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From zero to cash: Waste as a main source for an inclusive recycling business in Cuenca (Ecuador)

De cero a dinero: La basura como fuente principal para un negocio inclusivo de reciclaje en Cuenca (Ecuador)

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Abstract

In an inclusive business (NI) context, this manuscript addresses the relationship between income and recycling. Within recycling, recycle workers are considered poor and vulnerable based on the economic pyramid (BDP) due to their annual income. Moreover, they depict the core of a value chain which includes various participants. On one hand, this research determines if the recyclers´ association membership directly influences their income level. On the other hand, it sets out to evaluate recycling working conditions to reveal an opportunity to generate profitability as an inclusive business. The methodology applied in this research is a cross-sectional study that follows an inductive approach to analyze quantitative information focused on 150 recycle workers, 27 private centers (intermediaries) and 2 recycling corporative centers. The highlights of the results are the value chain design from the city of Cuenca (Ecuador), the high commercial gross margins from intermediaries and the ensuing weak correlation between recycler´s association membership and income level. Hence, the overriding conclusions show that recycling has promising economic advantages conducive to create an inclusive business, considering that intermediaries are the main beneficiaries. Furthermore, recycle workers are limited because of their working conditions, and lastly the recycling association membership does not bring clear advantages regarding income level improvement.

Resumen

El presente trabajo se enmarca en la relación existente entre el ingreso y la actividad del reciclaje bajo el contexto de Negocio Inclusivo (NI). Esta población de recicladores definida como pobre y vulnerable por la Base de la Pirámide Económica (BDP) en función de sus ingresos anuales, es el centro de la cadena de valor de reciclaje. Se plantea determinar si la figura de asociación de los recicladores influye directamente en su nivel de ingreso y evaluar las condiciones en las que se realiza la actividad del reciclaje para analizar la oportunidad de generar rentabilidad como NI para estos grupos vulnerables. La metodología empleada, con carácter cuantitativo-inductivo de corte transversal, se centrará en el estudio de 150 recicladores, 27 centros privados (intermediarios) y dos centros corporativos de reciclaje. En los resultados destaca el diseño de la cadena de valor de reciclaje para la ciudad de Cuenca (Ecuador), la débil correlación entre estar asociado y el nivel de ingreso del reciclador, así como el elevado margen bruto comercial de un intermediario. La conclusión principal demuestra que el reciclaje tiene bondades económicas atractivas para crear un NI y los intermediarios son los principales beneficiarios dentro de esta actividad. Los recicladores se ven limitados por sus condiciones de trabajo y la figura de asociación no se considera como una solución imperante para mejorar su nivel de ingreso.

Keywords | palabras clave

Income, recycle workers, value chain, inclusive business, solid waste, Cuenca.
Ingreso, recicladores, cadena de valor, negocio inclusivo, residuos sólidos, Cuenca.

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1. Introduction and state-of-the-art

This research is part of the need to integrate the population of recyclers into the global economic dynamics through the development of Inclusive Business models (IB), which are business initiatives that incorporate the segment of the "Base of the Pyramid » (BOP) in its value chain, contributing to poverty reduction, generating greater access to opportunities and facilitating these communities to be income-generating and exercising the right to economic freedom (Ishikawa Lariú & Strandberg, 2009), in such a way as to promote the scope of certain Sustainable Development Goals (SDG) such as: end of poverty, gender equality, reduction of inequalities, sustainable cities and communities; And specifically objective 12, which refers to the responsible production and consumption in which the importance of recycling and reducing.

1.1. Waste generation and recycling

Developed and developing countries face population growth and industrial progress associated with the production of large amounts of solid waste (Akhtar *et al.*, 2017; Oyekale, 2017; Yang *et al.*, 2018) because today's society exploits different materials (Vázquez *et al.*, 2016). Our consumption practices increase the rates of solid waste generation (Vieira & Matheus, 2018) since, according to Ribeiro and Kruglianskas (2015), it continues to dominate the linear economic model of extracting, manufacturing, using and discarding (quoted by Wadhy *et al.*, 2017).

Benton-Short and Short (2013) point out that the generation of waste, along with the problems of collection, disposition and environmental risks, continue to be a challenge for many cities (quoted by Jiménez, 2015), besides the management for the municipalities which is a great difficulty (Abdoli, Rezaei, & Hasanian, 2016; Meylan *et al.*, 2018; Botello *et al.*, 2018). This management of municipalities develops with small pilot projects including the informal recycling sector (Ferronato *et al.*, 2018), considering other major public works (Ross & Rogoff, 2012). It means that the increase in the determination of local authorities to resolve these problems is crucial (Ferreira, Bila, & Ritter, 2017).

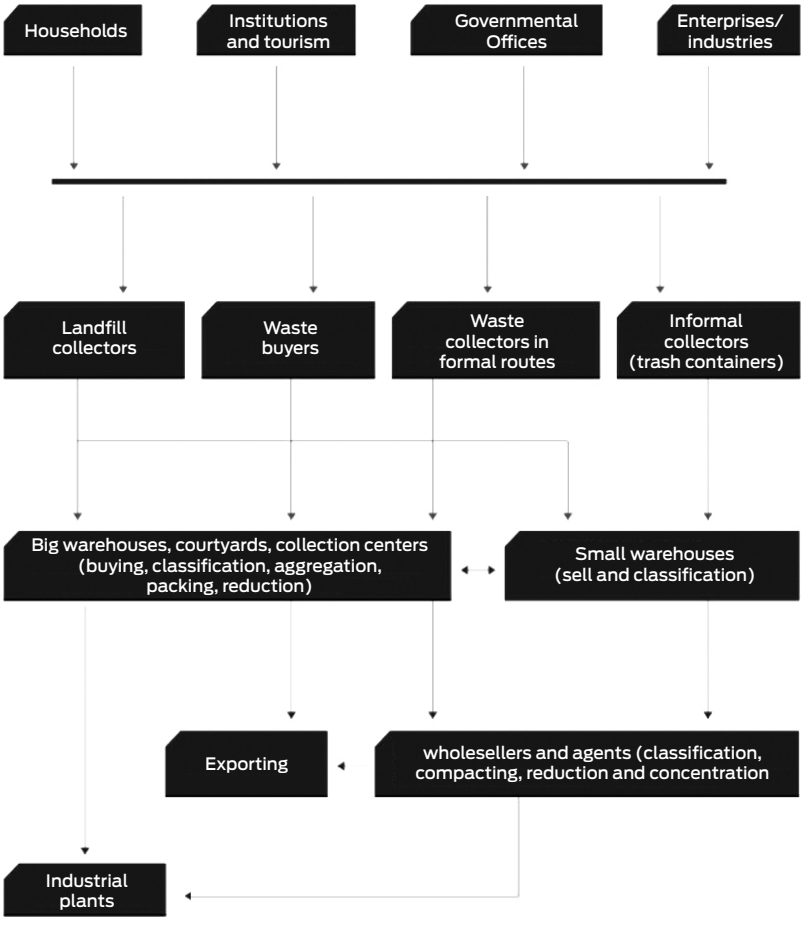
On a global scale, in 2010 a total of 7 to 10 million tons of solid waste was generated (Wilson & Velis, 2015). According to Global Waste Management Outlook (GWMO), nearly two billion tons of Municipal Solid Waste (MSW) per year are produced (quoted by Byamba & Ishikawa, 2017; Sorkun, 2018). Kawai and Tasaki (2016) affirm that in big cities a generation of 2.2 trillion tons is forecast for 2025 (quoted by Gu *et al.*, 2018). Developed countries belonging to the Organization for Economic Co-Operation and Development (OECD) are listed as the countries with the largest amount of waste generated at the global level, such as the United States, Mexico and much of the European Union, among others, generating 62% of waste, followed by East Asia and the Pacific with 21%. For its part, Latin America and the Caribbean (LAC) generate 12% and the remaining 5%, Sub-Saharan Africa (Borrás, 2018).

Hoornweg and Bhada-Tata (2012) mention that the World Bank projects a generation of 220 million tons of urban solid waste for 2025 in LAC (quoted by Hernández *et al.*, 2016). Likewise, in LAC, a 66% increase in waste generation (TN/day) is expected in less than ten years (Padilla & Trujillo, 2018). In fact, in LAC there

are about 0.63 kg/hab/day of solid household waste and 0.93 kg/HAB/day with respect to urban solid waste (Sanmartín, Zhigue, & Alaña, 2017).

Based on the above, it is essential to know the flow of the value chain of recycling, stated by the Regional Initiative for Inclusive Recycling (IRR, 2013): "it starts at the moment that the waste is generated and ends with the sale of the materials transformed into the national industry or its export to third countries" (p. 12). Figure 1 reflects the simplified model of the proposed value chain that may vary according to the reality of each country within LAC.

Figure 1. Recycling Value Chain for Latin America and the Caribbean



Source: Regional Initiative for Inclusive Recycling (IRR, 2013, p. 12).

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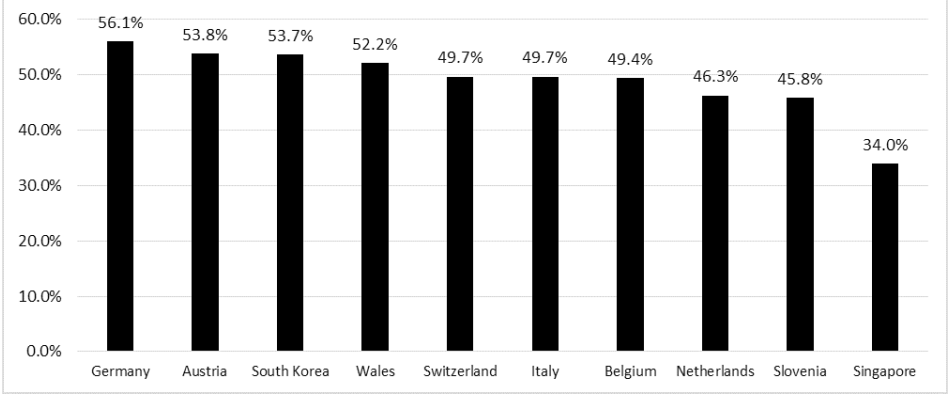
According to the IRR (2013) This «Value Chain» of the sector is composed by different actors grouped according to their work with respect to solid waste: the generators are those producers of the different wastes and solid wastes; the collection is provided by the urban solid waste collection service and the base recyclers. The collected material is transferred to collection centers or intermediaries that accumulate and commercialize so that the material is at the disposal of industrial plants or it is exported in the case of not existing a local market (IRR, 2013).

Castells (2012) defines recycling as an operation that allows recovering, transforming and elaborating a material from waste, also notes that "recycling and waste, respond to various activities that can be used from the different waste streams to take advantage of it for the same use or for another" (quoted by Álvarez, 2013, p. 11), reducing costs in the management of landfills, pollution impacts and health problems (Sullivan Sealey & Smith, 2014). According to Gray (2017), of the World Economic Forum (WEF), Germany is a world leader with 56.1% of the MSW recycling rate, as shown in Figure 2; Austria with 53.8%, South Korea with 53.7%, Wales with 52.2% and the rest of countries are located below 50%.

Figure 2. Top 10 Municipal Solid Waste Recycling Rate 2017



Source: World Economic Forum (WEF).

1.2. Classification of waste in Ecuador

According to Bravo and Bravo (2012), recycling in Ecuador started with the implantation of a paper factory in the year 1970, requiring recycled material as the main raw materials to produce their products (quoted by Silva *et al.*, 2015). In 2017, the country recycled only between 15 and 25% of the total of one million tons that were recovered (Alarcón, 2017).

According to the National Institute of Statistics and Censuses (INEC, 2017) at national level, 47.47% of Ecuadorian families classified waste, showing a percentage higher than 2015 and 2016 with 39.40% and 41.46%, respectively. Plastic is the most recycled residue nowadays (32.98%), surpassing organic waste, such as paper, cardboard and glass (INEC, 2017).

According to the IRR (2017b) in 2014, 4'100,000 ton of solid waste were generated, of which 1'025.000 are potentially recyclable residues and only 24% of that potential was recovered and recycled. 51% of the 245,000 recycled tons were recovered by base recyclers in the main cities of the country. In 2017, the number of families in Cuenca that classified waste was around 53.37%, ranking above Guayaquil, Machala and Ambato (INEC, 2017).

1.3. Cuenca, a city with potential

Based on the fact that base recyclers are people with low resources that "collect and classify waste in the streets, landfills to open air or other points in the MSW chain looking for materials with potential resale value (...) they tend to belong to the poorest and most vulnerable sectors of society" (The Economist Intelligence Unit, 2017, p. 7); however, the designation of primary recyclers (PR) proposed by the Municipal Public Company for the Cleaning of Cuenca (EMAC-EP, 2018) will be used. It Is Important to note that the vulnerability of this population must be addressed from a well-recognized priority base for human well-being, including food security, income, water and sanitation, health, education, energy, gender equality, social equity and jobs (Velenturf & Jopson den, 2019).

These people are in the concept of the "Base of the Pyramid" (BOP), developed by Prahalad and Hart (2002), divided in levels according to annual income per capita based on Purchasing Power Parity (PPP), using the graph of a pyramid for representing the income ranges. At Level 4 – called the BOP – "There are 4 billion of people whose income is less than $1,500.00 dollars a year" (Jimbo, 2016, p. 143).

Given the above conditions, it is obvious that the idea of forming a recycling environment is feasible, according to the contributions of the Lacandon (2013), Prahalad and Hammond (2005), AVINA (2010), who consider the IB as business strategies that "seek economic profitability under the social and environmental perspective, where the first beneficiaries are the people in a situation of poverty and vulnerability, being strategic allies the companies and the state for their achievement" (quoted by Jimbo & Ñauta, 2017, p. 102).

Additionally, there is the potential for the creation of recycling in Cuenca. This statement is supported by the data provided by the EMAC-EP (2018), which ensures that only in 2017, the per capita generation of waste and solid waste in the urban area was 0.54 kg/hab/day, ascending to 9,288 TN/month; of which 25.8% is usable inorganic material and this material is recovering only 19.2%. In general, the inorganic material is perceived with a null monetary value, not so for the PR, since they are considered a resource by the potential to generate profits by means of its recycling (Giovannini & Huybrechts, 2017) causing that on a global scale "15 Millions of people are involved in the informal recycling of waste" (Yang *et al.*, 2016, p. 452). In addition, the efficient management of shared natural resources and the way in which toxic waste is eliminated is the vital livelihood for achieving the objective of responsible production and consumption, in order to create more efficient production and supply chains (UNDP, 2016).

2. Materials and method

In this paper is proposed as a starting hypothesis that the income level of a primary recycler (PR) is not based on its associate status. It aims to answer the following

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objectives: i) to determine the relationship between the income and the way of carrying out its activity: associates vs. non-associated; evaluate the conditions under which the recycling activity is carried out in Cuenca (Ecuador) and; analyze whether there is an opportunity to generate profitability in recycling under the context of IB.

This is a quantitative design research, with inductive and cross-sectional approach articulated as a field work. the formula proposed by Murray and Larry (2009) was used to determine the sample, which applies to finite populations: with a confidence level of 95% and a sample margin of +/-5%; the result obtained was a total of 150 observations. According to the official registry of the EMAC-EP, in July 2018 a total of 246 PR were recorded in Cuenca, population that was considered as the sample.The application of surveys to the 150 PR was carried out in calls made by the EMAC-EP, with the purpose of obtaining data concerning the recycling activity. In the same way, technical visits were made to the only two corporate recycling centers in order to obtain information concerning the management of the recovered material and as a measure of validation and control; the filling of Information forms to 27 private recycling centers (intermediaries) identified in the city was also performed.

The design and structuring of surveys and forms are based on instruments used in IRR research (2017a) that were adjusted to comply with the objectives of this research. In the case of PR, the survey consisted of 25 questions categorized in the following dimensions: (i) General Data; Educational Level and; III. Conditions and characteristics of the recycling activity. For intermediaries, the forms consisted of 14 questions. If an intermediary does not provide information, it is excluded by not providing interest data. In addition, they were categorized into two dimensions: General Data and Economic Activity.

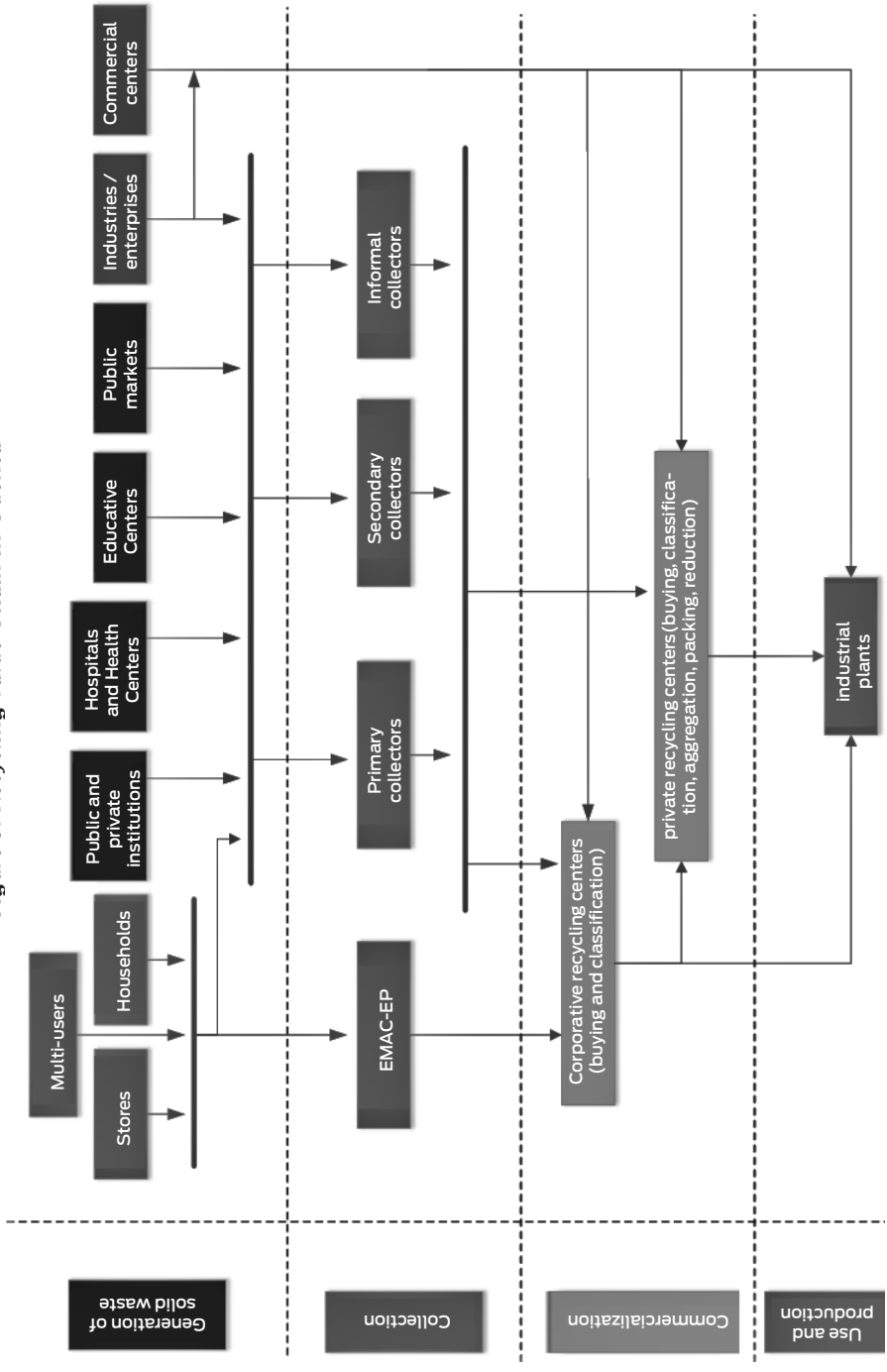
The registration, tabulation and processing of the data obtained were made using the Excel statistical tool for the generation of information. To establish the degree of representativeness among the variables of income and association, a test of hypothesis, correlation analysis and analysis of variances (ANOVA) was employed. The latter proved that the averages of two or more populations are the same, compared to the average income variations of the recyclers that are associated vs the non-associated. Additionally, it was considered necessary to externalize the antagonism degree presented by the entry of an intermediary compared to that perceived by a PR, exposing the gross commercial margin by commercialized material. This is framed by the varied realities presented by the recycling activity at each level of the recycling value chain.

3. Analysis and results

3.1. Recycling value Chain in Cuenca, primary recyclers as a main piece

The criteria presented by Porter (1986) and Francés (2001), help to conceptualize the value chain as an analysis tool that allows to identify ways of generating value based on making the greatest effort to achieve the fluidity of the productive processes (quoted by Quintero & Sánchez, 2006). Figure 3 shows the recycling value chain designed for Cuenca based on the observation made and the information provided by the EMAC-EP.

Figure 3. Recycling value Chain in Cuenca



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According to Figure 3, the generators are the producers of waste and solid waste that correspond to the citizenship in general. According to EMAC-EP (2018), Cuenca has a population of 591,996 inhabitants with 565,476 belonging to the urban part, so their conviction for a correct separation of these residues is necessary (De Feo *et al.*, 2018).

In the second phase, the collection, EMAC-EP and primary (PR), secondary and informal recyclers intervene. The public company transports the material only from one segment of the generators. PR are authorized by the EMAC-EP to collect it using non-motorized means of transport unlike the secondary ones that have a motor vehicle for the transfer of the recovered material. Finally, there are the informal recyclers, whose record is unknown by the EMAC-EP because they recycle without authorization.

Two types of collection centers are displayed: the first called "Corporate Recycling Centers" (CRC), administered by PR associations that retrieve, classify and market the material. The second type are the "Private Recycling Centers" (PRC), commonly recognized as intermediaries and who perform additional work on CRC, such as packaging and/or processing.

The process ends with the industries that supply the recycled material as raw matter for its production, such as Acería del Ecuador C.A. Adelca and Cartopel as the only companies in Cuenca. Scrap, bronze, copper, aluminum, paper, cardboard and duplex are required by the local market, while the rest of the materials are sold outside the municipality, sending to cities such as Guayaquil and Quito.

As shown in Figure 3, PR are fundamental in the value chain and it is important to present the conditions under which they perform the activity. By conforming 76.7% of women and 23.3% of men, it supports what the International Labor Office (ILO) alleges about the greater participation of women in informal employment (quoted by Ogando, Roever, & Rogan, 2017) who have found in the recycling a job opportunity. Its average age is 45 years, with a minimum age of 19 and a maximum of 77 years. 75.7% of the female gender sample received primary or secondary education and the remaining 24.3% never attended formal schools. For their part, 88.6% of males had academic training and only 11.4% received no instruction.

This activity has been done for about 12 years on average, where 77.0% of PR work in the streets looking in the historic center, main avenues, citadels, parks, markets and the industrial park. The collection centers have 10.9% of recyclers; 7.5% obtain in institutions and buildings; 4.6% work in other parts of the city. 53.3% of the recyclers prefer to work alone and 46.3% do it on average in groups of three people, commonly made up by the spouses or members of their family circle, so that the income received at the time of selling the material is distributed among the members of the same family and protect their route of material by problems of organization and invasion of territories.

There are months where more material is observed. In the period of July-August-September, a large number of households discarded school material from the previous academic year. The second period December-January coincides with Christmas and New Year. 14.50% of PR do not consider an opportunity to increase material in these months, as it also increases the number of informal recyclers.

3.2. Recyclers' Income, the real value of the 'garbage' and the association figure

There are 16 materials identified by the EMAC-EP in Cuenca with an economic value, and that are possibly recoverable, the information is listed in Table 1. It is essential to clarify that priority is given to certain materials at the time of collecting according to the requirements of PRC, CRC and the industry.

Table 1. Average prices for the material

Material	Average price (US$/kg)
Cardboard	0,09
Duplex	0,09
Newspaper	0,07
Mix	0,09
White paper	0,13
Soft plastic	0,16
Blown plastic	0,12
PET	0,45
Scrap	0,13
Tetra pack	0,10
Glass	0,02
Aluminium	0,33
Cooper	1,59
Bronze	1,21
Electronic Scrap (RAEE)	0,54
Others	0,03

A total collection of 129.68 TN/month is estimated by PR, being cardboard the most collected material with 32.1% followed by white paper with 10.6%, glass with 10.2%, scrap with 8.6%, soft plastic with 7.7%, PET (containers made with polyethylene terephthalate) with 7.6% and blown plastic with 6.8%. Other materials are not collected in big quantity for reasons of market demand, logistics, appropriate classification and non-representative prices. Although PET is a material that is not available in big quantities, it has a good price.

The Monthly income of a recycler is based on the volume and market price of the material as can be seen in Figure 4. 52.7% of PR received a lower income of US $100,00 per month; 22.0% between US $100,00 and US $150,00; 16.0% between US $150,00 and US $200,00. Finally, 9.30% received an income exceeding US $200,00 for recycling. On average, the monthly income of a recycler is US $76,16 using approximately 4.19 days/week for 5.50 hours/day. It means that they work around 92.11

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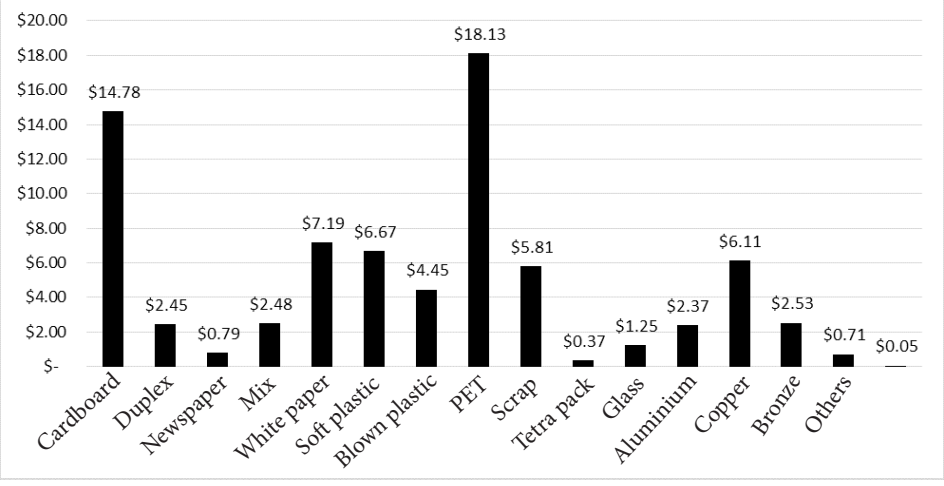
hours/month to collect about 527.16 kilograms of material. It is important to clarify at this point that the monthly minimum wage in Ecuador is US $394.00.

Figure 4. Average monthly income by material



For 33.0% of PR, income collected in recycling is insufficient, forcing them to work in addition to informal sells, cleaning, domestic work and agricultural activities. The Association figure originated just as an alternative to overcome low income. There are seven associations registered in the EMAC-EP: Corporación ARUC, Corporación AREV, Asociación Solidaria del Sur Feria Libre, Asociación San Alfonso-Centro Histórico, Organización Pichacay, Asociación El Chorro y Asociación Cristo Rey. They show difficulties regarding the organization, registration of new partners, lack of infrastructure, itinerant meetings and conflict of interest, being only 41.3% of recyclers in the condition of associates (AR), and 58.7% of non-associated recyclers (NAR) Who do not assume the association as an advantage or a priority for bad perception, lack of knowledge and little availability of time to fulfill obligations of the associates.

There is a little significant difference regarding the income between AR and NAR: AR obtain an average monthly income of US $80,85 and the NAR of US $70,90, revealing that the AR gets 14.0% more income, even 14.5% of AR have exceeded the US $200,00 and only 5.7% of NAR reached that figure. This difference can be attributed to the working day, since the AR work on average 114.07 hours/month, as opposed to the 78.00 hours/month worked by the NAR.

Once the PR income was determined, a correlation analysis was carried out to determine the dependence level of the "association" variable. A correlation coefficient (r) of 0.68% was obtained as shown in Table 2, which implies that there is a positive but negligible statistical relation, i.e., the association is not an explanatory and influential variable in the level of income. This is because five of the seven existing associations are limited to organizational areas and register new partners, without considering the productive issue.

Table 2. Statistical relationship

Statistical relationship	Valor
Correlation coefficient r	0.116224714
Determination coefficient R^2	0.013508184
Adjusted R^2	0.006842699
P Value (two-tailed)	0.173596059
Alpha	0.05

Given the P-value of the F-Statistic calculated in Table 3, and the level of significance of +/-5%, the information provided by the explanatory variables is not significantly better than that which would provide a basic mean, i.e., the differences in the means of the income between AR and NAR is not significant, accepting the hypothesis that the income level of a PR is not based on its associate condition.

Table 3. Analysis of variances: ANOVA

	DF	Sum of the squares	Quadratic mean	F	Pr > F
Model	1	5411.660	5411.660	2.027	0.157
Error	148	395209.173	2670.332		
Adjusted Total	149	400620.833			

In the case of the ARUC Corporation and El Chorro Association, the figure of CRC originates with the minimum infrastructure required for the classification and commercialization of the recovered material. They represent a means of protection and social and economic development, due to changing market conditions such as price fluctuations and volumes, increase of informal recyclers and labor insecurity. The main advantage lies in the negotiating power that they have at the time of the commercialization of the material, demanding higher prices for the considerable quantities that they have, because the companies that buy the material prefer suppliers with capacities of supply according to their production cycles.

3.3. The Business is in the volume, the challenge for the IB recycling

In conjunction with the EMAC-EP, 27 PRC was identified, stressing that there was a degree of resistance to provide private information, and there is no ordinance or legal framework at the moment that fully regulates its economic activity.

Therefore, an intermediary hires seven workers on average in the plant with a working day of 42.99 hours/week. The recyclable materials they sell come from various sources: recyclers, CRC, offices and shopping centers, educational units and industries. The CRC is supplied on a daily, weekly, fortnightly and monthly basis, allowing the collection, classification and packaging operations to be continuously developed. The portfolio of recyclable materials offered by a CRC is varied by oper-

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ating an estimated 116.84 TN/month that allows them to obtain an attractive gross commercial margin, shown in Table 4.

Table 4. Commercial gross margin for the intermediary by type of material

Material	Sell price (US$/kg)	Purchase price (US$/kg)	Difference (US$)	Gross margin
Cardboard	0,13	0,09	0,05	34,8%
Duplex	0,09	0,09	0,00	5,2%
Newspaper	0,08	0,07	0,01	9,9%
Mix	0,17	0,09	0,08	44,4%
White paper	0,17	0,13	0,04	22,0%
Soft plastic	0,35	0,16	0,19	53,3%
Blown plastic	0,27	0,12	0,15	54,1%
PET	0,61	0,45	0,15	25,4%
Scrap	0,18	0,13	0,06	30,2%
Tetra pack*	-	0,10	-	-
Glass	0,03	0,02	0,01	22,7%
Aluminium	0,66	0,33	0,33	49,5%
Copper	3,85	1,59	2,26	58,7%
Bronze	3,30	1,21	2,09	63,4%
RAEE*	-	0,54	-	-
Others*	-	0,03	-	-

** information non provided by PRC (intermediaries).*

The monthly gross income of an intermediary is estimated to be US $25,346.73. It is important to mention that the activities of an intermediary do not provide considerable added value, i.e. they accumulate large volumes of material and commercialize it. PRC specific cases perform additional procedures, such as pelletizing the plastic by generating recycled material (pellets) ready for processing in finished product. However, the results obtained can be a reward for the entrepreneurship initiative and the risk assumed when making an investment in this business framed in an environment of informality and instability.

As mentioned, an IB poses strategies that favor the poor and vulnerable population framed at the BOP, fulfilling the PR with this criterion. Consequently, recycling can be seen as an IB because it is made by people of the BOP "articulated with private enterprise and supported by the generation of laws or ordinances issued by the

Ecuadorian State and Municipal Decentralized Autonomous Governments (GADM), which allow this population to have economic resources" (Jimbo, 2016, p. 152).

The company Novacero S.A., in Ecuador dedicated to producing steel materials for the construction, exemplifies the concept of IB by working together with scrap recyclers and qualify them as the basis of their operations, being raw material suppliers for their productive processes. In 2008 it joined the IB program: "We all win", in which it provided technical training and working capital to the recyclers (Maldonado, 2012). Initially, seven micro-entrepreneurs collaborated; later the number amounted to 27, to finally work with 200 recyclers in 2012, who obtained no less than 260.00 US $/tonelada of scrap by optimizing their productivity and getting better prices (Maldonado, 2012).

Undoubtedly, the experience of Novacero reinforces the opportunity to create an IB based on the BOP since the price per kilogram of scrap obtained in the program was US $0,26; higher than US $0.13 that a recycler receives on average, this is mainly because the intermediary in not considered in the value chain when negotiating directly and on a large scale with the industry.

At the same time, the potential of recycling in Cuenca lies in the volume of recyclable material, since according to the EMAC-EP (2018), a 19.2% of the 2,396 metric tons of recyclables are barely recovering. Thus, the revenues are substantial when considering the important role that the fluctuation of prices of each material plays in relation to the recovered volume.

4. Discussion and conclusions

The value chain is a necessary and useful tool for evaluating the process undergone by any product or service and, due to its lack of existence at the time of developing this work, it has been essential to develop its design adjusted to the reality of Cuenca (Ecuador), not only to understand the flow of the process of solid waste generated, but also for the approach of strategies related to the application of IB with the people of the BOP. In addition, it is important to note that the value chain designed and presented in Figure 3 has the approval of the technical department of the EMAC-EP.

On the other hand, it was found that under the association figure, PR obtain a little more in income than the NAR. In spite of this, they are not highly representative and as demonstrated, the situation of PR Association is not a total and influential explanatory variable in the income level. In either way, they continue to be part of the BOP. Additionally, it was observed that the working conditions of PR are not conducive or adequate, owing to labor instability, low incomes, unsanitary working conditions, informality and conflicts of interest. It is essential to consider the antagonistic relationship that the recycling activity has, referring to the average age of the recycler with more presence of women relative to the level of physical effort required for development of the activity.

Understanding the conditions in which the recycling work is performed, and once proven that the admission of an AR is slightly higher than the NAR, the association cannot be considered as a solution given the above conditions. They require the inclusion of formality with regard to their legal constitution, organizational structure,

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procedures and duly defined responsibilities aimed at improving their productivity and consequently the socio-economic conditions.

Thus, due to the design of the recycling value chain for Cuenca, the measures that EMAC-EP can take to improve the management of solid waste, should be designed to contribute to ODS (UNDP, 2016), which represents a great challenge and a chance to provide better opportunities for recyclers in such management, not only because of the poor consumer practices of citizens (Vieira & Matheus, 2018) and the linear economic model (Ribeiro & Kruglianskas, 2015) but also for the problems detected in the associations and working conditions of the recyclers, in particular by their age condition and the feminization of the activity.

Finally, those who are instantly benefiting economically from recycling are the industry by obtaining cheaper raw materials and the intermediaries with revenues much higher than a PR; justified with the infrastructure, logistics and investment capacity for the treatment of recycled material, concluding in this way that there is an attractive profitability in the activity. Therefore, it is shown that there is the opportunity to generate profitability in recycling for PR. The success on applying a profitable recycling in Cuenca that impact in the income of PR will depend on factors such as the approach of a defined business strategy, strategic alliances with industry, regulations or municipal ordinances that efficiently and effectively regulate waste management in the city throughout the recycling value chain; joint collaboration between control agencies and the recyclers; finally, a CRC management model that fits the reality of PR.

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