Conceptualization of the Servuccion in Outpatient Care in Level 3 Health Companies under Lean Healthcare Approach: Case Study

Hernando Garzón Saenz
CIPTEC Research Group - Faculty of Engineering - Industrial Engineering Program - Technology in Industrial Production
Fundacion Universitaria Tecnologico Comfenalco
Cartagena de Indias, Colombia
Hernando.garzon@tecnologicocomfenalco.edu.co

Andrés Redchuk
ETSII. Department of Computer Sciences. University Rey Juan Carlos. Madrid. Spain.
Director of Operational Excellence and Process Improvement Institute. School of Engineer. University of Lomas de Zamora. Argentina.
andres.redchuk@urjc.es

José Manuel Solana Garzón
CIPTEC Research Group- Faculty of Engineering - Industrial Engineering Program - Technology in Industrial Production
Fundacion Universitaria Tecnologico Comfenalco
Cartagena de Indias - Colombia
jsolana@tecnologicocomfenalco.edu.co

Gustavo Adolfo Ortiz Piedrahita
CIPTEC Research Group- Faculty of Engineering - Industrial Engineering Program - Technology in Industrial Production
Fundacion Universitaria Tecnologico Comfenalco
Cartagena de Indias - Colombia
gortizp@tecnocomfenalco.edu.co

Abstract

This article aims to conceptualize the manufacture of outpatient services in a level 3 entity of the health sector, under a Lean Healthcare approach. For the development of the proposed objective, it was necessary to characterize the system from the analysis of waiting lines due to the variable and non-deterministic behavior commonly observed in service systems. The phases of the characterization are composed of a general description of the processes that make up the outpatient service, followed by an economic-operational diagnosis, where productivity measurement was used with a value-added approach (MPVA) and a questionnaire to evaluate compliance with criteria of the Lean philosophy. Using the Kolmogorov-Smirnov test, probability functions are determined and from this the process of outpatient care is conceptually proposed.

Keywords
Outpatient Consultation, Lean Healthcare, Servuccion, Kolmogorov-Smirnov test, Productivity with a Value-Added Approach.

1. Introduction

Colombia is a country that has been growing in the health sector thanks to the implementation of regimes such as contributory and subsidized, which achieved a coverage of 90.8% of this service (Bonet-Moron & Guzman-Finot, 2015), but still does not cover all places for the provision of this service, which shows there is still room for improvement in this regard, since it has this coverage, but has little access for its users (Ayala Garcia, 2014), since only 75.5% used the medical service, according to data from the National Quality of Life Survey -ECV-, which shows that the provision of services in the health sector must be improved.

The improvement of health services can be done through studies of medical systems through the implementation of tools such as a time study, these help to standardize processes, because they provide information on how much time is required to perform the activities that are part of a process, and in the same way knowing the working methods that are used to perform that activity do not give a level of detail that we They make known if that activity carried out is adding value to a process and the product that is being developed. Within the health sector, the need to carry out this type of studies is evident since they allow us to know what resources a clinic needs to provide its service and the capacity that a system needs to meet demand. In external medicine clinics, it is known that this work privately or with health care providers, which seek to provide their service to people referred by the EPS, but within the allocation of appointments it has been possible to observe an increase in the wait for the assignment of appointments, having an increase from 7.75 days to 12.11 days from 2009 to 2014, and which shows an upward trend, due to the increase in demand, according to the Ministry of Health (Ministerio de Salud y Protección Social, 2015). The realization of this work, seeks to know and detail the activities that are carried out in this and know the behavior of the system through a time analysis which will provide us with information for the realization of a conceptual model.

1.1 Objectives

- General Objective.

Conceptualizing Ambulatory Care Service in Level 3 Health Companies under the Lean Healthcare approach: Case Study.

- Specific Objectives.

- ✓ Describe and characterize the overall outpatient service process using the flowchart and arrival, care, and confirmation rates.
- ✓ Diagnose economically and operationally the Outpatient Service by measuring productivity with a value-added approach (MPVA)
- ✓ Evaluate the degree of implementation of the Lean Healthcare philosophy through a technical questionnaire.
- ✓ Propose the conceptual model of the external consultation service using the Kolmogorov-Smirnov test

2. Literature Review

2.1. Lean Healthcare. The main objective of Lean Healthcare is to improve the management and organization of health services. According to the principles of lean production, the company must define what value is according to the customer's point of view, reduce waste by implementing a continuous flow, to mitigate inventories, delays and interruptions (Bianchini de Barros, y otros, 2021). Health services face challenges in increasing efficiency, quality of care and coping with sudden increases in demand (Zepeda-Lugo, y otros, 2020). With which it is intended to improve the efficiency of the system, translated is in terms of the health system to provide greater opportunity in care through the increase in the availability of resources (medical personnel) to the extent that care times are reduced which undoubtedly mark a milestone in the manufacture of health services whenever a patient despite presenting the same symptoms that another is not the same disease (Garzón Saenz & Redchuk, Optimization of Shift Scheduling for Medical Staff: An Application in The Outpatient Servuccion , 2021).

2.2. Servuccion. When we talk about Servuccion (manufacture of services), it is very important to establish mechanisms that allow standardizing processes in order to guarantee the necessary resources to manufacture quality and highly productive services. The service refers to those manufacturing systems of very high complexity framed in most cases in the classification of production systems by project since it is to satisfy particular needs, not standardized of customers from various sectors of the market as is the case of the health sector, where the standardization of processes is difficult because although the symptomatology of a disease is the same the cause that the generation is different therefore the way to face this symptomatology is different (Garzón Saenz, Solana Garzón, Ortiz Piedrahita, & Cogollo Sepulveda , 2017).

Servuccion is related to an approach to the management of service provider organizations, which is supported by the application of a management model that equates "production" as product manufacturing, with "servuction" as service manufacturing. This model frames a whole system that shows a service as the visible part of the organization, consisting of a set of processes (moments of truth), procedures and activities, guides the actions for manufacturing, distribution and consumption a certain servicio (Briceño de Gomez & Garcia de Berrios, 2008).

2.3. Productivity with a Value-Added Approach (MPVA). Value-added productivity enables the evaluation of performance, innovation and business strategy. The Value-Added Productivity Measurement (MPVA) model is a methodology that allows to comprehensively measure the productivity of organizations, through some financial indicators (Riaño Solano, Luna Pereira, & Gonzalez Mendoza, 2021).

For the calculation of productivity in servuction systems, the added value generated by the organization in the n moments of truth that are generated in the manufacture of a service will be taken into account, in order to establish if they are really having acceptable productive indexes or if on the contrary the resources are being misused in the organization. For this, the company must have sufficient financial information (financial statements, cost program, expenses) to be able to calculate its added value. The added value of an organization will be defined by the sales or revenues obtained during the analysis period minus payments to third parties – understanding expenses to third parties such as the costs of attention, administration and sales plus the change of inventories from one period to another (Shimizu, Wainai, & Nagai, 1991).

$$\boldsymbol{VA = V - G + \Delta I}$$

Where**,**

VA= Value Added generated over a Period V= Revenue during Period G= Payments to third parties ΔI=Final inventory less initial (if applicable).

Table 1. Calculation of the added value of the company for n periods.

Information	**Enterprise**				
	Period 1	Period 2	Period 3		Period n
Net sales	$\frac{V_1 * 100\%}{V_1}$	$\frac{(V_2 - V_1)}{V_1} * 100\%$	$\frac{(V_3 - V_2)}{V_2} * 100\%$	…	$\frac{(V_{(n-1)} - V_n)}{V_{n-1}} * 100\%$
Purchases from third parties	$\frac{G_1 * 100\%}{G_1}$	$\frac{(G_2 - G_1)}{G_1} * 100\%$	$\frac{(G_3 - G_2)}{G_2} * 100\%$		$\frac{(G_{(n-1)} - G_n)}{G_{n-1}} * 100\%$
Inventory(final-initial) (if applicable)	$\frac{(I_1 - I_0) * 100\%}{(I_1 - I_0)}$	$\frac{(I_2 - I_1) * 100\%}{(I_2 - I_1)}$	$\frac{(I_3 - I_2) * 100\%}{(I_3 - I_2)}$		$\frac{(I_{(n-1)} - I_n) * 100\%}{(I_{(n-1)} - I_n)}$
Added value	$\frac{VA_1 * 100\%}{VA_1}$	$\frac{(VA_2 - VA_1)}{VA_1} * 100\%$	$\frac{(VA_3 - VA_2)}{VA_2} * 100\%$		$\frac{(VA_{(n-1)} - VA_n)}{VA_{n-1}} * 100\%$

For the purposes of the case study raised, the added value will be determined from the financial indicators established in table 1, it will give an idea of the fluctuations in productivity during n periods of time. The indicators will allow us to know with more certainty which factors are having the greatest impact on productivity. In addition, it will be possible to quantify the performance of the organization in relation to productivity, propose improvements and verify if these improvements take effect over time. Below are some of the indicators proposed in the MPVA methodology that will be used to measure productivity in services. (Shimizu, Wainai, & Nagai, 1991):

$$\boldsymbol{Value\ Added\ Index} = \frac{\boldsymbol{Added\ Value}}{\boldsymbol{Operating\ Income}}$$

The value-added index tells me how much of the company's operating income contributes to the added value of the organization. (Shimizu, Wainai, & Nagai, 1991).

$$\boldsymbol{Capital\ Participation\ Index} = \frac{\boldsymbol{Profit\ of\ the\ Period}}{\boldsymbol{Added\ Value}}$$

The Capital Participation Index shows the distribution of value added with equity, allows to see the percentage of value added that results from capital, that is, the capital resulting from the activity of the company (Morales Sandoval & Masís Arce, 2014).

$$\boldsymbol{Contribution\ of\ Personnel\ Costs\ to\ Value\ Added} = \frac{\boldsymbol{Added\ Value}}{\boldsymbol{Personnel\ Cost}}$$

The contribution index of personnel costs to value added is the ratio between value added and personnel costs, this shows us the productivity of the organization in terms of the wages paid to its workers. (Shimizu, Wainai, & Nagai, 1991).

$$\boldsymbol{Labor\ Productivity} = \frac{\boldsymbol{Added\ Value}}{\boldsymbol{Number\ of\ Employees}}$$

$$\boldsymbol{Labor\ Productivity\ Index} = \frac{\boldsymbol{Personnel\ Cost}}{\boldsymbol{Added\ Value}}$$

The concept of labor productivity can be defined as the relationship between the added value and the total number of employees, this tells us how much each employee contributes to the value of the company. On the other hand, we can denote it as the relationship between personnel costs or salaries over value added, indicating how much of the value added is the result of personnel costs. (Morales Sandoval & Masís Arce, 2014)**.**

The calculation of the added value of the company and the previous indicators will give an idea to the organization about how productive it is being, to know the behavior of productivity for a certain period of time in order to verify whether or not the company is generating value**.**

2.6. Kolmogorov-Smirnov test. The Kolmogorov-Smirnov test is used to test the goodness of fit of a given set of data to a theoretical distribution, which makes it a test of a sample. (Berger & Zhou, 2014). It is a goodness of fit test used to test the normality of sample data, being particularly useful in phenomena that show nonlinear behavior as is the case of Servuccion systems, since these lead, generally, to non-Gaussian distributions, so that the generating mechanism of the phenomena can be better understood by examining the distribution of the selected variables (Flores Tapias & Flores Cevallos, 2021).

The Kolmogorov-Smirnov test is applied to test the hypothesis of normality of the population, equation 8 represents it and is shown below. (Flores Tapias & Flores Cevallos, 2021):

$$\mathbf{Fn(x)} = \frac{\mathbf{1}}{\boldsymbol{n}} \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \qquad \{(\mathbf{1}: \boldsymbol{If\ yi \leq x,})/(\mathbf{0}: \boldsymbol{alternative})$$

$$\boldsymbol{Dn+} = \boldsymbol{max}(\boldsymbol{Fn}(\boldsymbol{x}) - \boldsymbol{F}(\boldsymbol{x}))$$

$$\boldsymbol{Dn-} = \boldsymbol{max}(\boldsymbol{F}(\boldsymbol{x}) - \boldsymbol{Fn}(\boldsymbol{x}))$$

Where F(x) is the distribution presented as a hypothesis. Fn(x) being the sample distribution function and F(x) the theoretical function or corresponding to the normal population specified in the null hypothesis. The distribution of the Kolmogorov-Smirnov statistic is independent of the population distribution specified in the null hypothesis and the critical values of this statistic are tabulated. If the postulated distribution is normal and its parameters are estimated, the critical values are obtained by applying the significance correction proposed by Lilliefors. The standard tables used for the Kolmogorov-Smirnov test are valid when testing whether a set of observations comes from a fully specified continuous distribution, whereas, if one or more parameters must be estimated from the sample, the tables are no longer valid. (Flores Tapias & Flores Cevallos, 2021).

3. Methods

For the achievement of the objectives proposed in this work has been based on a methodology of descriptive and applied type since variables that impact the behavior of productivity, added value, as well as attention times in the context under study and from this and supported in Lean Healthcare approach were measured and analyzed. establish the conceptual model for the manufacture of specialized medical services (Outpatient Consultation. For the established methodological development, 4 stages will be developed as shown in Figure 1:

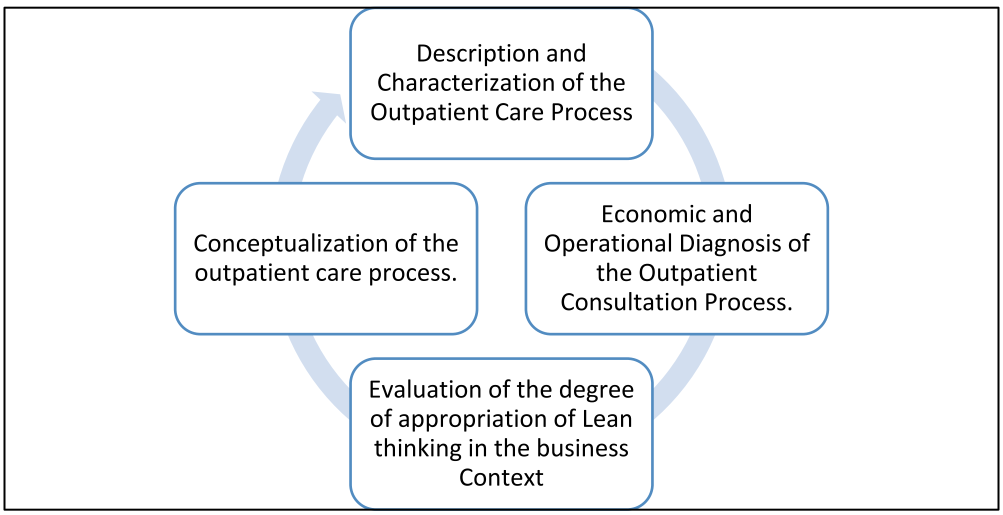


Figure 1. Methodology for the Conceptualization of Production Processes

4. Results and Discussion

4.1. Characterization of the Outpatient Consultation Process

Next, the data is analyzed to determine the behavior of arrivals in the processes of assignment and confirmation of appointments, so the necessary tests were carried out and the behavior of the fees for each of the processes was determined.

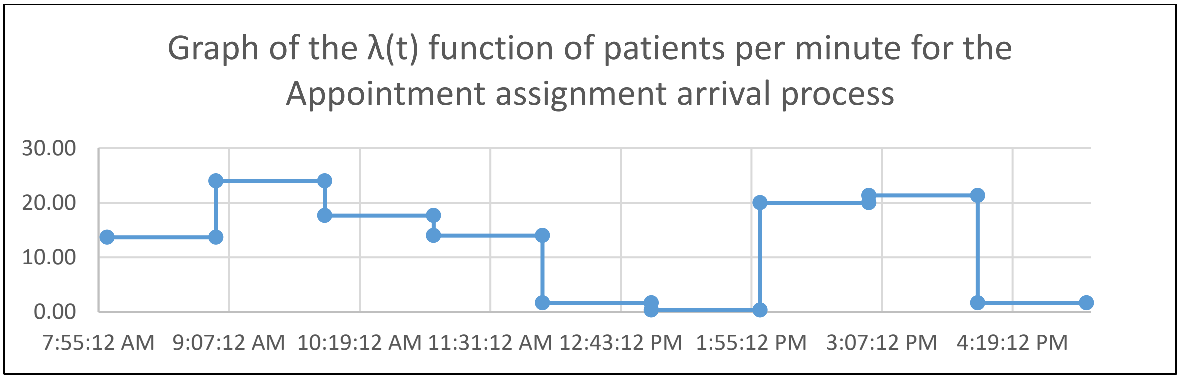


Figure 2. λ(t) function of patients per minute for the appointment assignment arrival process.

Figure 2 describes the processes of non-stationary arrivals in which the rates of arrivals of patients change as time passes, as is the case of the arrival rates of patients in the health service provider entity under study, it is described that the arrival rates in the range of 10:00 a.m. – 11:00 a.m. is very different from the range of 1:00 p.m. – 2:00 p.m., this is because at that time the entity leaves a space for staff lunch, but it is not ruled out that patients arrive at that time as in the case of day 3.

4.1.1. Arrival fees for appointment confirmation.

For this, data collection was carried out in the external consultation processes, in order to know the behavior of the arrivals for the previously assigned care, since the data collection was subject to the schedules programmed by the company. Within the collection work, it was taken into account that the schedules established by the health service provider, this sample was analyzed through a randomness run-test to know if there were random or trend patterns in these data. Taking into account that the specialty of Otorhinolaryngology presented little data at the time they were collected, since the attention is once a month and on this occasion (20) patients were attended, and due to the small amount of data collected, these were adjusted to a triangular probability function, through the performance of goodness and fit tests, with a Kolmogorov-Smirnov test where it is evident that the p-value fits a triangular function with probability of 0.9164 and the other specialties analyzed by the number of patients arrived per hour. Below are the Kolmogorov-Smirnov Arrival Charts and Test Table for Otolaryngology Arrivals (Figure 3 to Figure 8):

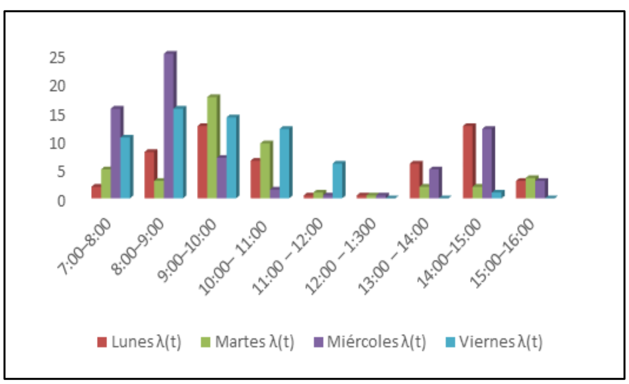


Figure 3. Patient arrival rates λ (t) per hour for allergology

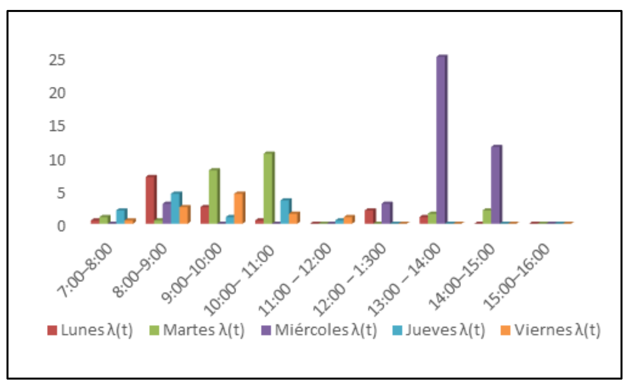


Figure 4. Patient arrival rates λ (t) per hour for Dermatology

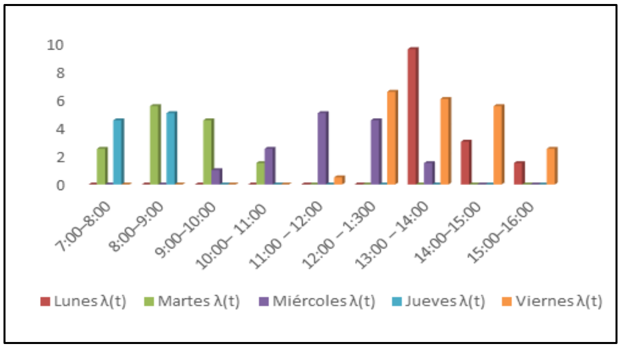


Figure 5. Patient arrival rates λ (t) per hour for Pulmonology A

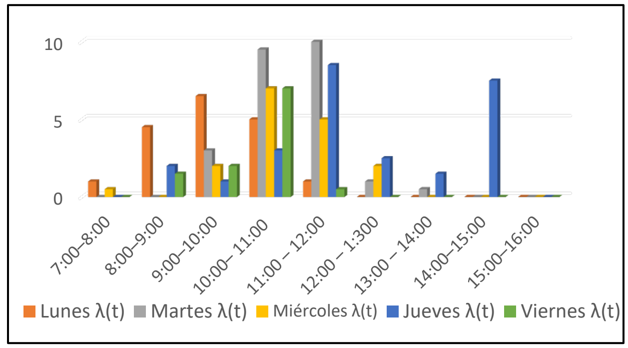


Figure 6. Patient arrival rates λ (t) per hour for Pneumology

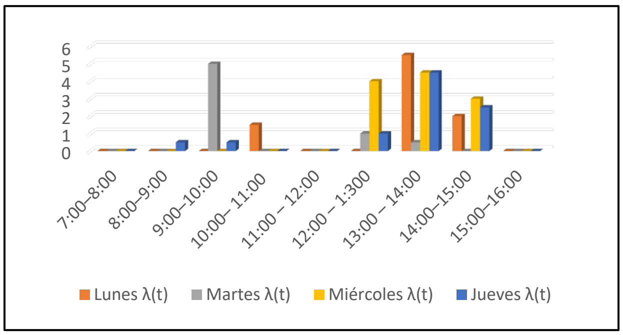


Figure 7. Patient arrival rates λ (t) per hour Pediatrics

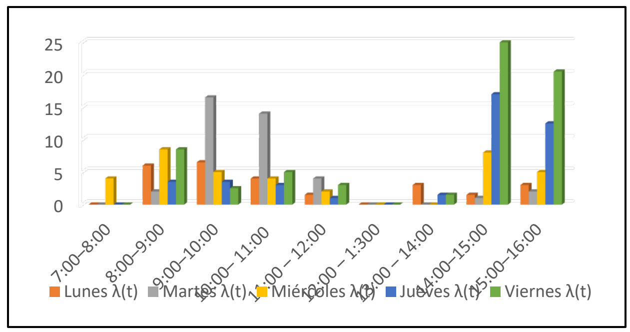
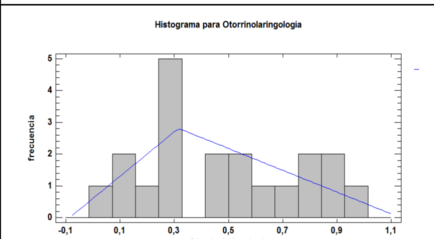


Figure 8. Arrival rates λ (t) of patients per hour for Resp Physiotherapy

The following Table 2, shows the arrival behavior of the ENT specialty for the confirmation process.

Table 2. Arrivals of the specialty of otolaryngology

	Probability function	***Lower value***	***Most likely***	***Increased Value***	***Histogram***
Otorhinolary ngology	***Triangular***	3,493731	8,5109	19,18054	

4.1.2. Data analysis for the processes of assignment care and confirmation of appointments.

For this, he used a simple random sampling to determine the sample size for each of the processes, this because they are different populations with different behaviors in different phases of the process, for both a confidence level of 90.45% is considered.

$$n = (\frac{40\sqrt{n'\sum X^2 - (\sum \llbracket (X) \rrbracket^2}}{\sum X)})^{\wedge}2$$

Where,

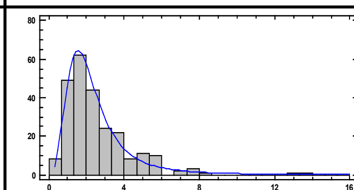
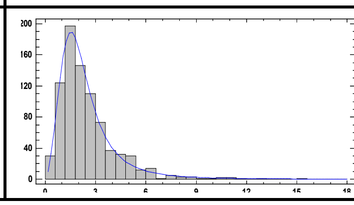
n'= Preliminary samples.
X= Value of observations.
40= Constant for a confidence.

Table 3. Number of preliminary samples obtained vs the number of samples required according to simple random sampling for appointment confirmation and assignment processes

Topical	Appointment confirmation	Appointment assignment
Preliminary samples	826	247
Stocking	2,48866021	2,586216596
Median	2,033333333	2,083333333
Standard deviation	1,748359849	1,823416266
Variance	3,056762162	3,324846878
Samples required	370	244

Table 3 describes that the amount needed for sampling is satisfied for the amount of pre-sample data taken in the citation assignment and appointment confirmation process. We performed a goodness of fit test based on the Kolmogorov-Smirnov Test to determine the probability function to which the data collected in the clinic during the sampling phase are adjusted, a total of 826 values ranging from 0.15 to 15.15 were taken into account.

Table 4. Adjustment of probability function for the data of appointment assignment and confirmation of appointments in the entity providing health services Ltda.

Process	**Probability function**	**P-Value**	**Parameters**			**Histogram and probability curve fitting**
			Median	**Form**	**U. Lower**	
Allocation	LogLogistic (3-parameters)	0,9812	1,91	0,38	0,16	
Confirmation	LogLogistic	0,8892	2,04	0,366	-	

The parameters shown in Table 4 show that the behavior of the data in the histogram, for the assignment process the central position of the curve is shown at 1.91, we can see in the assignment histogram that the data are skewed to the right and the shape is 0.38 which shows that the data are grouped to the left with a lower threshold of 0.16 taking into account that this is a Loglog Logistic function of three parameters, so we see data grouped in the curve queue where an attention time greater than 10 minutes is shown. In the next process, which is the confirmation process, the value of the central position of the data can be seen in the table, which is 2.04, and its shape parameter shows that most of the data are centered between 1 and 3, so its shape is 0.366 and is more centered.

4.1.3. **Data analysis for the care process**

For this phase, a random sampling technique stratified by the ease of working within a heterogeneous population (N) different homogeneous Nh stratum (each of the specialties of the clinic) was chosen, for this work an infinite N population is assumed, this because the number of individuals who currently request the service does not affect the frequency with which the population requests new services. Proportional affixing was used to ensure that each weighting (Wh) of the population specialties (Nh) remains within the sample size (n).

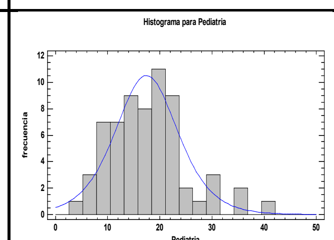
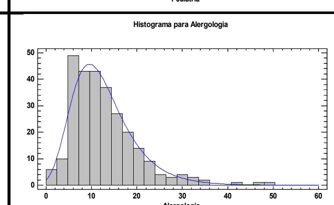
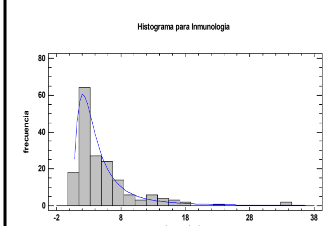
The weights of the population (Wh) are assumed when detailing the frequency of occurrence of care by specialty on different time scales within an annual, semiannual and quarterly period (data collected during 2020) (Table 5 and Table 6):

Table 5. Proportion of specialties (Nh) on different time scales of the population (N).

Timeline	**Pediatrics**	**Allergology**	**Immunology and Physiotherapy**	**Dermatology**	**Pneumology**	**Pediatric pulmonology**	**Otorhinolaryngology**	**Total**	**Total data**
January - December	8,354%	36,723%	3,032%	16,963%	13,950%	20,000%	0,978%	100,000 %	20.050
January - June	8,557%	35,872%	3,002%	15,786%	12,292%	23,235%	1,255%	100,000 %	
January - March	8,412%	35,880%	3,334%	15,346%	10,930%	24,266%	1,833%	100,000 %	

Next, the probability functions to which the data collected during the previous process best fit are established, to do this we went to the Kolmogorov-Smirnov Test, for the goodness adjustment of the data to their corresponding functions:

Table 6. Probability adjustments through a Kolmogorov-Smirnov test for outpatient care.

Speciality	**Probability function**	**P-Value**	**Parameters**						**Histogram and probability curve fitting**
			Moda	**Escala**	**Media**	**Forma**	**U. inferior**	**Desvest**	
Pediatrics	Logistics	0,9813	-	-	17,43	-	-	7,26	
Allergology	Larger extreme value	0,8992	9,57	5,35	-	-	-	-	
Immunology and Physiotherapy	*LogLogistic (3-Parameters)*	0,9473	-	-	3,13	0,54	0,48	-	

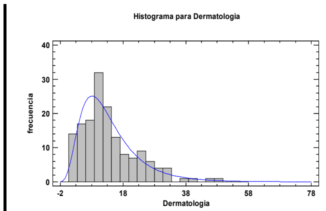
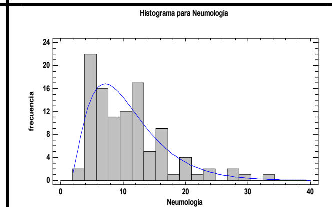
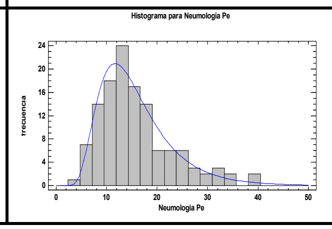
Dermatology	*LogNormal (3-Parameters)*	0,8506	-	-	13,73	-	-3,67	9,45	
Adult Pneumology	*Gamma (3-Parameters)*	0,8916	-	0,26	-	2,48	1,6		
Pediatric pulmonology	*LogNormal (3-Parameters)*	0,9946	-	-	15,87	-	0,66	7,43	

Table 6 describes the results of the probability adjustment for outpatient care data with their parameters and histograms. It is observed that in the specialty of Pediatrics that their attention times are adjusted to a logistic function with an average of 17.43 minutes and the time data have a deviation of 7.26. As for allergology, its data conforms to a larger extreme value function with a mode of 9.57 minutes which may be the most likely value in attention and its curve has a scale of 5.35 which generates that the curve looks a little compressed horizontally. In Immunology or physiotherapy, the data are adjusted to a Loglog Logistic function of three parameters with average of the data of attention times in 3.13 minutes, with the shape of the curve of 0.54 which shows that more than one hundred (100) data among those collected are centered between two (2) and eight (8) minutes, but data are shown at the tail of the curve, which could be atypical data within care. Dermatology also conforms to a LogNormal function of three parameters with average of the data of attention times of 13.73 minutes with a lower threshold in negative that shows that there are data very far from the average, but it could be an atypical data since its deviation is 9.45. In adult pulmonology it is shown that this fits a three-parameter Gamma function with a scale of 0.26 that shows that the curve is a little narrow, although it should be narrower, but as the lower threshold is 1.6. And as last the pediatric pulmonology that fits a LogNormal function of three parameters with mean data attention in 15.87 minutes, and a lower threshold of 0.66 that shows that the data are positively biased and a deviation the data of 7.43.

4.2. Economic – Operational Diagnosis of the Outpatient Service by measuring productivity with a value-added approach (MPVA).

To diagnose productivity in terms of added value, the accounting information provided by the company had to be verified, specifically in the income statement the necessary data were found to generate the diagnosis of productivity in terms of added value. To know the added value generated during the 11 periods (months) from February 1, 2016 to December 31, 2020 of the organization, it was necessary to subtract from the income generated by sales the costs of the operation of the period minus the difference of the inventories of the current and previous period – due to the fact that the company is a health service provider entity and what is provided It is a service that does not take into account the inventory because it does not have. From the information obtained we have that the company obtained similar income throughout 2020, however, in the month of May extra income was received for a total of $ 68,068,716 due to a congress organized by the clinic and that is usually held annually.

Table 7. Variation of the value added during the 11 periods of 2020 of the entity providing health services

Information	**Company: Entity providing health services**									
	Feb	**Mar**		**May**	**Jun**		**Aug**	**Sept**		**Nov**	**Dec**

SALES			Apr			Jul			Oct		
(+) Net sales	100,00%	-1,17%	-2,12%	12,10%	12,96%	-28,85%	29,15%	10,52%	1,79%	-69,25%	-13,98%
(+) Other income	100,00%	41,24%	324,43%	5477,05%	-98,23%	-99,43%	36691,09%	-99,24%	-25,51%	27,86%	99,34%
Costs	100,00%	-1,77%	4,23%	4,28%	5,07%	0,28%	-1,44%	3,44%	0,39%	2,49%	1,36%
ADDED VALUE	100,00%	-0,34%	-5,28%	233,03%	-56,96%	-53,92%	94,34%	9,83%	2,94%	-128,07%	355,31%

.

As described in Table 7, the trend of the added value generated by the company is evidenced and observe if at the end of 2016 the company increased its value with respect to the beginning of that same year. For this, the variation of the value added for each of the periods was determined, in order to know which were the months with the best and worst behavior and to recognize what were the causes of this. Some volatility can be observed between the various periods, however, if we take into account that in May additional income was received for the congress held, we have that during the first 6 periods stability is observed in the variation. Revenues were increasing, except during the month of November where there was a loss of money for the company, which indicates the abrupt rise for the month of December. In relation to the related costs in table 2 we have that they were also increasing throughout the accounting year.

Generate indicators that allow measuring the behavior of the organization in terms of its productivity over a given period of time is the main idea of the diagnostic part of the work, from the results obtained to know how well the resources have been used and generate profits, and use these profits to increase the value of the company. This was based on the information provided by the organization, detailed in Table 3, where they found the necessary data to calculate the indicators of value added, capital participation, productivity and participation of personnel costs in value added. Other indicators such as the use of equipment proposed within MPVA (measurement of productivity with a value-added approach) was left aside due to the little use of machinery within the clinic process, since it is a process carried out purely by personnel, that is, doctors. Below are the indicators to be used to determine the productivity of the company:

Table 8. Value added indicators for 11 months of 2020 from February to December.

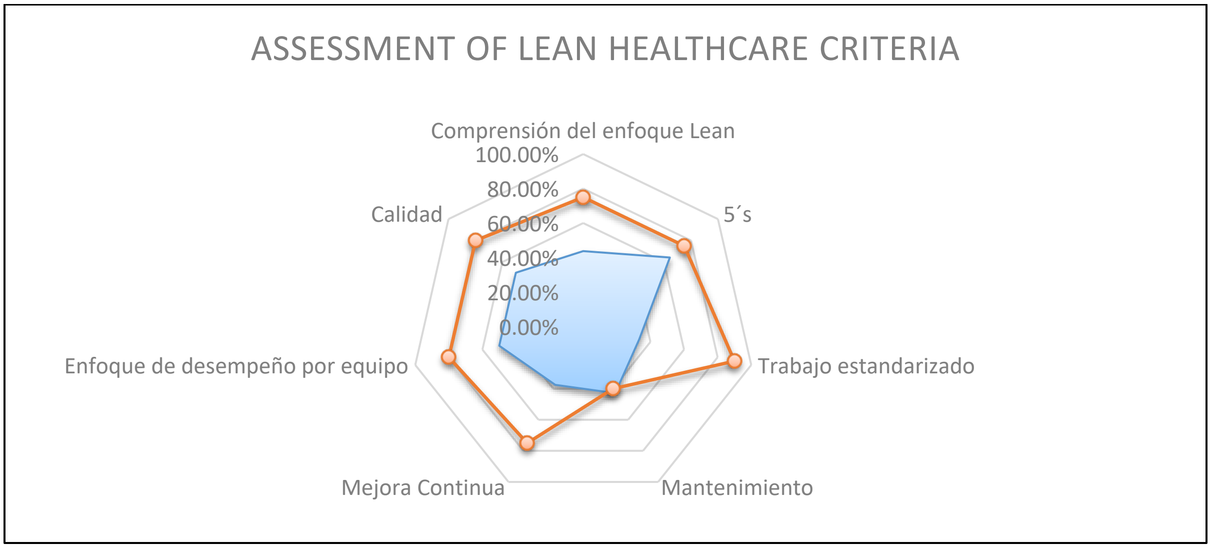
Indicators	Company: Entity providing health services										
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Value Added Index	51,18%	51,61%	49,94%	148,37%	56,53%	36,61%	55,08%	54,74%	55,36%	-51,44%	46,12%
Capital Participation Index	39,68%	39,91%	-61,66%	80,21%	59,30%	-4,96%	43,60%	55,34%	51,10%	251,61%	24,18%
Contribution of personnel costs to value added	0,65370	0,65590	0,69240	0,20790	0,48310	1,0484	0,53950	0,49120	0,47710	-1,69900	0,66580
Labor productivity	$ 1.328.279	$ 1.323.826	$ 1.253.888	$ 4.175.836	$ 1.797.294	$ 828.176	$ 1.609.437	$ 1.767.620	$ 1.819.664	$ 510.770	$ 1.304.067
Labor productivity 2	$ 2.075.436	$ 2.068.478	$ 1.959.200	$ 6.524.743	$ 2.808.271	$ 1.294.025	$ 2.514.745	$ 2.761.906	$ 2.843.224	$ 798.091	$ 2.037.604
Labor Distribution Index	63,37%	65,59%	69,25%	20,79%	48,31%	1,05%	0,54%	0,49%	0,48%	-1,70%	0,67%

As described in Table 8, the entity providing health services under study shows a good value-added index, which implies that the added value of the company depends to a large extent on the operating income it generates, this situation is quite common in organizations that depend on the service provided to generate profits. The equity participation index shows how much is the distribution of value added among the capital of the organization, which we can observe is quite significant. We can observe certain negative values because during these periods losses in profits were obtained (in the added value the expenses of the organization are not being taken into consideration). The contribution of staff costs to value added indicates how much of what the clinic is paying its workers (doctors) is attributable to value added, we observe that this value is also quite high, exceeding 50% in most of the periods observed. Labor productivity indicates how much each worker contributes to the VA of the organization taking the total of 16 doctors of the clinic or the 25 people who work in it between doctors, administrative and auxiliary.

4.3. Evaluation of the degree of implementation of the Lean Healthcare philosophy through a Technical Questionnaire of the Outpatient Service.

To evaluate the degree of implementation of the Lean Healthcare philosophy, a technical questionnaire was used in the health service provider entity based on criteria such as: understanding of the lean approach, the 5'S, standardized work, Maintenance (If applicable), Continuous improvement, performance approach by team and quality. Obtaining as a result the following graph:

Figure 9. Radar of Lean criteria applied to the Health Services Provider Entity under study



According to Figure 9, the organization shows that its understanding of the Lean approach is low, since it only understands 31.25% of this philosophy which aims to be understood by 75% by all employees. As for the application of the 5'S the company reaches 50% use of this tool, and although some of the criteria in 5'S are high, such as cleaning, others such as the use of space efficiently is low, this shows the need to raise awareness among all employees in this aspect. In the standardized work it shows a low result with respect to its objective that defined by the clinic is 90%, being in 45.83 % of application of this, since it is not known how long it could take a medical attention and some activities carried out by the doctors for the care of the patients. Maintenance is one of the criteria that, although it does not seem very used in this type of company is used greatly, although the main resource is doctors, maintenance is performed on physical infrastructure, air conditioners, office equipment and medical equipment, but in this it is evidenced in the score that only has 28.57%, which must be improved in order to implement activities effectively. Within the continuous improvement that is the lowest with 6.25% compliance, it is evident that the clinic does not have any type of management for this to be carried out. The team performance approach has a score of 55% in which some aspects of remuneration for meeting goals and training must be improved for this criterion to be met. With regard to quality, it can be said that it is low with 45% compliance, it shows that the service lacks focus on processes and the customer in order to provide a good service.

4.4. Conceptualización de la servucción de consulta externa mediante la prueba de Kolmogorov-Smirnov.

The conceptualization of the outpatient service based on the behavior of the system of the Health Service Provider Entity under study, through the realization of a data analysis and time study as a basis, will allow to know the resources, entities and locations used for patient care. This took into account the study methods to know the activities carried out to perform the operations and the times in order to know the stochastic behavior of the system and take into account the output variables and evaluate according to the results obtained, which is very useful for the construction of the conceptual model and offers a detailed perspective of the behavior of the activities.

The process of care within the outpatient clinic, has different activities carried out for this case, as mentioned in the description of processes, in which there are seven (7) different types of entities that are patients who present different types of pathology and are assigned to the seven (7) specialties offered as a service by the clinic, which are: Allergology (x1), Dermatology (x2), Adult Pneumology (x3), Pediatric Pneumology (x4), Pediatrics (x5), Otorhinolaryngology (x6), and Physiotherapy / Immunology (x7). When patients arrive to take their assignment appointment, they show a behavior which is defined by function λ(t) which were established with a ratio of arrivals per hour, as shown in Figure 2.

After knowing in detail, the behavior of the arrivals to make the assignments to each of the seven entities, the λ(t) functions for the confirmation of appointments are shown, which is the activity prior to the attention of specialized medicine, and are shown in Table 6, where there is a detail with the behavior of the arrival of otolaryngology, since this fits a triangular function because the amount of data obtained in the collection was twenty (20). Next, the arrivals data (See Figure 2 and Table 2).

These arrivals are subject to shifts scheduled by the clinic, which depend on the availability of specialists, availability of locations, since there are four (4) offices and one (1) equipped for respiratory therapies, fifteen (15) medical specialists, and two (2) general practitioners who provide support in the specialty of Pediatric Pneumology which are shown below (Table 9).

Table 9. Scheduling of care of specialists and assigned offices.

SCHEDULING AND MEDICAL OFFICES						
SPECIALTIES	**MEDICAL**	**MONDAY**	**TUESDAY**	**WEDNESDAY**	**THURSDAY**	**FRIDAY**
PAEDIATRIC PNEUMOLOGY	NP 1		OFF 4 11 AM - 1 PM	OFF 4 11 AM - 1 PM	OFF 4 11 AM - 1 PM	
	NP 2	OFF 4 11 AM - 1 PM			OFF 1 2PM-5PM	OFF 4 11 AM - 12 M
ALLERGOLOGY	A 1	OFF 1 8 AM - 12M				OFF 1 8 AM - 12 M
	A 2			OFF 1 8 AM - 11 AM		
	A 3	OFF 2 2:00PM- 5:00PM	OFF 1 - OFF 2 2:00PM- 5:00-PM	OFF 1 2:00PM- 5:00-PM		
ADULT PNEUMOLOGY	NA 1	OFF 1 1PM-5PM				OFF 1 1PM-5PM
	NA 2		OFF 2 830:00AM- 11:00AM	OFF 2 1:00PM- 3:00-PM	OFF 2 8:00AM- 9:30-AM	
RESPIRATORY AND SPIROMETRIC THERAPIES	TR 1	THERAP	THERAP	THERAP	THERAP	THERAP
	TR 2	THERAP	THERAP	THERAP	THERAP	THERAP
PEDIATRICS	P1	OFF 4 1PM-5PM		OFF 4 1PM-5PM		
	P2		OFF 2 1PM - 5PM		OFF 2 1PM - 5PM	
DERMATOLOGY	D1		OFF 1 9 AM - 11 PM			
	D2	OFF 3 2:00PM- 4:00PM	OFF 3 2:00PM- 4:00-PM	OFF 3 2:00PM- 4:00-PM		
	D3	OFF 3 8AM-12M			OFF 3 8AM-3PM	OFF 3 8AM-3PM
OTOLARYNGOLOGY	O1	1 TIME PER MONTH	1 TIME PER MONTH	1 TIME PER MONTH	1TIME PER MONTH	1 TIME PER MONTH

The assignment, confirmation and appointment attention are activities within the process that present stochastic behaviors when executed, this was known through a streak test, applied to the data collected for each specialty performed, so for the understanding of the conceptual model it is necessary to show its behavior (See table 4, Table 6).

Within the conceptual model, some performance measures will also be taken into account, in order to measure the behavior of the system while it is performing its operations, within these we have: No. Of Patients in the System; Percentage of People in Line and Number of Patients Served.

The output variables will be analyzed to know how the real system behaves its respective events, the variables that will be measured are: Average operating time, Utilization and Average waiting time.

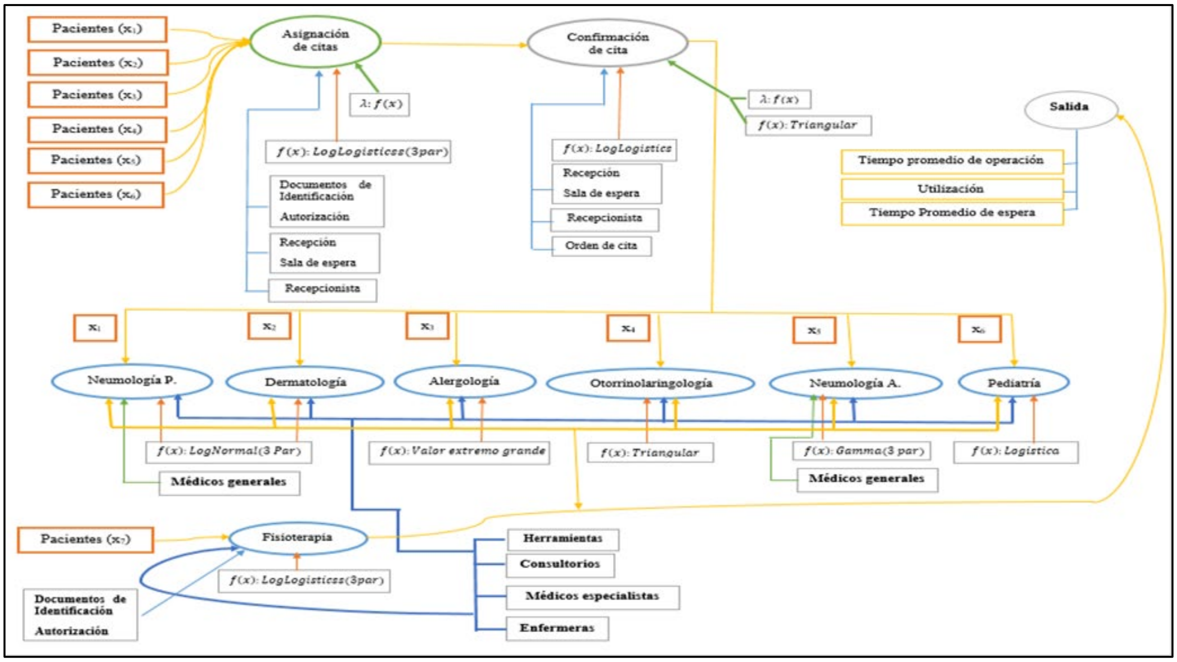


Figure 10. Conceptual model for the care process of the Health Service Provider Entity

6. Conclusions

- As described in the statistical analysis, the behavior of the outpatient consultation process of the entity providing health services Ltda., object of study shows a great randomness and variability precisely due to the diversity of specialized medical services manufactured, which greatly hinders to develop an optimal operations management, supported by a process management and a standardized structure.
- Given the randomness and variability of patients and symptoms treated in the entity providing health services, the production system developed by the organization is framed in a structure by projects where the service is made in a personalized way and tailored to each patient, which largely makes it impossible for care times to be the same for each patient, but nevertheless by government guidelines and for the sake of To guarantee coverage, accessibility and timeliness to the health care service, standardized care times of between 15 – 20 minutes per patient have been established.
- Another mitigating factor in the manufacture of medical services offered by the entity providing health services is the availability of specialized medical personnel, as can be seen in the schedule the use of the system is not 100% which greatly impacts the opportunity in the allocation of appointments.
- From the measurement of productivity with a value-added approach, it can be affirmed that the company shows healthy finances, is a company that responds positively to its social interest groups and that operationally speaking behaves appropriately and adjusted to the behavior of the health system.
- From the diagnosis of the lean approach, it can be established that an organization that does not focus its work on the reduction of waste, given the variability of medical services, symptoms that attend and diversity of patients is difficult to standardize processes but nevertheless it would be possible to organize and / or synchronize in a better way its activities in order to continuously improve its levels of quality and productivity and therefore its profitability.
- It should be noted that the proposed conceptual model serves as an initial framework for future research such as the development of simulation models using software such as Flexsim and / promodel as the object of validating their behavior and thus proceed to make the respective adjustments and changes in the medical protocols that to date are working in the institution.

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Biographies

Hernando Garzón Saenz. is Food Engineer from the University of San Buenaventura, Specialist in Production Management and Quality from the Technological University of Bolívar and Master in Business Administration with specialization in Integrated Management of Quality, Safety and Environment of the University from Viña del Mar Chile, candidate for a PhD in Engineering with a minor in Industrial Engineering from the National University Lomas de Zamora (Buenos Aires - Argentina). Certified in Certified Quality Improvement Associate - CQIA granted by the ASQ - CQIA granted by the ASQ. He is a Research Professor at the Comfenalco - Cartagena Technological University Foundation, for the programs of Industrial Engineering, Technology in Industrial Production; developing the subjects Administration of production and Operations, Modern Operations Management, Production I and Production II. His industrial experience covers companies in the Port Logistics, Food Processing and Manufacturing, Hotels and Catering and Health sectors, mainly as an external consultant and consultant on issues related to the management and optimization of the productive chain of goods and services and strengthening the business fabric; using tools such as BPM, HACCP, Planning, Programming and Control of Production, Lean Manufacturing, Six Sigma, Theory of restrictions among others.

Andrés Redchuk. is Research Professor in the Department of Computer Sciences and Statistics, University Rey Juan Carlos in Madrid, Spain. Director of Operational Excellence and Process Improvement Institute in the School of Engineer, University of Lomas de Zamora, Argentina. Lean Six Sigma Master Black Belt of the Spanish Association for Quality (www.aec.es), Spain. He is an Industrial Engineer, Master of Total Quality Management and Doctor in Computer Sciences and Mathematical Modelling.

José Manuel Solana Garzón. is an Industrial Engineer. Specialist in Production and Quality Management and PhD student in Engineering mention in Industrial Engineering with experience in administration and process improvement in the industrial and service sector. He has excelled in the standardization of processes with a view to the automation of business systems through ERP-type applications. He also has experience in the organization of processes with a view to compliance with international norms and standards in Quality Management Systems and Physical Safety. He has developed chairs focused on Operations Research and Quantitative Methods for Higher Education. The research it is carrying out is focused on Operations Management and Operations Research in productive and service contexts. He currently serves as Director of the Industrial Engineering and Technology in Industrial Production programs at the Fundacion Universitaria Tecnologico Comfenalco Cartagena, where he has participated in the redesign of the Industrial Engineering program and in the Process of Accreditation and Reaccreditation in High Quality of the Technology in Industrial Production program.

Gustavo Ortiz Piedrahita, is an Industrial Engineer from the Technological University of Bolívar, a specialist in Applied Statistics from the Universidad del Norte and a Master's Candidate in Industrial Engineering from the same university. Lead Quality Management Systems Auditor, with a course Reliability Management of Physical Assets developed at the Universidad Santiago de Chile. With professional performance in different organizations of the construction and tourism sectors, with functions related to the design, implementation and certification of Management Systems, both quality and safety and health at work and environmental. In the academic sector I work as a research professor at the Comfenalco Technological University Foundation, developing research applied to productive and service sectors, in conjunction with chairs of the subjects Operations Research I and II, Simulation of Processes and Standardized Systems. The research projects that I am currently developing have as central axes the automation of processes with tools such as BPM, also the study of asset reliability models describing the dynamic relationships that are presented between their elements and the applications of stochastic models in the analysis of service provision in the health sector.