

Lean manufacturing and sustainable development in the urban markets of City of Riobamba, Province Chimborazo, Ecuador

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Abstract

In the policies and practices of environmental sustainability involves the marketing process, the objective of the research is to identify the practices of Lean Manufacturing in and sustainable development in 12 cadastralized markets in the Decentralized Autonomous Government of the Municipality of the canton Riobamba in the different sections (fruits, vegetables, vegetables, meat, among others), the population of 4,498 traders of the markets in the urban area Riobamba, Province of Chimborazo. The lean manufacturing model and the Five "S" tool were applied: i) environmental protection and waste management; ii) creation and maintenance of clean and safe work areas; iii) training and dissemination; iv) self-regulation processes; and v) application of good food handling practices (GMP). The descriptive, field and documentary research, the sample was applied to 380 traders. The results indicate that there are limitations in the marketing systems that make it impossible to participate competitively and effectively in the markets. It is concluded that the Five "S" allow improving the quality/product through GMPs, which guarantee

safety, reduce biological risks, and avoid Food Transmitted Diseases (FBD), promote a positive perception of the markets and in this way contribute to transform and promote sustainability.

Key words: markets, traders, lean manufacturing, Five S's, sustainability, sustainability.

Introduction

The globalized economy and advances in communication technologies (ICTs) have brought about substantial technological, economic and geopolitical changes. The growth of emerging economies, the proliferation of "free trade" treaties that promote cost and price competitiveness, the constant changes in power relations in geopolitics and the integration processes of countries, where there is talk of quality and the same thing is still being done, how can substantial changes be achieved in our economy without improving the quality of the products and services offered? It is the markets that supply the basic necessities, the same that have been neglected in the quality of the products for sale, there are biological, economic and health risks; therefore, it is necessary hygiene, food handling, presentation and customer service; these factors are the fundamental pillars in the quality of markets, Lean Manufacturing is a tool for continuous improvement, which creates value and the application of the Five "S" promotes the sustainable development of markets in the canton Riobamba, province of Chimborazo, Ecuador.

Lean Manufacturing is a tool that allows eliminating all operations that do not add value to the product/service and its processes, in order to increase value in each activity performed and eliminate the unnecessary ones by reducing waste and improving operations. Lean Manufacturing was born in Japan and was conceived by the great gurus of the Toyota Production System: William Edward Deming, Taichi Ohno, Shigeo Shingo, Eijy Toyota among others. The Lean Manufacturing system has been defined as a philosophy of excellence in manufacturing, based on: the planned elimination of all types of waste through continuous improvement Kaizen and the consistent improvement of Productivity and Quality. Diaz (2009).

The principles of the "Five S's" or 5's in this study have been adapted to the needs of the research, being the markets an important challenge for the Decentralized Autonomous Governments, the National Government and the Ecuadorian Universities, who seek to improve the quality of life of the most vulnerable sectors of society and who are part of the popular and solidarity economy system.

In this context, it is necessary to apply the National Development policies "Creating Opportunities, 2021", which represents a titanic effort to promote equitably the generation of sources of employment, the

development of businesses, enterprises or productive units established with commercial practices, with the use of quality distribution channels and fair prices. Consequently, product quality is improved and losses are avoided; likewise, the biological risk of contaminating products and the environment with the excessive use of packaging and packing is avoided. The lack of stability of work spaces in the markets has caused the proliferation of informal activities in the economy and, consequently, has caused a marked disorganization of sales in the markets of the city of Riobamba, as well as street sales of different consumer products in neighboring streets in the different markets of the city, weakening the control of the sectional authorities, causing in parallel a marked unfair competition among traders.

It is important to add that the Decentralized Autonomous Government (GAD) of the canton of Riobamba has a preliminary study that comes from the Management Model of the markets, and addresses the following points of interest: (i) number of available gates 5,209 and used 4,498, (ii) characteristics of civil infrastructure, (iii) conditions of basic services of the markets, (iv) surface used, (v) opening hours, (vi) needs, (vii) weaknesses and pressing threats, among other points. However, no comprehensive communication and marketing plans have been implemented to facilitate social recognition of the quality of the products sold, in order to increase sales in the different markets.

On the other hand, municipal management is limited to the verification of land use, establishing sanctions according to the current legal framework in order to safeguard human mobility, food security, payment of taxes, fees and contributions for improvements and for the welfare of users through continuous verification of quality and fair prices, a task shared with various agencies such as: Ministry of the Interior, Municipal Police, General Police Intendancy and the Health Directorate of Chimborazo. Despite the above scenario, where the competencies of the GADM are defined, it is important to recognize the compliance of the activities that have been carried out under the competencies determined by law; however, the city's markets have not yet achieved in recent years a sustainable and sustainable development.

The post COVID-19 pandemic crisis has generated a decrease in consumer income, which caused several traders to suspend their economic activity in the markets and others to move to the surrounding streets (approximately 700 traders); under these circumstances, there is a lack of motivation in the diversification of the supply of products in the commercialization spaces, such as the plazas and markets, which are underutilized; in addition, there are no initiatives to generate added value in the products that are sold, consequently an efficient and effective service for the riobambeña community is not guaranteed.

The Municipality of Riobamba in its administrative structure contains the competence of the markets, according to the Administrative Resolution

No. 2015-049-SEC dated 05/19/2015, signed by Engineer Napoleon Cadena Oleas Mayor of the City of Riobamba, the same that is defined in the "Manual of valuation and classification of positions of the GADM of Riobamba" which expresses: the Directorate of Municipal Services Management performs processes that add value to improve the services and experience of consumers; below, in Figure 1 are the areas of management of municipal services that are visualized in the organizational structure.

Figure 1: Municipal service management areas.



Source: Administrative Resolution No. 2015-049-SEC, 15/may/2015.

Figure 1 shows the areas of management of municipal services, which are: cemetery, slaughterhouse and market administration. In the dual agreement with the Municipal Decentralized Autonomous Government (GADM) of Riobamba and the Polytechnic School of Chimborazo (ESPOCH), the School of Business Administration and the Marketing Career, which aims to strengthen the linkage, contribute to the satisfaction of the needs, desires and expectations of society. This dual agreement aims to identify the current situation of the markets and propose strategies for continuous improvement for customers, in order to promote hygiene and food handling (GMP), the care of the environment of urban markets, and that later these studies can be reapplied in other rural markets and other cities to be sustainable markets in an economic, social, ecological and sustainable way. According to Mercado, Córdova and Testa (2007):

The participation of markets in the economy is positive, due to the supply of staple products in a fresh state; however, the economy is threatened by several factors: supply and demand, seasonal production of different products from different parts of the coast, highlands and east and lack of knowledge in the handling and preservation of these products. The markets must guarantee a standardized price, safety, and biological risks that affect the health of consumers; therefore, they are forced to incorporate elements of improvement in their internal processes.

This situation results in competitive disadvantages, which require a government policy to apply internal self-regulation measures; as stated by Mula, Poler and García, (2005) markets that: "tend to eliminate waste, add value, guarantee, quality and good hygiene and food

handling practices, without risking sustainable development that lead to the adoption of "lean thinking" will be competitive".

According to Rodríguez, Caldas and Ogeeralic (2009), traders have weaknesses in waste management, maintenance of clean and safe work areas, lack of a culture of cleanliness and order, lack of self-regulation processes in phytosanitary control standards and the application of good food handling practices. These factors have a significant impact on p

Economic activity in the city of Riobamba.

According to data from the Riobamba Cantonal Plan (2020), extreme poverty in Unsatisfied Basic Needs is around 23.56% of the population; that is, only 45,559 inhabitants of which 24,703 women and 20,856 men of the total population of the canton of Riobamba of 193,335 inhabitants, these figures show those who do not enjoy the minimum conditions for a decent life.

The most important economic activities of the city of Riobamba, due to its geographical location, are agriculture and livestock. However, they are not the only ones, there are also activities such as tourism, the manufacture of handicrafts, sale of tourist packages, markets, churches, squares and others. Riobamba's economy is based largely on agricultural production, for this reason there are fairs of organic products mainly on Wednesdays and Saturdays in the markets: La Merced, La Condamine, San Alfonso, Mayorista, Oriental, Santa Rosa, San Francisco, La Esperanza, Dávalos and the Macají Citizen Fair.

In the city there is also the presence of industries such as: Ceramics, Chimborazo Cement, dairy companies, lumber, milling, construction, automotive parts, tourism, computer assembly, manufacture of furnaces, roofs, pipes, among others. On par with the main cities in the country, Riobamba has evolved in ICT and internet connection, with several local providers in the city such as: NETLIFE, FASTNET, CNT and ECUANET, the municipality in the city has implemented greater coverage with the expansion of Wi-Fi links (wireless services) in parks and downtown areas of the city. In November 2011, was inaugurated in the city the shopping center "El Paseo Shopping Riobamba", the largest in the central inter-Andean region of Ecuador that has dealers of commercial brands and international brands; later in March 2013, another shopping center called "Multiplaza Riobamba" was inaugurated; there are also other shopping centers such as Ibérica, Alamos, Aki, Tía, Santa María and Gran Akí among other dealers of various brands.

Lean Manufacturing.

Lean Manufacturing is a tool that eliminates operations that do not add value to the product, service and processes, it seeks to increase the value of each activity performed in order to eliminate what is not

required. In addition, it reduces waste, minimizes risks and improves operations.

Paredes-Rodriguez, Chud-Pantoja & Peña-Montoya (2022) identify the main biological risks (insects and diseases in the producer), mechanical risks (technical failures in vehicles in transport), failures in the physical infrastructure (packaging line), and contamination in transport from the supply chain in order to mitigate them.

Lean manufacturing has its genesis in the Japanese automotive company in the last decade of the last century, coined as a term by researchers at the Massachusetts Institute of Technology assigned to the International Motor Vehicle Program (IMVP) project. It is based on the implementation of production, quality and continuous improvement strategies. A "lean" manufacturing process is when the production of its products optimizes inputs, labor, space, investment and time, to obtain greater satisfaction of internal and external customers. It is a system in which it is produced with the least effort, people, space, capital, time; consequently, its products have fewer defects. Cruz (2004); Pires and Machado (2006); Ballesteros Silva (2008) and Padilla (2010)5.

According to Báez, Limón, Tiapa and Rodríguez (2010) the attributes of production systems are: "products of different shapes, dimensions and finishes, the use of techniques such as: just in time and others to eliminate waste. It also involves the creation of systems to produce without defects, maintain relationships with suppliers in order to share mutual needs, eliminate activities that do not add value" which implies a production based on continuous improvement, this is achieved according to Cardozo, Rodriguez and Wilfredo (2011) with the application in the process of the five "S".

The Five "S" or 5'S.

It is a tool of lean manufacturing, Castillo-Rodriguez (2009); Salazar, Castillon & Cardenas (2022) this concept refers to the creation and maintenance of clean, organized and safe work areas; that is, the method of the Five S, aims to improve the quality of life at work, companies and also markets, in order to maintain clean and organized places to increase productivity, improve working conditions and reduce unnecessary costs. It is based on 5 fundamental principles: Seiri: classification, Seiton: order, Seiso: cleanliness, Seiketsu: standardization and Shitsuke: discipline. For Diaz (2009) the central objective of the 5'S is "to achieve the efficient and uniform functioning of people in workplaces and workplaces" in this case the markets.

Classify (Seiri)/environmental protection and waste management. - consists of classifying each necessary object and discarding the unnecessary ones. Applied to the care of the environment, it consists of recycling what is unnecessary and giving it another use; in addition, an

increase in available space is achieved by eliminating the excess of unneeded objects.

Order (Seiton)/creation and maintenance of clean and safe work areas. - In this phase the objects are ordered and selected by areas, in the case of points of sale in the markets would be the location by products such as: vegetables, fruits, spices, among others. The products with the highest sales or with greater frequency should be located in spaces close to the exhibition and thus facilitate a better visualization of the products for sale.

Cleanliness (Seiso)/training and dissemination of this culture. - When everything is clear and tidy, it is easy to clean. This task has to be assumed by the merchant as part of his job. The workplaces will be hygienic, this generates the motivation of the buyer to purchase more products in these places.

Standardization (Seiketsu)/self-regulation processes. - aims to maintain the state of cleanliness, classification, organization with standards and programs that are designed for mutual benefit (merchant-customer). To standardize different tools can be used, one of them is the signage, and photographs of the work site in optimal conditions, so that they can be seen by the merchants and thus remind them of the state in which their stalls should remain; also, the development of standards in which it is specified that each merchant must do in their work area.

Discipline (Shitsuke)/application of good food production practices. - means avoiding non-compliance with established procedures. Discipline is the compliance with standards and procedures that enables product quality. Discipline is the channel between the 5'S and continuous improvement. It implies periodic control, surprise visits, self-monitoring of merchants, respect for oneself and for others to improve the quality of work life. It is the respect of the established norms and standards that allow to keep the workplace impeccable, it is to perform a continuous personal control and respect the rules that regulate the correct operation, it is to promote the habit of self-control and reflect on the level of compliance with the established rules, according to Diaz (2009), it is "to understand the importance of respect for others and the self".

Sustainable development.

Cascante (2022) states that "sustainability is a way of life of the human being, in several aspects such as: health, politics, education, economy, social relations" SEMANART (2006) sustainability "implies the questioning and reconstruction of ethical, social, political, economic, ecological elements that give meaning to societies and their relationship with the natural environment. It is progressive, framed in a critical thinking, based on social justice and economic and ecological equity". It is the notion of development that associates the growth of peoples, and the eco-environmental aspects to ensure the sustainability of future

generations. Tapia (2022) is a society with progress towards the future that respects the environment, that generates a paradigm shift in social and industrial processes; with environmental awareness to ensure natural resources are not in danger of scarcity and compromise the proper functioning of ecosystems, which do not affect the development of life on the planet. Fernandez (2009), points out that the sustainability process requires an agenda that includes "normative proposals that have to do with public policies, related to the economy, environment, urban planning, health or education" This statement considers the following aspects:

Ecological: that allows preserving the diversity of ecosystems and species in a dynamic balance.

Economic: allow the generation of wealth in adequate form and quantities, achieving its redistribution, the promotion of an equitable exchange in society and the diversification of the productive capacity for the strengthening of economic activity (production and consumption).

Social: through the adoption of values that generate the harmonious behavior of man with nature; as well as the maintenance of an adequate standard of living that includes employment, education and security, promoting solidarity, strengthening the organization of civil society and social participation.

Political: with the development of democratic structures, the empowerment of the population, the reduction of dependence on the state and the promotion of relations of solidarity between communities and regions. The characteristics of politics include: its appreciation in time, since it comes from the past, is in the present and is part of the future; reduction of the dependence of the community in relation to the environment that is proper to its natural conditions; due to its intangibility.

In order for the markets to be inserted in this concept of development, they require a standardized production process with the implementation of norms associated with good food handling practices and waste management that may affect the environment and guarantee the safety of the product to avoid food-borne diseases (FBD). All of the above leads to a reconsideration of the commercialization process with innovations conducive to optimizing the use of resources, eliminating factors that do not add value and adjusting costs.

Methodology

The field research was descriptive. The population consisted of 4,498 merchants of 12 markets, which are registered by the Municipal Government of Riobamba in the different sections (vegetables, third, fruits, food, natural products, footwear, handicrafts, fabrics) in the

urban area of the city of Riobamba-Province of Chimborazo. The sample was 380 merchants, the instrument used was the survey with a questionnaire based on the five "S" and then presented the analysis and interpretation. The study identified the Five "S" as a tool of lean manufacturing; the beneficiaries are:

- Traders in the urban markets of the city of Riobamba who benefit from innovations, with greater technical and sales capacity.
- Consumers who receive better quality and hygienic products at a fair price.
- Pre-professionals of the Marketing career with theoretical and practical knowledge immersed in the economic and social reality of the markets of the city of Riobamba.

Results.

The results of the investigation of the markets were: the non-application of the Five "S"; in the basically handmade commercialization.

Q1. What products are sold in the markets of the city of Riobamba?

Table 1: Main products sold in the markets.

Main products sold in the markets	F	%
Vegetables and fruits	182	40 %
Typical meals	82	18 %
Meat and seafood	131	28 %
Others	65	14 %
TOTAL	460	100 %

Source: Market traders.

Table 1 shows the results of the surveys conducted with market customers. This traditional commercialization space is characterized by the offer of legumes and vegetables (onions, potatoes and others) which represents 40%, fruits and meats 28%, typical foods 18% and others (sale of dairy products and kitchen articles and utensils and others) 14%, making it the main offer that characterizes the markets of the city of Riobamba.

Q2. What actions are needed in the market to improve the quality of the products?

Table 2: Shortcomings in the markets

Market failures	F	%
Presentation and image of the products they sell	111	23%
Improved presentation and hygiene in the retail space	199	42%

Food organization and preservation	79	17%
Knowledge of commercial strategies	48	10%
Basic Services (Hygiene, Safety, sewage, etc.)	27	6%
Others	10	2%
TOTAL	474	100%

Source: Market traders.

Table 2 shows the results of the survey, 42% of the market traders state that it is necessary to improve the presentation and hygiene in their sales space; 23% require the presentation and image of the products they sell; 17% state that they require organization and conservation of food, 10% state that they need to have knowledge of commercial strategies; 6% state that basic services need to be improved and 2% state that other requirements are important.

Table 3: Summary table of the survey results.

No.	Indicators	%	Analysis
V.1. Environmental protection and waste management in markets.			
1	What types of waste are produced daily in the markets?	60 % 40 %	60% of the waste is organic and 40% inorganic.
2	Is aware that waste produces polluting effects on the environment.	75 % 25 %	75% of traders are not aware of environmental pollution from waste; only 25% are aware.
3	How is waste management carried out in the market?	97 % 3 %	Ninety-seven percent of the merchants leave their waste and residues in the market so that the garbage collector of the municipal government of the canton of Riobamba can proceed to remove them. Three percent collect their organic waste and take it home to be used as plant fertilizer.
4	What is the process through which market waste is disposed of?	98 %	98% of the municipal government's garbage collection service.
5	Waste separation is performed.	95 % 5 %	95% do not separate organic and inorganic waste.
V.2. Creation and maintenance of safe work areas.			
6	There are Security Policies in the market, what are they?	85 % 15 %	85% stated that there are no safety policies for sales. 15% say that the safety policies are disinfection at the end of the daily cleaning day by the municipal GAG of the canton of Riobamba.
7	There are signs at your	92 %	92% of the work areas do not have

	place of work.	8 %	signage in their workplace. 8 % of the markets have signage.
8	Applies food hygiene and handling policies.	88 % 12 %	88% consider hand washing to be sufficient for food handling; however, they handle money and products at the same time. 12% do not know what the food hygiene and handling policies are.
9	There are safety policies in place for the storage of products in your workplace.	66% 24%	66% consider that it is safe to leave their products stored at their place of work and pay a guard for nighttime surveillance. 24% do not trust the security of their product storage.
10	There are protocols for action in the event of accidents.	90 % 10 %	90% are unaware of first aid practices in the event of an accident involving a merchant or customer. 10% state that they know something about first aid.
V.3. Training and dissemination of this culture.			
11	You would like to apply some improvement tool to provide product quality at your retail location.	70 %	70% say that they would like to apply some tool to improve the presentation and quality of their products in the market. 30% say no, because they know what they have to do and are not willing to change.
V.4. Self-regulation process.			
12	The products sold in the market comply with sanitary regulations.	65% 35%	Sixty-five percent comply with the sanitary regulations for vending, who undergo annual medical examinations regulated by the Ministry of Health, but they state that there are informal traders who do not pay and do not comply with sanitary regulations. Thirty-five percent state that in order to sell their products they pay fees for the use of their stall.
13	Sanitary regulations are frequently carried out at the point of sale.	60 % 40 %	Sixty percent of the traders state that health inspectors visit them twice a year. Forty percent stated that the control should be applied more frequently.
14	It complies with the sanitary permits for the	60 % 40%	Sixty percent comply with sanitary permits for the sale of food; 40% do

	sale of food...		not comply with this requirement.
V5. Good Practices for food use and handling.			
15	There are food preservation areas.	72 % 28 %	72% state that there are no specific areas for food preservation; 28% of the traders bring the products to be preserved in their home refrigerators.
16	Do you know about any food handling protocol?	78 % 22 %	Seventy-eight percent stated that they do not know any food handling protocol; 22% stated that they use disinfectant after washing their hands at the most.
17	There are separate areas according to the nature of the food.	66 % 34 %	66% keep areas separate from food; 34% do not keep food separated into areas.
18	You have received training in proper food handling.	48 %	Forty-eight percent of the merchants surveyed have not received adequate training in waste management.
19	The merchant has a protection system in his clothing for the sale of food products.	77% 23%	77% do not have any protection systems for the tradesman, such as uniforms, boots, hats, gloves, mouth protection. 23% use a cap, an apron and a maximum mouth guard for protection.

Source: Market traders.

Discussion

i) Environmental protection; waste management.

In this aspect it was considered that 60% is organic waste and 40% inorganic, the garbage collection system is through the municipal government, 97% of traders leave waste and residues in the market for the garbage collector of the municipal government of the canton of Riobamba, there is a lack of awareness in environmental protection and waste management; only 3% collect their organic waste for other uses such as plant fertilizer. Most of the merchants use plastic bags or covers, which are harmful and contaminate the environment and health, and there is also a lack of proper cleaning of work stations and merchants' clothing. Waste management generates environmental liabilities because it goes into the environment without any type of control, generating insect pollution and different types of pests (flies, mosquitoes, etc.), thus affecting the health of the surrounding population.

ii) Creation and maintenance of clean and safe work areas.

Eighty-five percent state that there are no safety policies in place for the sale of products. 92% of the work areas do not have signage printed and posted in their workplace. 88% consider that hand washing is sufficient for food handling; however, they handle money and products at the same time. In terms of nighttime security, 66% consider it safe to leave their products stored in their workplace, and they pay a guard for nighttime security at their own expense. Ninety percent are unaware of first aid practices in the event of an accident involving a merchant or client.

iii) Training and dissemination of this culture.

70% say that they would like to apply some tool to improve the presentation, quality and hygiene of their products in the market.

iv) Self-regulation processes.

Municipal management is limited to verifying land use and establishing sanctions in accordance with the current legal framework to ensure human mobility, food safety, payment of taxes, rates and improvement contributions, and, fundamentally, the wellbeing of users through continuous verification of quality and fair prices, a task shared with agencies such as the Ministry of the Interior, the Municipal Police Station, the General Police Department and the Chimborazo Health Department. Sixty-five percent comply with sanitary regulations and annual medical exams regulated by the Ministry of Health; however, the merchants report that there are informal merchants who do not pay taxes, fees, and contributions for improvements and do not comply with sanitary regulations. Thirty-five percent state that in order to sell their products they have to pay fees for the use of their stall. Sixty percent of the traders.

Conclusions

The urban markets studied are not able to insert themselves competitively, they have limitations that prevent them from guaranteeing the quality and safety of the products (food), on the other hand, there is no evidence of actions related to environmental protection and waste management, which generate an environmental impact.

There is evidence of an empirical commercialization process, without good hygiene practices in food handling; in addition, it is identified in lean manufacturing that the Five "S" tool is not applied and there is a lack of these; therefore, the implementation of this tool is required as an opportunity for improvement and quality for the sale of basic products in the markets of the city of Riobamba.

It is necessary that the control agencies implement the Five "S" to ensure product safety and prevent foodborne diseases (FBD) and food safety for consumption, avoiding biological risks to the health of the population. Likewise, environmental protection policies and strategies are attended to, in order to obtain the capacity to be competitively inserted in regional and international markets, and to avoid the risk of non-continuity and permanence (sustainability) by being replaced by multinationals such as Supermarkets and Hypermarkets.

In order to be competitive in the markets, tools are required to generate change, and the way to do it is to progressively incorporate in the current context lean manufacturing tools and others related to quality and service.

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