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Reverse logistics and social responsibility: Rethinking production ecosystems

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Abstract

The objective of this study is to analyze reverse logistics as a tool for social responsibility in dairy production ecosystems. The methodology is a descriptive, non-experimental, field, quantitative, and transversal. The population consisted of seven dairy products companies in the Maracaibo and San Francisco municipalities of the Zulia state in Venezuela, and a questionnaire-type data collection instrument was designed and applied. The results show that reverse logistics represents an important tool for implementing social responsibility practices in organizational ecosystems in the dairy sector. These ecosystems are made up of linear chains, structured in phases: supply, production, and marketing. The ecosystems studied deploy closed-chain reverse logistics systems and subsystems of recovery and commercial returns that represent initial practices in the field of social responsibility. They apply processes for the recovery of waste, containers, and expired and/or damaged products, presenting self-management as an outstanding characteristic. The recovery is in charge of the quality department, which leads procedures with the application of its technologies, recovering a high percentage of returns. There is a need to articulate social and organizational aspects such as stakeholder participation and information systems to achieve sustainable management and enhance social responsibility.

Keywords: reverse logistics, supply chain, social responsibility, production ecosystems, dairy derivatives, recovery, sustainable retro logistics.

1. Introduction

Industrialization and progressive socioeconomic development of nations in search of a better quality of life for citizens has always been a concern for the countries of the world. The gradual work, supported by science and constant technological innovation in Latin American realities, has not been enough to overcome Third World barriers, where the deployment of open economies is becoming increasingly difficult, given the demands in the realization of competitive advantages in products and prices (Jimenez and Hernandez, 2002), quality, and time.

In these scenarios, the efficient and sustainable logistical performance of production ecosystems, which operate under the articulations imposed by production chains, becomes a requirement for organizations, which must recognize, adopt, and adapt multifactorial

strategies to meet the requirements not only of demanders, society, and the environment but also of governments and institutions, i.e., the stakeholders that surround them.

The adoption of responsible and sustainable business practices is an imperative need because of the demands of multilateral organizations to promote balances in three essential dimensions of sustainable development: economic, social, and environmental as a roadmap to articulate the formulation of global policies (Gil, 2017). From the organizations, integrating commitments with societies, and from these with the environment, regains strength, and becomes powerful in a context that demands the development of clean, ecological, efficient, and sustainable practices. Under these approaches, how the various economic and social actors relate to each other is no longer a purely commercial relationship, but one of cooperation and alliance, to generate value, as well as social and environmental protection (Regional Support Center for Latin America and the Caribbean -CRAALC-, 2016).

Globally, they are echoing the treaties signed in the 2012 Global Compact. Many companies are leaders in waste management and recycling because they were pioneers in gaining competitive advantages. In Latin America, induced mainly by transnationals and some governments, the first steps have been taken in waste management (Amato, 2015); adopting industrial waste levels, countries such as Argentina, Brazil, Chile, Colombia, and Mexico, regulations ranging from laws (Baena et al., 2020), to regulations, which are closely followed by the authorities, the population and non-governmental organizations, especially on the issue of hazardous waste (Amato, 2015). In Venezuela very little has been done in this regard.

The above is altered in early 2020 when the organizational reality worldwide was affected by the health crisis caused by the disease caused by the SARS-CoV2 coronavirus, known as COVID-19. It was declared a worldwide pandemic, affecting all areas of life. It presents a new context, threatening the human beings of the world, and with their organizations of every order and level. The development of life itself changed, and with it, organizational performance, including business as we knew it, was altered. The weakness of man in the world is demonstrated, and emerging work models emerge to face new realities.

Organizational agility and proactivity are put to the test; the capacity to respond and adapt to the challenges of shrinking economies and paralyzed markets as a result of social confinement is declared worldwide. However, despite the health crisis, with implications in all sectors of activity, Latin America and the Caribbean, from its central and local governments, define public policies as part of the public agenda of several countries, on the one hand, to cope with the pandemic, and on the other, to maintain active economies, which today more than yesterday must perform under precepts of sustainability and economic, social and environmental sustainability, the latter by the existing susceptibilities resulting from the virus and the very life of human beings.

From a business perspective, it is important to study the practices implemented in restrictive contexts, with greater demands in terms of logistic performance. Because of these arguments, this research analyzes reverse logistics as a tool for social responsibility in dairy production ecosystems in the western region of Venezuela, particularly in Zulia state, a region that contributes about 22% of the national production of milk and meat in the country (IESA, 1997), with livestock being the second most important activity in the region, after the oil industry (IESA, 1997).

The study of reverse logistics in production ecosystems requires the study of activities for the recovery and use of waste or returns in each of the phases of the chain that encompasses production ecosystems, as an option for organizations to orient their management towards clean, effective, and sustainable processes. Because of the growing concern for the environmental and social impact of the productive actions of companies in the world, that is to say, that their performance is assumed as part of the social responsibility they develop, respecting the social and environmental dimensions, which must coexist in balance with

the economic profitability pursued by the companies.

The Venezuelan dairy sector, and particularly the one developed in the Zulia region, has been a reference in productivity for more than 50 years; since it has been developed and consolidated through an infrastructure with appropriate technology for industrial processing and transportation, selected cattle, as well as excellent pasture and land, however, the potential of the sector looks reduced today, because of deteriorated infrastructures, with low production capacity, which leads according to Kowalski (2021) to negative impacts on milk production at the producer level, leading to a reduction in supply. Boscan, M., and Sandrea, M. (2009) also state that the sector faces problems in broad dimensions.

Serious difficulties are present in the Venezuelan dairy industry and, in particular, in the milk processing industry, which in 2016 produced 35% of its installed capacity (Figueroa, 2016; Ayala, 2016; Ojeda, 2016), as a consequence of the insufficient supply of milk and the difficulty to import, coupled with the fact that there is little differentiation of products in the market. In 2019, according to Kowalski (2021), the industry lost its capacity to process and place its products in the market; from being an industry that bought 1.5 million liters of milk daily, it became a sector that processes 600 thousand liters of milk daily, the drop was of more than 60% in its processing; the sector is still struggling to reconquer the market in the main cities, but it is not an easy task given the business and industrial crisis that the country has been going through for more than 10 years.

This situation is accentuated by the pandemic, and under slow performances, work is being done to keep the sector active. According to Jiménez and Hernández (2002) and Escarria and Giraldo (2014), the supply chain of dairy products in the country (and in Latin America) presents deficiencies; being perishable products, the cold chain is insufficient to ensure product reaches the consumer in optimal conditions for consumption. In addition, customer service is an influential factor in logistics and marketing in general, which is very little taken into account in the strategies of this sector.

The country's precarious economic situation and the subsequent contraction in demand - which is very price sensitive - will not allow Zulia's dairy derivatives industries to continue passing on the costs of their inefficiencies to the consumer. Shortages and difficulties in accessing foreign currency, low rates of return on inventories and capital, large investment amounts, and high production costs are reducing their results. Consequently, if the present situation continues, these industries will remain unprofitable and inefficient. The efforts to keep their customers captive will be far greater than what they can achieve in an integrated supply chain that includes retro-logistics.

The prognosis of inaction, therefore, will continue to be the progressive reduction of competitiveness, the isolation of the sector concerning global trends in supply chain management and sustainability, and the setback in the development achieved, in which the state of Zulia was a pioneer and, ultimately, evidence of the imminent closure of operations.

For these reasons, the study of reverse logistics is of interest, to analyze how to guide strategies, activities, and socially responsible practices that allow the organization to generate a sustainable competitive advantage oriented to benefit the stakeholders in the supply chain.

1.1 Literature review

In Venezuela, there are few research studies related to the reverse logistics chain in the dairy sector in the country, and very few in other sectors applicable to specific cases. To date, there is no particular theory on which reverse logistics is based, and there is scattered information about reverse logistics.

Until the end of the 20th century, the natural logistics cycle began at the exit of the production line and ended with the placement of the product at the point of sale; what happened to the product during its life cycle was no longer the responsibility of the supplier company, both producer and consumer remained indifferent to the implications of costs, accumulation of waste,

sanitary damages, environmental deterioration, among other aspects (Holohlavsky, 2012). Throughout the last 50 years, business logistics has been evolving; from the sixties (60's), in which it was only considered the movement of materials or production inputs, from a source or origin to a destination, (Barros and Turpo, 2017; Holohlavsky, 2012). To this day, logistics manages the supply chain by planning, implementing, and effectively controlling the direct and reverse flow of goods, their storage, and related information between the point of origin and the point of destination or consumption.

In this sense, logistics becomes important and is defined according to Tapia et al. (2016:9), as the process of planning, executing, and controlling the efficient and cost-effective movement and storage of raw materials, products in manufacturing, and finished products, as well as related information, from the point of origin to the place of consumption, according to the customer needs.

Since the 1990s, reverse logistics has evolved to adapt to major social, economic, and environmental trends: globalization of markets and companies, political and legislative changes, and accelerating technological advances. Currently, the changes that the world is experiencing make organizations must rethink their way of producing, marketing, and distributing their products thus adapting to the new rules in business and consumer habits (Rubio, 2003; Tapia et al., 2016). At the end of these years, terminologies such as recycling, and recovery of end-of-life products (PFU) (Rubio, 2003), were gaining strength in response to the demands of society in this area.

The first five years of the new millennium were characterized by an important academic interest in the study of reverse logistics as a strategy for competitiveness and sustainability. Parallel to this, other related areas included the environmental impact of industrial waste, green logistics, and the study of the life cycle of products, to name a few aspects associated with reverse logistics. The purpose is to adopt measures to reduce negative impacts on the environment. According to Arango-Serna et al. (2020), the formulation of reverse logistics systems allows companies to make responsible disposal of waste, maximizing the obtaining of value.

Reverse logistics includes sustainable aspects and is assumed as the process of planning, development, and effective and efficient control of the flow of materials, products, and information from the place of origin (consumer) to the place of consumption (producer) recovering the waste obtained and managing it in such a way that it can be reintroduced into the supply chain for reuse, remanufacturing, recycling or proper disposal, thus satisfying the needs of stakeholders and creating shared value for the organization and society as a whole (Amato, 2015).

Because of the importance of the topic in the current context, basic definitions of the subject are specified (Table 1), following chronological order:

Table 1. Reverse Logistics: Definitions

Year	Definition
Ruiz, González, Carmenate (2020)	It takes advantage of the value of end-of-life products, giving them a new function or using them to manufacture new products. It makes it possible to reduce costs in production and packaging, reduces the use of virgin raw materials, improves the distributor-customer relationship, establishes a good company image, and minimizes the environmental footprint, which contributes to the so-called circular economy.
Herrera-González, Suárez-Franco, Cantero-Cora (2019)	Activity with an enormous growth potential, whose objective is to achieve a favorable environmental impact, and an efficient management of waste or surplus products generated in the production processes or the provision of services.

Pagán, Tonelli, Silva y Da Silva (2017)	It includes the design of recyclable packaging to facilitate the recovery and reuse of waste, thus contributing to the preservation of the environment.
Saravanan, Sathiyagothai, Manigandan (2017)	Management of returns, once the useful life of the good is over, or when there are defective items; their safe return to the company where they were manufactured is managed.
Amato (2015)	Process of effective and efficient planning, development, and control of the flow of materials, products, and information from the place of origin (consumer) to the place of consumption (producer), recovering the waste obtained and managing it in such a way that it can be reintroduced into the supply chain for reuse, remanufacture, recycling or proper disposal, thus satisfying the needs of stakeholders and creating shared value for the organization and society as a whole
Garrido (2013)	Part of supply chain management that efficiently and effectively plans, implements, and controls the flow and storage of goods, services, and related information between the point of consumption and the point of origin to meet customer needs.
López (2010)	The process of efficiently planning, implementing, and controlling the flow of raw materials, work-in-process materials, and finished products and related information from the point of consumption to the point of origin to recover the value of the materials or ensure their proper disposal.
González (2005)	Management of the flow of products (components, materials, containers, packaging) destined for reprocessing, recycling, reuse, or destruction, including the corresponding activities of collection, conditioning, and disassembly.
DeBrito (2004)	The process of planning, implementing and controlling reverse flows, process inputs, packaging, and finished products from production, distribution, or point of use to the point of recovery or point of proper disposal.
Rubio (2003)	The process of planning, developing, and efficiently controlling the flow of materials, products, and information from the place of origin to the place of consumption in such a way as to satisfy the needs of the consumer, recovering the waste obtained and managing it in such a way that it can be reintroduced into the supply chain, obtaining added value and/or achieving adequate disposal of this waste.

Source: Own elaboration based on the referenced authors.

Reverse logistics is defined as a set of activities developed by companies as part of the logistics management of their supply chains, to effectively manage the flow of recoverable materials from the point of consumption to the point of recovery or final disposal, to recover value and meet the needs of different stakeholders.

A broad scope is considered, ranging from activities that have only ecological connotations; such as product recovery and recycling, and partially those activities that seek, in some way, to improve operations, to the processes of return and/or returns of customers, obsolete products, seasonal inventories, to name a few (Rubio, 2003).

References to the concept of reverse logistics are made both from the point of view of returns and the perspective of product recovery and, generally, in an exclusive way; that is, the consideration of a reverse logistics function for returns does not contemplate the possibility of using such systems to recover out-of-use products and vice versa. Thus, one can speak of reverse logistics on the one hand and recovery on the other, both of which coexist in the concept of reverse logistics.

Typical reverse logistics processes are undertaken by companies to collect used, defective, surplus, or expired products, as well as the packaging and transport elements, used to get their products to the final consumer or distributor (Ruiz et al., 2019; Garrido, 2013; López, 2010; Cure, Meza and Amaya, 2006). Consequently, the processes of economic recovery (5R's) and disposal (revaluation or final disposal) are included. The analysis of existing management options is developed according to the different characteristics of the products returned from the consumer, either before use (returns) or after use (recoveries) (López, 2010).

In any case, among the most representative processes of reverse logistics are assumed (Ruiz et al., 2020; Herrera-González, Suárez-Franco and Cantero-Cora, 2019; Saravanan et al., 2017; Huérfano and Meleán, 2017; López, 2010; Rubio, 2003):

a) End-of-use product (OUP) collection: the input conditions to a metrologist's system must be such that they can be reduced to a manageable minimum. The aim is to obtain the maximum value from the return, so the unrecoverable return has to be reduced through strategies and policies such as more appropriate channel selection, appropriate return policies, incentives, and credits, and an adequate level of after-sales service. The collection of end-of-life products is at the core of all other activities in the retro-logistics chain and can come from the consumer directly, from the distribution channel, from factory waste, or recyclers (Amato, 2015). It is a critical activity in any recovery process as it generates most of the uncertainty associated with reverse logistics systems (RLS).

b) Inspection and classification: After the products have been collected they must be examined. According to Rubio (2003), inspection and classification refer to the set of operations necessary to determine whether the products collected or any of their components are susceptible to economic recovery. Conditions are evaluated according to their state of deterioration. In this phase of the recovery process, tasks such as product segregation and cleaning, quality testing, and separation of components for recovery or storage of these components and materials are carried out (Díaz et al., 2005). They are selected based on their relevance or feasibility for economic recovery and in turn, determine which recovery process they will undergo (classification). In other words, it is determined whether the product or its components can be reused, remanufactured, recycled, or discarded. Until the recoverable item reaches this stage, its economic possibilities cannot be known with total certainty, since they will depend on the quality level of the recovered components (Qualitative Uncertainty).

c) Disposal: Disposal needs to be planned following the policies of each company, once the reversed product has been inspected, disaggregated, and classified it will be in a position to proceed with its management through the means considered most appropriate and its resources will be assigned depending on proposed objectives.

d) Waste management (Disposal): Some returned products must be disposed of since they cannot be processed within some of the mechanisms mentioned above, although it may also be for technical or economic reasons. This activity will require deciding on the most convenient form of disposal (landfill or incineration).

e) Waste management (Value recovery): The selection of the type of recovery will depend on the economic value obtained, the cost of recovery, and the market for the recovered good. The recovery option is also related to the type of product, the origin of the reverse, and the company's strategy. The underlying premise is a comprehensive and integrative design of the metrology function and the flows that comprise it.

2. Method

The methodology is a descriptive, non-experimental, field, and cross-sectional, focused surveys were conducted on key informants in logistics management: from the documentary level, the research is supported by authors such

as López (2010), Rubio (2003), and De Brito (2003), DeBrito and Vaan der Laan, E. (2010)." and Amato(2015). The population (and, therefore, study subjects) was made up of dairy derivatives companies in the state of Zulia; however, although they can be grouped into a finite number (81 in total, according to the National Land Institute -INTI-), these have very different organizational characteristics, especially in terms of size, number of employees, the volume of milk processed and geographical location, which could have an impact on the scope of the proposed objectives. Based on this, a representative sample of the population was selected, in which selection/delimitation criteria were specified, inherent to the subject of the study: 1) Typification in cheese and other derivative industries, according to the classification of the Venezuelan Chamber of the Dairy Industry (Cavilac), 2) Geographical delimitation in the municipality of Maracaibo, according to the list of the Livestock Circuit of Zulia state published by INTI, being conformed as shown in Table 1.

Table 1. Maracaibo dairy products companies

TIPO DE ESTABLECIMIENTO	RAZON SOCIAL	ENTIDAD	MUNICIPIO	CAPACIDAD INSTALADA	CAPACIDAD OPERATIVA	UNIDAD DE MEDIDA CAPACIDAD	FRECUENCIA	CONDICION DE ACTIVIDAD
PLANTEA LACTEA	AGROINDUSTRIAS LACTEOS PACOMELA C.A.	ZULIA	MARACAIBO	4.800.000,00	4.800.000,00	LITROS	MENSUAL	ACTIVO
PLANTA LACTEA	LA CREMA DE LOS LACTEOS C.A	ZULIA	MARACAIBO	3.000.000,00	1.500.000,00	LITROS	MENSUAL	ACTIVO
PLANTA LACTEA	MARALACTEO C.A	ZULIA	MARACAIBO	1.200.000	864.000	LITROS	MENSUAL	ACTIVO
QUESERA	LÁCTEOS ZULIA C.A	ZULIA	MARACAIBO	1.170.000,00	720.000,00	LITROS	MENSUAL	ACTIVO
QUESERA	INDUSTRIAS VENELACTEOS C.A.	ZULIA	MARACAIBO	600.000,00	580.000,00	LITROS	MENSUAL	ACTIVO
PLANTA LACTEA	PRODUCTOS DALVI C.A	ZULIA	MARACAIBO	500.000,00	500.000,00	KILOGRAMO	MENSUAL	ACTIVO
QUESERA	FAPROLAC C.A	ZULIA	MARACAIBO	240.000,00	120.000,00	LITROS	MENSUAL	ACTIVO
QUESERA	PRODUCTOS LÁCTEOS HATO PARAISO 2009 C.A	ZULIA	MARACAIBO	140.000,00	120.000,00	LITROS	MENSUAL	ACTIVO
PLANTA LACTEA	UNION DE PRODUCTORES COLON (HATO VIEJO)	ZULIA	MARACAIBO	12.325	12.325	LITROS	MENSUAL	ACTIVO

Similarly, considering other criteria such as 3) selection by operating capacity, according to the same INTI data: companies with higher and lower capacity, as well as intermediate capacity (the latter at random) and 4) inclusion of the company Prolacteca from the municipality of San Francisco, as it is considered a significant company of dairy derivatives (ice cream), which is not included in the INTI dairy circuit, the sample is made up as follows (Table 2):

Table 2. Sample of dairy products companies in the municipalities of Maracaibo and San Francisco, Zulia state.

Operating capacity	Cheeses	Dairy Derivatives
Higher	Industrias Pacomela	Prolacteca
Intermediate	Faprolac Maralacteos	Industrias Dalvi
Lower	Venelacteos	Uprocosa

The sample selected is considered non-probabilistic and purposive. This type of non-probabilistic or directed sample is useful for a certain study design, when not so much a

"representativeness" of elements of a population is required, but a careful and controlled selection of subjects and elements of a population with certain previously specified characteristics (Ferrer, 1993; Hernández et al., 2006).

Nevertheless, given the difficulty of developing research focused on direct observation, due to the conditioning factors and safety standards of these companies, it was decided to resort to the selection of key informants, directly involved with the operational and organizational processes linked to the variables, to collect the most relevant information. Therefore, seven (7) key informants were selected, one subject per company, with the most representative rank, position, or position according to the organizational hierarchy. In this case, managers from the logistics and marketing areas were chosen, who are the ones involved in the main reverse logistics networks, as well as business managers and analysts. As can be seen in Table 3.

Table 3. Key informants

Company	Management Unit or Area	Position
Industrias Pamela	Logistics	Foreign Trade Analyst
Frolic	Administration	Logistics manager
Maralacteos	Administration	Commercial Manager
Venelacteos	Administration	Administration Manager
Prolacteca	Production	Production Manager
Industrias Dalvi	Corporate Marketing	Marketing Manager
Uprocosa	Operations	Plant Manager

As a data collection technique, the design and use of the structured interview were considered pertinent, since the handling of the interview technique requires the management of the communicative context in which the interaction takes place (Galindo, 1998), to facilitate an approach to the key informants and to know the scope required to obtain the fundamental information. Therefore, with this resource, the researcher undertook to explain the motives and intentions of the study, the value of anonymity, and the spatial-temporal logistics of the meeting.

The instrument applied was structured in three parts: identification, regulations for its completion, and presentation of the items to be answered by the researcher, respectively. The presentation of the latter will be structured in two parts: the first one includes information regarding the supply chain; the second one corresponds to reverse logistics including some items to measure social responsibility in reverse logistics activities implemented in each phase of the companies' supply chain.

In this research some statistical methods, derived from descriptive statistics, were introduced to summarize and compare the observations that have been evidenced concerning the variables studied and, at the same time, to describe the association that may exist between any of these from the perspectives of the question posed in this study.

To develop the analytical task, it is necessary to take each of the data or homogeneous sets of data obtained and questioned their meaning, exploring and examining them employing all known methods, in a meticulous work that allows obtaining the best ones, by the type of data that were analyzed. Derived from personal concerns about the economic situation of the country, lack of competitiveness of dairy companies, professional knowledge of the sector to be studied, and personal interest in the environment, globalization, and sustainable development, the possible research questions were determined. Once the problem had been selected, the theoretical review and the selection of appropriate techniques and instruments for the collection of the information were carried out.

Bibliographic documents extracted from internationally recognized databases were reviewed: Scopus, Redalyc, Dialnet and SciELO, and other open access databases. Inclusion and selection criteria were used, specifying articles related to reverse logistics and social responsibility, which allowed the operationalization of the variables and the

design of the information collection instrument applied to the selected sample.

The questionnaire was validated from the perspective of its conceptual and methodological construct with the opinion of five experts, whose recommendations allowed for enhancing its quality. Once approved, the companies were formally invited, by written communication, to participate in the research. At the same time, a copy of the glossary of terms related to the research was sent to them. After the design of the total response entry sheets and the database for subsequent processing, interviews were arranged with each of the key informants to collect the data, and then the information collected was tabulated for discussion and analysis. The data collected in 2019 and updated in 2020 was organized in a database (Excel sheet); responses from each company were grouped by the question and these, in turn, by indicator, and the data shown in the research was calculated under absolute and relative frequencies.

3. Results

The analysis of reverse logistics in dairy derivatives production ecosystems in the Maracaibo and San Francisco municipalities of Zulia State in Venezuela, indicates that the dairy industry is divided into the following chapters: 1) Cheeses, 2) Pulverized products, 3) Fluids, 4) Derivatives, companies that have a linear organizational structure.

The dairy sector in Venezuela is mostly represented by micro and small enterprises, characterized by low capital investment, intensive use of labor, market problems, and marketing of their products. These companies account for 63% of the country's milk production since they are primarily engaged in the production of fresh cheese. Large companies control close to 60% of the national market for other dairy products.

The experiences of the last few years alone have demonstrated the lack of a mechanism for regulating the price of raw milk in all regions of the country. This consideration has had direct and indirect repercussions on the evolution of the trajectory of all products involved in the dairy chain. This situation is a consequence of imports of dairy products whose prices are subject to the exchange rate benefits of the opportunity. Milk, as well as its dairy derivatives, are perishable products due to their chemical and microbiological composition. Consequently, a high rate of returns is expected because any deviation in the organoleptic properties of the product is easily perceived.

Most of the companies dedicated to dairy production present factors that affect the quality of their products, due to deficiencies in handling, processing, and storage, as well as inadequate handling during transportation and distribution. All this results in a negative impact due to the presence of breakdowns, dirty material, deformed packaging (damaged due to lack of adequate refrigeration), organoleptic deviation due to inadequate storage, and expired products due to low and inadequate rotation.

About the acquisition of recoverable materials, it was determined that four (4) of the seven (7) companies analyzed (57.14%) have clauses for the return of raw materials. Only two (2) different companies stated that they also have specifications for the return of in-process and expired products (28.57%). In addition, there are no clauses relevant to the management of returns of recoverable products. Similar results were found for the procurement of these materials (Table 4):

Table 4. Acquisition of recoverable materials

	Commercial returns	Production returns	Functional returns	PFU
Si	42,86%	14,29%	14,29%	14,29%
No	57,14%	85,71%	85,71%	85,71%
TOTAL	100,00%	100,00%	100,00%	100,00%

According to the results of the surveys, three (3) of the seven (7) companies (42.86%) may occasionally purchase certain materials from returns, only 14.29% of the companies analyzed manage purchases of wastes and by-products. Only one (1) of the companies investigated purchases of recoverable containers and packaging (14.29%). In the same vein, these companies only control inventories of returnables, such as containers and packaging (71.42%). There is no inventory control of production waste. However, some of them do so for inventories of by-products and/or semi-finished products (28.57%) (Table 5).

Table 5. Inventory of returnees

	Packaging containers	Production waste	Semi elaborados	Sub products
YES	71%	0%	29%	29%
NO	29%	100%	71%	71%

The products returned to the Zulian dairy products companies are stored -in most cases- in the same warehouses of the company, but located in different locations (72%), although some of these companies usually store their returns in different warehouses of the same factory (14%).

At the level of the results obtained, the reverse logistics process in the production phase of the chain, considering the collection, inspection, and disposal in the companies studied, the following findings can be shown (Table 6). Referring to the production phase of the supply chain of these companies, the materials that are returned to the company include the following recovered products:

Table 6. Inclusion of returned products in production

	Products returned by customers	Production waste	Recovered material	None of the above
YES	71%	71%	71%	14%
NO	29%	29%	29%	0%

71% of the companies consulted (5 in total) include in their production processes products that have been returned by clients, production waste, and recovered materials. Another (14%), on the other hand, has a policy of not including any type of recovered or returned material. The rest of these companies include at least two types of returns. Depending on the recovery activities, the production processes of Zulia's dairy products companies use the following (Table 7)

Table 7. Recovery activities in production processes

	Reuse	Reprocessing	Recycling
YES	57%	86%	29%
NO	43%	14%	71%

These companies have confirmed that their production processes are adapted for the insertion of recovery activities; mainly for reuse (42.86%) and remanufacturing (or reprocessing) (85.71%). However, some of these also include recycling (28.57%), but it is not the main trend.

Although the trend is negative - especially in terms of recycling - the recovery option most used in their companies is the recovery of returnables (57.14%), such as containers and packaging. Recovery also tends to be applied to non-conforming products (42.85%) (Table 8). The recovery of residual materials and waste is not included in production programs.

Table 8. Purpose of recovery

	YES	NO
Residual materials	9%	71%
Production waste	14%	86%
Returnables	57%	43%
Non-conforming products	43%	57%

Dairy products companies in their production phase are characterized by including recovered materials in their production processes; that is, the use or inclusion of customer returns, residues from other previous productions, and other recovered materials are defining features. For these reasons, it was demonstrated that the application of remanufacturing (of returnable materials such as packaging and containers). As a recovery practice, it is a determining characteristic of the evaluated sector, as well as the reuse activities, since both have adequate technology for their application and inclusion in the production programs.

About the collection, inspection, and disposal processes, the results show that:

Collection: Reverse logistics processes are performed by different groups of people. In the companies studied in this research, the collection processes are carried out by the internal personnel of each organization and, to a lesser extent, by personnel with specific functions for this purpose, or by volunteers (Table 9).

Table 9. Collection participants

	PFU	Commercial return	Functional	Production
Internal Staff	71%	71%	71%	71%
Volunteers	0%	0%	0%	14%
Hired	0%	0%	0%	0%
Logistics operator	0%	0%	14%	0%
Others	0%	14%	14%	0%
None	14%	14%	0%	0%

The companies manage collection activities with their workers, and these personnel practices these activities for all returned products. It is very important to know the origin of the returned products since this is the basis for the subsequent activities to be applied (Table 10)

Table 10. Origin of returns

	Final consumer	Distribution channel	Factory	Recycler	Others	No returns
PFU	14%	14%	43%	0%	0%	29%

Commercial return	14%	71%	14%	0%	0%	14%
Functional return	0%	57%	14%	0%	0%	29%
Production return	0%	16,67%	83,33%	0%	0%	0%

Unused products come mainly from the factory itself (43%) but also from the final consumer (14%), but 28.54% of the companies said that they do not return any material. Commercial returns are returned directly from distribution channels (71%) and customers (14%). They can also come from the factory itself (14%) because they are previously brought by partner distribution companies from the commercial channel to the manufacturer. 14% of the companies analyzed have policies of not accepting returns. Functional returns originate from the same distribution networks (57, 24%); transport elements, packaging, and containers are also returned through the same factory, but 29% of these companies do not return this type of material.

Regarding production returns, it was determined that these - as might be expected - are carried out internally in the factory itself (83.33%), although occasionally they are usually formalized through transfer from the distribution centers (16.67%). In short, it is a characteristic of these companies that they carry out their collection activities and that they apply to all returned products regardless of their origin.

Inspection: to determine which of the returned products will go through the subsequent recovery processes, a series of selection criteria were applied. To this end, the most important criteria are those that are in line with the policies and interests of each of the companies belonging to the group analyzed. The results reflect that the prevailing criteria in the sector are as follows (Table 11):

Table 11. Inspection criteria

	Degree of deterioration	Economic value	Returned Characteristics	Non-financial interest	Interest in bidding
PFU	62,50%	25,00%	0%	0%	12,50%
Commercial Returns	23,08%	30,77%	30,77%	15,38%	0%
Functional Returns	33,33%	33,33%	0%	33,34%	0%
Production Returns	22,22%	33,33%	33,33%	11,11%	0%

The most common criteria for the selection of an end-of-life product for recovery are the degree of deterioration and its residual economic value (88%); although, less frequently, the interest in bidding is also often considered (12%). On the other hand, for the selection of commercial returns, the characteristics of the returned product and its economic value are considered the main criteria (61.54%). No less important, companies also consider the degree of deterioration (23%). Likewise, the degree of deterioration, residual value, and non-economic interest of the returned good are also considered to the same extent (33.34%).

All the inspection criteria are important for recovering production returns. It was found that for each of the types of returns at least three (3)

selection criteria prevail and each of them has in general the same value in importance. These operating conditions are determinant or very determinant characteristics of the dairy sector evaluated.

Once the materials for recovery have been received, they are subjected to a series of preliminary tasks (inspection) that determine the subsequent selection of the recovery process to be applied. The tasks presented have a sequential order and each of these must be carried out in the same order since they have a specific objective, the omission of which can affect the efficiency of the subsequent recovery. For this reason, managers were asked to specify the activities performed during the inspection of returned products:

Table 12. Inspection activities

	Segregation	Cleaning	Quality test	Separation of parts	Storage
PFU	43%	29%	14%	14%	29%
Commercial return	29%	43%	43%	14%	43%
Functional return	43%	29%	0%	14%	57%
Production return	57%	14%	43%	29%	29%

According to managers, unused and functional products are segregated, cleaned, and stored. Defective or expired products and all those returned by customers are subjected to cleaning, quality assessment, and storage. Similarly, production returns are subjected to all pre-established inspection tasks. The results found in the present investigation allow characterizing the activity of the sector as determinant and very determinant, in this sense the inspection activities are carried out in most of the companies according to the theoretically established parameters.

The omission of segregation in the inspection of commercial returns is noteworthy; this fact suggests a weakness in the procedures because it indicates that there are no criteria for acceptance or rejection and that everything returned by the client is accepted. This may have an impact on the subsequent efficiency of the recovery because the cause of the defect or deterioration is not taken into account.

As for the participants of the inspection, the management of the return is in charge of a staff that executes the different assigned activities. In the case that concerns this research, specifically the inspection and classification tasks are undertaken by an interdisciplinary group whose participants are assigned specific tasks, according to the data highlighted in Table 13:

Table 13. Participants in the inspection

	Quality laboratories	Expert group	Trained operator	Untrained operator	Recycling operator
Inspection/sorting	85,71%	0,00%	42,86%	0,00%	0,00%
Selection	28,57%	28,57%	42,86%	0,00%	0,00%
Evaluation	28,57%	28,57%	28,57%	0,00%	0,00%

Inspections are carried out by the quality department personnel (86%) and with the assistance of trained operators (42.86%). Selection and evaluation, on the other hand, are

verified by a larger group of participants, made up of trained operators, expert groups, and quality inspectors. Synthesizing the previous results, the group of dairy products companies is characterized from determinant to very determinant in the execution of its inspection and selection activities, since its internal personnel participates in the reverse logistics tasks by carrying out each of the inherent activities.

Disposal: in Zulia's dairy companies, once they have been inspected, the recovered products have two defined destinations: return and donation.

Table 14. Destination of recovered products.

	Re distribution	Sales of second-hand products	Donations	Sales to third parties	Municipal landfills	Recovery
PFU	29%	14%	57%	14%	0%	14%
Commercial return	0%	57%	57%	0%	0%	14%
Functional return	57%	0%	0%	14%	0%	86%
Production Return	14%	43%	57%	14%	14%	14%

Company policies regarding the disposal of materials to be recovered are reflected in the destination specified for each product flow. Thus, out-of-use products are mostly directed to donations (57%) and redistribution in the channel (27%). Commercial returns tend to be redirected in the same proportion (57%) to secondary markets or donations. Baskets, packaging, and containers are placed back into the distribution network or are destined for recovery itself (86%). Those materials that are selected and will be recovered are stored in the company's facilities, regardless of their origin (Table 15):

Table 15. Storage of recoverable

	Company warehouse	Own stockpiling	Contracted warehouse	Another
PFU	86%	0%	0%	14%
Commercial returns	86%	14%	0%	14%
Functional returns	100%	0%	0%	0%
Production returns	100%	0%	0%	0%

In the disposal phase of the supply chain analyzed, it was found that companies take advantage of those materials that are returned in one way or another and regardless of their origin through a recovery method. This very decisive characteristic is positive, as it implies a revaluation of the assets. Consequently, it is interesting to note that only a small percentage is disposed of in municipal landfills (14%), which represents production waste.

4. Discussion

Reverse logistics requires the development of responsible business management practices, since the implications derived from the process account for sustainable behaviors and actions that benefit the environment and society, thus prevailing the organization's commitment to the preservation of social ecosystems. From this perspective of analysis, the contribution of

reverse logistics to society is imminent, since the recovery of waste and PFU are polluting agents that leave their ecological footprint in the environment. The enhancement of benign practices will speak of the company's social responsibility to society. Perhaps the ultimate goal that justifies reverse logistics is the emergency logistics system for health and safety risk collection (Recall) as a strategy. Many companies employ them to prevent safety risks and save their share of social responsibility.

In Venezuela, it is a challenge to implement a reverse logistics system as an essential and potential strategy, since the term is unknown and integration is not characteristic of the sector, even though the Constitution of the Bolivarian Republic of Venezuela specifies sustainability as a legislative reference framework in articles 127 to 129. However, some of the companies analyzed have corporate social responsibility policies, but they do not have sustainable components associated with reverse logistics, nor do they define marketing strategies to position themselves as responsible organizations that care for the environment and non-renewable resources.

Regarding reverse logistics processes, De Brito (2003) proposes that logistics processes should be analyzed holistically to understand the dimension that they encompass and the scope of activities related to operations. This proposal makes it possible to determine how this process can be integrated into the supply chain, as well as to offer tools for the establishment of strategies. For this reason, the characterization of reverse logistics in dairy products companies was based on the results obtained from the answers to five (5) questions that covered the different aspects inherent to this variable.

In the collection process, the distribution network is responsible for receiving from the client those products that are expired or damaged -as a fundamental characteristic- following the parameters established in the sales policies -as a determining characteristic-. Likewise, this network also has a plan for the return of containers and all transport elements to the factory, as specified in the characterization of the supply chain: the collection is carried out in parallel with the dispatch of finished products, using the same routes and fleet of the direct distribution flow. The origin of the collection arises from the factory itself since the production processes generate defective or deteriorated products (PFU) or products that are rejected for being "nonconforming" products. This characteristic, although not detailed by the managers, could be exemplified by the production - as returns - of broken tubs and plastic bags, cheese whey, buttermilk, ice cream bases, toppings, mozzarella whey, and curd grains, among others.

Likewise, in the collection process, personnel belonging to the quality department, together with trained operators, are responsible for segregating these returns, identifying them, and controlling their logistics and inventories -determining characteristics-; in addition, this personnel is also assigned to receive returns from commercial returns. Once the returned products are received, they are usually placed in the company's warehouses, where they are stockpiled until a significant lot is obtained.

Regarding inspection, it was determined that this activity is carried out by the company's operating personnel, made up of an interdisciplinary group of experts, trained operators, and led by the quality department. This personnel carries out the activities involved in the inspection of segregation, cleaning, quality testing, and storage of each type of return according to their origin. In dairy products companies, the inspection of returns is focused on the degree of deterioration and the economic value, it agrees with the origin and the post-recovery destination, but it depends on the strategies and from these, the recovery option is also determined. For returns, the degree of deterioration of the products returned by the customer is set as the only criterion, the rest of the returns are also evaluated according to the economic value and the characteristics or properties of the materials.

As far as disposition is concerned, the vast majority of returned products are recovered. This statement is made due to the null percentage of responses to the option of municipal landfills as disposal. The common

destination of recovered products is reinsertion in secondary markets or the same channel. Donations to public institutions and gifts to staff are other options but are less frequent.

5. Conclusions

Regarding reverse logistics processes, it can be determined that Zulia's dairy products companies self-manage the collection, inspection, and disposal processes, including recovery tasks. The companies' personnel, facilities, and technology are directly involved in retrologistics; consequently, they have established reverse logistics processes to recover both commercial and production returns and are associated with the production processes, but not integrated.

The group of dairy products companies in Zulia state considers the inclusion of reverse logistics in their operations to be particularly important since they have a system that is not very functional, but relatively satisfactory. This system is complete because it includes both the subsystem for the treatment of commercial returns and economic recoveries.

At the level of sustainability and social responsibility, the information provided by managers indicates that the reason for applying reverse logistics in the sector is due to economic reasons, whose objective is the reduction of waste and, therefore, operational efficiency. However, information on the costs and benefits generated by recovery are not monitored or presented in the results reports. This discrepancy could indicate that the organization is not consistent with the economic recovery strategy.

This study reflected the circumstances at a given time and determined certain characteristics from a contextual reality. Therefore, the importance of the inclusion of reverse logistics is demonstrated by its constant application in operations, but its importance is diminished because the production processes are contracted, in addition, there is an evident decrease in supply. The flexibility of the reverse logistics system in dairy companies is determined not only by its adaptability to the volume of operations but also by market circumstances. This means that each return has a predetermined recovery option, although the destination or purpose may vary according to need.

The Zulian companies of dairy derivatives self-manage their reverse logistics processes and are motivated by economic reasons, but develop the processes with unsustainable practices. As their operational processes are adapted to a traditional and departmentalized organizational structure, the establishment of a culture of sustainable development will allow these companies to remain in the market, as it increases the efficiency of the processes, as well as their image and corporate identity by being perceived as "environmentally responsible". Strengthening reverse logistics processes in the supply chain under these criteria will undoubtedly result in a better characterization of this subsector from a managerial point of view.

In the National Constitution (articles 127 to 129), the guidelines for sustainability are expressed as a legislative reference framework, its relationship with the industry, and the different interest groups (stakeholders). However, dairy products companies in the Zulia state have not focused their attention or interest in analyzing to guide their reverse logistics strategies and activities as socially responsible practices, which allow the organization to generate a sustainable competitive advantage oriented to the benefit of stakeholders in the supply chain.

Some companies analyzed have corporate social responsibility policies, but do not have sustainable components associated with reverse logistics, nor do they define marketing strategies to position themselves as responsible organizations that care for the environment and non-renewable resources.

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