“Scavenging Revisited: Supporting Scavengers in Santiago de Chile”

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Abstract

Policies towards the urban economy in general, and towards waste-pickers in particular, are fundamentally based on four approaches: (1) dualist, which proposes repressive policies against scavenger activity, perceiving it as a means of preserving poverty and slowing economic growth; (2) structuralist, which argues for weak supporting policies aimed at reinforcing waste-picker associations, in order to enhance their negotiating power and ultimately avoid capitalist exploitation; (3) neoliberal, which promotes scavenging by way of its legalisation and exposure to the free market without government intervention; and finally, (4) co-production, which promotes a strong level of support from local policies as a means of enhancing waste-pickers' productivity. Both qualitative and quantitative research regarding the impact of different policy approaches on waste-pickers' sustainable performance are scarce. This paper attempts to fill this gap in the literature by operationalizing concepts, building waste-pickers' sustainable performance indicators and evaluating the impact of competing policy approaches. The empirical results obtained from studying scavenger cooperatives in Santiago de Chile suggest a positive association between the amount of government support and waste-pickers' sustainable performance: the higher the level of local support, the higher the indicators of economic growth, social equity and environmental protection, and the lower the indicators of negative externalities of the activity. Consequently, further positive government intervention is advocated as the primary policy recommendation of this paper.

Keywords

Waste-Pickers, Co-production, Santiago, Recycling, Solid Waste Management

1. Introduction

Thirty-five years have passed since the implementation in New Jersey of the first city recycling system (Miller 2002), and yet the majority of cities in developing countries have still not incorporated recycling as part of their Solid Waste Management System (SWMS). The more developed of these cities contain a system whereby waste is simply collected and disposed of, and in the least developed cities waste is not even collected. The main reason for the absence of an integral SWMS (comprised of reduction, reuse, recycling and disposal) is the high capital cost required to establish traditional recycling systems for countries that are labour rich. In this sense, waste-picking provides a spontaneous labour incentive solution, becoming an alternative means of achieving an integral SWMS (Ackerman 2005). Furthermore, Medina (2007, 2010) cites waste-picking as an example of sustainable development, emphasising that waste-picking activity enhances environmental protection by increasing the amount of waste collected, reused, and recycled, resulting in high indicators for energy saving, pollution prevention and pollution reduction, as well as extending the useful life of landfills (see also Troschinetz and Mihelcic 2009). At the same time, waste-picking is relevant for economic growth, as it reduces the cost of raw materials for local enterprises. Finally, it contributes to social objectives by providing more than 15 million jobs for the poor in developing countries (Medina 2007, 2010). Drawing arguments from these points, neoliberal theories promote the deregulation of waste-picking as a way to reach efficiency in the sector, working within a free-market framework with an ultimate aim of no

governmental intervention (De Soto 1990; Medina 2007). Other theories, however, emphasise the negative impact of waste-picking activity. Dualist theories (Geertz 1963; Lomnitz 1975) suggest that waste-picking is a consequence of the lack of economic growth that keeps people in poverty. Structuralists (Portes et al. 1989; Birkbeck 1979, Centeno and Portes 2006) perceive waste-picking as a source of capitalist exploitation. As a result, both schools of thought hold the ultimate aim of stopping the practice of waste-picking from continuing. Finally, co-production theory suggests that waste-picking has the potential to be the best available means of providing a recycling service in developing countries (Fergutz et al. 2011). This school of thought emphasises that, in order to maximise sustainability and minimise negative externalities, public sector support is vital.Co-production interventions are being supported and implemented with increasing frequency in Latin America and Asia (Medeiros & Macêdo 2006; Besen et al 2007, Fergutz et al 2011). Although these four schools of thought have a long history, few empirical studies have attempted to evaluate the impacts of their competing policy recommendations. . This paper represents an unique attempt to bridge the gap between theories and policy impacts, drawing from data based on four Greater Santiago waste-picking cooperatives affected by various municipal policies.

2. Literature review

The urban informal economy debate provides a theoretical framework with which we can understand the logic behind the competing policy approaches applied to waste-pickers. Consequently, it provides a useful entry point for the aims of this study. Chen *et al* (2004) identify three main schools of thought: dualist, structuralist and neoliberal. To this framework we add the recent development of co-production theory. Although there are debates within each of these schools, using this classification allows for an understanding of the fundamental elements of current debate on waste-pickers and its policy implications.

The dualist school contends that there are few direct economic links between waste-picking activity and other formal economic sectors (Santos 1979). From this perspective, waste-picking emerges as the result of a lack of economic growth and availability of formal employment in developing countries. It is perceived as a 'last resort' or marginal survival activity, with low productivity potential (Geertz 1963). This dualist conception of waste-picking is widespread among academics and policymakers (Lomnitz 1977; Souza 1980). Dualists argue that the number of people working as waste-pickers is essentially counter-cyclical to economic strength: it expands in times of economic crisis as the need for survival activities becomes more pronounced, and shrinks with economic expansion as people tend towards formal employment. Such counter-cyclical reactions have been observed in analyses of waste-picking activities in the 1994 Mexican and 2001 Argentinean economic crises, as economic turndown was followed by a dramatic increase in waste-picking activity (Schamber & Suárez 2007). Dualist polices towards waste-pickers are based around repression and the creation of formal jobs to reduce the number of people working as waste-pickers (Navarrete 2010, Salah-Fahmi 2005, Schamber and Suárez 2002)

For structuralists, scavenging is an integral part of the capitalist system. Waste-picking provides the link between recyclable materials and their demand from formal enterprises (Birkbeck 1979). By having access to low-cost recyclable materials, enterprises are able to reduce the cost of inputs, ultimately increasing their profit – a relationship perceived as exploitative by Birkbeck (1979). It reduces production costs in two ways: first, due to the monopsony and oligopsony of large recycling industries and the intermediaries who buy from waste-pickers, the prices of recycled materials are dramatically reduced – the profits of 'the buyer [are increased] at the cost of the seller' (Birkbeck 1979). Second, large formal industries use a 'hierarchy of intermediaries' or warehouses to shift the labour responsibility of large enterprises further down in the hierarchical chain to smaller enterprises and, then,

to self-employed waste-pickers. This permits large enterprises to avoid contractual relationships and the payment of labour benefits to waste-pickers, who are a fundamental link to their core activity and income. Under structuralist theory, waste-picking is essentially pro-cyclical to economic impacts: it grows in times of economic expansion as the demand for recyclable materials from local industries increases. Structuralist policies promote waste-picker associations and unions, in order to reinforce waste-pickers' power to negotiate better prices and working conditions (Birkbeck, 1979, Schamber & Suárez, 2007).

According to neoliberals, waste-pickers are micro-entrepreneurs (Medina 2007). From this perspective, scavenging is strongly connected with the formal industry in two ways. First, industrial scavenging provides local industry with cheap substitutes for raw materials, reducing production costs, and accordingly, enhancing profits and competitiveness within the industry. Second, the formal market of raw materials determines the types of substitute materials that are in demand and the prices paid to waste-pickers. Consequently, scavenging plays a structural role in the competitiveness of local industry. Neoliberals argue that waste-picking is counter-cyclical to economic growth (Medina 2007). In periods of crisis, local currencies tend to devalue, raising the prices of imported raw material, and in turn increasing the demand for cheaper substitutes provided by waste-pickers. From a neoliberal perspective, scavenging is highly efficient, but due to excessive regulation and a lack of legalisation of the activity, waste-pickers are not able to attain their full economic potential (Medeiros & Macêdo 2006; LCABA 2002, Piovano 2008).

Finally, an increasing number of academics call for the recognition of the role of the informal economy as a provider of public services in developing countries. Joshi and Moore (2004) argue that the monopolistic provision of the state and the modern public management strategy of privatisation have failed to provide public services in developing countries because of logistical and governance-related failures. Logistical failures are associated with the cost of providing public services for poor populations who are widely dispersed geographically and have a low capacity to pay for services. Failures of governance arise from an institutional incapacity to effectively provide core public services and achieve a sustainable financing system (Joshi & Moore 2004). In both cases, the problems are rooted in the traditional 'supply-led engineers' approach based on expensive capital investments, high operational costs and high standards for developing countries that have high availability of labour, low governance capacity and limited investment capacity (Allen et al. 2006; Ostrom 1996). According to Ostrom (1996), 'co-production' arrangements, in which, through a long-term partnership, citizens and the state pool resources to provide public goods and services, offer an alternative solution for the delivery of basic services in developing countries. Joshi and Moore (2004) underline that co-production with the informal economy should be taken seriously, as it has the potential to be the best available alternative for providing necessary public services. Under co-production theory, public sector support is required to maximise waste-pickers' productivity. This in turn will maximise the economic efficiency, social equity and positive environmental impacts of the activity.

Table 1: Main points of the scavenger debate

	General Authors	Scavenger Authors	Conception of Scavengers	Economic Relationship	Policy Implication
Dualist	*Geertz (1963) Santos (1979) Germani (1973)*	*Lomnitz (1975)*	*Hidden unemployment*	*Counter-cyclical (expands when economy contracts)*	*Repression and expansion of formal economy: elimination*
Structuralist	*Portes et al (1989)*	*Birkbeck (1979) Sicular (1992)*	*Exploited cheap labour*	*Pro-cyclical (expands when economy expands)*	*Weak support policies and changing the system: empowerment*
Neoliberal De Soto (1990)	*Medina (2007)*		*Micro-entrepreneurs and self-employed*	*Counter-cyclical (survival activity) and pro-cyclical (micro-entrepreneurs)*	*No government intervention: neglect*
Co-production	*Ostrom (1996)*	*Fergutz et al (2011)*	*Micro-entrepreneurs in need of governmental support*	*Counter-cyclical (survival activity) and pro-cyclical (micro-entrepreneurs)*	*Strong governmental support for micro-entrepreneurs: development*

Adapted from Chen et al (2004)

3. Data and methodology

In order to study the role that local government plays in enhancing waste-pickers' sustainable performance indicators (economic growth, social equity and environmental protection) and reducing the negative externalities underlined by the literature, this research uses a mixed strategy of qualitative and quantitative research techniques.

Qualitative research is used to understand the possible mechanisms driving local policy impact. Criterion purposive samples of waste-picker cooperatives in Greater Santiago de Chile (GSC) were taken to represent the diversity of municipal policy approaches towards waste-picking activity. Each selected municipality represents one of the four policy approaches: dualist (Santiago Centro), neoliberal (Maipu), structuralist (Cerrillos) and co-production (La Reina). Qualitative data collection was carried out on these four municipalities of GSC where the views of 28 participants were collected. Eight in-depth semi-structured interviews were undertaken with the chiefs of the SWMS departments of selected municipalities, with the heads of waste-picker cooperatives, and in four group discussions with waste-pickers from four different cooperatives. These interviews explored two themes: first, understanding the waste-picking activity itself by looking at the economic, logical and social issues behind the activity; and second, studying the consequential impact of municipal policies on waste-pickers. Inductive thematic analysis was used to explore interviews and focus groups, and the results were contextualised within the wider literature of waste-picker activity. This then led to the generation of a testable hypothesis regarding sector dynamics and policy impacts on waste-pickers' performance, which could be explored using quantitative techniques.

A quantitative analysis then followed, with the aim of testing the veracity and relevance of the hypothesis that had been constructed prior. While a qualitative analysis allows us to understand the mechanisms at play regarding policies and their impact on waste-pickers' sustainable performance, it tells us nothing about the effectiveness of these policies. Primary data collection was the only possible means of obtaining quantitative data on waste-pickers, as no alternative sources were available at the time of the research, and so within each municipality a waste-picker cooperative was selected to take part in a census. A survey was designed to collect data from all the 100 waste-pickers in the four

cooperatives analysed. Based on the literature, 11 indicators of waste-pickers' performance were built. These indicators measure waste-pickers' performance in the four dimensions underlined by the literature: economic efficiency, social equity, environmental protection, and negative externalities. Finally, the collected data is analysed using two methods: in the first method, the overall performance of cooperatives is assessed, first through an analysis of variance, testing for equality of means, followed by a multiple comparison method with Bonferroni corrections for levels of significance. In the second method, the impact of specific policies is analysed with 11 Ordinary Least Square (OLS) models. These models show the relationship between 11 sustainability indicators (Y) and 12 municipal policies (β1) controlling for five socio-economic conditions (β2) of waste-pickers, as shown in the equation:

$$Y_{(indicators)} = \beta_0 + \beta_1 loc.policies + \beta_2 soc\text{-}econ + \epsilon$$

Education has been excluded as a control variable, as almost all waste-pickers have very low levels of educational. The sustainable performance indicators and municipal policies used in these two analyses are presented in tables 2 and 3. Quantitative analysis reported along with qualitative evidence, primarily in the form of basic reportage using transcripts from interviews and focus groups.

Table 2: Waste-pickers' sustainable performance indicators

Response Variables	*Authors*	*n.*	*Indicators*
Economic efficiency			
Individual productivity	*Medina (2007)*	*1*	*Earnings per hour worked*
Impact on productivity of local industry	*Medina (2007)*	*2*	*Kilograms recycled per hour*
Social equity			
Poverty reduction	*Medina (2007); Chaturvedi (1998)*	*3*	*Income as multiple above/below minimum salary*
Internal income equality	*Chaturvedi (1998)*	*4*	*Income dispersion within the cooperative*
Environmental protection			
Energy saving and prevention of waste entering landfill	*Medina (2007)*	*5*	*Tons recycled per worker per month*
Prevention of toxic material from entering landfills	*Medina (2007)*	*6*	*Tons of toxic materials recycled per month*
Diversity of material recycled	*Medina (2007)*	*7*	*Number of different materials collected per worker*
Negative externalities			
Physical health	*Begun (1999); Nguyen et al (2003)*	*8*	*Number of work-related accidents suffered within six months*
Child labour	*Chaturvedi (1998)*	*9*	*Frequency of scavengers accompanied by a child (a)*
Waste dispersion	*Chaturvedi (1998)*	*10*	*Frequency of cleaning after waste collection (b)*
Working conditions	*Medeiros and Macêdo (2006)*	*11*	*Length of working week*

a) In a perceptual scale where 1 means never go with my child/chidren to collect and 6 means always go to collect with my child/children
b) In a perceptual scale where 1means always clean after collecting/sorting waste and 6 means never clean after collecting/sorting waste.

Table 3: Types of local policies implemented by each borough (independent variables)

	Explanatory Variables	La Reina (Co-Production)	Cerrillos (Structuralist)	Maipu (Neoliberal)	Santiago (Dualist)
A. Individuals socio-economic conditions (control variables)					
1	*Income*	*Monthly income as waste-picker per month in Chilean pesos*			
2	*Work-week*	*Number of hours of work per week*			
3	*Age*	*In years*			
4	*Gender*	*male / female categories*			
5	*Experience*	*Number of years in the activity*			
B. Supportive local policies (explanatory variables)					
1	*Access to credits*	*yes*	*no*	*no*	*no*
2	*Donation of tools& machinery*	*yes*	*no*	*no*	*no*
3	*Donation of vehicles*	*yes*	*no*	*no*	*no*
4	*Provision of a recycling centre*	*yes*	*no*	*no*	*no*
5	*Borough identification card & uniforms*	*yes*	*no*	*no*	*no*
6	*Coordination with waste lorry*	*yes*	*yes*	*no*	*no*
7	*Waste monopoly*	*yes*	*no*	*no*	*no*
8	*Regularisation of schedules*	*yes*	*no*	*no*	*no*
9	*Promoting waste segregation*	*yes*	*no*	*no*	*no*
10	*Restrictions on work in landfills*	*yes*	*no*	*no*	*no*
11	*Place to leave children*	*yes*	*no*	*no*	*no*
B. Repressive local policies (explanatory variables)					
12	*Restriction of collection schedules and police harassment*	*no*	*no*	*no*	*yes*

GSC is composed of 37 boroughs which fully administrate their own local SWMS. Scavenging accounts for 70% of the waste recycled in GSC, contributing to the recycling of 10.1% of total waste produced (Conama 2005). An estimated 6000 waste-pickers, working both in cooperatives and independently, collect materials for recycling – by selling to middlemen who on-sell as raw materials to local industries – or for reuse – by selling odds and ends in informal street markets – removing 810 tons of waste from landfills each day (CONAMA 2005). Scavenging activities play an undeniable and vital role in achieving an integral SWMS in Greater Santiago de Chile.

4. Analysis of the results

This section is structured in three parts. First, waste-pickers are characterised using descriptive data and the accuracy of the different theories' conception of waste-pickers is compared. Next, variation in sustainable performance among cooperatives is estimated, assessing the accuracy of the policy recommendations of the schools of thought. A final section discusses the impact of specific local policies on sustainable indicators.

4.1 Waste-picking as one-way street

The results obtained by our triangulation (qualitative/quantitative) analysis show that there is no

single waste-picker school of thought that can provide a full explanation of the cause, dynamics, or evolution of waste-picker activity. Rather, it is necessary to use a mix of dualist and neoliberal perspectives to explain this complex reality.

Dualist theory matches more closely with the motivations behind becoming a scavenger, whilst a neoliberal perspective better explains the evolution of waste-pickers. On the one hand, the dualist argument that people are drawn to the activity because of living in poverty, being unskilled workers and an absence of formal employment opportunities convincingly explains the causes behind adopting scavenging methods (Lomintz 1975; Souza 1980). Indeed, 84% of the subjects declared a complicated economic situation as the main motivation behind becoming a scavenger. Additionally, 92% of these people have an incomplete secondary education, in turn leaving them with a low level of employability. In this sense, as dualist theory suggests, times of economic crises are likely to see an increase in the amount of scavenging activity due to increased poverty and unemployment. As explained by Esteban (52), a member of the National Asociation of Waste-Pickers of Chile (MNRCh):

> *E: Of course, there is an impact… Economic crisis increase the number of waste-pickers… I'll give you two examples… that I have seen as a (national) waste-picker leader. The Argentinian Economic Crisis in 2002, (that) not only affected Argentinian waste-pickers but also affected Chilean waste-pickers, and the (financial) crisis of 2009. (In both) it is incredible the number of (new) waste-pickers that suddenly appeared…*

On the other hand, the neoliberal perspective better explains the evolution of scavenger activity once it has started. Indeed, scavenging is not a temporary activity as dualist theory suggests, but rather it is largely permanent. In fact, 86% of the subjects from the study have been dedicated to scavenging as their primary activity for more than 4 years, with 12 years being the average. As reported by Ramon (57), Cristian (35) and Nicolas (62) in a focus group in Maipu, in response to my question about how many years have been working as waste-pickers:

> *R: Uff, a lot of time, around ten years?*
> *C: No, more than that*
> *N: In my case, 30 years.*

In this context, the dualist claim that economic growth will significantly decrease scavenger activity is misleading – indeed, after having become waste-pickers, many choose to remain in the activity. Reasons to remain in the activity align with neoliberal arguments of entrepreneurship. In fact, the majority of waste-pickers feels satisfied with their work (84%), consider themselves to be micro-entrepreneurs (80%) and would like to continue with their current activity even if a formal job were to be offered (81%). A crucial point systematically expressed by waste-pickers, during interviews and focus groups, is that this activity has a series of monetary and non-monetary benefits that exceed those of formal employment offered to low-skilled workers.As explained by Carlos (48), a waste-picker leader of La Reina, and Gloria (54), Hugo (54) and Daniela (60), in a focus group of waste-pickers in Cerrillos

> *C: if you offer… to a waste-picker (a formal job), they would not work there … we work for (more than) two minimum salaries per month [minimum salary is 362.60USD]. We are speaking of 450,000 to 800,000 pesos [725.28-1,289.3USD]. Those who earn less, gain 350,000 pesos [564.11USD], considering recyclable and reusable materials.*
>
> *D: …we earn more than people that work formally. Moreover, it is the freedom we have, you have flexible time, you are your own boss…*
> *H: Not being a dependant of other people (that give you employment).*
> *D: ...if you are smart and like to make money, you work hard and make money, otherwise not…*
> *H: … you get used to the (flexible) schedule. You work in the street market in the morning and in the afternoon you go to recycle…*
> *G: In my case, I would not change (to a formal employment) because I arrange my time with my kids as I want.*
> *D: In my case, (me) neither…*

It could be said that scavenging is a one-way road. As dualism suggests, poverty is the initial motivating

factor behind moving into waste-picking and the activity expands with economic crises. However, following neoliberal arguments, once an agent is engaged in scavenging, remaining in the activity becomes a choice, and waste-picking suffers no significant contraction in response to expansion in the formal employment sector.

4.2 Waste-pickers' sustainable performance: the relevance of local policy framework

In this section, waste-pickers' sustainable performance is estimated, first through an analysis of variance, testing for equality of means, followed by multiple comparisons of statistical differences in cooperatives' sustainable performance, using Bonferroni corrections.

The results from the tests are presented in Table 4. In tests 1-2, the economic efficiency of different cooperatives is tested. Here, economic efficiency refers to income per hour worked (indicator 1) and kilograms of recyclable materials collected per hour worked (indicator 2). In tests 3-4, social equity indicators are analysed using the monthly waste-picker salary divided by the minimum salary in Chile in 2010 (indicator 3) and the Gini coefficient of each cooperative (indicator 4). In tests 5-7 environmental protection performance is assessed by the amount of kilograms collected, of both recyclable and reusable materials, per waste-picker per hour worked (indicator 5), the quantity of toxic materials collected per worker per month (indicator 6) and the number of different types of recyclable materials collected by each waste-picker (indicator 7). Finally, in tests 8-11, negative externality variables are compared. Indicator 8 analyses the number of accidents suffered by a waste-picker in a six month period, indicator 9 is a perception indicator referring to how often they bring their children to work, indicator 10 indicates their perception of how often they organise waste after opening rubbish bags or bins, and indicator 11 analyses the length of waste-pickers' working week compared with the legal working week length. For all the perception indicators from 0 to 6. The expected results derived from theory are as follows: 1) if dualist hypotheses are correct, regardless of the applicable local policies, all the cooperatives should perform poorly as scavenging is a survival and low productivity activity. 2) If the structuralist hypotheses are correct, all cooperatives should perform poorly except for the cooperative affected by structuralist policy, which should show stronger performance. This is because this last cooperative has the capacity to negotiate. 3) If neoliberal hypotheses are correct, cooperatives should have a negative relation between performance indicators and government intervention, i.e. as intervention increases, sustainable performance decreases. 4) If the co-production hypotheses are correct, there should be a positive relation between levels of local government support and performance indicators of the different cooperatives, i.e. as supportive intervention increases, sustainable performance increases. 5) Finally, if none of the theories are correct, the indicators should not follow any of these patterns.

Table 4: Multiple testing of differences in cooperatives' performance : economic efficiency, social equity, environmental protection, negative externalities

Indicators (I)	*Earnings/ hour worked*		*Kilos/ Hour Worked*		*N. of time Minimum Salary*		*Income Equity (Cooperative)*	*Total Kilos per Worked*		*Toxic Material Kilos/ Month*	
	1		*2*		*3*		*4*	*5*		*6*	
ANOVA F-test	0.0002	***	0.064	*	0.0001	***	-	0.0295	**	0.0001	***
CP vs SP	0.0010	***	0.4580		0.0010	***	-	0.4610		0.0010	***
CP vs NP	0.0010	***	1.0000		0.0010	***	-	1.0000		0.0010	***
CP vs DP	0.0010	***	0.0920	*	0.0010	***	-	0.0910	*	0.0010	***
SP vs NP	1.0000		1.0000		0.1810		-	0.6200		1.0000	
SP vs DP	1.0000		1.0000		1.0000		-	1.0000		1.0000	
NP vs DP	1.0000		0.2760		0.0870	*	-	0.0880	*	1.0000	
AVERAGE											
CP	2437	a	28.6		1.8		0.17**b	28.6		278.6	
SP	1099	a	16.8		0.8		0.26**b	16.9		99.1	
NP	1127	a	21.7		1.1		0.33**b	24.6		81.1	
DP	1077	a	10.7		0.7		0.30**b	10.7		68.2	

Note 1: *** p<0.01, ** p<0.05, * p<0.1 (Bonferroni corrections)
Note 2: a: Chilean Pesos (510 CLP= 1 USD); b: Gini coeficients.
Note 3: Co-production Polices (CP), Structuralist Policies (SP), Neoliberal Polices (NP), Dualist Policies (DP).

Table 4: (continuation)

Indicators	*Types of Material Collected*		*Quantity of Accidents*		*Frecuency of Childwork*	*Waste Dispersion*	*Work Day*	
	7		*8*		*9*	*10*	*11*	
ANOVA F-test	0.0001	***	0.0001	***	0.167	0.0686	0.0007	***
CP vs SP	0.4470		0.3200		1.0000	1.0000	1.0000	
CP vs NP	0.0010	***	0.0590	*	0.5210	1.0000	0.0430	**
CP vs DP	0.0010	***	1.0000		1.0000	1.0000	1.0000	
SP vs NP	0.0010	***	0.0010	***	0.6700	0.3850	0.0020	***
SP vs DP	0.0130	**	0.0190	**	1.0000	1.0000	1.0000	
NP vs DP	1.0000		0.0740	*	0.4560	0.0750	0.0130	**
AVERAGE								
CP	10.7		2.7		2.9	5.6	0.8	
SP	9.3		1.5		2.4	5.4	0.8	
NP	7.2		4.4		1.7	5.9	1.3	
DP	7.3		3.1		2.7	5.1	0.8	

*Note 1: *** p<0.01, ** p<0.05, * p<0.1 (Bonferroni corrections)*
Note 2: a: Chilean Pesos (510 CLP= 1 USD); b: Gini coeficients.
Note 3: Co-production Polices (CP), Structuralist Policies (SP), Neoliberal Polices (NP), Dualist Policies (DP).

Several implications can be extracted from the results of the empirical analysis. First, regarding economic efficiency, the data suggests that only high levels of local government support can allow waste-pickers to reach high levels of economic performance in indicators 1 and 2. First, the cooperative under co-production policies (CP) performs significantly better in indicator 1, having a higher level of productivity. Similarly, the cooperative under CP collects a larger quantity of recyclable materials, and is statistically different from the cooperative working under dualist policies (DP). The cooperatives under structuralist and neoliberal policies (SP and NP) seem to perform similarly in both economic indicators. In relation to social equity indicators, the data shows again a positive relationship between social performance indicators and levels of local government support. Regarding poverty reduction (indicator 3), it is only the cooperative under CP that promotes high levels of social mobility, bringing all its members above the poverty line and beyond minimum wages to a middle class salary (indicator 3). Furthermore, the CP cooperative promotes higher levels of income equality among its members (indicator 4), reaching a low Gini inequality index (0.17). Similarly, regarding Gini coefficients, the cooperative under SP (0.26) performs better than those under NP (0.33) or DP (0.30).

The empirical results also suggest that local government support enhances environmental protection. Regarding quantity collected per worker (indicator 5), waste-pickers under CP and NP perform significantly better than waste-pickers under SP and DP. Of note, waste-pickers under DP perform significantly worse. In relation to toxic materials (indicator 6), waste-pickers working under CP recycle almost three times as much toxic material as any other cooperative. Finally, waste-pickers with higher levels of support, under CP and SP, recycle a larger number of types of materials (indicator 7). Ultimately, the results suggests a significant positive relation between levels of municipal support and waste-pickers' sustainable performance, which supports the hypothesis drawn from co-production theory.

In relation to negative externalities, the connection between local government support and waste-picker performance seems weaker. . First, regarding the prevention of work related accidents (indicator 8), there seems to be some positive association with local government support, as waste-pickers under SP and CP have significantly less workplace accidents than waste-pickers under NP and DP. The issue of child work (indicator 9) seems not to significantly vary alongside levels of local government intervention. It also appears that governmental control over waste-pickers does make a difference for waste dispersion (indicator 10), as scavengers under DP disperse significantly less waste than scavengers under NP. In relation to the length of workday for waste-pickers (indicator 11), it appears that it reduces along with local government support, as waste-pickers under CP and SP work an average of 80 percent of the legal workday length. The short workday of the cooperative under DP seems to be the result of policies that artificially restrict schedules of collection for waste-pickers. To summarise, the results suggest a weaker but positive association between local government support and the reduction of negative externalities for waste-pickers. The co-production hypothesis is confirmed in two out of four indicators (reduction of accidents and reduction of workday length).

In conclusion, overall, the results from the empirical analysis of externalities largely support the co-production policy hypothesis, suggesting that local government support has a positive impact on waste-pickers' sustainable performance.

4.3 Policy impact of municipal policies: evaluation

Once knowing that municipal support does makes a positive difference in waste-pickers performance, the objective of this section is to evaluate the specific impacts of local each supporting policies on enhancing waste-pickers' sustainable performance and reducing negative externalities. As

explained above, drawing from the results of our survey, eleven OLS models have been constructed to disentangle the impact of specific support policies on waste-pickers' sustainability where response variables represent the eleven sustainability indicators extracted from the literature (Table 2), and twelve supporting policies are used as explanatory variables, controlled by five socio-economic variables (Table 3) The results of the statistical analyses are summarised in Tables 5. In OLS models 1-2, the impact of policies on economic efficiency (indicators 1 and 2) has been tested. In OLS models 3-4, the impact of supporting policies on social equity performance (indicators 3 and 4) is analysed. In OLS models 5-7, environmental protection performance (indicators 5, 6 and 7) is assessed. Finally, in OLS models 8-11, negative externality variables (indicators 8, 9, 10 and 11) are introduced (see tables 6 and 7). Qualitative analysis is then used to understand the mechanisms at play behind statistically significant impacts of local policy intervention.

Individual productivity: earnings per hour worked (indicator 1)

Regarding economic efficiency, the data suggest that a higher level of local government support leads to stronger economic performance of waste-pickers. First, productivity per hour of work (indicator 1) sees an increase that results from a number of supporting policies – creating a waste monopoly over an urban area, providing identification cards and uniforms, the regularisation of schedules of waste collection, and providing tools. As a result of these policies, neighbours become more willing to collaborate with waste-pickers through the segregation of waste and the provision of odds and ends for collection. In turn, waste-pickers are able to access recyclable and reusable materials of higher quality and in higher quantity in a shorter overall period of time, thus increasing earnings per hour. Sofia (46), a waste-picker leader of La Reina, elaborates on how waste monopoly strengths the relationship between waste-pickers and local households:

> *S: Each waste-picker has their particular borough where they collect and they must respect that area. Neighbours are enrolled [in a recycling program) and the municipality assigns a local waste-picker…[we) rely on neighbours' cooperation because (our earnings) depend on what they provide… (In each area) we have a strong relationship with the neighbours, they know us…they hold on to 'cachureos' (odds and ends) and provide segregated (recycling) material for us.*

Similarly, identification cards and uniforms influence this trusting and collaborative relationship. This policy additionally allows waste-pickers to access high-income gated communities, thus expanding their collection area. As Lorenzo (45), a waste-picker leader from Cerrillos, and Sofia (46), in another intervention, noted:

> *D: (Neighbours will say) 'here come the waste-pickers – be careful, close the door, the waste-picker has arrived'…'he is looking for houses to steal from'. We are stigmatised. If you arrive with an identification card, they will say: 'Okay, he comes from the municipality'…they look at you and they see the municipality. For example, when we had our 'collection day'. All of us (waste-pickers) were wearing green uniforms. All (of the neighbours) could identify us and came with pleasure to donate items (reusable and recyclable materials).*
>
> *S: (It is important) to have an identification card or our jackets…to show to the locals, because if we walk through the street in uniform…they will actively ask us…'What do you recycle?'…and they give us 'cachureos' or (recyclable) material…They prefer (giving) to a waste-picker in uniform rather than one without. (Gated communities) can have private guards…who now say hello…they know that we come from the municipality and they open their doors to us.*

Table 5: Summary of the impacts of municipal policies on the sustainable performance of waste-pickers

Response Variable	*Positively Impacting Policy*	*Negatively Impacting Policy*	*Magnitude*		*Overall Impact (a)*
A. Economic Efficiency					
Indicator 1: *Earnings per hour worked*	*Provision of identification card & uniform*		*2,291*	***	*A*
	Waste monopoly		*764,9*	*	*A*
	Donation of tools & machinery		*250,1*	*	*B*
	Regularisation of schedules		*198,2*	**	*A*
		Restriction of collection schedules and police harassment	*-826.5*	***	*B*
Indicator 2: *Quantity collected per hour (recyclable material only)*	*Donation of vehicles*		*18.68*	*	*B*
	Coordination with waste lorry		*5.509*	***	*B*
		Restriction of collection schedules and police harassment	*-29.65*	***	*B*
B. Social Equity					
Indicator 3: *Income relative to minimum wage*	*Provision of identification card & uniform*		*0.714*	*	*A*
Indicator 4: *Gini coefficient within cooperatives*	*Provision of identification card & uniform*		*-0.142*	***	*A*
	Access to recycling centre		*-0.054*	***	*A*
	Restriction of collection schedules and police harassment		*-0.015*	**	*B*
	Place to leave children		*-0.012*	**	*A*
	Promote waste segregation		*-0.005*	***	*A*
	Regularisation of schedules		*-0.003*	*	*A*
		Coordination with waste lorry	*0.005*	**	*B*
		Donation of tools & machinery	*0.006*	**	*B*
		Donation of vehicles	*0.020 / 0.025*	***	*B*
C. Environmental Protection					
Indicator 5: *Quantity collected per hour (recyclable and reusable material)*	*Donation of vehicles*		*21.09*	*	*B*
	Waste monopoly		*11.61*	*	*A*
	Coordination with waste lorry		*6.223*	***	*B*
	Waste segregation		*2.585*	*	*A*
		Restriction of collection schedules and police harassment	*-30.64*	***	*B*
Indicator 6: *Kilograms of toxic material collected per month*	*Access to credits*		*62.56*	*	*A*
Indicator 7: *Diversity of materials collected*	*Provision of identification card & uniform*		*4.009*	**	*A*
	Provision of a recycling centre		*2.269*	*	*A*
	Restriction on work in landfills		*0.579*	**	*A*

Notes:

a) Overall Impact A denotes municipal policies that have only a positive impact across indicators; B refers to municipal policies that have both positive and negative impacts across indicators; C denotes policies that have only negative impacts across indicators.

b) Where 1 signifies 'I never go with my child/children to collect waste' and 6 signifies 'I always go with my child/children to collect waste'

c) Where 1 signifies 'I always clean up after collecting/sorting waste' and 6 signifies 'I never clean up after collecting/sorting waste'

**** p<0.01; ** p<0.05; * p<0.1 : Robust standard errors in parentheses*

Table 5: (continuation)

Response Variable	*Positively Impacting Policy*	*Negatively Impacting Policy*	*Magnitude*		*Overall Impact (a)*
D. Negative Externalities					
Indicator 8: *Frequency of workplace accidents*	*Provision of a recycling centre*		*-2.695*	***	*A*
	Restriction of collection schedules and police harassment		*-2.224*	**	*B*
	Provision of identification card & uniform		*-2.091*	*	*A*
	Donation of tools & machinery		*-0.751*	**	*B*
	Regularisation of schedules		*-0.642*	***	*A*
		Storage in an informal plot	*2.125*	***	*C*
Indicator 9: *Child work (b)*	*Place to leave children*		*-2.7 /-2.126*	*	*A*
	Restriction on work in landfills		*-0.321*	*	*A*
Indicator 10:*Waste Dispersion (c)*	*Provision of a recycling centre*		*-1.314*	**	*A*
Indicator 11: *Number of hours worked in a week*	*Restriction of collection schedules and police harassment*		*-0.931*	***	*B*
	Provision of identification card & uniform		*-0.695*	***	*A*
	Provision of a recycling centre		*-0.546*	***	*A*
	Donation of tools & machinery		*-0.198*	**	*B*
	Regularisation of schedules		*-0.129*	**	*A*

Notes:

a) Overall Impact A denotes municipal policies that have only a positive impact across indicators; B refers to municipal policies that have both positive and negative impacts across indicators; C denotes policies that have only negative impacts across indicators.

b) Where 1 signifies 'I never go with my child/children to collect waste' and 6 signifies 'I always go with my child/children to collect waste'

c) Where 1 signifies 'I always clean up after collecting/sorting waste' and 6 signifies 'I never clean up after collecting/sorting waste'

**** p<0.01; ** p<0.05; * p<0.1 : Robust standard errors in parentheses*

The regularisation of waste-pickers' collection schedules means that, in the long run, neighbours are able to get to know waste-pickers personally, again influencing the trust inherent in their relationship. As explained by Esteban (52), a leader of the MNRCh:

> *E: Here in this street…a waste-picker comes every other day…always following the same schedule…We have work in this office for 4 to 5 years…it's always been the same guy...Now, we know him...People (in this street) recognise him and gather 'cachureos' and (recyclable) material for him.*

The supportive policy of providing waste-pickers with processing machines allows workers to increase the value of their recyclable materials, leading to higher prices paid per kilo and thus higher salaries. As stated by Esteban (52) in another intervention:

> *E: Our cooperative is paid the highest prices (per kilo) amongst all waste-pickers in Chile…because we have a…baler machine. Today, we are getting paid 68 pesos per kilo [0.11USD]of cardboard…In Santiago, the maximum amount paid is 40 [0.06 USD].*[i]

` Running counter to these examples, policing of the activity restricts the access that waste-pickers have to higher income urban areas, where recyclable material of higher quality is concentrated in larger amounts. Policing also prohibits waste-pickers from selling in informal markets, depleting an important source of their income. These points are explained by Fernando (56), Gloria (54), Hugo (55), Daniela (60) in my focus group in Cerrillos:

D: Uphill (in high-income areas) you get better (recyclable and reusable material) than here.
G: That's the problem; you can't go to work there uphill.
F: What happens uphill is that the civil police, the investigation police, the municipal police, all harass you…they say that we are 'sapeando' (trying to commit a burglary), we are stealing. So, we try to avoid (these situations) where they kick us out.
G: At least now we can work here [in Cerrillos], because for a time we couldn't. (The municipality) expelled us many times.
F: Of course, before we used to sell in La Serena (a street market)…they kicked us out.
H: The municipal inspectors and the police…and in the past municipal administration…have separated us (from the informal market).
G: We had to move elsewhere…you could sell little or nothing (of the 'cachureos')…

Local industry productivity: quantity of recyclable material collected per hour (indicator 2)

Regarding indicator 2, the quantity that each waste-picker collects in an hour faces a significant rise with the provision of motorised vehicles and coordination with the waste lorry. When vehicles are provided for waste-pickers, the entire collection process is sped up and they are able to carry more material with each trip, resulting in higher collection rates per hour. Claudia (48), a waste-picker form La Reina, expands on this:

C: I was able to grow, increasing the number of things that I collected… (I started with) a shopping trolley…next, I had a tricycle, which was a wonderful step. But, I was still struggling to work all the way up in Pocuro Street, since I recycle in Providencia [located further down the hill], so I used to get exhausted, but it was still an improvement. When I got the pick-up van, I was so happy…now I can go anywhere…wherever people (with materials to provide) call for me. I can carry big things that I could not before…tables, kitchens….

The coordination of waste-pickers with the waste lorry schedule has a significant impact on increasing quantities collected per hour. Without this coordination, waste-pickers risk arriving to collect materials after the waste lorry has passed through for collection. When waste-pickers know the route and time of waste lorries, however, they can first come through to salvage almost all recyclable and reusable materials in an urban area before it can be taken away to landfills. This ultimately increases the quantity collected per individual. As explained by Carlos (48), a waste-picker leader from La Reina:

C: Here, everyone knows when the waste lorry passes…waste-pickers start collecting from uphill at 7 am and finish here, near the recycling centre, around 1 pm…This means that almost all the material that can be recycled ends up here (in the recycling centre) and not in the landfill…If a waste-pickers tries collecting at 2 pm he will find very little (material in the streets).

As noted earlier, the adoption of more hardline policing measures restricts the urban areas where waste-pickers collect, reducing the quantities collected. As Belen (58), a waste-picker leader from Santiago Centro and Estacion Central, noted:

B: …The only case when we have problems is when the police (in Santiago Centro) become strict and demand identification cards. So, you are forced to stay in your municipality [Estacion Central] as they create a boundary. Then, things get bad because we collect less. This is because in Santiago Centro there are more (recyclable) materials and 'cachureos'.

Poverty reduction: income relative to minimum wage (indicator 3)

It appears that supporting policies can be effective in moving waste-pickers out of poverty, while simultaneously reducing income differences within cooperatives. More specifically, this indicator appears to be impacted by the provision of identification cards and uniforms, as well as the experience of the worker. The trust and collaboration between locals and externally identifiable waste-pickers discussed earlier leads to higher incomes, as waste-pickers gain access to higher quality and therefore more valuable materials. Moreover, identification cards allow waste-pickers to secure a stable place in street markets, where they are able to sell reusable products. As David (48), a waste-picker of La Reina, noted on this last point:

D: The municipality helps us, and we pay the minimum 200-300 pesos [0.32-0.48 USD] for a municipal permit. We have a good relationship with the police and the municipal inspectors. I will say to the inspectors: I have to go to recycle, I won't be able to go to the 'feria' [street market]. (And they say): no problem, good luck…and I keep my stall (in the 'feria').

At the same time, waste-pickers' experience plays a role in learning more efficient ways to carry out their work. Their experiential learning includes, but is not restricted to, selecting the most profitable routes of collection, locating the most appropriate buyers for materials and managing and maintaining customer relationships. As explained by Natalia (48), from La Reina, Sebastian (62), from Maipu, and Lorenzo (45), from Cerrillos:

N: To recycle you need be talented, because if you don't know how to recycle you'll find nothing. If you don't know better…you put your hands in the rubbish bin and you find rats, dead cats…So, with the years, now I know the good spots, the streets where you find rubbish and the ones where you find (recyclable) material.

S: (I collect) bottles…'petacas' (small bottles of alcohol)…There are some people that buy these bottles and they pay well…. I have the whole (recycling) market in my head…over the years I have learnt where to sell.

L: Experience has taught me how to do my work...I have learnt to look after the locals in the neighbourhood… if you treat people badly (they will say): no, don't donate to him…If I treat people well, the clients will say: give to him because he is kind, he is not rude. Treating people well is fundamental.

Income equality: Gini coefficient within cooperatives (indicator 4)

In relation to reducing income differences within cooperatives (indicator 4), a large number of support policies appear to be effective: the provision of recycling centres, the promotion of waste segregation, providing identification cards and uniforms, allowing coordination with waste lorries, the regularisation of schedules of collection and providing workers with a place to leave children during the workday. Recycling centres homogenise the prices paid per kilogram to waste-pickers. This is because all waste-pickers sell in one single location and those selling in small quantities are not penalised with lower prices. Moreover, waste-pickers associated with the recycling centre share in any profits made from the centre. Esteban, a waste-picker leader from the MNRCh, explains:

E: The recycling centre creates a change…(waste-pickers) benefit because they are paid a higher price (per kilo), but also later on…(because the cooperative) has to invest in improvement (of the recycling centre) or distribute the profits, and it is the members who decide what to do…So, you see the benefits even though you sell every day in small quantities.

As detailed above, the promotion of waste segregation, the regularisation of collection schedules and the provision of identification cards and uniforms are all factors that aid less socially capable individuals in gaining the trust and support of locals, and this in turn increases their productivity and salaries. Antonio (52), a waste-picker from La Reina, explains how the municipal support helps him to gain the cooperation of his neighbourhood:

A: When we started, we were all accompanied by a municipal officer as well as a monitor from Casa La Paz [and NGO]…I worked with Carlos [from the municipality], teaching people what to give (for recycling and reuse) and what not to give, door to door. It was hard work. We were given our uniforms and houses to visit…now almost all families know us and they help us (to recycle).

Female waste-pickers face a higher burden of family tasks, meaning that they must dedicate more hours to childcare. Through the provision of public childcare centres, women are able to increase their working hours (and feasibly their productivity while at work), in turn increasing their monthly salaries and decreasing inequality when compared to their male counterparts. As stated by Paula (28), a waste-picker of La Reina:

P: I have my son, and for me it is complicated to work…because I cannot leave my children alone. I have a partner…but he works, and I have problems going to work with three children…wherever I go, I go with them. I go to the 'feria' with them, from the 'feria' to the house, then to collect (materials), everywhere. So if I had help from someone to take care of them I could work more hours and faster.

Restrictions of workday length and police harassment tend to reduce inequalities within a waste-picker collective. A short workday means that all waste-pickers obtain a lower monthly salary due to working fewer hours, and police harassment ensures that more profitable areas not accessible to waste-pickers. No waste-pickers are able to excel at their work and increase their productivity, and as a result, waste-pickers become homogenously poor.

On the contrary, coordination with waste lorries can increase inequality within a cooperative if not all members are able to participate in scheduled collection, as some members' salaries are left behind. The donation of vehicles and processing machinery has a similar effect as, in general, they are received by only a few members within a cooperative. This in turn increases the disparities in capital endowments among waste-pickers, which creates differences in individual productivity, and thus, in salaries. Fernando (56), a waste-picker of Cerrillos, and David (48), a waste-picker from La Reina, describe the advantage they have as a result of their access to vehicles and machinery:

F: I have a pick-up van to recycle better, in larger quantities, to earn more and have a better salary. This allows me to work uphill (in high-income urban areas) all night…where you can obtain items of higher value.
D: Triturated plastic, when it's chopped, (the recycling companies) pay around 700 pesos per kilo…because it's almost raw material…I have (a machine), so you go turning the bottles and putting them in a bag, you can put in up to 40 kilos…

When all members of a cooperative do not have access to this technology, some workers' wages are left behind. This leads to a wider general disparity in monthly salaries amongst the community.

Prevention of waste entering landfills: quantity of recyclable and reusable material (indicator 5) and toxic material (indicator 6) collected

Supporting policies seem to have a positive impact on waste-pickers' environmental protection indicators. Regarding the prevention of waste from ending up in landfills (indicator 5), the provision of vehicles, waste segregation by the household and creation of a waste monopoly all have a positive effect. Since motorised vehicles allow waste-pickers to speed up their collection process when compared to more rudimentary methods of collection, workers are able to collect a larger total quantity of material (both for recycling and reuse), which stops these items from entering landfill. By arriving to collect materials before the waste lorry, waste-pickers are able to selectively collect items for reuse and recycling that would otherwise have been picked up in bulk by lorries, once again bound for landfill. When households participate in waste segregation, the entire collection process for recyclable and reusable waste is sped up, and waste-pickers can collect more materials in less distance and time. Regarding the creation of a monopoly over the waste of a certain urban area, alongside leading to the collaboration of neighbours described above, it also minimises problems of redundancy that arise when several waste-pickers are collecting in the same area. Fernando's (56), a waste-picker form Cerrillos, and Sofia (46), a waste-picker form La Reina, contrasting comment exemplify how waste monopoly solves the redundancy problem:

F: We have our cooperative, but there are other waste-pickers that do not belong to any cooperative… they go everywhere, they don't have a fixed route…it often happens that you go (to a street) and someone already took everything…so you are forced to move to a different urban area.

S: Every waste-picker has their neighbourhood…the locals enrol themselves and the municipality assigns a waste-picker…Nobody goes beyond their area…This is good because everyone knows that they are going to collect their materials and nobody else is going to take them first.

Since police harassment significantly reduces the urban area covered by waste-pickers, the result of repressive policies is lower overall rates of collection of reusable and recyclable materials, meaning once again that these materials enter landfills, hence its negative overall effect on indicator 5.

Regarding the collection of toxic materials (indicator 6), it is only through access to credit that waste-pickers are able to obtain the necessary capital to manage this type of waste – waste-pickers without access to appropriate tools tend to avoid the collection of toxic materials for fear of sustaining injuries. Belen (59), a waste-picker leader from Santiago, explains:

> *B: I received a credit with the Banco Estado. There are waste-pickers that have received up to one million pesos. Usually, we use them for tricycle supplies or for business growth. For example, I want to build a small storage space in my house…that allows me to collect products like batteries. This is fundamental (for my business)…*

Diversity of material recycled: number of different materials recycled (indicator 7)

In relation to the diversity of materials collected (indicator 7), provision of a recycling waste centre, the identification of waste-pickers and allowing waste-pickers to collect in landfills are policies that have a significant impact. Some materials are not profitable in small quantities (time spent searching/collecting/selling them versus price paid) or require cleaning to be recycled (such as cardboard or detergent bottles), thus are not collected under normal circumstances. With access to a recycling centre, waste-pickers are able to store material found in small quantities until they reach a quantity worth selling. As described by Natalia (50), Claudia (48), Victor (60) and Antonio (52), in a focus group with waste-pickers in La Reina:

> *V: The problem (with recycling some materials) is that our houses are too small.*
> *N: You cannot store (recyclable) material, you cannot store the 'cachureos'...Only the tricycle. I have only the most necessary things.*
> *C: Of course, in a recycling centre you can recycle more things… they recycle bottles or cans that you cannot keep in your house.*
> *A: For example, we recycle plastic bottles at green points…we store them there in big bags. In your house you cannot do this because of the space.*

As identification cards and uniforms increase the neighbourhood collaboration, materials tend to be cleaned before being handed in for waste collection. As Sofia (46), a waste-picker leader from La Reina, noted:

> *S: …the neighbours already know what we collect and how the material must be…For example, the detergent bottles must be clean because the detergent pollutes. The same goes for the oil bottles… cardboard must to be clean, because if it comes with traces of food you cannot sell it. My neighbours already know this and provide everything cleaned.*

Finally, landfills provide larger quantities of the less profitable materials, making their collection in large quantities more convenient. As Esteban, a leader of the MNRCh, explains:

> *E: In landfills you collect much more (material than in the streets)…When we worked in the landfill, we collected three times as much as we do now. In landfills, you can collect everything because you have (storage) space so you can collect in large quantities…*

Physical health: frequency of workplace accidents (indicator 8)

As well as increasing sustainable performance, supportive policies have a positive impact on reducing the negative externalities of waste-picking. Work-related accidents (indicator 8) can be reduced through the provision of a recycling centre, tools, identification cards and uniforms, and regularising schedules of collection. Recycling centres allow for safer manipulation of recyclable waste

and reduce fire incidents. As notes by Esteban (52), a leader of the MNRCh, and Carlos (48), a waste-picker leader of La Reina:

> *E: Waste-pickers are exposed to accidents as…cuts, falls, being run over…Sadly, waste-pickers continue to use their homes for storage…this is a weak point…because it creates a risk of fire and sanitary problems when conditions are not adequate….these problems do not occur in formal storage spaces.*
>
> *C: Wherever you go, you will never find a waste-picker with gloves…However, to work here (in the recycling centre), goggles, gloves, safety boots (are provided)…for safety reasons.*

The provision of tools reduces accidents that occur when waste-pickers collect with tricycles, when opening plastic bags or when sorting through waste for classification. As observed by Claudia (48), and Natalia (50), two waste-pickers of La Reina:

> *C: (If I have enough money), I will buy the right type of clothes to collect at night-time. You have to wear something warm, gloves and safety boots; currently I am using sneakers.*
> *N: I will use my money to repair my tricycle, (to buy) safety equipment for myself, to protect my hands, gloves, safety shoes, a reflective jacket and lights to work more safely.*
> *C: …for summer, solar cream and a sunshade…*

The regularisation of collection schedules and provision of card identification make neighbours more willing to provide pre-organised material, thus avoiding risks that arise from manipulation of waste. As expressed by Natalia (50), a waste-picker of La Reina.

> *N: My neighbours know when I come, and have everything ready…I don't put my hands into the waste, I have taught them… they give me everything clean, crystal clean…They give one plastic bag with the 'cachureos', another with the cardboard, another with newspaper, everything separated...*

Policies of restriction of waste-pickers' working hours reduce accidents simply because waste-pickers spend less time overall collecting in the streets and opening garbage bags, and are thus exposed to a lower number of opportunities for accidents. On the contrary, the storage in an informal plot increases fire-related incidents and accidents associated with the manipulation of waste. As Esteban (52), a leader from the MNRCh, explains:

> *E: The problem with the accumulation of waste in (illegal) plots is the risk of fire and sanitary problems. You do not have the right conditions to hoard. Moreover, sometimes you have(other type of) accidents, cuts, with broken bottles or sharp pieces of steel, as waste is dispersed all around.*

Child labour: frequency of waste-pickers accompanied by a child (indicator 9)

The results for the frequency of children located at the workplace (indicator 9) raise an interesting point. Contrary to the literature, and as female waste-pickers consistently stressed during interviews, bringing children to work is not used as a means of complementing a waste-pickers' salary (Porto *et al*. 2004) as this indicator is not statistically significant, but is rather the result of having few alternative options for places to leave children during the workday. In this sense, the availability of public facilities (nurseries or schools) or the use of waste-pickers' social networks (relatives, friends or neighbours) significantly reduces the frequency of the indicator for children at the workplace. In addition to the comments made by Paula (28) above, Esteban (52), a waste-picker leader from the MNRCh, offers an explanation:

> *E: I used to go with my children to work in my pick-up van, and even on the tricycle with my older (daughter) in a wooden banana crate…because who could I leave her with? …This (problem) affects more women than men…our female co-workers have had to leave their children at home or take them to work many times, because they do not have access to public childcare. When they do have access to it, since we don't have a formal job, we have to pick them up either in the morning or in the afternoon, whereas if you have a formal job they will keep children all day. We*

have spoken with some municipalities…to keep them in the nursery longer, so we can develop in our work. Some of them have accepted…

Waste-pickers collecting in landfills have lower rates of children at work because public institutions target these places to control child labour and offer childcare support to waste-pickers. Esteban (52) again explains:

E: (Eliminating) child labour has been difficult… and I think we still have not won (the battle), because when I go to collect material I still see one or two (children). It happens more often in the streets. In landfills, there is more control, and normally there is the PDI [Investigative Police], the SERNAM [National Service for Women], and the municipality with the DIDECO providing alternative options for places to leave children to allow the parents to work… Many of these children… ended up studying in boarding schools. But on weekends they reappear in landfills…(as) there is nowhere to leave them on Saturdays and Sundays.

Waste dispersion: frequency of cleaning up after collecting (indicator 10)

Waste dispersion (indicator 10) can be reduced by providing a recycling centre where neighbourhoods can bring their recyclable materials. This reduces the overall quantity of waste that is extracted from rubbish bins, and in turn minimises 'challas' – literally 'confetti', referring to the trail of waste that is sometimes left behind as waste-pickers follow their collection route. Carlos (48), a waste-picker leader of La Reina, discusses some of the negative environmental side effects of waste-picking:

C: Opening up garbage bags…(can) make it harder for the companies that collect waste (for disposal). Also, (waste-pickers) scatter things (during their routes)…Of course, a recycling centre or a green point reduces the (scatter of) waste because people bring their waste material directly. So, the amount of material collected on the streets is lessened.

Working conditions: number of hours worked in a week (indicator 11)

Finally, workweek length (indicator 11) can be reduced through the provision of recycling centres, tools, identification cards and uniforms, and the regularisation of collection schedules. Waste-pickers decide their workday length according to how much they want to earn, i.e. they stop when their reach a personal quota (determined by their anticipated salary after selling the recyclable and reusable material) that will cover their expenses. Esteban (52), a waste-picker leader of the MNRCh, and Carlos (48), a waste-picker leader of La Reina, explain:

E: To decide when to stop (working), you normally look at your quota – if it is little, you must continue to work…For example…when I see that the pick-up van (isn't carrying material worth) 25 000 pesos [40.25 USD], I make another trip…I continue not because I like it, but because I know that I have to cover the costs of my house, my children, the school…

C: A waste-picker doesn't stop working until… they have reached their quota. If you see that in your tricycle, between the 'cachureos' and the (recyclable) material, you have around 7 000 to 8 000 thousand pesos [11.27-12.88 USD], you start to go back (home)...

As explained with regards to indicators 1 and 3, through the provision of recycling centres, tools, identification cards and uniforms, as well as the regularisation of collection schedules, waste-pickers are able to increase their earnings per hour. In relation to workday length, this means that waste-pickers can reach their quote in fewer hours on average. On a negative note, although the restriction of the workday and harassment forcibly reduce the hours worked by waste-pickers, this means workers will often need to end a day's work before reaching their quota, and so it comes at the cost of their income.

Table 6: OLS models testing local policy impact on economic efficiency and social equity

VARIABLES	1 Earnings/ hour worked	2 Kilograms/hour worked (recyclables)	3 Multiple of Minimum Wage	4 Income Inequality (cooperative)	5 Kilograms per Worker (reuse and recyclables)
Income		3.08E-05		-	3.14E-05
		(-0.0000275)			(-0.0000273)
Workday		-19.31***	0.0326	0.00153	-20.70***
		(-6.118)	(-0.183)	(-0.00509)	(-6.043)
Age	-3.012	-0.0839	-0.00833	-3.52E-05	-0.0102
	(-15.25)	(-0.286)	(-0.00775)	(-0.000214)	(-0.277)
Gender (Male)	50.65	2.858	0.236	0.000136	1.882
	(-271.1)	(-4.744)	(-0.166)	(-0.00498)	(-4.634)
Experience	2.647	-0.0598	0.0175*	-0.000518	-0.131
	(-26.76)	(-0.328)	(-0.00922)	(-0.00043)	(-0.325)
Access to credits	-114.9	9.309	0.143	0.00457	7.711
	(-386.1)	(-8.231)	(-0.241)	(-0.00545)	(-8.032)
Tools & machinery	250.1*	3.32	0.0165	-0.00576**	3.038
	(-138.1)	(-2.675)	(-0.0801)	(-0.0023)	(-2.706)
Tricycle	201.7	1.209	0.221	0.0195**	3.655
	(-333)	(-6.91)	(-0.242)	(-0.00924)	(-7.409)
Van/Truck	793	18.68*	0.486	0.0247***	21.09*
	(-511.2)	(-10.32)	(-0.32)	(-0.00909)	(-10.72)
Recycling centre	444.2	-7.289	-0.094	-0.0538***	-8.744
	(-377)	(-7.594)	(-0.228)	(-0.00659)	(-7.543)
Informal Plot	136.7	13.99	0.0366	0.00743	12.01
	(-487.2)	(-12.63)	(-0.323)	(-0.00623)	(-12.01)
Identification and uniforms	2,291***	-12.73	0.714*	-0.142***	-12.66
	(-589.8)	(-11.23)	(-0.394)	(-0.00784)	(-10.74)
Coordination with waste lorry	-63.42	5.509***	0.0153	0.00457**	6.223***
	(-157.8)	(-2.012)	(-0.0639)	(-0.00194)	(-2.023)
Waste monopoly	764.9*	10.01	0.324	0.00794	11.61*
	(-408.4)	(-6.176)	(-0.217)	(-0.0119)	(-6.141)
Regularisation of schedules	198.2**	-0.689	0.0623	-0.00306*	-0.424
	(-73.83)	(-1.433)	(-0.0572)	(-0.00178)	(-1.376)
Waste segregation	-115	2.398	-0.0711	-0.00472***	2.585*
	(-133.8)	(-1.441)	(-0.0656)	(-0.00169)	(-1.424)
Collection in landfills	66.77	0.491	0.00983	-0.000893	0.615
	(-217.3)	(-1.57)	(-0.0909)	(-0.00226)	(-1.523)
Place to leave children (social network)	56.83	5.021	0.0646	-0.0116**	4.904
	(-277.5)	(-4.429)	(-0.239)	(-0.00531)	(-4.616)
Place to leave children (school/nursery)	-96.27	4.195	0.0543	-0.00141	3.085
	(-484.3)	(-6.209)	(-0.308)	(-0.00762)	(-6.038)
Restriction of workday length and harassment	-826.5***	-29.65***	-0.158	-0.0150*	-30.64***
	(-398.1)	(-9.511)	(-0.335)	(-0.00746)	(-9.631)
Constant	48.91	-14.88	0.161	0.289***	-22.28
	(-1676)	(-21.32)	(-0.726)	(-0.0248)	(-20.66)
Observations	59	59	60	61	58
R-squared	0.445	0.601	0.496	0.917	0.627

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Ols models testing local policy impact on environmental protection and negative externalities

VARIABLES	6 Kilograms of Toxic Materials/ Month	7 Diversity of Material Collected	8 Number of Accidents	9 Frequency of Child Labour	10 Waste Dispersion	11 Working Week Length
Income	-0.000115	-5.85E-06	-4.04E-07	1.33E-06	-1.74E-06	1.14E-07
	(-0.00016)	(-0.0000036)	(-0.00000345)	(-0.00000223)	(-0.00000171)	(-0.000000752)
Workday	25.38	0.794	-0.762	-0.582		
	(-34.92)	(-0.79)	(-0.593)	(-0.533)		
Age	-1.642	0.0468	0.0141	0.00404	-0.00496	0.00618
	(-1.558)	(-0.0466)	(-0.0272)	(-0.023)	(-0.0101)	(-0.0085)
Gender (Male)	24.92	-0.752	0.879	-0.56	-0.123	0.0586
	(-38.65)	(-0.701)	(-0.561)	(-0.555)	(-0.22)	(-0.156)
Experience	-0.41	-0.00399	0.0632	0.0195	0.00275	0.00424
	(-1.685)	(-0.0429)	(-0.0403)	(-0.034)	(-0.0159)	(-0.0103)
Access to credits	62.56*	-0.157	0.727	-0.0211	0.123	-0.116
	(-34.26)	(-0.932)	(-0.608)	(-0.614)	(-0.297)	(-0.134)
Tools & machinery	-1.2	-0.233	-0.751**	0.137	0.093	0.198**
	(-21.44)	(-0.376)	(-0.34)	(-0.32)	(-0.121)	(-0.0854)
Tricycle	1.666	-0.0247	0.231	0.592	-0.0426	0.0832
	(-52.73)	(-1.74)	(-0.807)	(-1.09)	(-0.363)	(-0.198)
Van/Truck	-1.635	0.899	-0.549	-0.035	0.237	0.0544
	(-59.68)	(-1.809)	(-0.999)	(-1.089)	(-0.527)	(-0.281)
Recycling centre	-11.39	2.269*	-2.695***	0.258	-1.314**	-0.546***
	(-35.36)	(-1.159)	(-0.625)	(-0.705)	(-0.59)	(-0.198)
Informal Plot	32.08	-0.504	2.172***	-0.161	-0.373	0.0432
	(-33.72)	(-0.961)	(-0.773)	(-0.477)	(-0.384)	(-0.314)
Identification and uniforms	101.7	4.009**	-2.091*	0.293	-0.0676	-0.695***
	(-79.56)	(-1.601)	(-1.108)	(-1.212)	(-0.553)	(-0.243)
Coordination with waste lorry	5.296	-0.164	0.186	-0.166	-0.0932	0.0444
	(-10.92)	(-0.229)	(-0.185)	(-0.25)	(-0.144)	(-0.0603)
Waste monopoly	-96.57	0.0911	1.31	0.649	-0.746	-0.149
	(-68.92)	(-1.475)	(-0.797)	(-1.295)	(-0.545)	(-0.245)
Regularisation of schedules	-5.453	0.211	-0.642***	0.0788	0.108	-0.129**
	(-7.159)	(-0.252)	(-0.195)	(-0.348)	(-0.117)	(-0.0539)
Waste segregation	13.87	0.356	-0.177	0.14	-0.183	-0.00261
	(-8.867)	(-0.259)	(-0.225)	(-0.217)	(-0.165)	(-0.0489)
Collection in landfills	8.454	0.579**	0.0403	-0.321*	-0.13	0.00419
	(-9.231)	(-0.249)	(-0.356)	(-0.19)	(-0.0816)	(-0.0855)
Place to leave children (social network)	15.48	-1.25	-0.223	-2.700**	-0.0178	-0.12
	(-48.51)	(-1.398)	(-0.748)	(-1.024)	(-0.537)	(-0.164)
Place to leave children (school/nursery)	71.35	-1.558	1.335	-2.126*	0.00107	0.138
	(-54.47)	(-1.427)	(-0.939)	(-1.065)	(-0.541)	(-0.2)
Restriction of workday length and harassment	-47.72	-1.501	-2.224**	0.858	0.118	-0.931***
	(-51)	(-1.573)	(-0.939)	(-1.446)	(-0.556)	(-0.255)
Constant	144.3	5.749	2.314	3.538	7.622***	1.029
	(-151.8)	(-4.422)	(-2.311)	(-3.166)	(-1.5)	(-0.796)
Observations	45	54	60	59	59	60
R-squared	0.692	0.516	0.568	0.358	0.411	0.465

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

To summarise, there is no single 'silver bullet' that can increase the sustainable performance of waste-pickers and reduce the negative externalities of the activity, but rather a combination of supportive policies is required. First, municipal policies should focus on increasing capital endowments of waste-pickers, particularly focusing on the provision of vehicles, tools, and a location for waste accumulation. Second, municipal policies need to work towards organise and increase market access of waste-pickers, particularly focusing on the provision of identification cards and uniforms, fostering waste segregation in households prior to collection, providing guaranteed collection areas for waste-pickers and facilitating the regularisation of waste-pickers' collection schedules. Finally, local governments should refrain from actioning policies of repression such as policing and restricting work schedules, which appear to have an overall negative impact.

5. Conclusion: a supporting role for local governments

The objective of this paper has been to analyse the role that local governments play in enhancing waste-pickers' sustainable performance. The study suggests that, contrary to dualist and neoliberal predictions that there will always be a negative relation between government intervention and waste-picker performance, local governmental support policies significantly enhance the sustainable performance of waste-pickers.

The study has shown that existing urban theory does not accurately describe the complex reality of waste-pickers' activities, but that an integrated approach is in fact needed. Scavenging is a one-way road: as dualist theory claims, poverty is the central reason that people initially enter into this activity, but as neoliberal theory suggests, once started, scavenging becomes a permanent activity in the lives of workers, where an increase in the formal employment market does very little to diminish the size of this activity.

At the same time, the results suggest a positive relation between waste-pickers' sustainable performance and levels of government support, i.e. the higher the level of support of local government to the activity, the higher their sustainable performance. Regarding sustainability indicators, waste-pickers under CP performed systematically better, and the DP cooperative working under repressive policies performed systematically worse. Weak support policies generally did not make a significant difference between waste-pickers' performance under SP and NP. Similarly, some negative externalities were significantly reduced as consequence of support policies: the number of work-related accidents was reduced, and extensive workdays saw a decrease to legal levels. The results show that the predictions drawn from co-production theory provided the more accurate framework for understanding the impact of municipal policy.

Finally, the study has drawn a number of support policy recommendations. First, a range of supporting policies is required to increase waste-pickers' sustainable performance and reduce the negative externalities of the activity. Second, municipal policies should focus on increasing capital endowments of waste-pickers, particularly focusing on the provision of vehicles, tools, and a location for waste accumulation. Third, municipal policies need to work towards a more organised picture of waste-pickers, particularly focusing on the provision of identification cards and uniforms, fostering waste segregation in households prior to collection, and facilitating the regularisation of waste-pickers' schedules of collection. Finally, local governments should avoid actioning policies of repression such as policing and restricting work schedules. The findings of this paper relocate the role of positive local government intervention as a central component in achieving sustainable scavenging, and open up discussion about the reliability and relevance of these conclusions for other informal urban economic sectors.

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