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## Learning about the circular economy in rural communities of Cauca

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### Abstract

The objective of this article is to reveal the learning about the circular economy from two research experiences in rural communities of the municipalities Cajibío and Popayan in the department of Cauca. For this purpose, the triangulation of information was used from the analysis of secondary sources and information from primary sources obtained through the application of surveys, focus groups and immersions in context. Finally, a contrast analysis was carried out on the results obtained with the theory found that supports the principles of the circular economy. The results tend to generate learning about the circular economy derived from community practices in the use of waste from rural households that can be oriented toward the valorization of benefits to leave behind the traditionally perceived linear economic model to highlight the use of these wastes as resources contributing to reducing pollution levels and increasing income generation options in the rural communities under study.

**Keywords:** Circular economy; Solid waste; Rural communities; Learning.

### Resumen

El objetivo del presente artículo es develar los aprendizajes sobre economía circular a partir de dos experiencias investigativas en comunidades rurales de los municipios Cajibío y Popayán en el departamento del Cauca. Para dicho propósito se recurrió a la triangulación de la información a partir del análisis de fuentes secundarias e información de fuentes primarias obtenida por medio de la aplicación de encuestas, grupos focales, inmersiones en contexto. Finalmente se realizó análisis de contraste de los resultados obtenidos con la teoría encontrada que sustenta los principios de economía circular. Los resultados propenden a la generación de aprendizajes sobre economía

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circular derivados de las prácticas comunitarias en aprovechamiento de residuos de los hogares rurales que pueden orientarse hacia la valorización de los beneficios con el fin de dejar atrás el modelo económico lineal tradicionalmente percibido para resaltar el uso de dichos residuos como recursos contribuyendo a reducir los niveles de contaminación e incrementar las opciones de generación de ingresos en las comunidades rurales objeto de estudio.

**Palabras Clave:** Economía Circular; Residuos sólidos; Comunidades rurales; Aprendizaje.

## 1. Introduction

The management of solid waste has become a worrisome environmental situation in Colombia, “with a general growing trend, for the year 2018, Colombia disposed on average 30,973 Ton/day of Solid Waste -SW-, within which the department of Cauca contributes more than 1000 Ton/day” Super Servicios and Departamento Nacional de Planeación [DNP] (2018), belonging to the category with the highest average daily SW contribution. -If the generation of waste per inhabitant is analyzed, the department is between 0.74 and 0.85 kg/inhabitant/day, placing it in one of the highest categories of waste generation per inhabitant, above most of the departments of the country, including Valle del Cauca and Antioquia.

Thus, the proper management of waste in rural contexts is constituted as a relevant environmental bet, which favors the solution of socioenvironmental and even economic problem areas, especially if it is considered that “68.38% of the inhabitants of the department are in locations

classified by Departamento Administrativo Nacional de Estadística [DANE] as dispersed rural locations, where the collection of solid waste is 44.35% according to the census carried out” DANE (2020).

At the national level, solutions are rarely in the process of implementation with the proclamation of Law 1955 of 2019, which in Article 279 establishes the provision of adequate solutions for water used for consumption, wastewater management and the management of solid waste in urban areas

with difficult access and in rural areas. In this matter, municipalities and districts must ensure the basic sanitation needs of human settlements in urban areas that are difficult to manage and in rural areas by implementing **collective** or individual alternative solutions or through the provision of public sanitation services (Plan Nacional de Desarrollo, 2019)<sup>1</sup>.

Despite the outlook presented, in the Colombian context, great opportunities are beginning to be elucidated to strengthen the circular economy processes, as is the case of Colombia’s recent incursion into the circular economy since the National Development Plan of 2018-2022 with its promotion in production processes, green businesses, among others, due to waste being considered as potential raw materials for the manufacture of other products, with strategies such as recycling, reuse, reassembly, renewal and redistribution DNP (2018) (República de Colombia, 2018) generating an important possibility for rural communities with problems derived from the inappropriate use of waste to generate ventures with circular economy processes. The potential of these practices becomes relevant if it is considered that in some communities, they have been carried out instinctively for a long time without knowing that they are the circular economy processes, which could be constituted as alternatives in the generation of income for households.

According to document CONPES 3874 (2016), approximately 20,000 families live in Colombia, whose means of livelihood is the recovery and commercialization of recyclable material. Thirty percent of these families are affiliated with 128 cooperatives, and 70% work independently DNP (2016), (CONPES 3874, 2016). In addition to the existence and consolidation of this type of cooperative, the Ministry of the Environment -MinAmbiente- promotes “the circular economy strategy promoting entrepreneurship, the generation of added value and the attraction of investment as a result of new forms of production, consumption and use of waste, which reduce the burden on landfills” Ministerio de Medio Ambiente [MinAmbiente] (2021a). Promoting the relationship of community practices of waste use with potential entrepreneurs around the circular economy strategies.

<sup>1</sup> However, at the time of the development of the present investigations the 1955 law was not in force, and even at the time of writing the article its implementation is incipient.

As a result, in recent years in different regions, efforts have been made to strengthen knowledge of concepts related to the circular economy to form capacities that give tools to communities in the development of processes and projects aimed at making better use of recyclable waste Ministerio de Medio Ambiente [MinAmbiente] (2021b).

Considering what has been stated thus far, this paper addresses experiences related to the transformation of waste in the villages la Viuda belonging to the municipality of Cajibío as well as in the Yunga and Río Hondo villages of the municipality of Popayán. Considering that in these places, the socioenvironmental and economic situations caused by the problems generated due to the inadequate management of waste are evident, there are artisanal alternatives of use that, although they are instinctively implemented in homes, are rarely contemplated within the waste management systems despite being viable options for low-income communities, providing them with alternative solutions not only to environmental problems but also to adverse economic situations.

Since, by linking the principles and strategies of the circular economy to its practices, waste has an important role by prioritizing its intelligent reuse, implementing recycling when possible, redesigning processes to reintroduce the waste generated to the production process and allowing these practices to imitate nature in its cyclical model (Lett, 2014).

Therefore, the present research tries to answer the question: What learnings about the circular economy can be identified in the community practices of waste management that allow their recovery and generate benefits to rural populations?

Finally, it is worth mentioning that this problem is addressed from a methodology of triangulation of information, with the application of different tools for data collection in the field and contrasting the results obtained with the theory, paving the way to the visibility of the learning and practices of the circular economy in the rural communities under study.

## 2. Theoretical background

### 2.1. Circular economy and rurality

A circular economy has been evidenced as a paradigm whose purpose is sustainable development, from various strategies throughout the production chain of goods and services Sandoval *et al.* (2017) and is approached from three principles (pp. 85-86).

Circular economy favors, first of all preserving and increasing natural capital, controlling finite stocks and balancing renewable resource flows. It is necessary to appropriately choose the technologies and processes so that the resources used have the highest performance. According to Cerdá and Khalilova (2016) "A circular economy also increases natural capital by encouraging nutrient flows in the system and creating the conditions for soil regeneration" (pp. 13-14).

Also looking to optimize the efficiency of resources, always circulating products, components and materials at their highest level of utility in the technical and biological cycles. This means redesigning to "rework, renew and recycle to keep materials and components circulating in the economy, and contributing to it" Cerdá (2016). To conserve energy and other values in the cycle.

Finally promote the effectiveness of the system, make patents and projects to eliminate negative externalities. For instance Cerdá (2016) "includes reducing the damage done to systems and areas that affect people and managing negative externalities such as air, water, land, and noise pollution, toxic emissions, and climate change"(pp. 13-14).

However, thus far, the circular economy approach is observed more from an industrial and commercial point of view than from community and rural sectors.

Rural communities facing current challenges such as globalization, opening markets, climate change and changes in territorial planning; are in the need to abandon the peasant economy that, according to Chayanov (1930), "is a noncapitalist form of production; for whom there is no profit,

no wage, no rent” CEPAL (1982) therefore, according to Chayanov himself, it would not be possible to determine the respective remuneration of the factors of production: capital, labor, land (pp. 128-129).

To diversify their income by entering the logic of a new rurality, where a diversification of production, consumption of goods and services is promoted, consequently generating an increase in negative externalities.

For Latin America, (Barbosa, 1963, as cited in Kay, 2019) address the concept of new rurality explained by the diversification of productive work in rural environments.

The new rurality “is not only influenced by a neoliberal approach that is determining its transformations by globalization but also by struggles of peasants and indigenous people to improve their living conditions” (Sepulveda, 2020, p. 13), where social groups try to face current challenges present in rural territory, such as climate change, loss of territories, lack of production and distribution opportunities, increase in the price of inputs, social inequality and exclusion.

Taking the circular economy as a cyclical flow, which involves extracting, transforming, distributing, using and recovering the materials and energy of products and services (Sandoval *et al.*, 2017) applied to rural community entrepreneurship, it proposes to contribute to reversing these adverse situations by applying their principles in the diversified production and transformation processes of the new rurality. Therefore, it is necessary to specify the frameworks of action of the circular economy in rural communities to identify opportunities for improvement at an environmental and economic level.

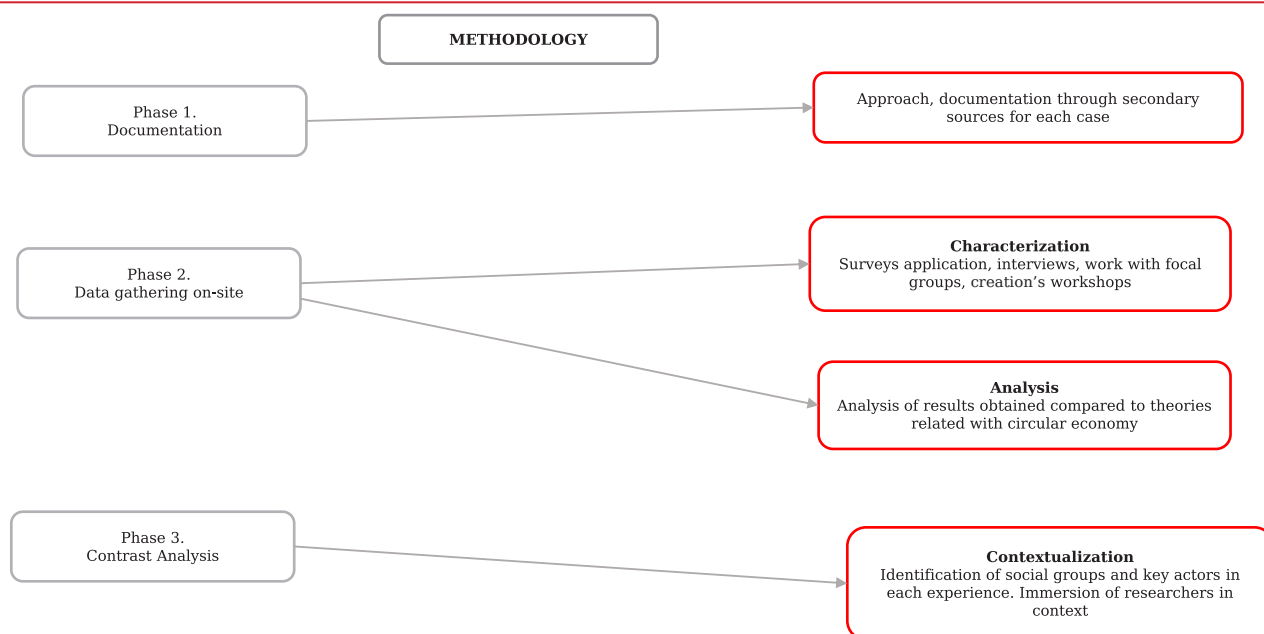
## 2.2. The role of waste in the process of circularization of the economy

Waste in the circular economy model requires special treatment to generate new uses, which is known as the “hierarchical strategy of waste before reaching its final disposal, specified as the rule of the three (3) R: Reduce, Reuse, Recycle” (Suazo, 2018, p. 4). It is worth making clear that the concept of “waste” does not conceptually equate to the notions of debris, spoilage or garbage since

these concepts suppose the nonusefulness of the matter, but rather, the product that has finished a cycle can be used in other cycles. This variety of waste acquires a new orientation in the logic of the circular economy, which bases its sustainability on the predominance of renewable energy sources and minimizing the use of finite materials. For this case, two material flows are proposed: “the biological one, which involves all the resources, products and parts of products composed of organic matter, which after being occupied can be reintegrated into ecological cycles, and the technical one, referring to the raw materials and synthetic or nonorganic materials contained in a product, which at the end of its useful life can circulate through the technical cycles” (Suazo, 2018, p. 8).

Linear Economy is expressed as a system that starts from “the extraction of raw material, the production of goods, consumption and the generation of waste” (Morato *et al.*, p. 21). It is linear because the product generated has a single use and a single destination focused on the final disposal once it has been consumed; that is, it is a model based on the cycle of “Take-Do-Discard” (Ellen Macarthur Foundation, 2020A). Conversely, the circular economy implies a change in current production and consumption systems; The change must be made toward systems that are regenerative from their design; to maintain the value of resources (minerals, water, soil and energy) and products and, to exponentially, limit the inputs of raw materials and energy. This will prevent the creation of waste and derived negative impacts, mitigating negative externalities for the environment, climate and human health (Morato *et al.*, 2017, p. 22).

In this sense, the product does not have a single use or a single destination; in contrast, it is thought of how to give a second life to the object from the design, with new added values, to drastically reduce subsequent inputs of materials and energy; thus, the circular economy proposes to use only renewable resources, due to its virtually unlimited availability, to drastically reduce the negative impact on the environment (greenhouse gas emissions, toxic discharges into rivers and seas, etc.) and human health (Morato *et al.*, 2017). Thus, the primary

**Figure 1. The advanced methodological process**

Source: Authors' own elaboration

product becomes waste and secondary raw material to be used again.

### 2.3. Waste Recovery

The successful application of a management method that contemplates the recovery and use of waste will allow a more rational use of natural resources and a lower demand for energy, economic income and job creation from the technical- economic variables (supply - demand) to the social, political and environmental variables, among others.

Biological Use with processes such as composting, vermiculture and bio digestion.

- Food use through the production of dry food for animals.
- Energy use through processes such as gasification. The recovery of plastics can be achieved by 18 - Mechanical treatment, either primary or secondary treatment depending on the quality of the material.
- Chemical treatment through processes such as pyrolysis, gasification, hydrogenation and chemolysis.
- Energy use through gasification, among other systems. The valorization of glass can be achieved by conditioning (cleaning and crushing) for subsequent

The change must be made toward

systems that are regenerative from their design; to maintain the value of resources (minerals, water, soil and energy) and products and, to exponentially, reuse in the manufacture of glass. The recovery of papers and cardboard can be achieved through their conditioning for subsequent reuse in the production of paper and cardboard and/or in the manufacture of products such as Tectan MinAmbiente (2014, 2021).

### 3. Methodology

For the present research as shown in figure 1, triangulation of information was used, starting with an initial documentation, application of surveys, focus groups, immersions in context, analysis of secondary sources and contrast analysis of the experiences in the field addressed.

Within the framework of the initial documentation addressed, the need to characterize waste disposal practices in the rural family contexts under study and the types of perceived pollution, goods and environmental services affected and the mitigation expenses that could be generated from these practices, adapting the contingent

valuation methodology (Azqueta *et al.*, 2007). For that purpose, a baseline survey instrument was applied, making it possible to also identify the economic activities of households and their management of waste. Then, the methodological technique of immersion in context was used as an adaptation of the techniques addressed by the thinking design methodology (IDEO, 2021) to have the perception of the research team regarding the variables already mentioned, establishing another source of information regarding the generation and use of solid waste in the rural households mentioned, allowing us to contrast what is addressed by the circular economy model, with the circular economy practices of the target population that could lead to economic valorization as a tool to establish alternatives for the generation of income in rural households, such as circular economy learning.

## 4. Results and discussion

### 4.1. Contextualization of experiences

The research experiences are located in the villages La Viuda corregimiento La Capilla- municipality of Cajibío Cauca, La Yunga and Río Hondo Municipality of Popayán Cauca, rural areas near the city of Popayán Capital of the department of Cauca

The village of La Viuda is located in the corregimiento La Capilla, a transitional rural area between the municipality of Popayán and Cajibío, and has an area of 551 km<sup>2</sup> (55,100 Has) in the upper region of the Cauca River basin (Alcaldía Municipal de Cajibío, 2012).

This area is inhabited by ethnic groups that make up 18.96% of the total population, where indigenous people are 15.34% and Afro-descendants are 3.6% and mestizo and mulatto groups corresponding to the remaining percentage of the population (Vidal, 2014). The population of 193 families has aqueduct service, but there is no basic sanitation service and no sewerage, and there is evidence of poor rural coverage of electric power service. Due to its population characteristics, most of the labor force is dedicated to realize typical of the peasant economy, “small family production” (Corrales

and Forero, 2015, p. 39) being its main source of work in the field and the forms of production that guarantee their subsistence and that of their family units, without marketing of their products. Finally, there are those who derive their livelihood from informal trade and several works in neighboring plots.

The Yunga and Río Hondo villages are located 25 km west of the city of Popayán. It is bordered to the east by the municipalities of Totoró and Puracé, to the west by the municipalities of Tambo and Timbío, to the north by Cajibío and Totoró, and to the south by the municipalities of Sotaró and Puracé; they are also surrounded by the Cauca and Hondo rivers (Alcaldía Municipal de Popayán, 2021).

In the corregimiento, 150 families have been censused; in the villages of La Yunga and Río Hondo, there are approximately 91 households inhabited by 331 people randomly distributed in the two villages, which are dedicated to different activities of production of goods such as agricultural production and work in artisanal bricks (Vélez Torres *et al.*, 2012).

### 4.2. Waste characterization and recovery possibilities

In the village “La Viuda”, plastic waste, paper-cardboard, metals, organic, common<sup>2</sup> (not usable) and special waste are produced. For the present study, the name of common waste was given to all those for which there is no possibility of recycling, recovery or use, that is, for unusable solid waste. Given that Colombian law, in its Decree 1713 of 2002, adopts the definition of nonusable solid waste as: “any solid or semisolid material or substance of organic and inorganic origin, putrescible or not, from domestic, industrial, commercial, institutional, service activities, which does not offer any possibility of use, reuse or reincorporation in a productive process. It is solid waste that has no commercial value, requires treatment and final disposal and, therefore, generates disposal costs” (Art. 1).

Inorganic waste susceptible to placing on the market or recovery is shown in the figure as follows.

**Table 1. Types of waste and marketing possibilities**

Study area	Type of waste	Quantity kg/ year per household	Marketing price kg	Value gain per household	Total for the community
La Viuda	Paper-cardboard	69,68	320	22367	4316831
	Plastic	97,76	480	47023	9075246
	Metal	82,68	240	19926	3845695
Total, marketing of inorganic usable waste				89316	17237772
La Yunga and Río Hondo	Paper and cardboard	25800	320	84245	8256000
	Plastic	6600	480	32393	3174600
	Metal	2300	240	5656	554300
Total, marketing of inorganic usable waste				122294	11984900
<i>Source: Authors' own elaboration.</i>					

In the village of La Viuda, one generation of waste per week was distributed as follows in the Table 1: generation of paper and cardboard of 1.34 kg, of plastic waste 1.88 kg of plastic waste are produced per week, metal waste generated on average of 1.59 kg per week, the average production of common or unusable waste, is 1.92 kg per week, coming mostly from toilet paper, cardboard paper contaminated with food or organic matter and polystyrene. The last information, based on the results obtained through the application of survey and verification in the field obtained in the projects "Model of Social Innovation for the Use of Solid Waste in the Villages La Yunga and Río Hondo (Popayán, Cauca) and Diagnosis of the management of solid waste in the village of La Viuda rural area of the municipality of Cajibío department of Cauca-Colombia with the purpose of generating strategies for the recovery of waste values are referenced from supra reciclaje (19 de diciembre de 2021).

Regarding strategies for the recovery of inorganic waste in La Viuda, only 8% of households manufacture handmade products, such as bags, bracelets, earrings and some other accessories from plastic bags and chairs from PET bottles, which are sold between 15000 and 30000 pesos and whose purpose is to acquire extra money.

With regard to the identification of inorganic waste generation in the Río Hondo and Yunga villages, 57.1% of all waste

generated is due to this type, specifically cardboard, paper and plastics, cans and glass. Of this percentage, 19.4% of the population claims to generate plastics, cans and glass. Only 2% of its inorganic waste is based on cardboard and paper and between 6.1% and 1% say that it only obtains waste in cans.

Considering the use of inorganic waste that is generated within the communities, the analysis is carried out in two moments, a first moment that characterizes the generation of inorganic waste and the second that is the valuation of the benefit comparing quantities with market prices.

It can be observed that the generation of inorganic waste concentrates its greatest load on paper, cardboard and plastic waste, which, according to the result of the immersions in context represented in the Yunga and Río Hondo 25800 kg/year of paper-cardboard, in terms of income generation would represent 8,256,000 pesos per year and 69.68 kg/year of paper-cardboard that would represent for the community an annual profit of \$4,316,831. In the case of plastic waste 6600 kg /year for the community of Yunga and Río Hondo, an estimated annual profit of \$3,174,600 and 97.76 kg/year for an estimated income \$9,075,246 per year in the community of La Viuda.

Despite this, the ignorance of the communities regarding the economic potentialities related to the use and insertion

in the value chain of inorganic waste does not allow additional income to be generated for the communities. The possibility of generating the economic benefits estimated in this study requires an appropriation of the processes associated with the circularization of the value chain and the formal links with other actors in the chain, such as marketers and transformers.

Regarding the generation and disposal of organic waste in the Yunga and Río Hondo villages, 52% of families generate waste from meals, fruits, vegetables and

crops, followed by 20.4% who only generate waste from meals, fruits and vegetables, since they do not have agricultural economic activities.

In this sense, 40% of families use organic fertilizer for the production of fertilizers, and 18.4% of families use food and fruit waste for animal feed, which implies that the generation of alternatives for use to this type of waste is a viable option for the population. In the case of the use of organic waste in the village of La Viuda, only 32.3% of the population uses techniques such as composting and vermiculture for the utilization of their organic waste, and 57% uses food and fruit waste in animal feed (MinAmbiente, 2014).

This reveals that in similar percentages, organic waste is transformed or used in some way, using biological use with processes such as composting, vermiculture and bio digestion. - The food used for animal feed. This situation can be explained by the knowledge acquired by communities through community organizations through strategic alliances with institutions, which also plays an important role in the transmission of knowledge through ancestral practices.

The use of organic waste in the three communities showed that the benefit generated was in the order of use and type of fertilizer, whose materials for the production and organic fertilizer are manure from livestock, guinea pigs, poultry, equines, pigs and crop residues (González and González, 2019). In this sense, the use of organic solid waste is carried out by the production and sale of organic fertilizers and fertilizers from vermicomposting that generate additional income to family units.

In line with the above, an approximation to the calculation of the profit generated by the use of waste is given by comparing the market price for the quantities generated in the area. Therefore, a monthly projection of organic solid waste generated in the family units is presented, a monthly estimate for all homes, that is, 98 families in the Yunga-Río Hondo villages and 193 families for the La Viuda village.

In this sense, a family unit produces on average 96.4 kg of solid waste monthly, which would indicate that each of the 98 family units will produce 9447.2 kg on average per month for the case of Yunga and Río Hondo and 29 kg/month of organic waste with an average of 5597 kg of production. As an example, if only 10% of the waste will be used, approximately 945 kg per month in the preparation of the fertilizer, and this will be marketed at \$ 1000, it would be talking about \$ 945,000 per month of savings for the 98 family units in Yunga and Río Hondo. Now, with regard to the use of waste for the generation of vermiculture as a result of the reuse of organic waste that comes out of the kitchen as fruits and vegetables, in the market the worm humus is in two presentations, a 10 kg bag with a value of \$ 22,800 and the liquid humus with a value of \$ 13,000, which saves them the same amount of pesos per kg produced, so it is reasonable to say that in rural communities it is necessary to strengthen alliances that generate capacities for the valorization of organic waste in order to reintegrate into the agricultural production cycle which would generate economic benefits.

## 5. Final considerations

The visibility of actions aimed at reducing the impact of inadequate waste disposal in rural households makes it possible to identify the transition process toward a circular economy that in these rural environments is not limited to reducing the negative impacts of pollution but represents the long-term resilience processes that have been occurring in the communities, which, together with the economic valuation of profit, tends to generate economic opportunities, providing environmental and social benefits in a cycle of positive continuous development that preserves and increases natural capital,



optimizes resource returns and minimizes system risks, managing finite stocks and renewable flows (Kowszyk and Maher, 2018).

That is why from the empirical experiences of the communities that can start to find ways to the circular economy from their daily practices to launch entrepreneurship under its principles, and that would be relevant if its considered that in the two experiences raised are processes aimed at the circular economy that help to reduce emissions, reduction of material losses and waste, to maintain the value of products, components and materials in the economy.

From the environmental situation of the waste generated by rural populations that have difficulties in their management due to different variables, such as the lack of coverage of sanitation services, lack of environmental education, and less access to technical and technological resources, among others, potentiality in the community organization can be identified through the present investigations to solve problems related to waste through the implementation of circular economy strategies, considering that most organic and inorganic waste are usable if the separation of waste is done properly and at the source and could be susceptible to use and even enter the production process again.

Therefore, when comparing the results obtained in the two investigations, it is observed that a very similar percentage of 59.2% in Yunga and 60% in La Viuda do not carry out an adequate separation process that could generate a significant use of inorganic waste if they are reincorporated into the production processes, starting with the appropriate segregation. In this reflection, it would also be possible to consider what would be the companies producing the goods and their responsibilities in the final management of the waste generated when consuming their products, which would be the subject of a new investigation and analysis.

However, at the economic level, the reduction of raw material costs, the repeated use of resources, income from the sale of byproducts, the attraction of new sources of financing, innovation in business models and the opening of new markets

could generate in organizations leading to the use of solid waste the improvement of productivity and competitiveness generating progress toward the productive and sustainable Colombia challenge that “seeks to modify the productive structure of the country toward circular economy companies, with export projection, taking advantage of the country’s comparative advantages in natural resources and their capacities” Ministerio de Ciencia [MinCiencias] (2019), with a synergistic component between company and community.

The possibility of generating the economic benefits estimated in this study requires an appropriation of the processes associated with the circularization of the value chain and the formal links with other actors in the chain, such as marketers and transformers. Despite this, the ignorance of the communities regarding the economic potentialities related to the use and insertion in the value chain of inorganic waste does not allow circularization to be carried out effectively.

Another interesting finding in the two investigations is that 32.3% in La Viuda and approximately 40% of the population in Yunga use techniques aimed at transforming organic waste for fertilizer production, making it a circular economy model by having “as an objective to resemble that of artificial production to the cycle of natural ecosystems” (Cansi and Cruz, 2020). This means, according to Voulvoulis (2018), on the one hand, the disposal of waste by composting biodegradable waste or, if it is transformed and nonbiodegradable waste, its reuse, remanufacturing and, finally, recycling (Voulvoulis, 2018); leads to reflection on sustainable economic models not only from the company or the enterprise but also at the community level, -“based on the natural and cultural diversity of the country and the creative economy, allowing a turn toward a knowledge economy and the conservation of such valuable resources as water and biological and cultural diversity” (Minciencias, 2019).

Among the results obtained is that interinstitutional alliances and community organization play a neuralgic role in the implementation of circular economy

strategies. Since the knowledge of the processes of exploitation either by oral tradition or by generation of capacities through alliances with entities such as SENA and UMATA in the case of Yunga and with SENA, cabildo and peasant and community associations in the case of La Viuda, are conducive to good practices and use lead to savings in production costs in crops such as vegetables. The savings in the displacement of producers to acquire fertilizers that are replaced by the waste generated constitute a positive externality. Thus, these processes show that the community is able to generate benefits with the activities they carry out through circular economy strategies.

Collaborative processes between communities and producers, “collaboration between the value chain, including suppliers and consumers of products turn everyday processes into sustainable processes” Ministerio de Ciencia [MinCiencias] (2021). Therefore, the circular economy must be addressed not only as a business issue but also as a collective commitment that can be generated from the very heart of the communities with the learning revealed but also with the support of academia and the technologies and innovations of the industry.

Learnings regarding the circular economy in rural communities make it possible to link Principle 1. To preserve and increase natural capital, controlling finite stocks and balancing renewable resource flows and Principle 2. To optimize the performance of resources, always circulating products, components and materials at their highest level of utility, in the technical and biological cycles. By choosing appropriate techniques for the circularization of family production processes (Cerdá and Khalilova, 2016).

The two investigation objects of this analysis show that there are potentialities for the circular economy in the processes of community waste management, which being well oriented could generate significant advances in the generation of green jobs, reduction of waste production, among other objectives sought by the circular economy, even reaching the generation of economic gains product of strategies aimed at closing the cycles. For the authors, it is important to highlight that the traditions and empirical

knowledge of the communities constitute a learning possibility in the community circular economy.

Finally, although it is not the objective of this study, it was obtained in the analysis that the role of women in the management of waste and their empowerment with respect to the management of waste is of the utmost importance because in the research, more than 50% of the population that handles waste at home corresponds to women, which is a line of the population in which emphasis should be placed when generating public policy on the implementation of a circular economy in communities.

## 6. Conflict of interest

The authors declare that they have no conflicts of interest.

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