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CHARACTERIZATION OF THE COLLECTION AND DISTRIBUTION PROCESSES OF BIENESTARINA IN BOGOTA

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Abstract

The production and distribution of Bienestarina to the vulnerable population of Colombia is one of the strategies of the "Colombian Institute of Familiar Wellness" (ICBF its acronym in Spanish) to fight malnutrition, especially among children. This article presents a first characterization of the supply chain for this product in Bogotá emphasizing collection and distribution logistics operations and identifying the actors in the chain, the currently applied regulations and the logistical requirements that leading the distribution of this complement to the different types of beneficiaries.

Key words: Food supply chain, distribution processes, Bienestarina, Instituto Colombiano del Bienestar Familiar.

I. Introduction

The food safety has been one of the commitments which wants to ensure the Colombian government as a right that the population must have (Dirección Nacional de Planeación 2007), so the state must help the part of the Colombians population who is under malnutrition due to nutrient deficiencies in their food, where the child population is seen as the main affected (ICBF et al. 2010). Malnutrition in children generates several problems such lake of concentration, lack of energy, decreased learning ability and general delay in physical and mental development, among others (Cuevas Garcia 2005).

There is a strategy over 30 years to strengthen food consumption of high nutritional value through the production and distribution of a food supplement based on mixtures of plant origin with high nutritional content, which is called Bienestarina. The purpose of this supplement is to arrive in time to children, young, elderly, poor families, ethnic groups and other population who require sufficient nutrients which their basic food is not covered completely. Production and distribution of Bienestarina to the vulnerable population of Colombia is one of the strategies of the Colombian Institute of Familiar Wellness (ICBF) to combat malnutrition, especially among children.

The Bienestarina supply chain starts with the production of the product in two plants located in the cities of Sabanagrande, (Atlantico region) and Cartago (Valle region). The product is then distributed through regional warehouses, primary distribution points and executing units to have fully national coverage, reaching 1119 municipalities (ICBF 2013a). However, there have been some failures and evidence of abnormalities in these logistical processes, such as time delays and lack of product distribution to the primary distribution points, as well as the supply of raw materials in the production plants giving as results delays of up to 15 days on average, causing re-scheduling in production and non-compliment of distribution dates. Finally there are few tools for monitoring and control of both raw materials and finished product (Procuraduría General de la Nación 2011).

This article aims to state at research level, how is the current state of Bienestarina logistic process under a point of view in managing the supply chain, starting with the city of Bogota that receives the highest number of primary distribution points of distribution in the country. This research then can provide a starting point for analysis in different parts of Colombian territory and thus able to establish a basis for the development of global logistics Bienestarina in the country.

We focus on the links between the distribution network and the supply chain echelon by identifying stakeholders and processes. Therefore its objective is to assess the current situation of this supply chain to establish new mechanisms for operational management.

Achieving these objectives and the results of this research would lead to the development of a logistical operational characterization in a wider, regional and national scope, and obtain a global analysis that allows integrated strategies.

This paper is organized as follows. First, the background and context of the research is presented. Then, the methodological issues are presented. After that, the main results of the research are proposed and discussed. Finally as a conclusion, practical implications of those results and further developments are proposed.

II. Background

The ICBF since 1976 produces the product Bienestarina as a dietary supplement of high nutritional value as a strategy to strengthen the fundamental right to food security in the country, which leads to child protection policy and the family of this institution (Dirección Nacional de Planeación 2006). In early 2013, the ICBF launched "Bienestarina Más" which is an improved product reformulation with more vitamin D, Omega 3 and minerals (Presidencia de la República 2013). The product is aimed at vulnerable Colombian population, especially among children, as a means to address the problem of child malnutrition.

Bienestarina is a food which the ICBF produces and distributes in various food security programs covering the entire national territory and it is addressed especially to children who are at risk conditions and food vulnerability. This product benefit adolescents, pregnant women, mothers, different ethnic groups, families and seniors belonging to levels 1 and 2 of SISBEN (The System for the Selection of Beneficiaries for Social Programs)¹.

This food, which is constituted of a mixture of flours of vegetable origin, such as starch from corn, wheat and rice, soy, plus milk powder, is a highly enriched source of calories, carbohydrates, proteins, natural fats, calcium, vitamins A, C and other nutrients that becomes a reinforcement to attack the problems of child malnutrition as a supplement food and it should not replace the basic food or breast milk. Bienestarina is also used as an input in the preparation of different foods such as cakes, cookies or breads, among others, which are also aimed at the target population in the different programs of ICBF. The nutritional information about Bienestarina is showed in Table 1.

Table 1 Nutritional Information Bienestarina (portion 100 g).

COMPONENT	CONTENT
Energy (kcal)	360
Carbohydrates (g)	64,79
Protein (g)	20,145
Fat (g)	3,082
Total dietary fiber (g)	1,806
Calcium (mg)	700
Phosphorus (mg)	550
Iron (mg)	14.1
Vitamin A (UI)	2000
Vitamin C (mg)	45
Niacin (mg)	7.3
Thiamine (mg)	0.5
Riboflavin (mg)	0,6
Vitamin B6 (mg)	0,9
Folic acid (mg)	160

¹ According to IDB (2016), SISBEN is the Colombian national system for social subsidy beneficiaries' identification. It classifies the people according to their socio-economic level into 6 levels, 1 homeless people and extreme poverty, 6 the highest level of affluence.

Vitamin B12 (mg)	1.4
Zinc (mg)	8,3

Source : ICBF, *Ficha Técnica Bienestarina*, 2009

Since December 2007, the ICBF through concession granted to the company INDUSTRIAS DEL MAIZ S.A. CORN PRODUCT ANDINA (IDM), currently under the name INGREDION manages the production and distribution of Bienestarina and other foods of high nutritional value, in the two production plants from ICBF, which produces 19.000 tons of Bienestarina per year. Those plants have a production capacity of 72 and 100 tons per day. The annual production was 25.000 tons which were expected to reach approximately 6.5 million of beneficiaries in the entire national territory (IA Alimentos 2013).

This research importance is based on the fact that in recent years there have been irregularities in the management of Bienestarina involving distribution processes, product quality and traceability, lead time distribution to the beneficiary (end consumer) among others. One example is the cases of product expiration, according to (El Nuevo Siglo, 2013) in the period January-June 2012, 190 expired product packages were reported.

III. Methodology

The methodology starts with the design of the conceptual model of the Bienestarina logistics process, based on the analysis of literature review, collection of relevant secondary data and also primary information. The source of the secondary data was collected by the revision scientific and academic books and articles, news reviews and public reports of the ICBF site web. The primary information was collected through interviews with stakeholders in the Bienestarina supply chain. Those interviews were made an informal way but following an interview guide proposed.

As a second step there is an analysis of logistical operation models identified in similar contexts to Bienestarina, there were a characterization of the distribution process of the Liconsa milk in Mexico as a supplement food (Talamantes *et al*, 2015). The main results were that the Liconsa milk and Bienestarina Supply chains have many similarities, because both are focused on meeting a basic need in a vulnerable social group. It is concluded that the inclusion of an integrated information system in the supply chain could improve the performance of the distribution of products in both cases (Liconsa and Bienestarina). Finally, it is recommended that further analysis must be done for an effective implementation of an information system that allows the articulation of all stakeholders in the supply chain.

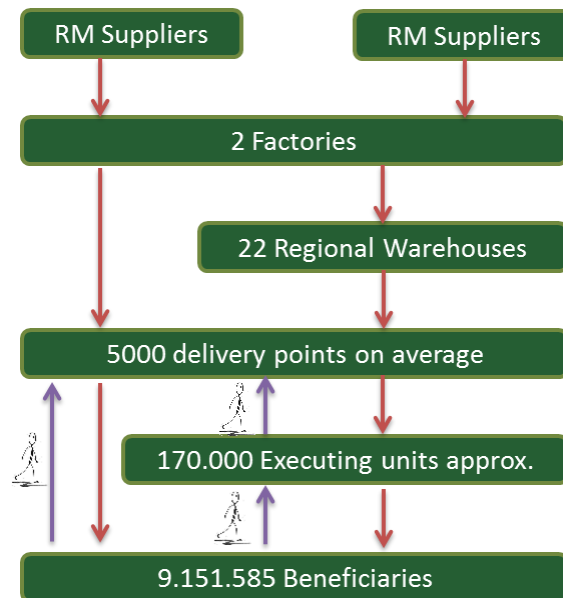
Finally, as a third step , the characterization of the Bienestarina logistics operation occurs after the analysis of documents which led to the construction as a result of the detailed conceptual model of the Bienestarina supply chain, regulatory and legal framework governing the product and the collection and distribution operations, the study of the stakeholders involved in this process, analysis of influences and dependencies between them, building instruments for gathering information for the diagnosis of the different operations at the point of primary distribution of Bienestarina as well the feedback analysis of the interviews with ICBF.

IV. Results

As part of the results that provide insight as is currently the logistics management Bienestarina in the city of Bogotá, it is necessary to know in detail the entire process of product distribution. Thus it is disclosed stakeholders and each stage of the distribution chain and its peculiarities.

A. *Bienestarina supply chain*

The distribution must take the dealer is like the ICBF established according to different actors who are responsible to bring the product to the final beneficiaries, through different programs of the ICBF for this purpose, as are programs School , Community Welfare Homes , Home Community FAMI , Breakfast Children , Elderly and other food late . Thus for Bienestarina, the supply chain is structured as shown in Figure 2.



*Figure 2 Scheme of Bienestarina distribution chain.
Own elaboration based on (ICBF 2009)*

The Bienestarina supply chain consists of 15 suppliers of raw materials and 2 production plants where the finished product is produced and packaged in small bags of 900 g, packed in big bags of 25 small bags as a reference unit, until it reach distribution or primary distribution points.

There are 22 regional ICBF warehouses distributed in Colombian territory where the product is stored and sent to nearly 5000 primary distribution points which can serve as a distributor or as point of care and distribution of products to the beneficiaries, as the 170,000 made executing units. However there are cases, which are showed in Figure 2, where the product is transported directly from the producer to the primary distribution point (or delivey point).

For distribution to primary distribution points, ICBF divides the territory in 8 Macro-Regions, according to issues of regional distribution programs and operating costs logistics, as shown in Figure 3, and Table 2 shows the distribution points for regional and transport modes that are used.

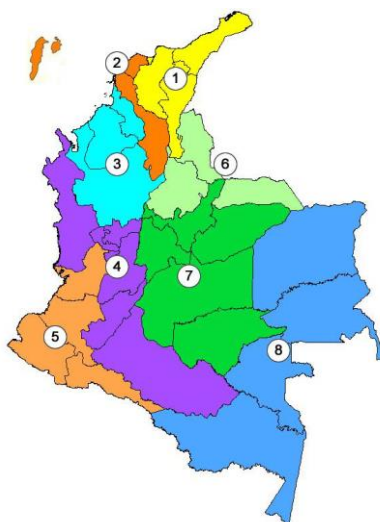


Figure 3 Division of logistic distribution Macro-Regions (MR)

The Bienestarina supply chain uses different mechanisms and means of transport (land, air, and sea) to bring the product to remote parts of the country and achieve full coverage of the territory as shows the Table 2.

Table 2 Logistic information about the Bienestarina distribution process in Colombia
Source : (ICBF 2013a)

Macro-Region	Regional	Delivery points	Modes
1	La Guajira	24	Land
	Cesar	238	Land, River
	Magdalena	279	Land, River
2	San Andrés	12	Land, Sea
	Atlántico	295	Land
	Bolívar	350	Land, River
3	Sucre	13	Land, River
	Córdoba	47	Land
	Antioquia	359	Land
4	Caquetá	31	Land, River
	Risaralda	44	Land, River
	Quindío	44	Land
	Chocó	115	Land, River, Sea
	Caldas	119	Land
	Tolima	177	Land
5	Huila	188	Land
	Putumayo	9	Land, River
	Nariño	72	Land, Sea
	Cauca	97	Land, River, Sea
6	Valle	341	Land, Sea
	Arauca	17	Land, River
	Santander	150	Land
7	Norte de Santander	397	Land
	Casanare	44	Land
	Guaviare	47	Land, River, Air
	Meta	124	Land, River, Air
	Boyacá	156	Land
	Cundinamarca	185	Land
8	Bogotá	626	Land
	Guainía	2	Land, River, Air
	Vaupés	7	River, Air
	Amazonas	9	Land, River, Air
	Vichada	14	Land, River, Air

Some primary distribution points and some executing units engaged in the manufacture of food products using Bienestarina as an ingredient: as cakes, biscuits, juices, etc. The supply chain ends on this Bienestarina distribution to 9,151,585 beneficiaries identified in this study, including those among children, teen, and women in gestation, nursing mothers, elderly and families who are in a vulnerability or risk position. In Bogotá, capital city of Colombia, concentrates the most amount of primary distribution points with 626, of which distributes mostly in south and west sectors of the city.

The beneficiaries of the product have the possibility to go to executing units or corresponding primary distribution points to receive the product, just as executing units has to go to the primary distribution point to receive the product, as shown by the purple arrows in Figure 2 with opposite way to the regular supply chain.

B. Distribution in Bogotá

Focusing distribution in Bogotá, each month, product distribution period, is made distribution schedules to the primary distribution points. In it get information that is sent to the information system; the corresponding ICBF zonal center, the distribution point name and its address, the responsible of the distribution point with a telephone number and the quantity to be delivered depending on the product type. This information must match with the distribution process; it referred later in the section information flows.

Based on the distribution schedules in the last three years, it observes that this has a very irregular behavior and in some cases is discontinuous, as evidenced in Figure 4 where, for example, cases like February and March in 2011, the amount of product increased significantly compared to the other months of the year and the same month in 2012 and 2013, this is because these months were delivered big amounts of product by firms like COLANTA (Bogotá), representative of the dairy sector.

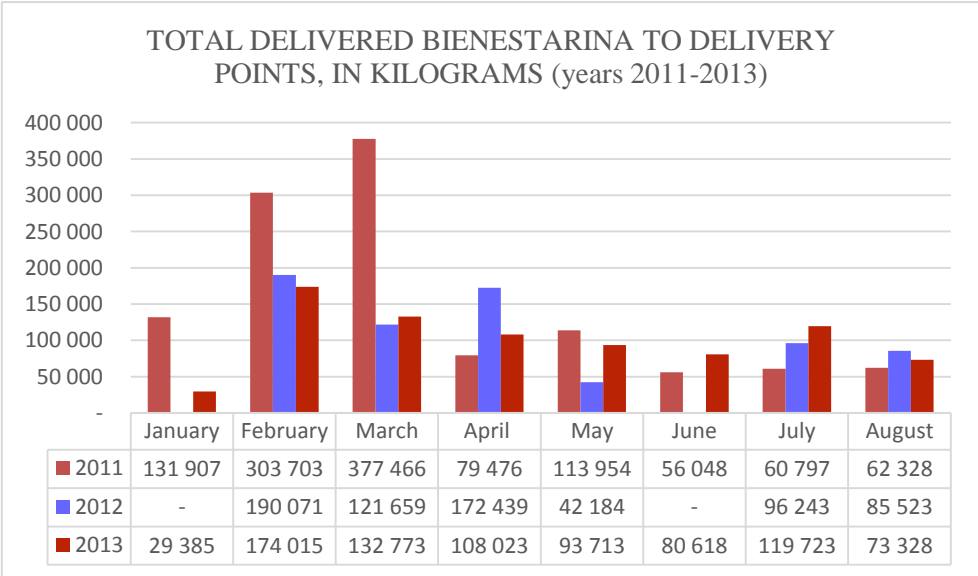


Figure 1 Total kilograms delivered of Bienestarina in Bogota (years 2011-2013 periods January-August)

The data provided by the ICBF, there are amounts distributed in a given month and consumption for the next month. The Figure 4 shows that in January 2012 there was not distribution and quantities delivered in February were for consumption in February and March. The same thing happened in June. In April there was distribution for consumption in May and June; in May there was distribution to consumption in June and July. So there was not distribution in June.

With this data, we can also identify the main city areas, which the complement arrives. Thus it is shown in Table 3, how is distributed the distribution points in Bogotá city, giving the locations of Ciudad Bolívar, San Cristobal, Engativá and Kennedy with biggest of these points.

Table 1 Primary delivery points per locality in Bogotá (period January-August 2013)

DELIVERY POINTS		
LOCALITY	POINTS	KG DELIVERED
Ciudad Bolívar	97	148,117.5
San Cristóbal	58	76,162.5
Engativá	56	74,700.0
Kennedy	55	99,922.5
Bosa	50	63,877.5
Rafael Uribe	50	65,362.5
Suba	49	60,412.5
Usme	42	77,917.5
Usaquén	37	35,775.0
Barrios Unidos	29	20,925.0
Fontibón	18	31,140.0
Santa Fe	17	19,620.0
Mártires	17	18,067.5
Tunjuelito	15	22,635.0
La candelaria	3	3,082.5
Puente Aranda	3	4,995.0
Teusaquillo	2	495.0

Thus, this table can also determine which sectors are located the target population to the product and allows to emphasize possible intervention instruments through local programs.

C. Beneficiaries

According that established by ICBF, Bienestarina is intended solely to children population, adolescent, women in gestation, nursing mothers, the elderly and families who are at leven-1 and leven-2 of SISBEN (Public subsidiary health system) and to be in a position of vulnerability or risk. Beneficiaries must be linked to one of the ICBF programs to be recipient of the supply of this food. For some programs, such as DIA (Child Breakfast with Love), it is restricted to enrolled beneficiaries at this that cannot be linked to a different program at the same institution.

The beneficiaries are formed by the following attention modes:

- **Child Breakfast with Love (DIA for its acronym in Spanish):** This program serves the population of children between 6 months and 5 years old, delivering nutritional supplements, where is present the Bienestarina. In this program they are also included children affected by violence and forced displacement. The program offers 2 types of complements according to age: Type 1, for children between 6 and 11 months old, it delivers 1 Bienestarina bag equivalent to food for a month (30g daily) and Type 2, children between 1 and 5 years old, it makes same deliver of 1 Bienestarina Bag, with a serving of milk, or oats, or liquid Bienestarina and a biscuit or enriched. Table 4 shows the number of children covered by this program in Bogotá, compared to throughout Colombia.

Table 2 Beneficiaries of program DIA. Source: ICBF. Cut until august 2013

Regional	Beneficiary type 1	Beneficiary type 2	Total beneficiaries
Bogotá	951	25,948	26,899

Total Colombia	28,101	711,867	739,968
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- **Mother and Child:** In this mode, we can find mothers in gestation, nursing mothers and children between 6 months old and 5 years old. It delivers monthly to them 2 Bienestarina bags for to be prepared in their homes.
- **Welfare Communitarian Homes:** It includes 2 modes: Household “Family Women and Children” (FAMI for its acronym in Spanish) and “Traditional Household”. These households are aimed at children under 5 years old, where in addition to providing nutritional attention so does health, safety and nutritional development. Children are given a daily ration of Bienestarina in the communitarian home, plus 6 deliveries per year of product to be prepared at home.
- **National Nutrition Program for the Elderly (PNAAM for its acronym in Spanish):** It is intended to provide nutritional aids to the Elderly in conditions of economic and social vulnerability. For 2011 the program is covering about 417,000 seniors offering aids consisting of prepared food, non-perishable food and deliver of 1 Bienestarina bag per month to be prepared at home.
- **Children’s home, Infants and Toddlers:** Serve within the program to children older than 3 months and under 6 years old. At points are prepared them Bienestarina, in addition to be served with 2 bags per year and can be prepared at home.
- **Specialized Institutions in Attention of Children in Special Conditions of Vulnerability:** Enter in this group boys and girls with hearing impaired, and children of mothers who are in prison. For them it delivers a daily ration of Bienestarina.
- **Nutritional Recovery:** Shelters children over 6 months and under 5 years who are in full malnutrition or at risk of the disorder. For children who are under 1 year will be supplied directly a daily ration of Bienestarina, as part of the basic nutrition. For children up to 60 months old are given a monthly ration to be prepared at home throughout the year.

D. Information flows for store and distribution operations

Among the activities in the traceability system that must perform the dealer that operates production plants, the 900g bags and the sacks that containing 25 bags have that are marked with information necessary for its identification throughout all distribution stage both primary and secondary and nutritional information, making compliance with Security Council resolution 5109 of 2005 and 333 of 2011 from the same plant where it was produced, so that the mark should be visible and legible until it is delivered to the final beneficiary.

In the information system used by the dealer must be contained all the information that contains the product’s mark, no later than 2 hours after being recorded. During the primary distribution must provide the following information in the marking at least (ICBF 2013c):

- Product (traditional or flavored)
- Factory where was made
- Date of production
- Product expiration date
- Weight of the package content
- Batch

- Unique identification of the bag or sack
- Identification of executing unit or beneficiary
- Program to which it belongs

Within the secondary distribution, the primary distribution point should handle various supports that monitors and controls the receipt, storage and distribution of product, whether to executing units or directly to beneficiaries. In order to receive the product, the information contained in the distribution act is checked, which must contain the amount, the batch from, the product expiration date and the distribution date. For the inventory control, the points must rely in an inventory form or KARDEX registering the product outlets daily. For product distribution must fill out the “Distribution form to executing units”. In this should be consigned name and signature of those responsible for the executing unit, the serial number of the sack or bag that is delivered together with the quantity delivered (ICBF 2009).

E. Regulations

Bienestarina is subject to different laws and regulations, as are mentioned in the technical sheet document that the product is presented to ICBF (ICBF 2013b). Currently it does not apply any additional local regulations, meanwhile, these laws apply to Bogotá equally to the rest of the country. A brief explanation of these regulations is mentioned as follows:

- Tributary Code: Under Article 30 of Law 788 of 2002, amends article 424 of the present Code where it includes the product Bienestarina to the list of products, mostly agro-industrial products, which are excluded from sales tax where sales or import cause this tax. Anyway for Bienestarina is considered a product that is delivered totally free to beneficiaries, also it is not for sale and is distributed only in Colombia.
- Resolution N 11488 of 1984 from the Ministry of Health “By establishing rules regarding processing, composition, requirements and marketing of child foods, fortified foods or drinks and dietetic foods or drinks”: This Resolution identify the different foods that are destined for the child population, categorizing this into two main groups, infants and Young Children. Also characterizes the different foods to these groups outlining the minimum chemical and nutritional compositions that should contain these products and doses allowed for these. (Presidencia de la Republica, 1989)
- Resolution N 5109 of 2005 from the Ministerio de Protección Social “By establishing the technical regulation on labeling requirements of packaged foods and food raw materials for human consumption”: This refers the requirements for the labeling, both content and layout of a clear and accurate description of the ingredients than contains any food intended for human consumption, which it must contain information about the product name, list of ingredients, net contents, name and address of the manufacturer, packer, and if is applicable, the distributors, importers or repackers, batch identification, expiration date and conservation instructions, instructions of use and sanitary registry, in order to meet required by the National Institute of Food and Drug Monitoring (INVIMA for its acronym in Spanish) for later merchandising. (Ministerio de Protección Social, 2005)
- Colombian Technical Standard 5148, processed cereal-based food feeding from 6 months of age: The standard refers a technical way of how should be the composition of these foods as mentioned un the title, to normalize their classification, the ingredients composition thereof, microbiological requirements for each product classification and methodology for conducting the tests to determine moisture factors, protein, coliform and other organisms that may include the product and be grounds for acceptance or rejection of it, also of give instructions on the labeling, similarly to Resolutions 5109 of 2005 and 333 of 2011. (ICONTEC, 2003)
- Resolution N 333 of 2011 from the Ministerio de Protección Social “By establishing the technical regulation about nutritional labeling requirements to be met by packaged food for human consumption”: Is related to Resolution N 5109 of 2005 but difference, this specifies in detail the requirements and

conditions that must include the marking or labeling of food products for human consumption, with accurate and concise information without incurring to consumers a wrong understanding to these information. On this develops the instructions for the declaration of nutrients that contain the ingredients of feeding product, such as energy, protein, fat, vitamins, minerals, etc., the daily reference values, whether young children (6 months to 4 years old), children over 4 years and adults, declaration of nutritional properties and formatting instructions to print nutritional information within the tag or label. (Ministerio de Protección Social, 2011)

- Decree 3075 of 1997, by regulate the activities of food handling: This Decree enacts good manufacturing practices that lead to good hygiene in food manufacturing, including also packaging, storage, transport, distribution and marketing; applied in facilities, equipment and utensils, the staff carrying the food handling, hygiene requirements in the factory and assurance and control quality, as well as storage, transport and distribution and other specific points holding the Decree. (Presidencia de la Republica, 1997)

In logistical issues that apply to Bienestarina there are some regulations that covering this kind of foods logistics in the Decree 3075 of 1997, which mentions that during the logistic processes must prevent any contamination or alteration to the food, the appearance of harmful microorganisms to food and deterioration of the packaging or container.

V. Discussions

According the selection of the delivery point's locations, it is defined at the disposal of these centers, mostly independent or affiliated public institution, where they offer their facilities and suitable adjustments for operation and establish agreements with ICBF to give then to supply chain product and deliver it to the executing units and beneficiaries. The concentration of the poor population and income of victims of the conflict to major cities also increased the number of vulnerable population, which can be reflected in the capital of Colombia as a region with the largest number of delivery points and these are located in areas with the highest concentration this population, in order to provide timely and efficient service.

As the ICBF commitment and mission of bringing the Bienestarina to every corner of Colombia, and since this presents great diversity in its geography , where there are municipalities that can only be accessed by sea or air environment, we can conclude that ICBF take advantage of the modes transportation available to meet the distribution goal. The main priority of the nutrition programs is to get full coverage to the beneficiaries, which employs multi-modal distribution strategies, without regarding the cost as primary factor but still important.

Finally, regarding the Bienestarina production capacities of plants in Cartago and Sabanagrande, they are 72 and 100 metric tons respectively, and whose production is set at 26,000 tons per year. This capacity utilization covers the target population reaches 9 million people, with the aim of lowering rates of malnutrition. Given the conditions and control of these indices, plants can reach a production capacity of 45,000 tons of product a year, to meet contingencies of different kinds. This mean that the configuration of Bienestarina supply chain could be consider as a pull supply chain and not a push supply chain.

Through analyze those main results of this Bienestarina supply chain characterization; we can affirm that the actual Bienestarina supply chain organization has some points of disjunction.

- In the distribution process, there are a large lead times distribution.
- Not accurate inventory management. It can be reflect by the product quality that sometimes it is delivered to the beneficiary when it has already expired.
- There is not product traceability in real time that reflects the state of the distribution process and as a result there are not controls on the product lost by the traceability of the production and consumption dates.

The possible action could be to establish new mechanisms for operational management.

- Taking into account that the Bienestarina Supply chain is a pull supply chain, it could be necessary analyze the stock policies and the inventory management at the different steps of the chain (stakeholders inventory). This inventory management initiative could help to reduce the lost product by minimizing stock and focusing on deliveries plan.
- The actual configuration of the supply chain can be profited by the fact that since there is a pull system, the inventory remains further up the supply chain, closer to the source. This means that the quantity and the strategy location of delivery points and execution units can be a positive factor for the Bienestarina distribution process.
- Under these strategies, the request of Bienestarina enters the supply chain when beneficiary demand is actually estimated by the ICF and its demand justifies it. In order to accomplish this target, the incorporation of information and communication technologies, and the development of mathematical models or analysis framework could be proposed. Develop a ICT to have the traceability in real time of the product through the distribution process in the entire supply chain, it could allow the ICBF avoid the cost of carrying inventory that may lost before arise the beneficiary.

VI. Conclusions

The ICBF program of Bienestarina is considered one of the most important to combat the problems of malnutrition in Colombia, which is shown reductions in the rates of chronic malnutrition and underweight (ICBF et al. 2010). This is why, it is important to a comprehensive development logistics, the implementation of strategies, methods and techniques of various kinds, according to the nature of each of the regions of the Colombian territory to bring Bienestarina in just in time and make compliance with the fundamental rights of the vulnerable population.

More in depth studies of supply chain operators and logistics platforms, infrastructure, information technology and other aspects allows to strengthen the Bienestarina logistics system and to get efficient results. It could be also develop various projects from the education sector and the private sector to establish strong interdisciplinary connections and good support for the implementation of the Bienestarina supply chain project to emerge, with a high degree of coordination.

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