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Environmental Management of the Tanning Industry’s supply Chain: An Integration Model from Lean Supply Chain, Green Supply Chain, Cleaner Production and ISO 14001:2004

N. Clavijo Buriticá, L.M. Correa Lópezand J.R, Sánchez Rodríguez

***Abstract*—**The environmental impact caused by industries is an issue that, in the last 20 years, has become very important in terms of society, economics and politics in Colombia. Particularly, the tannery process is extremely polluting because of uneffective treatments and regulations given to the dumping process and atmospheric emissions. Considering that, this investigation is intended to propose a management model based on the integration of Lean Supply Chain, Green Supply Chain, Cleaner Production and ISO 14001-2004, that prioritizes the strategic components of the organizations. As a result, a management model will be obtained and it will provide a strategic perspective through a systemic approach to the tanning process.

This will be achieved through the use of Multicriteria Decision tools, along with Quality Function Deployment and Fuzzy Logic.

The strategic approach that embraces the management model using the alignment of Lean Supply Chain, Green Supply Chain, Cleaner Production and ISO 14001-2004, is an integrated perspective that allows a gradual frame of the tactical and operative elements through the correct setting of the information flow, improving the decision making process. In that way, Small Medium Enterprises (SMEs) could improve their productivity, competitiveness and as an added value, the minimization of the environmental impact. This improvement is expected to be controlled through a Dashboard that helps the Organization measure its performance along the implementation of the model in its productive process.

***Keywords*—**Integration, Environmental Impact, Management, Systemic Organization

I. Introduction

TODAY’s Supply Chain Management should be focused on solving critical global issues, meet the market’s dynamic needs and the conservation of natural resources. One of these problems is certainly the environmental impact generated by the industries involved in the tanning process, because of their operational dynamics and their complex systemic relationships generated along the supply chain.

N. Clavijo is with the Fundación Universitaria Agraria de Colombia Uniagraria, Bogota, Colombia (Phone: 57-1 6671515; e-mail:nicolasclbr@yahoo.es).

L.M. Correa is with the Fundación Universitaria Agraria de Colombia Uniagraria, Bogota, Colombia (Phone: 57- 3123488770; email:linacorreal@gmail.com).

J.R. Sánchez is with the Fundación Universitaria Agraria de Colombia Uniagraria, Bogota, Colombia (Phone: 57- 3123672547; email: ricardo.sanchezr@hotmail.com).

A. Logistics and Supply ChainManagement (SCM)

According to the Council of Logistics,Logistic Management (2003) “is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements”. This definition is closely related to the management processes that include shopping, transportation, storage, production, marketing, product and package return (reverse logistics aftermarket) waste and environmental management (reverse logistics post-consumer) [1].

According to [2] the SC management is the art of management that determines the requirements, acquisition, distribution through different channels and activities that create quality products and services for life. Supply Chain Management is the design, planning, execution, control and monitoring the activities of the SC, from the raw material to finished product. This ensures the right product movementto the right customer in a smart, efficient and quick way andat the place, time and right price.

B. Systemic approach of the Organization and Supply Chain

The interaction between actors in the supply chain as a complex system, which is characterized with the concept of Systemic Organization (SO) based in the paradigm addressed by the General Systems Theory (GST) proposed by Ludwig von Bertalanffy, refers only to a fixed and unchanging structure, a dynamic system, whose characteristics vary as circumstances change, media and parameters with it operates.

This concept of Systemic Organization suggests that this type of organization operates according to the first cybernetic principle in which the organization is conceived as a dynamic system where each party contributes to the whole operation through the feedback of information generated at different points and levels. Through this feedback, each of the members of the system should contribute creatively to achieve the objectives of various processes [3]

This dynamic perspective of the systemic organization has the ability to adapt to changing situations, which happens to be one the most important assumptions today to refer to systemic supply chain. Here the information, communication and knowledge perform support essential functions to achieve high levels of competitiveness, looking profitability, sustainability and market share.

The proposal made in this research will address the problem of productivity and environmental contamination from the perspective of supply chain management of systemic organizations.

C. The integrated approach of Management in the Supply Chain

Here is necessary to highlight the importance of integrating the management of each organization and supply chain in order to increase productivity and reduce environmental impact from two perspectives: systemic and lean.

D. Decision making with multiple criteria

To fulfill the purpose of this research which is to propose an integrated environmental management in the supply chain based on Lean Supply Chain, the situation must acclimate in a decision making problem with multiple criteria. The result of the integration process of the management model is carried out under an atmosphere of uncertainty, which will be addressed from the precepts of fuzzy logic. The main goal here is to eliminate as possible the subjectivity in the decision process, so the Analytic Hierarchy Process (AHP) methodology is chosen.

Since the process of integration requires compliance guidance to customer requirements, the methodology of integration refers to the use of the House of Quality (HOQ) as a tool for the Quality Function Deployment (QFD), which in the case of this research will be used by defining the attributes of management systems to integrate.

II. Reference Framework for the Sector of Tanneries in Colombia

The first activities of tanning in Colombia dating from the 1920_{th} in the Department of Antioquia.In the Department of Cundinamarca appears in the 1950_{th} placing on the outskirts of Bogotá, near to Rio Tunjuelo, epicenter of this research.

Nowadays there are industries in the departments of Nariño, Quindío, Risaralda, Cundinamarca, Antioquia, Atlántico, Valle del Cauca, Tolima, Bolívar, Santander and Huila. [4].

However, there is no updated official information about the informality of these tanning industries, but it is estimated that there are countless of these manufacturing practices that are informal due to local environmental regulations and high operating costs. According to the National Center Of Cleaner Production (Centro Nacional de Produccion Mas Limpia), there are around 677 distributed companies within the national territory, of which 502 companies are micro-enterprises representingaround 75.62% of the whole; 128 small industries (18.9%); 18 medium-sized industries (2.62%);6large industries (0.89%) and 13 companies without information (1.97%). [4].

The Tanning industry is closely related to two productive sectors of the economy: the footwear industry and the leather accessories industry [5]. The production of leather has recently declined because of the strong foreign competition and the national economic situation.

Environmental diagnoses have been done in this sector, using information found in documentation centers and environmental authorities in each of the national regions.

The Tanning industries are located in different departments with an existing environmental regulation.However,there are other factors that affect the operation of the organizations involved, as seen in Table I

TABLE I
FACTORS AFFECTING OPERATIONS IN TANNING INDUSTRIES

Social	• Educationalproblems
Environmental	• Insufficient compliance with regulatory requirements
Competitiveness	• Lowrate of Innovation

From an environmental point of view, the companies in this sector have always been listed as highly polluting, due to the emissions of the tanning process. In this process the skins of animals (such as cattle, sheep, and swine) are transformed into leather through different stages. In Colombia the underdeveloped and artisanal manufacturing process increase the environmental impact. This problem can be seen in micro, small, medium-sized enterprises and all of the informal companies.

In terms of technological development, according to studies carried out by the National Learning Service (Servicio Nacional de Aprendizaje -SENA) in the tannery sector German and Italian machinery can be found, although there are also French, Spanish and Czechoslovakia machines. "The tanning technology has advanced mainly in the finishing process, where the greatest advances have occurred both nationally and internationally". [6]

According to the study of the profile of the leather chain, "In this industry, the machinery acquired in recent years is about two machines per company, and mostly of traditional technology. The largest investment is made in the finishing processes with calendar machines, polishing machines, presses, drying machines, and mostly with manual and electro-pneumatic machinery to paint." [6]

In Colombia a series of measures to prevent and reduce pollution has been developed, through an environmental guide for these processes oriented to cleaner production (CP).Other efforts have been made by many universities, such as the study of the National University of Colombia published in the Colombian Journal of chemistry, as the "Use of Betonia for the removal of chromium in the wastewater" [7] among others, but in the review, the application of these studies in the sector was not found.

This research addresses the problem of the generation and treatment of industrial waste, and how it relates with low productivity

III. Methodology

The main purpose of this study is to propose an integrated management model that addresses the problem of supply chain management, developing a greater commitment to the reduction of environmental impacts, from a highly productive operating dynamics, taking as reference tanning industries in Bogotá, Colombia.

A. Considerations for the Integration

To achieve the primary objective of this study, different scenarios were suggested for the design of an integrated management model that considers the environmental problems as much as the productivity requirements, through the understanding of the dynamics of the supply chain management processes. Thus, the result will be a series of stages for the integration of the following models: ISO 14001:2004, Cleaner Production (CP), Lean Supply Chain (LSC) and Green Supply Chain (GSC).

The problem is approached from the paradigm of a comprehensive management and from the concept of systemic organization as key concepts in the creation of this synergy quantitatively and objectively. As a mechanism to propose a methodology for integrated management model, the problem of integration, in this study, forces to form two sets of management systems, according to its focus and structure. The first set refers to those models that mainly focus on supply chain management and not just a particular organization. This is the case of Lean Supply Chain models (LSC) and Green Supply Chain (GSC), which also share the same scope in terms of management, and share a structural approach too, which is clearly systemic. The second set of management models is made up of those that are structured according to the PDCA cycle (Deming cycle) as the basis for its operation. This is the case of ISO 14001 and Model of Cleaner Production (CP) Fig.1.

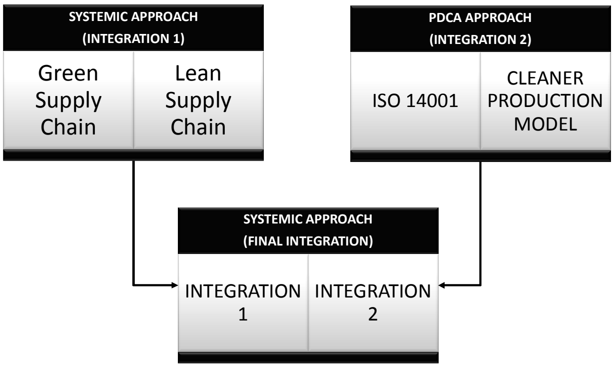

Fig. 1 Green Supply Chain, Lean Supply Chain, Cleaner Production and ISO 14001:2004. Source: Own

B. Methodological Stages

As an innovative contribution, an integrated management system that includes Lean Supply Chain, Green Supply Chain, Cleaner Production and ISO: 14001 was not found in the literary review from the last five years; neither the Multi Criteria Decision Making tools nor the fuzzy AHP and QFD were implemented to generate integrated management systems.

TABLE II
METHODOLOGICAL STAGES FOR STUDY DEVELOPMENT

Stage 1	Setting the needs for the integration of Supply Chain management
Stage 2	Setting the problem
Stage 3	Setting the aims of the research
Stage 4	Identify the design of the integrations
Stage 5	Establish the Types and sources of information
Stage 6	Establish the form of the management models integration
	a) Integration of management models under PDCA approach.
	b) Integration of management models under systemic approach.
Stage 7	Integration of the Set (a + b)
Stage 8	Data Analysis
Stage 9	Final report

IV. INTEGRATION OF MANAGEMENT MODELS

Following the methodological design raised to achieve the integration of management models, has been defined for the stage 1, to the need to integrate the management models Lean Supply Chain, Green Supply Chain, cleaner production and ISO: 14001, is evidenced by the lack of a strategic support and management structure consolidated in the supply chains of the tanneries sector in Bogotá, Colombia, dealing with the environmental and productivity problem jointly.

In stage 2, manifests the problem already described above, which in synthesis is addressing environmental and productivity issues from the perspective of the tanning industry supply chain management; stage 3, manifested as a result the determination of objectives of the study, which flying under the idea of integrated management in the supply chain from the models set out in stage 1.

In stage 4, been determined integrations design should follow the parameters and proposed structure in the case of this study, where the resulting integrated model, is the result of integrating two sets of management systems, which are represented in the Fig. 1; in the case of the stage 5, the sources of information are associated directly under two links, one determined by the secondary information that describes the management models to integrate; and two, the primary information resulting from visits and Diagnostics to some companies in the industry of the tanneries in the city of Bogotá.

Stage 6, is perhaps one of the main stages of the study, since it is where materializes and the transformation of the models of management private in an integrated model take place and ultimately that will address environmental problems and productivity from the point of view of the supply chain management. The importance of this stage also lies in the treatment of the data, which is where operations aimed at reducing the subjectivity that presents the process of integration. In line with this, for the integration of management models opted for the combination of tools where the AHP and the QFD with fuzzy extension in this scenarios significantly eliminates the existing subjectivity and at the same time provides a high reliability degree in the results.

For integration using the fuzzy sets proposed by [8] Who resume work on the use of fuzzy sets in QDF and systematic approaches to determine the characteristics of engineering priorities and in addition proposes a method to determine the values objective is optimal in a QFD using fuzzy numbers; This in order to represent the imprecise nature of trials and better define the relationship between the client's requirements and characteristics of engineering.

For the integration of management models, the fuzzy sets correspond to a set of attributes or criteria to evaluate possible alternatives, allowing perform and obtain a classification scale.

They are used in this case five skill levels which are used for the relationship and correlation within the QFD model: very low (MB), bass (B), medium (M), high (A), very high (MA).

A. Integration of management systems

1st Step: identification of elements of each one of the systems of management

To avoid the loss of identity of each of the elements of management systems is the individual identification of each using mind maps. The use of QFD model allows a quantitative integration while preserving the characteristics of the elements. For the case in point of this research work, numbering is assigned to each of these, so that it can be recognized for their integration. This way avoids problems that underlie language tag associated with the systems. As shown in Table III.

TABLE III
MANAGEMENT MODELS

MODELS	GENERAL ELEMENTS	SUB ELEMENTS
LEAN SUPPLY CHAIN	Supplier Assessment and Organization	-Identify of the system -Setting Performance Target - identify the first tier suppliers - document the process
	Assess the Current state of supply chain	- Assess the first-tier supplier (VSM). - Training to suppliers in lean first-tier - Development VSM macro Vision of the supply chain.
	Projection of the future state the supply chain	- Project future VSM - List of Opportunities - Assessment of Opportunities - Developing macro vision VSM through future Opportunities
	Measurement and control of implementation	- Lean Project Planning - Implementation of the project - Measurement and documentation of the execution
GREEN SUPPLY CHAIN	Life Cycle Assessment	- Define product - Objectives and measurement - Characterization Flow of raw materials and energy - Assessment of sustainability strategies - Tracking Tools
	Management of services and demand in the Green Supply Chain	- Identification and Grouping of potential customers - Selection of waste Treatment plants - Management inverse or supply chain reverse
	Strategic Management supply chain	- Strategic management for senior Management. - Product Green desing - Waste management, reverse Logistics, re-manufacturing - Evaluation of the efficiency of the supply chain
	Using Information systems	- Monitoring and information from the client
ISO 14001	Environmental policy	
	Planning	- Objectives - Goals
	Implementation and operation	- Training - Communication - Control documentary - Operation control - Procedures
	Checking and corrective Action	- Monitoring and corrective action - Records
		- Corrective actions - Preventive actions
	Review by senior management	
CLEANER PRODUCTION	Initial Review	- Commitment of top management
	Diagnostics business	- Flow of Energy and raw materials - Identify of critical points
	Assessment	- Financial Analysis - Current Evaluation of The organization
	Implementation and Monitoring	- Procedures - Monitoring - Continuous improvement

2st Step: Relative weights by means of Fuzzy – AHP

To define the elements of the Green Supply Chain, Lean Supply Chain models, production more clean and ISO 14001: 2004, comes to the application of the AHP fuzzy extension. So the qualifications of each of the elements were determined using fuzzy numbers proposed by [9] these are related in Table IV and Fig. 2.

TABLE IV
TRIANGULAR FUZZY CONVERSIÓN SCALE

LINGUISTIC SCALE	TRIANGULAR FUZZY SCALE
Just equal	(1, 1, 1)
Equally Important	(1/2, 1 , 3/2)
Weakly Important	(1, 3/2, 2)
Strongly more Important	(3/2, 2, 5/2)
Very Strong More Important	(2, 5/2, 3)
Absolutely more important	(5/2, 3, 7/2)

Linguistic level and scale triangular STFN (Simetric Triangular FuzzyNumbers). Source: [9]

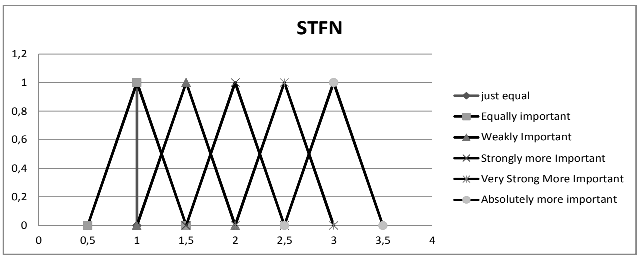

Fig. 2 Triangular scale for the extension of AHP-fuzzy analysis application. Source: Own

As a methodological requirement for the processing of data by the AHP tool, were assigned the following criteria:

i. C1: Quality
ii. C2: Cost
iii. C3: Competitiveness
iv. C4: Environment
v. C5: Productivity.

As the model AHP is based on the properties of matrices for the allocation of weights to established trials, for decision-makers and for the normalization of the pairwise comparison matrices, used the same mathematical process of the classical AHP. The difference is that STFN (symmetric triangular fuzzy numbers) are being used instead of traditional numbers. For the purposes of the definition of fuzzy numbers triangular symmetric STFN, it may denote as a triple (a, b, c) where to <

b < c and functions of belonging can be defined as they are proposed by [10],[11]

For the calculation of the matrix of priorities defined as the relative weight of each of the alternatives, which in turn are the elements of each of the models of management, where identified five (5) alternatives to the model of the ISO 14001: 2004 (A1, A2, A3, A4, A5), four (4) alternatives for cleaner production models, lean Supply Chain Management, and Green Supply Chain Management (A1)(, A2, A3, A4).

A. Mathematical process of the AHP model with fuzzy sets

Calculations with numbers and fuzzy sets are required for the mathematical process. The calculations used in this research project are proposed by (Chien& Tsai, 2000).

$$Fuzzy\ Number\ Addition: \tilde{A}_1 \oplus \tilde{A}_2$$
$$(l_1, m_1, u_1) \oplus (l_2, m_2, u_2) = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (1)$$

$$Fuzzy\ Number\ Subtraction: \tilde{A}_1 \ominus \tilde{A}_2$$
$$(l_1, m_1, u_1) \ominus (l_2, m_2, u_2) = (l_1 - l_2, m_1 - m_2, u_1 - u_2) \quad (2)$$

$$Fuzzy\ Number\ Multiplication: \tilde{A}_1 \otimes \tilde{A}_2$$
$$(l_1, m_1, u_1) \otimes (l_2, m_2, u_2) \cong (l_1 * l_2, m_1 * m_2, u_1 * u_2)$$
$$for\ l_i > 0,\ m_i > 0, u_i > 0 \quad (3)$$

$$Fuzzy\ Number\ Division: \frac{\tilde{A}_1}{\tilde{A}_2}$$
$$= (l_1, m_1, u_1) \oslash (l_2, m_2, u_2) \cong (l_1/l_2, m_1/m_2, u_1/u_2)$$
$$for\ l_i > 0,\ m_i > 0, u_i > 0 \quad (4)$$

First add all the values of each of the columns, i.e. of the triplet (a, b, c) of the matrix of pairwise comparison and in the same way in the matrix of priorities, that is the most important for the specific case of the integration. Each value of the array is later divided between the resulting sum obtained in each of the columns corresponding to the triple (a, b, c). The result of this Division produces the matrix of pairwise comparison and just as the matrix of priorities. Continually add all the results of the matrix corresponding to the triple (a, b, c) present in each of the rows of the alternatives.

Finally, for the calculation of $W_i$normalized diffuse ratings with an average that is obtained by using the following equation:

$$\frac{(a+4b+c)}{6} = N \quad (5)$$

With this result diffuse numbers will be linearized to return them exact values or crisp, giving a useful to these within the integration.

With the use of the AHP with a fuzzy extension minimizes subjectivity in the decision-making process and determines the relative weights for each of the elements of the different models of management within the integrated management system to propose.

3rd Step: Determine the relationships of each of the management systems by HOQ (House of quality) of the QFD model.

Once established the relative rating through the Fuzzy-AHP for each of the elements of the different management models is to incorporate them in the HOQ (House of Quality) of the QFD model. Through integration the QFD model used the proposed fuzzy sets by [8]

For the integration of management models the fuzzy sets correspond to a set of attributes or criteria to evaluate possible alternatives, obtaining a classification scale. Five skill levels are used in this case which are used for the relationship and correlation within the model QFD these can be seen in Table V and Fig. 3

TABLE V
TRIANGULAR FUZZY CONVERSIÓN SCALE

LINGUISTIC SCALE	TRIANGULAR FUZZY SCALE
Extremely High (EH)	(8, 9, 10)
High (H)	(6, 7 ,8)
Medium (M)	(4, 5, 6)
Low (L)	(2, 3, 4)
Very low (VL)	(0, 1, 2)

Scale and fuzzy numbers for the integration of management models.Source: [8]

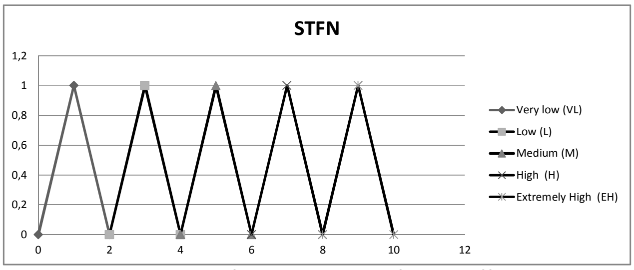

Fig. 3 Triangular scale for the extension of QFD-diffuse analysis application

B. Integration process

The framework for the achievement of the integration of the systems of management through the use of the QFD is composed of 3 main stages. In Fig. 4 has a step description of the integration process.

C. The mathematical process of the QFD model with fuzzy sets

The objective of the proposed integration is obtain a model of environmental management which has as a foundation look at the degree of relationship of one other element and identifies which of these integral elements has greater effect in the supply chain. The following mathematical expressions were used for this:

Rij = degree of relationship of the element (I) with respect to the element j,

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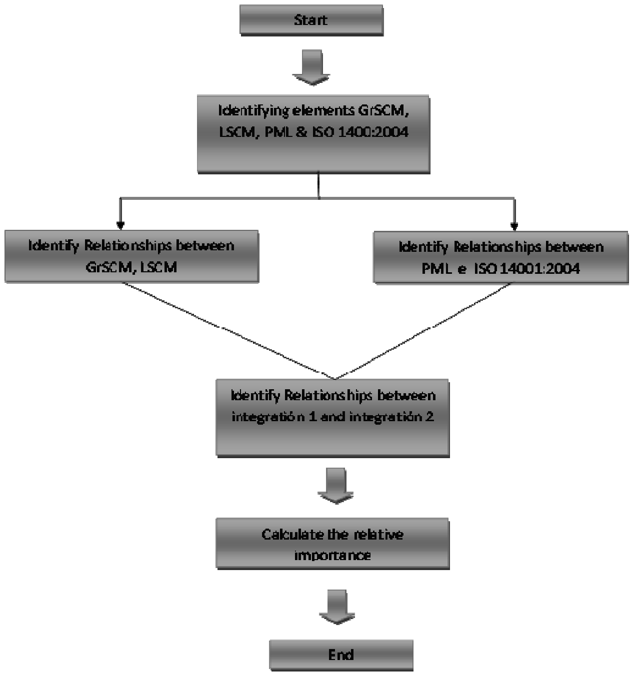


Fig. 4 Stages of the integration process. Source: Own

W_i = relative rating obtained from the AHP with the extension diffuse for each of the elements,

Y_{jk}= degree of correlation element j with the element k,

NZ_{ij}= standard qualifications.

With the aim of determining relations the following expressions were used to perform calculations:

$$RI_j = \sum_{i=1}^{n} W_i \otimes R_{ij} \quad j = 1, \ldots . m. \tag{6}$$

$$YJ_k = \sum_{i=1}^{n} W_i \otimes R_{jk} \quad j = 1, \ldots . m. \tag{7}$$

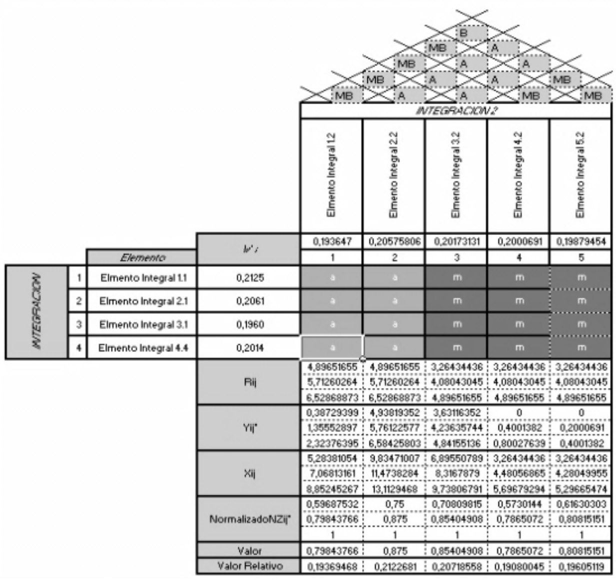
The degree of correlation of the element j Y_{jk}shown in the part of the roof of the HOQ. The parameters mentioned above are shown in Fig. 5. The standardization of each of the relationships was carried out by dividing the highest value according to the algebra of numbers diffuse, in order to classify the relationship with an exact number and give validity to the time to evaluate each of the integrals of the proposed management system elements.

For the integration of the elements of each one of the systems of management are three integrations. In the first of these integrated models under the systemic approach (Green Supply Chain Management and Lean Supply Chain Management), in the second integrated models under the focus of the PDCA (ISO 14001: 2004 and Cleaner Production Model). Finally turns to carry out a process of integration of the results of integration one and two for the final integration.

Possible combinations of qualifications through the construction of a decision tree, using the language scale proposed were identified to carry out integration [8].

D.Implementation of integration

This section presents the HOQ were used to determine the integration and the record of results obtained from the final integration with different combinations. Integration number one (1) relates four (4) elements of Lean Supply Chain with four (4) elements of Green Supply Chain. The second integration relate four (4) elements of cleaner production to five (5) elements of the ISO 14001: 2004 model



	Elemento	W'i	1	2	3	4	5
			Elmento Integral 1.2	Elmento Integral 2.2	Elmento Integral 3.2	Elmento Integral 4.2	Elmento Integral 5.2
			0,193647	0,20575806	0,20173131	0,2000691	0,19879454
1	Elmento Integral 1.1	0,2125	a	a	m	m	m
2	Elmento Integral 2.1	0,2061	a	a	m	m	m
3	Elmento Integral 3.1	0,1960	a	a	m	m	m
4	Elmento Integral 4.4	0,2014	a	a	m	m	m
	Rij		4,89651655	4,89651655	3,26434436	3,26434436	3,26434436
			5,71260264	5,71260264	4,08043045	4,08043045	4,08043045
			6,52868873	6,52868873	4,89651655	4,89651655	4,89651655
	Yij*		0,38729399	4,93819352	3,63116352	0	0
			1,35552897	5,76122577	4,23635744	0,4001382	0,2000691
			2,32376395	6,58425803	4,84155136	0,80027639	0,4001382
	Xij		5,28381054	9,83471007	6,89550789	3,26434436	3,26434436
			7,06813161	11,4738284	8,3167879	4,48056865	4,28049955
			8,85245267	13,1129468	9,73806791	5,69679294	5,29665474
	NormalizadoNZij*		0,59687532	0,75	0,70809815	0,5730144	0,61630303
			0,79843766	0,875	0,85404908	0,7865072	0,80815151
			1	1	1	1	1
	Valor		0,79843766	0,875	0,85404908	0,7865072	0,80815151
	Valor Relativo		0,19369468	0,2122681	0,20718558	0,19080045	0,19605119

Fig. 5 Integral Elements and Determination of Relative Values

These values are recorded to determine the degree of variability that is obtained with the different combinations according to the linguistic level assigned to the integration.

The final integration process can be seen in Fig. 5, where refers to the results of the first two integrations. However, to avoid linguistic problems not was assigned a specific name or a description, since that philosophical questions and defining call them an integral element.They possess the same characteristics and have the identity of the management system of which was initially integrated.

IV. Result and Discussion

For this data analysis were obtained 125 combinations with respect to scale linguistic and a record of scores obtained to all integrations. That is, there are records for the integration number one, integration number two and final integration. For purposes of analysis only is considered the final integration register, since in this case other combinations of integrations one and two.

After validating the proposed integrated model in the industry´s tanning chain, you can have a management model that ensures, from the integral management paradigm with a range covering the logistics system, the following benefits:

i. Reduction of waste along the supply chain.
ii. Control of solid waste, discharges and air emissions in the supply chain
iii. Control and abatement of pollution sources
iv. Increased productivity of the different actors in the supply chain

v. Increased competitiveness of the different actors in the supply chain
vi. Management of integrated management which includes the following approaches:
- Systemic component
- Continuous improvement component
- Strategic planning component
- Lean component
- Environmental component
- Process approach component

vii. Improvement of the measurement system and system monitoring
viii. Document Management more objective.

Green Supply Chain, Lean Supply Chain, cleaner production and ISO14001:2004 were developed with the purpose to obtain an environmental management model that covered the supply chain under a systemic approach and components of continuous improvement (PDCA). With the use of AHP-QFD with a fuzzy extension, it was demonstrated that the application of MCDM methodologies specifically QFD can identify, relate and correlate a defined set of management models to quantitatively prioritize, against the vagueness of linguistic judgments about. This was done to have a comprehensive model for managing the supply chain and integrated management system in which the models do not lose their identity and address on the organization functionality.

To manage the supply chain information are considered a number of factors in the strategies to be competitive. This research proposes a Dashboard that would come to operate decentralized and autonomous actors within an integrated management system to coordinate the stakeholders within the systemic approach are embedded in organizations, which aim to generate greater value to their products or services. For the improvement, establishing the need to develop a measurement system for a comprehensive management model that frames the environmental responsibility of organizations belonging to the chain.

To control and measurement process of the management model, were collected regarding particular key environment, taking into account that it is contemplating the supply chain. For the study indicators are established for two main references, [5], [13]. These indicators build the result of the key indicators of the integrated management model (KPI's Key Performance Indicators).

Continuing the project development methodology, we propose a Dashboard to provide a systems perspective to the organization, and allow the measurement, monitoring and control of organizational dynamics within the integrated management model proposed, supported by the Information and Communications technologies. This is projected Dashboard is a tool for decision making at any organizational level where it is to implement, giving primary emphasis to the management component.

This proposal seeks to link each of the elements of integrated management systems with indicators that make up the respective KPI for the whole supply chain are covered 4 main KPIs that can be assessed on any actor, functional group or chain as entirety, *ie* systemically. This approach supports the concept of Systemic Organization.

V. Conclusion

Under the partial results of the proposed methodology to integrate models Green Supply Chain, Lean Supply Chain, cleaner production and ISO: 14001, it has addressed the issue of productivity in the supply chain, framed with the environmental responsibility of organizations belonging to the chain. The methodological design to achieve the integrated model, as the product was characterized by the use of tools of MCDM ((Multiple Criteria Decision Making) such as AHP, subsequently extended under a diffuse focus FAHP (Fuzzy-AHP); as also the orientation towards customer denoted by HOQ (House of Quality) tool from the deployment of the role of quality (QFD, by its acronym in English), which together generate a goodness in the integration process)which lies in the decline of the vagueness, uncertainty and vagueness of the criteria for the integration of systems, contributing as a result to the development of this methodology the decrease of subjectivity in the process of integration.

From an investigative perspective, reiterates the novelty generated in the implementation of the methods previously described in the processes of construction of integrated management models under a scenario of environmental conservation supply chains and thus also concluded:

i. On the characterization of the sector and the productive process of the tanning of skins in the current state it was found that:
   -About 75,62% of the total of the tanneries in the country are micro-enterprises, mostly of family origin. Main feature is a low level of education and cultural in owners and workers of the enterprises that triggers in a brake on productivity and the competitive development of the same.
   -The sector boasts a number of studies of the environmental impact associated with its activity, mitigation plans and environmental guides, but which in practice still not been carried out.
   -In the most critical processes regarding the associated environmental impact minimum levels of development, investment and technological progress are presented.
   -There is competition from the foreign market, primarily from China, where its main competitive advantage is the low cost of production, resulting in low selling price to the public. In addition to this, they do not have legislation.

ii. As a result innovative investigative perspective of this study, it must denote that the management system that integrated models Lean Supply Chain, Green Supply Chain, cleaner production and ISO: 14001: 2004, was not found in the literature review of the last 5 years, in addition to the application of the methods used in this research project in the construction processes of integrated management models under a scenario of conservation supply chains environmental.

iii. III. The methodological design used to develop integrated management model, based on an approach of fuzzy logic, which allows the treatment of vagueness, uncertainty and vagueness of the criteria for the integration of systems, with regard to their linguistic variable.

iv. IV. Organization systemic approach creates a base that allows the monitoring of the actor in the supply chain as an individual, as a link and as a single complex system, where control and measurement metrics are a standard that reflects the operation of the system, becoming a tool to understand the element and improve decision-making.

VI. Recommendations

Based on the carried out integrations and obtaining of integral management model is recommended:

i. Develop a methodology to enable the implementation of the model outlined in this research project in a company in the real sector and subsequently ensure a collection of accurate and reliable information, in order to build the information system that allows validation against the proposed indicators.

ii. Validate the operation and effectiveness of the proposed integrated management model, in different sectors which demonstrated problems in terms of environmental pollution in a way together with the topic of productivity problems.

iii. Propose initiatives for technology transfer and knowledge to catalyze them processes of implementation and validation of the model proposed in the companies in the sector of tanning, especially in small and medium-sized enterprises.

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