in their own terms. Waste pickers have been able to elaborate complex management technologies in order to create their own jobs, for example, by designing and providing door-to-door household sorting and differentiated collection services in large residential districts. They have also developed sorting taxonomies by which they are able to identify more than seventeen plastic materials in packaging, using their sensory registry (sighting, hearing and touching) as testing procedures. In a similar vein, they have designed and constructed a wide variety of artifacts (hydraulic presses, grinders, washers and dryers, sorting surfaces, among others) to meet their specific productive requirements. There is growing interest to map and analyze these innovations by Global.

South scholars (Baillie et al. 2011; Charles 2019; Gutberlet 2008; Hettiarachchi et al. 2018; Lima 2017; Oteng-Ababio, Arguello, and Gabbay 2013; Oyake-Ombis, van Vliet, and Mol 2015; Scheinberg and Anschtz 2006; Turcotte and Gómez 2012) highlight that in-between the narrative of the extensiveness of waste valorization and its scarce materialization in concrete processes and results, a wide space unfolds for what is (still) indeterminate. Therefore, and specifically in Global South contexts, waste valorization exists as potential: a praxis of informal actors, rather than a defined corpus of standardized and stabilized techno-scientific practices.

In its growing institutionalization, the waste pickers movement considered this advantage. For example, in 2011 the Latin American and Caribbean Waste Pickers Network (Red LACRE)¹¹ launched a call for projects, including one specific line devoted to financing technological innovations developed by waste pickers cooperatives (Sorroche 2017). FACCyR in Argentina is currently developing a software for managing Classification Plants with assistance of universities and cooperatives of programmers and social communicators.¹²

In the following sections, I will describe similar technological innovation initiatives “from below” as reflected in my own fieldwork in Buenos Aires. More precisely, I will focus on the *Reciclando Sueños* waste pickers cooperative, which has developed a wide range of innovations “from below” around waste picking and recycling. In 2011 it won the innovation contest held by Red LACRE by presenting a self-made kit for machinery to grind and wash plastic waste. Since then, it has developed a wide range of innovations, from building tools and machines to designing processes needed to transform discarded materials, that I have been mapping and analyzing while conducting fieldwork with them (Carenzo 2014, 2017; Carenzo and Schmukler 2018).

In this sense, if one considers their gain in techno-cognitive skills, it is fair to recognize that *Reciclando Sueños* is quite a unique experience among waste pickers cooperatives. However, as I have mentioned before, it is far from being an exception. Several waste pickers cooperatives in Buenos Aires provide empirical evidence about developing innovations “from below.” For example, the *Cooperativa Amanecer de los Cartoneros* (Waste Pickers Dawn Co-op) has created the management software app mentioned before; the *Cooperativa Reciclando Conciencia* (Recycling Awareness Co-op) has developed machinery to manufacture garden furniture by using recycled plastics;¹³ the *Cooperativa*

¹¹<https://www.redrecicladores.net/>.

¹²<http://ritep.com.ar/>; https://www.youtube.com/watch?time_continue=5&v=HaXcn1MovLQ&feature=emb_logo.

¹³<http://www.reciclandoconciencia.com.ar/#servicios>.

Jóvenes en Progreso (Youth in Progress Co-op) has built machinery to transform LDPE composites;¹⁴ the Cooperativa Creando Conciencia (Raising Awareness Co-op) has developed a process to obtain “plastic wood” reusing recovered plastics,¹⁵ among other examples.

It is striking how this techno-cognitive praxis is still poorly recognized by government and non-government agencies, which place waste picker cooperatives at the base of the recycling value chain, crystallizing their role in providing collection and sorting of materials but not in transformation and recycling (Gareis, Insúa, and Ferraro 2016; Puig 2018; Villanova 2014). Before I analyze the empirical data, the next section provides some theoretical guidelines to approach innovation dynamics through power relations and legitimacy building, as they provide key insights to understand what underpins those asymmetries.

3.1. Innovation through the lens of power relations

When mapping this complex variety of technological innovations, I accounted for its specific conditions and trajectories, as well as the categories mentioned by waste pickers that condense the deep meaning these practices of innovation have had for them. This represents a valuable contribution in terms of challenging our rationalistic and instrumental visions of technology, also in terms of the potential for strengthening political demands for social recognition of the multiple dimensions of work done by waste pickers on a daily basis.

The implicit risk here is to reify these grassroots innovation practices and significations in terms of a “second technological culture,” detached from the hyperrational and capital-centric mainstream perspective, and therefore to propose a dichotomous approach to those innovations “from below.” On the one hand, costly, intensive knowledge-based innovations seem to characterize the current stage of capitalism. On the other hand, low-sci, horizontal, emancipatory and sustainable technological innovations seem to correspond to grassroots and community-based movements and organizations.

In order to avoid dichotomical biases, I follow current perspectives traced by contemporary scholars who tackle inclusive innovations through the lens of power relations, drawing on a global justice and basic needs approach (Levidow and Papaioannou 2018; Papaioannou 2014) as well as social technology (Fressoli et al. 2014; Thomas et al. 2017). Thus, rather than crystallize inclusive innovations as corresponding to a specific actor or culture, these authors propose to focus in the dynamic interactions of diverse bodies of practice and knowledge that converge in their development, including accredited science and technology agencies. Therefore, what becomes analytically relevant is not limited to identifying innovations derived from grassroots environments (communities, cooperatives, social movements), but to analyze their encounters, intersections and hybrid arrangements, as well as their resistances, contestations and obstacles.

These guidelines have become key for my approach, as they highlight the relevance of being aware of power dynamics, at the same time departing from a dichotomous

¹⁴<https://es-la.facebook.com/pages/category/Organization/Cooperativa-Jovenes-en-Progreso-1794081524137317/>.

¹⁵<https://creandoconciencia.com.ar/shop/>.

approach when considering the inclusive innovations presented in section 2.2 through this lens, it is possible to highlight a relevant observation. When inclusive innovations are prompted by already legitimated actors, opening a dialogue with their potential adopters does not seem to be a requirement as I have shown before, this has not prevented them from been recognized with an award and gaining recognition as “innovators.” However, this is quite different in the case of waste pickers who develop innovations. In wanting to transcend the narrow limits of their organizations to search for support and funding opportunities, they would need to seek for tutelage of an accredited S&T institution. This it is not an option, but mandatory. In this sense, to ethnographically track the trajectories of innovations “from below,” allowed me to address these innovation processes in a cognitive, epistemological and political perspective simultaneously.

This approach becomes relevant when analyzing the creative/experimental praxis carried out by mere “practitioners” from popular sectors, who lack the symbolic, economic and technical capitals required to socially legitimate these competences. Deriving from my ethnographic fieldwork, in what follows I briefly reconstruct and analyze the trajectory of innovation developed within the *Reciclando Sueños* cooperative. Before continuing I will provide a more thorough characterization of this cooperative and its technological praxis.

Reciclando Sueños started in 2003 with twenty unemployed males¹⁶ who began recovering materials from waste to make a living. They collected within the surroundings of the urban settlement where they lived (San Alberto in La Matanza municipality). Many of them were militants in the *Federación de Tierra y Vivienda* (Land and Housing Federation), one of the largest “*piquetero*” social movements, very active during the 2001 social and economic crisis. Marcelo Loto, one of its founders, worked for several years in the nearby Mercedes-Benz factory where he learned to weld and do mechanical turning work, when in the late 1990s he was fired along with hundreds of colleagues.

Supported by his more sophisticated technical background, Marcelo led the innovation praxis developed in the cooperative since its early beginnings. Trajectories of this kind were usual for several members of *Reciclando Sueños*, since La Matanza was historically one of the biggest industrial districts in Buenos Aires and many of them were fired from local industries and workshops. Hereon I follow Tim Ingold’s (2010) perspective on creativity and knowledge production, in this case technical expertise. Rather than considering creativity and skills as embodied in individuals, Ingold proposes a different understanding based on the pedagogical potential of shared experiences entangled within material environments. In this sense, Marcelo’s disposition to design and manufacture cannot be explained by considering his own working and educational background in isolation, but by the collective mastering of materials and their experimentation (Carenzo 2014, 2017).

This does not imply the absence of conflicts and controversies based on the different capacities of individuals to appropriate and value the derived general intellect. This includes a gender bias by which the sphere of machinery and metal manufacturing

¹⁶A distinctive feature of the *Reciclando Sueños* cooperative has been the predominance of male members over women. For long periods of time since its foundation in 2003, it was exclusively made up of men. The period 2015–2016 included in the ethnographic reconstruction presented below constituted one of them. This suggests lines of analysis in relation to the unequal distribution of burdens of productive and reproductive work among its members, as well as the naturalized definition of tasks and skills between men and women. Although it was not the objective of this article, I am aware of the relevance of this analysis, to be carried out in future writings.

skills are configured as male-dominated because they involve “physical strength” duties, in contrast with attributed capacities of women to sort, clean and organize invoking “sensitive” skills (Gorbán 2014; Wirth 2013). It is not the place nor the purpose of my contribution to focus on dynamics of that kind, as I want to highlight how a different kind of asymmetry is configured, the consequences of which become more harmful, given that they involves epistemic gaps from which the subalternization of entire repertoires of popular knowledge is justified. In this sense, I was most interested in tracking those situations where the so-called “experts” and “practitioners” join together to design and come up with technological innovations.

This happened between February 2015 and December 2016 when the members of the *Cooperativa Reciclando Sueños* (Recycling Dreams Cooperative) in collaboration with engineers from the National Institute of Industrial Technology (INTI), worked towards the development of a prototype for recycling expanded polystyrene (EPS). At the time, I had limited chances to deploy a collaborative ethnographic inquiry when those encounters were taking place.

In methodological terms, I drawn on Tomás Sánchez-Criado and Adolfo Estalella definition of a “collaborative ethnographic experimentation,” as a modality that proposes two key displacements in respect to conventional forms of anthropological fieldwork based on participant observation. First, it ponders relationality in the field as intersubjective collaboration, rather than limiting itself to “distanced participation” in the practices that our interlocutors develop. Second, it proposes to deploy experimentation as a form of anthropological knowledge production, instead of prioritizing mere observation. In this sense, “experimental collaboration” refers to fieldwork devices as

exploratory socio-technical arrangements, common research infrastructures that are built jointly with those that on other occasions would have had the role of informants and would have been considered objects of study. The objective of such devices is to produce knowledge jointly with those who become collaborators. (2016, 162)¹⁷

My contribution to the project was to organize periodical co-design workshops based at the cooperative’s shed, in which waste pickers and engineers took part. I was responsible for taking detailed fieldwork notes about the relational dynamics, and then to provide an analytical return to all the participants in order to develop a collective reflection on epistemic and techno-cognitive asymmetries. As I will show next, using the workshop as an ethnographic device provided significant insights for addressing relational dynamics among waste pickers and engineers.¹⁸

Over the next three sections, I will briefly summarize the creative and relational labor that sustained the development of the innovation dynamic during those encounters. The reconstruction is based on my ethnographic records of the workshops, which I have organized in stages for the sake of a clearer exposition.

¹⁷The cited authors draw on the conceptualization proposed by John Law and Evelyn Ruppert about research methods as “devices that assemble and organize the world in specific social and material patterns” (2013, 330; cited in Sánchez Criado and Estalella 2016, 162).

¹⁸The ethnographic record of workshops was complemented with field visits to the Cooperative and also by using phone calls and social media (WhatsApp groups and Facebook) to trace the development of in-progress innovations. The workshop captured most of my research efforts, and framed the participant’s expectations about the results of my work in a roughly immediate timeline, as each workshop was started with a briefing of my notes derived from our past encounter. This has oriented my findings towards the interactions between waste pickers and engineers, rather than among waste pickers themselves, establishing a limitation of my methodological strategy to be taken into account in further research.

3.2. Stage 1: Experimenting with uncomfortable materials

Reciclando Sueños cooperative has oriented its business to verticalize its productive process, by processing recyclable materials rather than merely collect and sort them (Carenzo 2017; Carenzo and Schmukler 2018). Their latest developments focuses on what they call “non-marketable recyclables” (reciclables “sin mercado”). This category comprises plastic or cellulose materials which lack demand in the local market for recyclables, due to technical infrastructure constraints of the recycling industry. Even though containers made of multilayered plastics or the cellulose plus plastic labels may reach the hands of waste pickers, they are again discarded and ends buried in landfills. Similarly, expanded polystyrene (EPS) is increasingly used by the food and construction industry. This wider use is contributes to urban floods, as an ultralight and floatable material that easily blocks pluvial collectors and natural drainage (López and Cánepa 2013).

Around February of 2015, Marcelo, the current president of the cooperative and “official” handyman, proposed to begin exploring ways to transform the EPS. The proposal was derived from a simple fact: for several years they had been stocking big bags filled with EPS, but as they could find no middlemen interested in buying it, a huge amount of stocked EPS was uselessly occupying space at the bottom of the shed.

With his restless spirit, Marcelo began to explore websites in order to learn about the technical procedures to utilize the EPS. He learnt that EPS is obtained by heating and pressuring polystyrene and toluene. When the mix boils, the plastic composite coats the bubbles that can be molded into any given form if the mix is cooled under pressure. As written in my field notebook:

In Marcelo’s terms: the EPS is obtained by “inflating” the polystyrene. Thus, if we can find a method to “deflate” the EPS we could obtain again only polystyrene, which has a very good market. Accordingly, they have started to work out some heating methods in order to “deflate” the EPS, including different experimental procedures. (Field note, June 12th, Recycling Dreams)

They started by exposing EPS chunks to direct fire flames while rolling inside an auto-fabricated machine used to dry plastics flakes (see [Figure 1](#)). Unfortunately, the chunks melted



Figure 1. Self-made plastics drying device, used to experiment on the transformation of EPS chunks when exposed to a heating source. Photo: author.



Figure 2. Marcelo removes a tray with deflated EPS chunks from the “hornito.” The metal sheet at the top, covered the leaned heating gun. Photo: author.

very quickly, being very difficult to manipulate. Moreover, twice the EPS caught fire, increasing the risks beyond an acceptable limit as the experiment was carried out inside a shed full of flammable materials.

Several days after, they started testing a heating arrangement with no direct flame. Shown in Figure 2, they built the new device by reusing a discarded household electric oven. They replaced the original heating source, by inserting a bricolage heating gun through an orifice made in the roof. “El hornito” (the little oven) allowed easy placement of a tray with EPS chunks before the heating gun was actioned. Less than two minutes after, the 5×5 cm EPS chunks were converted into semi-melted and very thin plaques of polystyrene (5×0.5 cm), that gained extraordinary rigidity when cooled when immersed in a tub with water.

The finding caused excitement. As shown in Figure 3, when transforming the EPS into polystyrene (PS), its morphological and mechanical properties changed, the material



Figure 3. The material properties contrast of EPS and “deflated” EPS (in fact PS) are evident. The soft drink bottle is used as witness. Photo: author.

turned tougher, and could be grinded, producing flakes that could be sold in the recyclables market. While EPS has no value, when transformed into PS it reaches an average price of u\$s 1/kg.

The result was demonstrative, as it was done using rudimentary tools and machines, lacking measuring instruments. It nevertheless was highly significant, as it proved a loose group of informal waste pickers had successfully challenged the “technical” arguments which established the impossibility of recycling EPS. The challenge for the next stage was to scale up the “hornito” device to a semi-industrial prototype, in order to simplify its operating procedures and address safety standards.

3.2. Stage 2: Calling the experts

In the quest for scaling-up, I offered to apply to the PROCODAS call, a program of the National Ministry of Science and Technology (MINCyT) to finance low budget projects of “social technologies.” The cooperative decided to move forward, so we contacted a team of engineers of the National Institute of Industrial Technology (INTI) in order to achieve the proper “technical” support requirement. The latter was subtly suggested in the call’s text, and considering that neither I as an anthropologist, nor them as waste pickers could ever fulfill that criterion, we decided to seek expert advice.

INTI’s engineering team was made up by Juan, Matías and Alfonso who belonged to a special task force on Urban Solid Waste, with previous experience in technological transfer projects with local governments and waste pickers cooperatives. However, this background was basically developed in a top-down and linear approach, in which the expert team designs and provides the technological solutions to be implemented by the adopters.

The project was approved and we began to work in October of 2015. As it was conceived in a collaborative research perspective, its concrete implementation evidenced a big difference in relation to the kind of projects the engineers had been involved in. Instead of taking place at INTI headquarters, the research was conducted at the cooperative’s shed “laboratory.” The relocation of the experimental arena initially shocked the engineer crew. For them, a clear division of labor between “professionals,” who design and systematize, and “users,” whom implement and put in practice, existed. Accordingly, this division between manual and intellectual labor evidenced a spatial correlation: the former should take place at INTI labs, the latter should occur at the cooperative’s shed.

Finally, our petition was accepted, and the project was carried out in one year, through bi weekly workshops held at the cooperative. Workshops like the one portrayed in [Figure 4](#) provided a valuable platform in which the engineers and waste pickers were able to design, manufacture and debate their findings. I was deeply involved in this process, since I was tasked with an ethnographic register of each workshop, which was shared among participants to collectively learn from the experience.

In what follows I reconstruct a sequence derived from my fieldwork notes which for the sake of synthesis and clarity I organized into a narrative format:

April 8th: Marcelo is worried, Juan the leader of the INTI team has proposed to stop meeting in workshops until they finish exploring some ideas derived from existing machines that they have found in the archive. As always he was very respectful, but he also suggested that the



Figure 4. Workshop at the Reciclando Sueños shed. The engineers examine one of the tests previously carried out at the cooperative. Photo: author.

“hornito” may also be an attempt to reinvent the wheel. That is why they started this back-ground scan in the databases they have at INTI.

April 22nd: Today we worked on the new idea brought by the engineers. It implies a radical change in relation to the thermal transformation of the EPS. They argue that the scaling up of the hornito will be very costly, as it would need a silicone based conveyor belt to feed the process. Therefore, they proposed to explore a grinding process, as the EPS is used to lighten concrete used in the construction industry. Thus, we have been working on a sketch derived from a low cost maize sheller. The new directions were a bit discouraging for Marcelo, Sacha and Alberto, as they were very enthusiastic about the hornito, however now they are awaiting the prototype of rolling grinders that the engineers are going to manufacture at INTI.

May 2nd: Bad news. Juan phoned Marcelo, the grinding process starts ok, but 10 minutes after, the EPS began to stick to the rollers. A second issue is related to the lightness of the material, that once grinded starts to float in the air. It will be necessary to incorporate a forced suction mechanism to capture the material. This would have incidence in the simplicity and cost of the prototype. Juan and their colleagues were really disappointed as they thought that grinding could provide the simplest way to make some money from the EPS, as the building industry is constantly increasing its demand for lightweight composites. In fact, Alfonso had met with the head of the INTI's building department to explore the current regulatory framework and identify certification requirements.

May 12th–26th: Nothing relevant happens during the meeting. Only Juan has attended from INTI. They are still looking for alternatives to the rollers. The experimental process itself seems to be stuck. Marcelo has been devoted to transforming the cargo box of the truck to allow more big bags to be loaded.

May 10th: Workshop suspended, nobody from the engineering team could attend.

Paradoxically, the new directions given by external expert advisors seemed to blur instead of strengthen the experimental process carried out in the cooperative. Even when the engineering team agreed to relocate the workshops in the cooperative sheds, their professional practices were in fact still referring to their habitus, molded by databases,

archives and mechanical labs, rather than hands-on trial and error initiatives that reused discarded objects to build new ones. However, and fortunately, the experimental process still went on.

3.3. Stage 3: Back to the shed

Here I return to the sequence that I have been rebuilding from my fieldwork records:

June 18th: Marcelo phoned me, he was very excited because he came up with a new variant to the hornito model, including a new heat source. He told me that he began to elaborate on this alternative by drawing on a previous comment by Matías (one of the engineers). Matías had said that the heat gun worked through the principle of “forced convection,” which he thought was ok. He said convection is one of the three principles that explain the transfer of heat within a given volume (in this case the furnace box) by the action of a fluid (in this case air) promoting heat exchange between zones with different temperatures. Marcelo remembered that Matías had exemplified with the convection ovens used in bakeries that incorporate more robust air bellows associated with digital temperature control systems. Thus, he wanted to fabricate a new heating source with a turbine (see [Figure 5](#)) to provide a constant homogeneous heat over the entire volume, capable to guarantee a fast transformation of the EPS inside the oven.

July 1st: The workshop was a failure. Marcelo and Sacha have been working a lot to build the new device, however the results were discouraging. The new heating source was fabricated by mounting a gas-fed torch spout attached to the mouth of the turbine. Inside the new oven the material was protected from the heat source but at the same time allowed the forced circulation of hot air throughout the volume. They had cut pieces of telgopor into different sizes hoping to analyze the differences in terms of time (how long it took to “melt”) and consistency of the different pieces once transformed (weight and hardness). They put together a first tray of assorted material that they introduced into the oven after lighting a blowtorch and turbine. They waited for the temperature to reach 182 °C and after a few minutes they turned off the device, in order to take the transformed EPS. However, EPS chunks lay virtually intact, barely degraded at their upper edges. Even repeating the operation, the result was the same. Matías



Figure 5. Marcelo, Sacha and Alberto from Reciclando Sueños cooperative are photographed next to the turbine they made. Photo: author.



Figure 6. Marcelo and Sacha while mounting the new prototype. Photo: author.

took the lead on the side of engineers, he said that probably the poor results had to do with design failures in the heating source. He said he needs to better study what happens, so he took several pictures of the hornito's inside with his phone. He seems enthusiastic about coming up with a new redesign to share next week.

July 29th: The guys at the co-op have completely transformed the prototype (see [Figure 6](#)). They have done an awesome job. During the workshop Marcelo said that they have been able to identify the problem and then redesigned the whole device. They have realized that the correct heat transfer principle was not “convection,” but “radiation.” Then they completely changed the heating source by reusing a discarded heating screen, and modifying the oven box by including a circular tray that that spins on its axis. Then, they performed a functional test. Alberto placed pieces of EPS at one end of the machine. Marcelo ordered that we count 20 seconds. Sacha started counting loudly. After from the other side, small pieces, melted, deflated began to appear. Perfect performance, great joy. Marcelo thanked Matias highlighting that he provided a key clue to unveil the way to transform the EPS. In retribution, Matias praised Marcelo's creativity and skills to build “out of nothing.” ([Figure 7](#))

I chose to finish the sequence with this last register as it represents a milestone in the process as a whole. Thereafter the interactions between recyclers and engineers aligned in order to adjust the design and manufacture of an operational prototype derived from the PROCODAS project. The model was finished in August 2017 and was in operation for a few months (see [Figure 8](#)). In the end the prototype was not escalated to a production phase since the cooperative then developed a new process for EPS treatment based on mechanical shelling and not on heating treatment (see [Figure 9](#)) as, ironically the engineers had first suggested.¹⁹ Nevertheless, the learnings developed during the implementation of the PROCODAS project were very significant not only in terms of the trajectory of the innovation process developed in the cooperative; but also to produce a broader

¹⁹The operation of this last model is far cheaper because of lower energy consumption in comparison to thermal transformation. Due to its implementation, Reciclando Sueños developed a new business unit devoted to the production of “EPS pearls” which are sold for around US\$ 2/kg to construction companies which use it as a load in cement structures.



Figure 7. Matías measures the temperature inside the rotary oven. Photo: author.



Figure 8. The PROCODAS EPS thermal transformation prototype in its final version. Photo: author.

reflection on the limits and possibilities of knowledge dialogue between heterogeneous actors.

4. Political and epistemic challenges for innovating “from below”

In the end, the PROCODAS project permitted to scale-up the “hornito” to a basic but promising prototype. But, at the same time, through periodic interactions which included collaboration and contestation, agreements as well as misunderstandings, the Reciclando Sueños waste pickers moved forward towards the recognition and valorization of their creative and innovative knowledge and skills. This was achieved not in an abstract or



Figure 9. The new machine built in Reciclando Sueños for mechanical shelling of EPS, in operation. Photo: author.

potential register, but in a concrete experience involving INTI engineers and officers from MINCYT. Achieving this goal was highly significant, as previous actors of the kind had been reluctant to seriously recognize the waste picker technological expertise, and even more, to be involved in joint experimental processes.

The initiative was not without problems, and there precisely lies the analytical relevance of the case, making it possible to derive conceptual findings. In particular, the ethnographical register of the workshops allowed me to critically approach the innovation dynamics by focusing on the appropriations and confrontations between types and styles of knowledge and experimental practices. In what follows, I return to experiential findings to propose a dialogue between epistemic (in)justice and inclusive innovation perspectives.

4.1. Innovations to build machines or to transform materials?: reflections from an epistemic (in)justice perspective

In her outstanding study of informal recyclers and the enclosure and privatization of the Soweto garbage dump, Melanie Samson (2015) analyzed how the enclosure process was putting in stake an economical, political and epistemological controversy over the value of the dumped materials. Drawing on Miranda Fricker's concept of epistemic (in)justice

(2007), Samson analyzed how the material dispossession (access and labor at the dump) also involved an “epistemic dispossession,” as the private entrepreneurs and governmental officers never acknowledged the role of waste pickers in reconceptualizing the dump as a site for the production of value.

The work of Samson makes valuable contributions for analyzing innovation dynamics involving grassroots actors in the waste management field. Firstly, to recognize the fact that even the most informal, poor, or marginalized population produces valuable knowledge. Secondly, that this condition of knowledge production is rarely socially recognized, much less legitimated in institutional terms. Thirdly, the knowledge they produce may be easily appropriated by dominant actors.

Getting back to the *Reciclando Sueños* case, an epistemic (in)justice perspective becomes productive for analyzing the interactions and relations held during the workshops between engineers and waste pickers. In fact, the concept distinguishes between “testimonial” and “hermeneutic” (in)justice (Fricker 2008). Testimonial (in)justice focuses on the dialogic dimension of a given interaction in which the prejudices of one actor towards their interlocutor undermines their status as a knowledge producer. Hermeneutic (in)justice refers to a situation where the interpretative frameworks in which the experience gains meaning are not shared by all the participants. Both dimensions can be made evident drawing from the workshop interactions.

Testimonial (in)justice events were frequent during the workshop, as when engineers avoided using their “technical jargon” assuming waste pickers were not able to understand it. But, above all, the fact of starting the advisory work from a background search of EPS transformation methods, instead of working around the existing “hornito” experience, was itself a way to undermine the value of the previous experimental job done by the waste pickers.

The material conditions of the experimental device and procedures were far from the technical and aesthetics standards of INTI engineers, which in turn resulted in the poor recognition of waste picker experimental experience. This is precisely the kind of issues taken into account by the hermeneutic dimension of epistemic (in)justice. By deepening the analysis, it is possible to evidence a gap in how both the waste pickers and the INTI engineers hermeneutically framed the experimental experience in which they took part. Briefly, the engineers “think through machines,” while waste pickers “make through materials.” Let me further explain.

From the engineers point of view, the experimental process was driven by the design of the machines needed to transform the EPS. Almost all their researches, designs and comments focused on the artifactual dimension of the experimentation process. Accordingly, the key finding followed from the first experimental stage. The fact that EPS can be transformed into PS by a thermal procedure remained almost invisible to their gaze. Thus, the richness of the experience was reduced to its evident material constraints and the randomness of the waste picker procedures. Therefore, their contributions focused on systematizing the process and building a proper semi-industrial prototype.

On the other side, for Marcelo and his mates, the driver for the experimentation process was focused on the material to be transformed. Their focus was on EPS and its current and potential characteristics. This was the reason why Marcelo started researching how EPS is manufactured resulting in the idea of “backtracking” the material. Following this rationale, if the EPS was made by heating toluene, the same thermal procedure could work in order

to return EPS to a previous stage. In this sense, despite its materials constraints, the “hornito” proved to be very efficient for demonstrating it was possible to “deflate” the EPS, reducing its volume up to 50 times, becoming far stronger. Following Tim Ingold’s (2007) remarks we could say that Marcelo does not frame the EPS by its stabilized condition, but as a material flux which experiments permanent transformations. Drawing on their experience as waste pickers, which entails manipulating a wide range of discarded materials every day, the Reciclando Sueños crew have developed a fine knowledge about the materials and their transformations. When Marcelo looks to a piece of plastic, he does not see in fact a piece, but the specific temporal modulation of a given material, which in fact is always in its journey to transformation.

That is why a non-marketable material like the EPS remained stocked in the cooperative’s shed. In a way, Marcelo and his colleagues resisted giving up on finding ways to recycle this material. By doing so, they were challenging the very ontology of materials in our current society, as they were contesting the categories by which a given material is considered non-recyclable. That is why they mobilized the creative and experimental practice that I referred to as innovation “from below.” However, as an epistemic (in)justice framework helps us show, the social recognition of that contribution is still at stake. In the next section I will further deploy this argument by showing the intersection with an inclusive innovation perspective.

4.2. Drivers and barriers to inclusive innovations

As I have already highlighted, people like Marcelo cannot be framed as mere “users” or “practitioners” of technological innovations designed by others considered “experts.” In fact, he and his colleagues have not only developed an innovative way to recycle non-marketable discarded materials such as EPS. They also contributed to make an epistemic shift towards the way we approach and categorize which materials are considered recyclable or not in our society. This contributions, derived from an epistemic (in)justice perspective, can also prompt a revision of current inclusive innovation frameworks.

More specifically, it provides some valuable clues to more precisely define what we considering as “inclusion” within the inclusive innovation perspective. Following Papaioannou (2014), it is valuable to differentiate “inclusion” from “inclusiveness,” as they relate to very different framings. Inclusion focuses on ways to develop technological innovations that could fill the gap left by mainstream Schumpeterian perspectives in addressing the needs of poor or marginalized groups. Thus, so-called “frugal” or “below the radar” innovation aim to target those groups in terms of new niches of consumers in which to offer tailored goods. Innovations still are developed by professional experts who are external to those populations. In contrast, inclusiveness involves political principles of distribution, equity and justice, as well as capacity building to elaborate demands and counter-balance power relations asymmetries. This remarks not only the importance of considering the needs of the poor or the informal, but above all, the recognition of the right to themselves define what those needs are, and how they should be addressed and satisfied. In a similar vein, contributions of feminist perspectives to Science and Technology Studies pointed out the extent to which constructivist approaches created “blindness to gender” (Wajcman 2010). Furthermore, even “inclusive” Social Technologies perspectives reproduce a dichotomous and naturalized perspective through which women’s

reproductive work remains invisible as well as their contributions to building and performing technologies (Vasconcellos, Dias, and Fraga 2017). Therefore, as these perspective points out, even the most well-intentioned inclusive approaches can also be excluding.

This connects with what was analyzed in the previous section, as it implies recognizing the poor and the informal as generators of innovations rather than mere users, and therefore to highlight the analytical relevance of approaching the process of innovation rather than its results. As several scholars have pointed out (Cozzens and Sutz 2012; Fressoli et al. 2014) this kind of grassroots innovations never occurs in isolation from established development and science and technology agencies. In this sense, the latter has stressed that inclusion is not unproblematic, and conflicts and antagonisms may arise even when working in a participatory environment.

In addition, Heeks, Foster, and Nugroho (2014) have proposed the “ladder of inclusive innovation” as a way to illustrate to what extent inclusion is being addressed in innovation dynamics. The ladder represents the divergence in the inclusive framings as the lower levels focus on instrumental participation of poor or marginalized groups (as consumers, users, testers), while the upper ones refers to the quality and depth of the inclusion dynamics which is prompted. In any case, most of the experiences of inclusive innovations situated in the first levels of the ladder, as the latter involve more radical changes in the innovation environments and dynamics. Specifically, level 6 (post-structure) considers to what extent the knowledge and discourse involved in the innovation dynamic is itself inclusive (2014, 5).

As I have analyzed in the *Reciclando Sueños* case, this is rather difficult to achieve as it involves challenging what type of knowledge could be considered as appropriate or legitimate. As happened with the “hornito,” there are epistemic biases that may hamper the best intentions to participate or include those people which have been defined as unskilled or even lumpenized, as happened with the informal waste pickers.

This shows a huge difference with the empirical cases that have informed most of the analyses of grassroots innovations, such as the Indian honey bee network and the social technology movement in Brazil (Fressoli et al. 2014); rural entrepreneurs in Nigeria (Obeng-Odoom and Ameyaw 2015); or undergraduate students in Ghana (Akinwale 2015). In all of those cases, the disposition to innovate could be to some extent admitted within their action repertoires. In fact, many of those who participated in those cases had previous trajectories in universities or in science and technology institutions. This is not the case of the waste pickers I have been working with, which for a long time have been considered as a useless and unskilled population (Cosacov and Perelman 2015; Perelman 2010). In this sense, as shown in the *Reciclando Sueños* workshops analysis, informality becomes an epistemological barrier which is rarely overcome, even when mobilizing participatory and inclusive perspectives.

5. Final remarks

I have provided a deeper understanding of innovations developed by waste pickers that goes far beyond the alienating practices of collecting and sorting recyclables. I ethnographically reconstructed and analyzed this “informal” experimental praxis through which waste pickers design and build up methods and processes to reuse/recycle odd materials, filling a gap left behind by the official Science and Technology institutions.

Drawing from the ethnographic analysis, I was able to reconstruct experimental and creative practices that, despite not being codified in terms of innovation (as happens with mainstream and inclusive innovations), also try to intervene in the process of waste valorizing. However, the most significant difference between them lies in the impossibility to inscribe these practices in a transparency register. In this sense, to frame the waste picker's experimental praxis in terms of innovations "from below," is not innocent, precisely because it challenges the epistemic and political foundations that crystallize their *savoir-faire* as a mere practical expertise, derived from the mechanic repetition of a simple routine.

The technological developments elaborated by Marcelo and his colleagues at the cooperative are not prize winners of public contests, nor advertised on social media and online platforms, nor are risk analyzed, or framed in a feasibility study. To say it briefly, they represent the "B side" of inclusive innovations. Its locus is displaced, it does not take place in laboratories, nor in computers, much less as socially legitimized expert knowledge. Basically, they are sustained in a procedural logic that is set against the dominant techno-bureaucracy.

Their findings are materialized in informal prototypes (they do not accomplish basic normalization standards). In that sense, they represent testimonies, rather than proper prototypes: testimonies of the unthinkable. Those informal prototypes materialize the displacement from a given social order, which crystallizes waste pickers as collectors and sorters of recyclables for the industry (the most alienating task in the whole value chain). In contrast, they innovate "from below" in order to challenge and contest their public recognition as unskilled workers, and their instrumental role in the waste management business. In this sense, transparency as the foundation of innovation dynamics around waste management represents a double limit.

The most obvious is in relation to the creative practice of the informal waste pickers, as I hope I have shown. But it also points out a broader limit. These larger issues, relatively new in terms of their social development, such as the recycling and reuse of discarded material, are still thought of as the exclusive assets of "experts," whose limited contributions are increasingly made viable in terms of positive and transparent social innovation. However, as I pointed out before, those innovations have very few chances to incorporate and transform the patterns of everyday practices that organize our social relationship with waste. In this sense, transparency as a requirement (and the techno-bureaucratic logic that sustains it) configures a conservative scheme that tends to reproduce the status quo. Innovation "for below" calls for a shift at the level of the socially legitimate locus to produce innovations. This sense is analytically revealing, as it allows us to focus on the tensions that shape the institutionalization of contributions of creative and experimental practices of the so called popular sectors, as the *Reciclando Sueños* members have shown. In this sense, as society, we still owe a proper recognition to them for their social and environmental contributions, even when they could be considered too bold.

Acknowledgements

I want to express my gratitude to editors, reviewers, and proof editors, whose comments and suggestions contributed to enhance the arguments which organize this paper.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributor

Sebastián Carenzo holds a PhD in Anthropology from the University of Buenos Aires (UBA) and works for the National Council of Scientific and Technological Research (CONICET) as an Adjunct Researcher. He also is a professor in the Department of Social Sciences of the National University of Quilmes (UNQ) and teaches postgraduate courses in the Master in Social Economy of the National University of General Sarmiento (UNGS), in the Master of Documentary Cinema (Fundación Universidad del Cine) and in the Diploma of Strategic Design of Technologies for Inclusive and Sustainable Development (IESCT-UNQ). His current line of research approaches, from an ethnographic perspective, practices of adaptation, design and construction of technologies developed by waste pickers in the metropolitan area of Buenos Aires through which they transform the discarded “garbage” into “materials” of different types, which then could be reused and recycled. In this way, he analyzes what could be called a “Circular Economy from below,” that is, a set of technological design and experimentation practices oriented to feed flows of reuse and recycling of materials, which are deployed not from scientific and technological institutions, but from worker’s cooperatives and community-based organizations. These practices are analyzed from a socio-technical approach that deals with the material, epistemic, political and cognitive dimensions involved in these complex processes. It should be noted that this work has been done from a perspective of collaboration and commitment with people and organizations that bring together the waste pickers, not only in terms of accompanying their claims and construction of demands, but also to generate spaces for critical reflection about the practices and roles of all the people involved, including those who come from the academic field. This work has been reflected in the publication of articles in prestigious national and international specialized journals, in chapters of books in specialized compilations, as well as in the direction of national and international research projects. In a complementary manner, this research has also involved training and technical advice to government agencies, NGOs and private companies on topics related to inclusive recycling and circular economy.

ORCID

Sebastián Carenzo  <http://orcid.org/0000-0002-6870-6937>

References

- Akinwale, A. A. 2015. “Development of Entrepreneurial Potential Among Undergraduates of a Private University in Nigeria.” In *Informal Sector Innovations: Insights from the Global South*, edited by Mammo Muchie, Saradindu Bhaduri, Angathevar Baskaran, and Fayaz Ahmad Sheikh, 24–33. Abingdon: Routledge.
- Aparcana, S. 2017. “Approaches to Formalization of the Informal Waste Sector into Municipal Solid Waste Management Systems in Low- and Middle-Income Countries: Review of Barriers and Success Factors.” *Waste Management* 61: 593–607. doi:10.1016/j.wasman.2016.12.028.
- Baillie, Caroline, and Eric Feinblatt. 2010. “Recycling Technologies and Cooperativism: Waste for Life.” *Affinities: A Journal of Radical Theory, Culture, and Action* 4 (1): 205–224.
- Baillie, C., D. Matovic, T. Thamae, and S. Vaja. 2011. “Waste-Based Composites – Poverty Reducing Solutions to Environmental Problems.” *Resources, Conservation and Recycling*, 973–978. doi:10.1016/j.resconrec.2011.05.006.
- Brouillat, Eric, and Vanessa Oltra. 2012. “Extended Producer Responsibility Instruments and Innovation in Eco-Design: An Exploration Through a Simulation Model.” *Ecological Economics* 83: 236–245. doi:10.1016/j.ecolecon.2012.07.007.

- Carenzo, Sebastián. 2011. "Desfetichizar para producir valor, refetichizar para producir el colectivo: cultura material en una cooperativa de 'cartoneros' del gran Buenos Aires." *Horizontes Antropológicos* 17 (36): 15–42. doi:10.1590/S0104-71832011000200002.
- Carenzo, S. 2014. "Lo que (no) cuentan las máquinas: la experiencia sociotécnica como herramienta económica (y política) en una cooperativa de 'cartoneros' del Gran Buenos Aires." *Antípoda. Revista de Antropología y Arqueología* 18: 109–135.
- Carenzo, S. 2016. "Waste Classification as a Craft Under Construction: The Worker's Experience at Buenos Aires' 'Social Classification Plants'." *The Journal of Latin American and Caribbean Anthropology* 21: 276–293. doi:10.1111/jlca.12220.
- Carenzo, S. 2017. "Invisibilized Creativity: Sociogenesis of an 'Innovation' Process Developed by Cartoneros for Post-Consumption Waste Recycling." *International Journal of Engineering, Social Justice, and Peace* 5: 30–49.
- Carenzo, S., and M. Schmukler. 2018. "Hacia una ontología política del diseño cartonero: reflexiones etnográficas a partir de la experiencia de la cooperativa Reciclando Sueños (La Matanza, Argentina)." *Buenos Aires, Immaterial. Diseño, arte y sociedad* 3 (5): 53–80.
- Chakrabarti, Priyanka. 2016. "Reframing the Informal Economy Through Social Innovation." Master of Science Graduate Project. School of Community and Regional Planning – The University of British Columbia. <https://open.library.ubc.ca/cIRcle/collections/graduateresearch/310/items/1.0300035>
- Charles, Goodluck. 2019. "Sustainability of Social Enterprises Involved in Waste Collection and Recycling Activities: LESSONS from Tanzania." *Journal of Social Entrepreneurship*. doi:10.1080/19420676.2019.1686712.
- Chukwunonye, E., J. A. Fazakerley, and C. L. Roberts. 2013. "Emerging Trends in Informal Sector Recycling in Developing and Transition Countries." *Waste Management* 33 (11): 2509–2519. doi:10.1016/j.wasman.2013.06.020.
- Constantino, María del Rosario. 2014. "Inclusión social de recuperadores de residuos sólidos urbanos." Ciudad Autónoma de Buenos Aires en el periodo del año 2011 al 2014. Rev. Plaza Pública, Año 12 - N° 21, Jun. 2019, pp. 75–86.
- Cosacov, N., and M. Perelman. 2015. "Struggles Over the Use of Public Space: Exploring Moralities and Narratives of Inequality. Cartoneros and Vecinos in Buenos Aires." *Journal of Latin American Studies* 47 (3): 521–542. doi:10.1017/S0022216X15000425.
- Cozzens, Susan, and Judith Sutz. 2012. *Innovation in Informal Settings: A Research Agenda*. Ottawa: IDRC.
- Cross, María Cecilia. 2016. "Experiencias de trabajo asociativo de reciclado en el Gran Buenos Aires (2004–2014)." Universidad Autónoma de Barcelona. Departamento de Psicología Social; Athenea Digital; 16; 2; 7–2016; 195–214. <http://hdl.handle.net/11336/42114>.
- Dias, Sonia Maria. 2016. "Waste Pickers and Cities." *Environment & Urbanization* 28 (2): 375–390.
- Dickerson, G. W. 1999. "Solid Waste: Trash to Treasure in an Urban Environment." *New Mexico Journal of Science*, 166 39. Gale Academic OneFile.
- Ferronato, Navarro, Elena Cristina Rada, Marcelo Antonio Gorrity Portillo, Lucian Ionel Cioca, Marco Ragazzi, and Vincenzo Torretta. 2019a. "Introduction of the Circular Economy Within Developing Regions: A Comparative Analysis of Advantages and Opportunities for Waste Valorization." *Journal of Environmental Management* 230: 366–378. doi:10.1016/j.jenvman.2018.09.095.
- Ferronato, N., Marco Ragazzi, Marcelo Antonio Gorrity Portillo, Edith Gabriela Guisbert Lizarazu, Paolo Viotti, and Vincenzo Torretta. 2019b. "How to Improve Recycling Rate in Developing Big Cities: An Integrated Approach for Assessing Municipal Solid Waste Collection and Treatment Scenarios." *Environmental Development* 29: 94–110. doi:10.1016/j.envdev.2019.01.002.
- Fressoli, M., Elisa Arond, Dinesh Abrol, Adrian Smith, Adrian Ely, and Rafael Dias. 2014. "When Grassroots Innovation Movements Encounter Mainstream Institutions: Implications for Models of Inclusive Innovation." *Innovation and Development* 4 (2): 277–292. doi:10.1080/2157930X.2014.921354.
- Fricker, M. 2007. *Epistemic Injustice: Power and the Ethics of Knowing*. Oxford: Oxford University Press.
- Fricker, M. 2008. "Forum on Miranda Fricker's. Epistemic Injustice: Power and the Ethics of Knowing." *Theoria. Revista de Teoría, Historia y Fundamentos de la Ciencia* 23 (1): 69–71.

- Galimberti, A. A., and G. Cimadevilla. 2016. "La máquina de ilusionar: rurbanidad, intervención sociotécnica y condiciones de vulnerabilidad." *Redes* 22 (43): 93–123.
- Gareis, María Cecilia, Mariana González Insúa, and Rosana Fátima Ferraro. 2016. "Incidencia de los recuperadores en las subhuellas de RSU y papel y cartón. El caso de Mar del Plata, Argentina." *Estudios Socioterritoriales* 19 (1): 63–77.
- Gorbán, Débora. 2014. *Las tramas del cartón. Trabajo y familia en los sectores populares del gran Buenos Aires, de. Colección Etnografía de los sectores populares*. Buenos Aires: Editorial Gorla.
- Guidi, D. 2013. "Waste Management & Resource Utilisation." Proceedings of the 4th International Conference on Solid Waste Management January 28–30, 2013, Hyderabad: 533–539.
- Gutberlet, J. 2008. *Recovering Resources – Recycling Citizenship*. London: Routledge. doi:10.4324/9781315604084.
- Gutberlet, J., and A. M. Baeder. 2008. "Informal Recycling and Occupational Health in Santo André, Brazil." *International Journal of Environmental Health Research* 18 (1): 1–15. doi:10.1080/09603120701844258.
- Gutiérrez, R. 2020. "A Troubled Collaboration: Cartoneros and the PRO Administrations in Buenos Aires." *Latin American Politics and Society* 62 (1): 97–120. doi:10.1017/lap.2019.
- Heeks, Richard, Mirta Amalia, Robert Kintu, and Nishant Shah. 2013. "Inclusive Innovation: Definition, Conceptualisation and Future Research Priorities (August 16, 2013)." Development Informatics Working Paper no. 53, 2013. SSRN. <https://ssrn.com/abstract=3438439> or <http://dx.doi.org/10.2139/ssrn.3438439>.
- Heeks, R., Christopher Foster, and Yanuar Nugroho. 2014. "New Models of Inclusive Innovation for Development." *Innovation and Development* 4 (2): 175–185. doi:10.1080/2157930X.2014.928982.
- Herranz, D. 2018. "It's Time to Tackle the Informal Economy Problem in Latin America." *World Economic Forum on Latin America*, March. <https://www.weforum.org/events/world-economic-forum-on-latin-america>
- Hettiarachchi, H., S. Ryu, S. Caucci, and R. Silva. 2018. "Municipal Solid Waste Management in Latin America and the Caribbean: Issues and Potential Solutions from the Governance Perspective." *Recycling* 3 (2): 1–19.
- Ingold, T. 2007. "Materials Against Materiality." *Archaeological Dialogues* 14 (1): 1–16. doi:10.1017/S1380203807002127
- Ingold, Tim. 2010. "Bringing Things to Life: Creative Entanglements in a World of Materials. Realities, Part of the ESRC National Centre of Research Methods." 1–14, Working Paper #15, July. University of Manchester. www.manchester.ac.uk/realities
- Kowszyk, Y., and R. Maher. 2018. *Case Studies on Circular Economy Models and Integration of Sustainable Development Goals in Business Strategies in the EU and LAC*. Hamburg: EU-LAC Foundation.
- Lehmann, S. 2011. "Optimizing Urban Material Flows and Waste Streams in Urban Development Through Principles of Zero Waste and Sustainable Consumption." *Sustainability* 3: 155–183.
- Lethbridge, J. 2017. "Municipal Solid Waste Management Services in Latin America." Technical Report. Public Services International (PSI), Ferney-Voltaire, France.
- Levidow, L., and Theo Papaioannou. 2018. "Which Inclusive Innovation? Competing Normative Assumptions Around Social Justice." *Innovation and Development* 8 (2): 209–226. doi:10.1080/2157930X.2017.1351605.
- Lima, Maria Raquel Passos. 2017. "Plasticidades criadas: conhecimento sensível, valor e indeterminação na atividade dos catadores de recicláveis." *Sociologia & Antropologia* 7 (1): 209–238. doi:10.1590/2238-38752017v719.
- López, Crystell Martínez, and José Ramón Laines Cánepa. 2013. "Poliestireno expandido (EPS) y su problemática ambiental. Kuxulkab'." *Revista de Divulgación Universidad Juárez Autónoma de Tabasco* XIX (36): 63–66.
- Martinez, C. A. 2010. "Informal Waste-Pickers in Latin America: Sustainable and Equitable Solutions in the Dumps." In *Global Sustainability as a Business Imperative. The Palgrave Series on Global Sustainability*, edited by J. A. F. Stoner and C. Wankel, 199–217. New York, NY: Palgrave Macmillan.
- Memon, Mushtaq Ahmed. 2010. "Integrated Solid Waste Management Based on the 3R Approach." *Journal of Material Cycles and Waste Management* 12 (1): 30–40.

- MINCYT. 2015. *Catálogo Concurso INNOVAR 2015*. Buenos Aires: Ministerio de Ciencia y Tecnología. http://www.innovar.mincyt.gob.ar/catalogos/catalogo_innovar_2015.pdf
- Obeng-Odoom, F., and S. Ameyaw. 2015. "A New Informal Economy in Africa: The Case of Ghana." In *Informal Sector Innovations: Insights from the Global South*, edited by Mammo Muchie, Saradindu Bhaduri, Angathevar Baskaran, and Fayaz Ahmad Sheikh, 16–23. Abingdon: Routledge.
- O'Hare, Patrick, and Santiago Sorroche. 2019. "Countering Dispossession Through Cooperativization?: Waste Picker Ethnography, Activism and the State in Buenos Aires and Montevideo." In *Research, Political Engagement and Dispossession Indigenous, Peasant and Urban Poor Activisms in the Americas and Asia*, edited by Dip Kapoor and Steven Jordan, 171–189. London: Zed Books.
- Oteng-Ababio, M., Jose Ernesto Melara Arguello, and Offira Gabbay. 2013. "Solid Waste Management in African Cities: Sorting the Facts from the Fads in Accra, Ghana." *Habitat International* 39: 96–104. doi:10.1016/j.habitatint.2012.10.010.
- Oyake-Ombis, L., Bas J.M. van Vliet, and Arthur P.J. Mol. 2015. "Managing Plastic Waste in East Africa: Niche Innovations in Plastic Production and Solid Waste." *Habitat International* 48: 188–197. doi:10.1016/j.habitatint.2015.03.019.
- PAHO-AIDIS-BID. 2010. "Regional Evaluation on Urban Solid Waste Management in Latin America and the Caribbean – 2010 Report." <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=36466973>
- Paiva, Verónica. 2013. "Cartoneros, recolección informal, ambiente y políticas públicas en Buenos Aires 2001–2012." *URBE – Revista Brasileira de Gestão Urbana* 5 (1): 149–158.
- Papachristos, George. 2014. "Transition Inertia due to Competition in Supply Chains with Remanufacturing and Recycling: A Systems Dynamics Model." *Environmental Innovation and Societal Transitions* 12: 47–65. doi:10.1016/j.eist.2014.01.005.
- Papaioannou, T. 2014. "How Inclusive can Innovation and Development be in the Twenty-First Century?" *Innovation and Development* 4 (2): 187–202. doi:10.1080/2157930X.2014.921355.
- Pereira de Carvalho, André, and José Carlos Barbieri. 2012. "Innovation and Sustainability in the Supply Chain of a Cosmetics Company: A Case Study." *Journal of Technology Management & Innovation* 7 (2): 144–156. doi:10.4067/S0718-27242012000200012.
- Perelman, Mariano Daniel. 2010. "Memórias de la quema: O cirujeo em Buenos Aires trinta anos depois." *Mana* 16 (2): 375–399. doi:10.1590/S0104-93132010000200006.
- Perelman, M. D. 2019. "Bodies in the tip." *Human Remains and Violence* 5 (1): 38–54.
- Pérez-Bustos, Tania, Martinez Medina Santiago, and Fredy Mora-Gámez. 2018. "What is '(un)Making' STS Ethnographies? Reflections (not Exclusively) from Latin America, Tapuya: Latin American Science." *Technology and Society* 1 (1): 131–137. doi:10.1080/25729861.2018.1551825.
- Potdar, Aditee, Anju Singh, Seema Unnikrishnan, Neelima Naik, Mayuri Naik, Indrayani Nimkar, and Vikrant Patil. 2016. "Innovation in Solid Waste Management Through Clean Development Mechanism in Developing Countries." *Procedia Environmental Sciences* 35: 193–200. doi:10.1016/j.proenv.2016.07.078.
- Puig, Ana Pilar Pi. 2018. "Reflecting on Local Reality: Tensions and Challenges of Sustainable Development in Contexts of Urban Poverty." *Glocalism: Journal of Culture, Politics and Innovation* 3. doi:10.12893/gjcpi.2018.3.5.
- Rateau, Melanie. 2017. "Conflictos de apropiación de residuos reciclables e innovaciones socioinstitucionales en Lima." *Territorios* (37): 61–80. doi:10.12804/revistas.urosario.edu.co/territorios/a.5086.
- Rebehy, W. P., Perla Calil, André Lucirton Costa, Carlos A.G.B. Campello, Diego de Freitas Espinoza, and Miguel João Neto. 2017. "Innovative Social Business of Selective Waste Collection in Brazil: Cleaner Production and Poverty Reduction." *Journal of Cleaner Production* 154: 462–473. doi:10.1016/j.jclepro.2017.03.173.
- Reno, J. 2009. "Your Trash Is Someone's Treasure: The Politics of Value at a Michigan Landfill." *Journal of Material Culture* 14 (1): 29–46. doi:10.1177/1359183508100007.
- Samson, M. 2015. "Accumulation by Dispossession and the Informal Economy – Struggles over Knowledge, Being and Waste at a Soweto Garbage Dump." *Environment and Planning D: Society and Space* 33 (5): 813–830. doi:10.1177/0263775815600058.

- Sánchez Criado, Tomás, and Adolfo Estalella. 2016. "Antropocefa: un kit para las colaboraciones experimentales en la práctica etnográfica." *Cadernos de Arte y Antropología* 5 (1): 155–167.
- Sarandón, Faustina, and Pablo Javier Schamber. 2019. "Fortalezas, debilidades y oportunidades de la política de gestión diferenciada de residuos para grandes generadores del área metropolitana de Buenos Aires (2013–2017)." *¿Gestión y Análisis de Políticas Públicas* 21: 61–79. doi:10.24965/gapp.v0i21.10559.
- Schamber, P. J., and F. M. Suárez. 2012. "Logros y desafíos a diez años del reconocimiento de los cartoneros en la CABA [2002–2012]." *Realidad Económica* 271 (Oct.–Nov. 2012): 102–132.
- Scheinberg, A. 2011. "Value Added: Modes of Sustainable Recycling in the Modernisation of Waste Management Systems." [S.I.]: S.n.
- Scheinberg, Anne. 2012. "Informal Sector Integration and High Performance Recycling: Evidence from 20 Cities." WIEGO Working Paper (Urban Policies) No 23 March 2012.
- Scheinberg, A., and J. Anschtz. 2006. "Slim Pickin's: Supporting Waste Pickers in the Ecological Modernization of Urban Waste Management Systems." *International Journal of Technology Management & Sustainable Development* 5 (3): 257–270.
- Scotford, Eloise. 2007. "Trash or Treasure: Policy Tensions in EC Waste Regulation." *Journal of Environmental Law* 19 (3): 367–388. doi:10.1093/jel/eqm022.
- Smith, A., M. Fressoli, and H. Thomas. 2014. "Grassroots Innovation Movements: Challenges and Contributions." *Journal of Cleaner Production* 63: 114–124. doi:10.1016/j.jclepro.2012.12.025.
- Sorroche, Santiago. 2017. "Experiencias replicables. Análisis de las vinculaciones entre cooperativas de cartoneros, agencias estatales y ONG en el Gran Buenos Aires." *Revista de Estudios Sociales* 61: 58–68.
- Souza, K., I. Brasileiro, and L. Schmidt. 2014. "Inovação social na gestão de resíduos urbanos biodegradáveis: reflexões sobre transferência de tecnologias e inclusão dos catadores de materiais recicláveis no Brasil." <http://m.biblioteca.juventude.gov.br/jspui/handle/11451/1109>
- Srinivas, S., and J. Sutz. 2008. "Developing Countries and Innovation: Searching for New Analytical Approach." *Technology in Society* 30 (2): 129–140. doi:10.1016/j.techsoc.2007.12.003.
- Thomas, H., L. Becerra, M. Fressoli, S. Garrido, and P. Juarez. 2017. "Theoretical and Policy Failures in Technologies and Innovation for Social Inclusion: The Cases of Social Housing, Renewal Energy and Food Production in Argentina." In *Research Handbook on Innovation Governance for Emerging Economies*. Cheltenham: Edward Elgar. doi:10.4337/9781783471911.00025.
- Thomas, H., A. Davyt, A. Lalouf, and L. Becerra. 2013. "Estrategias de desarrollo inclusivo sustentable y cambio tecnológico. Críticas y propuestas." In *Múltiplos Olhares sobre Tecnologias Sociais. Pesquisas e práticas sociais*, (Orgs.) A. Suárez Maciel, and E. Bomfim Bordin, 43–56. Porto Alegre: FIO.
- Turcotte, I., and G. M. Gómez. 2012. "Linking the Poor to New Modalities in Service Delivery." Partnership Innovations in Solid Waste Management in Bogotá, Colombia (No. 548). ISS Working Paper Series/General Series (Vol. 548, pp. 1–33). Erasmus University Rotterdam. <http://hdl.handle.net/1765/37169>
- Vasconcellos, Bruna, Rafael Dias, and Lais Fraga. 2017. "Tecendo conexões entre feminismo e alternativas sociotécnicas." *Scientiae Studia* 15 (1): 97–119.
- Vergara, S. E., A. Damgaard, and D. Gomez. 2016. "The Efficiency of Informality: Quantifying Greenhouse Gas Reductions from Informal Recycling in Bogotá, Colombia." *Journal of Industrial Ecology* 20: 107–119. doi:10.1111/jiec.12257.
- Vernis, A. 2014. "Innovación social a través del mercado en las organizaciones de la sociedad civil en Iberoamerica." *Tercer Sector* 99: 12–16.
- Villanova, Nicolás. 2014. "Los cartoneros y la estatización de su condición como población sobrante para el capital por intermedio de las cooperativas. Ciudad de Buenos Aires, 2001–2012." *Trabajo y Sociedad* 23: 67–91.
- Vuletin, G. 2008. "Measuring the Informal Economy in Latin America and the Caribbean." IMF Working Paper WP/08/102, International Monetary Fund, April.
- Wajcman, Judy. 2010. "Feminist Theories of Technology." *Cambridge Journal of Economics* 34: 143–152.

- Wilson, D. C., C. Velis, and C. Cheeseman. 2006. "Role of Informal Sector Recycling in Waste Management in Developing Countries." *Habitat International*. 30 (4): 797–808. doi:10.1016/j.habitatint.2005.09.005.
- Wirth, I. G. 2013. *Mulheres na triagem, homens na prensa: questões de gênero em cooperativas de catadores*. São Paulo: Annablume; Fapesp.

Documents

- CEAMSE, 2018. <http://ceamse.gov.ar/plantas-de-clasificacion-y-separacion/>
- Federación Argentina de Cartoneros, Carreros y Recicladores (FACCyR). 2018. Situación actual de la FACCyR. Buenos Aires: FACCyR.
- GCBA, 2017. http://www.buenosaires.gov.ar/areas/med_ambiente/dgpru/area_de_desarrollo_de_reciclado_urbano.php
- Red LACRE. 2016. Recicladores inciden en Latinoamérica. IRR-REDLACRE-Chile Sustentable.
- SAyDS, 2011. <http://www.ambiente.gov.ar/?idseccion=191>.