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MATRIX DESIGN AS A TOOL FOR THE ASSESSMENT OF QUALITY, ENVIRONMENTAL AND SAFETY REQUIREMENTS

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Summary. The general objective of this research is the design of a matrix as a tool for the evaluation of quality, environmental and safety requirements for an automotive company located in Reynosa Tamaulipas, Mexico, addressing the problem that is generated due to the impact on the organization by breaches in the lack of standardization and evaluation of customer and regulatory requirements. This research is presented and developed using the logical methods of deduction, analysis and synthesis of continuous improvement, the Ishikawa methodology or fish diagram, the methodology of cause and effect analysis and risk assessment. Analyzed the changes of the norms and their requirements, it is observed that the main findings in the audits are in relation to the compliance in the evaluation of the client's requirements, due to the fact that the implementations of the management systems in the organizations are carried out in different stages. and this mismatch in project management complicates standardization and creates the potential for risk. The matrix as a tool for the evaluation of quality, environment and safety requirements provides us with guidelines to make the management of the organization more efficient, by eliminating the duplication of documents, non-applicable controls and repetitive training, it also allows us to minimize the workload and efforts generated due to the analysis of system requirements as isolated sections and not globally.

Key words: Matrix, tool, evaluation, requirements, management.

DISEÑO DE MATRIZ COMO HERRAMIENTA PARA LA EVALUACIÓN DE REQUERIMIENTOS DE CALIDAD, MEDIO AMBIENTE Y SEGURIDAD

Resumen. El objetivo general de esta investigación es el diseño de una matriz como herramienta para la evaluación de requerimientos de calidad, medio ambiente y seguridad para una empresa automotriz ubicada en Reynosa Tamaulipas, México, abordando el problema que se genera debido al impacto en la organización por los incumplimientos en la falta de estandarización y evaluación de requerimientos de cliente y normativos. Esta

investigación se presenta y desarrolla con el uso de los métodos lógicos de deducción, análisis y síntesis de mejora continua, la metodología de Ishikawa o diagrama pescado, la metodología de análisis de causa y efecto y de evaluación de riesgos. Analizados los cambios de las normas y sus requerimientos se observa que los principales hallazgos en las auditorias son con relación al cumplimento en la evaluación de requerimientos del cliente debido a que las implementaciones de los sistemas de gestión en las organizaciones se llevan a cabo en diferentes etapas y este desfase en la gestión de los proyectos complica la estandarización y genera la posibilidad de riesgos. La matriz como herramienta para la evaluación de requerimientos de calidad, medio ambiente y seguridad nos brinda la pauta para eficientizar la gestión de la organización, al eliminar la duplicidad de documentos, de controles no aplicables y entrenamientos repetitivos, también nos permite reducir al mínimo la carga de trabajo y esfuerzos que se genera debido al análisis de requerimientos de los sistemas como apartados aislados y no de forma global.

Palabras clave: Matriz, herramienta, evaluación, requerimientos, gestión.

Introduction

The world is changing as we know it; the future is today…

Intelligent, electric, autonomous, more efficient and less polluting cars are not concepts reserved for the distant future, a voracious and increasingly demanding market that seeks a set of comprehensive energy solutions and as a result of previous research into the impact on production, which translates into more quality, environmental and safety requirements for companies in the automotive sector.

The justification of this study to design this tool is part of the need for a working model to improve the efficiency and effectiveness of managers of organizations during the processes of standardization of customer requirements, this being an original idea because currently there is no tool that facilitates the harmonization of management inputs even when customers send us the requirements, this project is important for the implementation of all sources of input but from the same perspective.

As the book the 4th industrial revolution points out "We are on the brink of a technological revolution that will fundamentally change the way we live, work and relate to each other" (Klaus 2016, cited by Velazquez, 2018).

Many countries are now looking to take the lead in assessing their suppliers with an operational risk approach, it is no longer just about meeting customer expectations, it is about assessing the entire supply chain and exceeding expectations with a high level of best practice and systems maturity. Sustainability through innovation and compliance with customer requirements.

The predominant globalization of products for different markets gives us a guideline for the design of this tool, as a personal motive for the development and continuous improvement of my management in quality systems in organizations.

The current national and international scenario is unprecedented, to address the research topic I will establish a general overview of quality systems using ISO international standards.

The ISO 9001 standard that we will use as a reference belongs to the a family of standardization and mentions "Think of them as a formula that describes the best way to do something". (ISO, 2021).

All types of companies, from small, medium and large companies, can be certified with the ISO 9001 standard, regardless of their economic activity. For this research we will also use the international automotive standard of IATF 16949:2016 which "Represents an innovative document, given the strong customer focus, with the inclusion of a number of previous consolidated customer specific requirements." (IATF, 2021).

I consider that, during the development of this research, that even though most of the concepts and models are based on plan, do, check and act, there is no consolidation as a tool or

a guide on how to use these concepts, nor is it clear how to put them into practice. The model is still valid "In the area of quality, the PDCA cycle for continuous improvement, now 81 years old, has proven to be an effective and still current tool". (European School of Excellence, 2020).

In this way, it allows us to quantify the impacts and evaluate the potential risks in the inputs of the identified processes that make up the quality system, risk management and its impact are key during the development of a project.

Stakeholders in this research include direct customers throughout the manufacturing processes of a product, end users, suppliers and partners, regulators and others. Others could include owners/shareholders and even the corporation.

In relation to occupational health and safety management during the development of this doctoral research, another important requirement of the automotive industry ISO 45001 is included as a reference in "Requirements with guidance for use". (ISO 45001, 2018).

ISO 45001:2018 is one of the international standards for the management of occupational health and safety systems formerly OHSAS 18001, also considering the harmonization ISO 14001:2015 as "The backbone of environmental management". (AENOR, 2020).

Focused especially on management, ISO 45001's ultimate goal is to help businesses provide a safe working environment for employees and anyone else in the workplace.

The requirements for the organization of the automotive sector in which this research is developed are extensive so the research raises the areas of opportunity and gray areas that arise in the implementation of projects and objectives presented taking into account their restrictions and constraints.

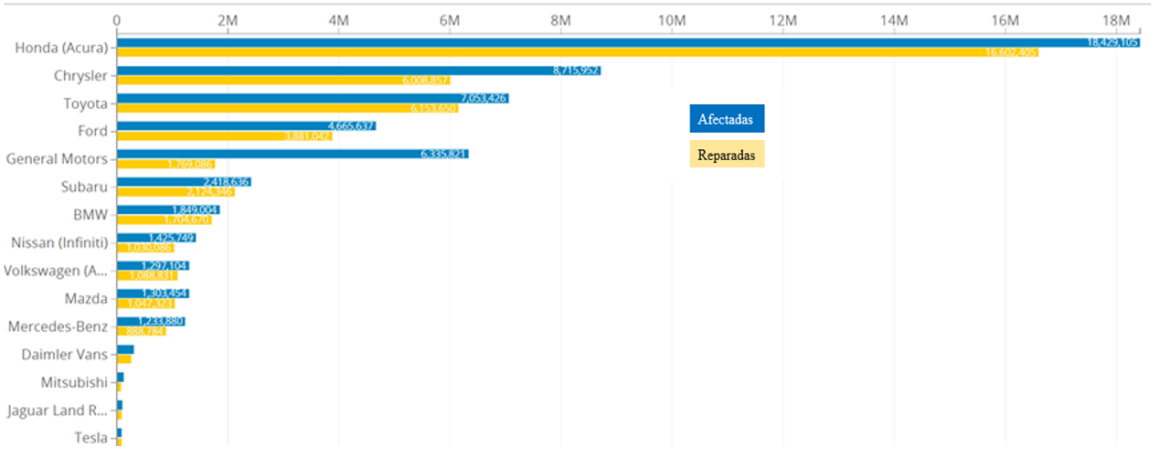
One of the sections included during the development of this research is how the lack of standardization of requirements limits and conditions their compliance and directly impacts the quality of the product with effects that can even lead to the death of the end user.

Cases of product quality failure are presented in detail with the findings of the NHTSA (U.S. Department of Transportation) which urges vehicle owners to take some simple personal steps to protect themselves and others from potential threats to personal safety due to poor quality by failing to meet customer requirements for quality, environment and safety.

NHTSA describes its mission as "Saving lives, preventing injuries, reducing vehicle-related crashes".

Airbags are a vitally important component in a vehicle, currently as part of the monitoring of complaints and warranties for non-compliance with customer requirements "Approximately 67 million Takata airbags have been recalled". (NHTSA, 2021). One of the automakers with the greatest impact due to the lack of quality and safety in airbags is Honda with 18,492,105 bags replaced or repaired. Figure 1 shows the number of air bags detected by brand:

Figure 1
Total number of air bags repaired and total number of affected air bags



Note. Source: NHTSA - National Highway Traffic Safety Administration

Method

For the procedures related to the research, the author presents the methodological design of the instrument with the use of data analysis of external audits carried out in the organization, the participation of different departments, processes, customer requirements, research instruments used during the phase descriptions and requirements planning.

The data analysis shows that the standardization of inputs from a harmonized requirements structure allows us to visualize the scope and focus of each essential point of the project. The final focus is how to harmonize the input requirements in an organization in the early stages of project development with the assessment of risk and outcome impacts.

As mentioned in the main theories of project management, the development of the research work will take into consideration the processes and activities where responsibilities, objectives and quality policies are determined in the different stages of development and evaluation of the project.

This project was carried out in the organization of the automotive sector in question in the areas of Quality, Environment and Safety management that are directly related to the issues of certification and regulation by international standards or in compliance with international agreements, official standards, treaties or protocols to be accepted their products in the market.

The final instrument is the evaluation matrix of customer requirements, international quality, regulatory, statutory, environmental and safety standards, taking into consideration the variables of the cause and effect analysis.

Taking into account the type of study presented in the report of the research work foundation and in the research methodological outline, I consider the concordance with the research objective to define as method a descriptive research approach, exploratory type, quantitative and qualitative oriented where applicable:

Exploratory:

- Secondary information.
- Survey results.
- Simulations.

- Case studies.

Counselor:

- Secondary information.
- Interviews.
- Session results.
- Projections.
- Observation techniques.

This method was used to determine the quality of information to narrow down the presentation results and confirm the continuity of the project.

The structure for the documentary research is based on the analysis of the results of certified organizations.

Phases used*:*

- Planning.
- Requirements evaluation analysis.
- Verification of project resources.
- Training and Coaching.

Compliance through:

- Collection of information.
- Data organization.
- Classification of information and data analysis.
- Research report.

The resources used for the design:

Direct sources of information, official web sites. Hierarchization and interpretation according to the hypotheses presented.

The scientific disciplines or as a field of study for this topic are engineering and management as part of the branch of knowledge that is investigated at the levels of higher secondary education or careers already defined with this focus and scope.

For this research, the representativeness of the sample was considered and participates, which allows us to extrapolate and therefore generalize the results observed in the organization of the automotive sector where I currently work for the certification of the quality system in the last audit cycles.

Statistics presented from 181 organizations that completed the transition from ISO/TS to IATF in accordance with the requirements of the standards and resulted in an average of 5.3 minor nonconformances and 1 major nonconformance per audit with considerable impact as OMNEX mentions "The end result was a major change for the approximately 6226 North American automotive industry sites." (OMNEX, 2021)

The research hypothesis in relation to the case study presented in this proposal:

should the design of a quality, environmental and safety requirements assessment tool include customer requirements for systems management and ISO standardization?

Presented in more detail below is a breakdown:

- Consideration of customer requirements.
- Changes in quality, environmental and safety standards.
- Improved process inputs on a continuous basis.

The variables of the hypothesis of this project allow the identification of impacts on the quality, environmental and safety systems in the organization, the customer requirements

identified by risk level are a fundamental part of the process.

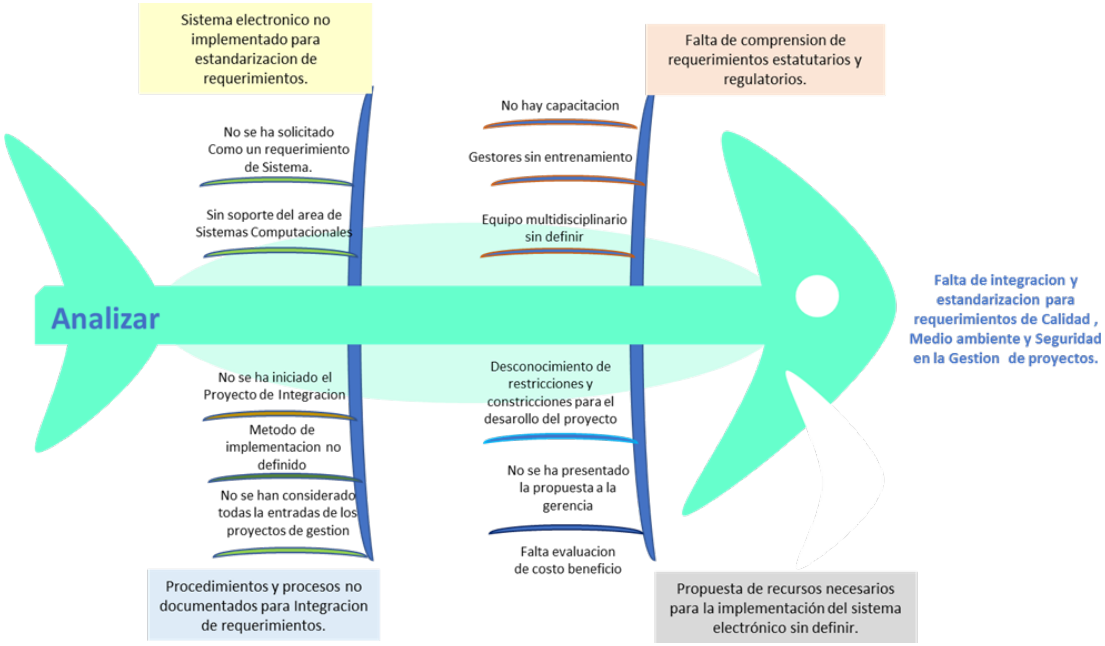
As part of the data analysis for the study variables considering the classification criteria as independent/dependent methodological criteria, variables of quantitative/qualitative nature, and for the determined value of nominal/ordinal/ratio/interval measurement, Table 1 shows:

Table 1
Variable classification criteria

Variable	Independent or Dependent	Quantitative or Qualitative	Measured value
Customer Requirements	Dependent	Quantitative	Interval
Standards and requirements System.	Dependent	Quantitative	Interval
Budget. Monetary resources required for the project.	Independent	Quantitative	Interval
Human factor. Labor	Dependent	Qualitative	Nominal
Documentation of management systems.	Dependent	Qualitative	Ordinal
Implementation cost.	Dependent	Quantitative	Reason
Number of non-compliances during the evaluation of the Project.	Dependent	Quantitative	Ordinal

The analyzed variables that are negatively impacting are described in a cause and effect analysis in the following diagram Figure 2:

Figure 2
Ishikawa Diagram or Cause and Effect



Following this method, comments on the approach are added to the work presented in order to determine the most important aspects included in the problem under investigation:

The next tool presented in this proposal for the analysis of problem variables is the 4 M's approach or the four types of causes that can create problems in a process.

The 4 main causes and effects in relation to the analysis of variables are:

- Machinery
- Labor
- Method
- Materials

Also as part of this method evaluation I define the relevance index of the 4 M's and cause-effect analysis.

- Machinery: Machinery refers to the equipment to be used in this case we consider it as the physical infrastructure, system and/or automatic process, which is what is used to carry out the activities. Cause-Effect Analysis: Standardization of requirements such as a database or a program due to lack of vision of the organization's managers in the different management systems, also due to the fact that it has not been requested to the information systems area (IT). In some organizations it is also defined as a lack of support from the systems development area.
- Labor: For Manpower we refer to the human capital, to the managers who are responsible for the execution of the activities of the processes either in a system or database. Cause-Effect Analysis: Lack of understanding of statutory and regulatory requirements of those responsible for the quality, environmental and safety management system. Not in all cases and organizations the managers have defined a training program for the multidisciplinary team that participates in the development of the projects, so it is very common that there are repetitive tasks or lack of focus towards efficiency and effectiveness in the implementation and maintenance of requirements and requirements.
- Method: For the method we refer to the procedures or processes duly documented in the

different management systems of the organization so that a methodology is followed in the operations in a standardized manner, thus reducing variability in the execution of tasks when the defined, documented and explicit rules are followed, applying concepts in an effective manner. Cause-Effect Analysis: Undocumented procedures and processes for requirements integration at the input of project management processes, this effect is common in organizations that have not initiated a project to standardize or integrate the different levels of systems documentation, for example: Manuals that include quality, environment and safety, as the inputs for each management system are not properly identified.

- Materials: The last M used in this cause-effect analysis refers to the materials and/or raw materials that we will use or consider using for the execution of the project in question from the individual point of view or with other materials. Cause-Effect Analysis: Proposal of necessary resources undefined due to the lack of knowledge of restrictions and constrictions for the development of the project of integration and standardization of requirements, even when the initial idea has been presented to the management, the proposal has not been submitted, so the resources are not obtained by the financial area without first presenting a return on investment as a cost-benefit evaluation.

For the data analysis of this research and its significant positive impact on the organization the author of this research used the specific customer requirements for "OEM - Original equipment manufacturer". (International Automotive Task Force, 2021).

The organization's current customers with their specific requirements for suppliers:

American automotive industry.

Ford Motor Company CSR for IATF 16949:2016 - Jan 2021.

Minimum automotive QMS requirements IATF 16949 - Sep. 2017.

General Motors CSR IATF 16949:2016 - Dec. 2020.

Minimum Automotive QMS Requirements IATF 16949 - Sep. 2017.

German automotive industry.

BMW Group customer specific requirements for IATF 16949:2016 - Apr. 2021.

Japanese automotive industry.

Honda CDA-07-001 - Honda Motor Supplier Quality Manual (Japan) - Nov. 2020.

NISSAN 3.1_changes - CDA-08-001 ANPQP Allience New Product Quality Procedure ver 3.1 NISSAN Motor Co., Ltd. - Jan. 2017.

French-Italian automotive industry.

Stellantis (ex FCA) Customer specific requirements:

FCA EMEA/LATAM Regions CSR IATF 16949:2016 - Mar. 2021.

Minimum automotive QMS for IATF 16949 - Sep. 2017.

The research instruments used during the phase descriptions and requirements planning are presented as shown in tables 2,3,4,5,6.

Research Instrument

Table 2
Planning of activities

Phase 1	**Planning.**		
Phase description	**Requirements evaluation planning.**		
No. Description of activities	**Variables involved**	**Proposed techniques**	**Estimated goals**
1 Research the organization's current customers.	Requirements of Customers	Research	2 weeks at the beginning of the project
2 Obtain the minimum requirements of the different quality, environmental and safety systems.	Requirements for the systems	Research	2 weeks after previous activity.

Table 3
Requirements Analysis

Phase 2	**Requirements evaluation analysis.**		
Phase Description	**Presentation of the status of the system vs. the project.**		
No. Description of activities	**Variables involved**	**Proposed techniques**	**Estimated goals**
3 Generate a report of system status results.	Norms and standards.	Comparison	1 week per complete 2nd activity.
4 Confirm evaluation results of the systems where opportunities for improvement are considered for integration and standardization.	Regulatory and statutory requirements and requirements.	Observation	2 weeks per complete the activity previous.

Table 4
Resource verification

Phase 3	**Verification of project resources**			
Phase Description	**Approval of the Project of Integration and standardization**			
No.	**Description of activities**	**Variables involved**	**Proposed techniques**	**Estimated goals**
5	Analyze project requirements for material resources and system.	Norms and standards.	Analysis	1 week upon completion of the previous activity.
6	Present return on investment for project approval.	Cost - benefit.	Negotiation	2 weeks upon completion of the previous activity.

Table 5
Development of competencies

Phase 4	**Training and Education**			
Phase description	**Development of competencies**			
No.	**Description of activities**	**Variables involved**	**Proposed techniques**	**Estimated goals**
7	Generate training plan for system managers.	Norms and standards.	Planning	1 week upon completion of the previous activity.
8	Provide training for those responsible as defined in the planning.	Training plan.	Debate	4 weeks upon completion of the previous activity.

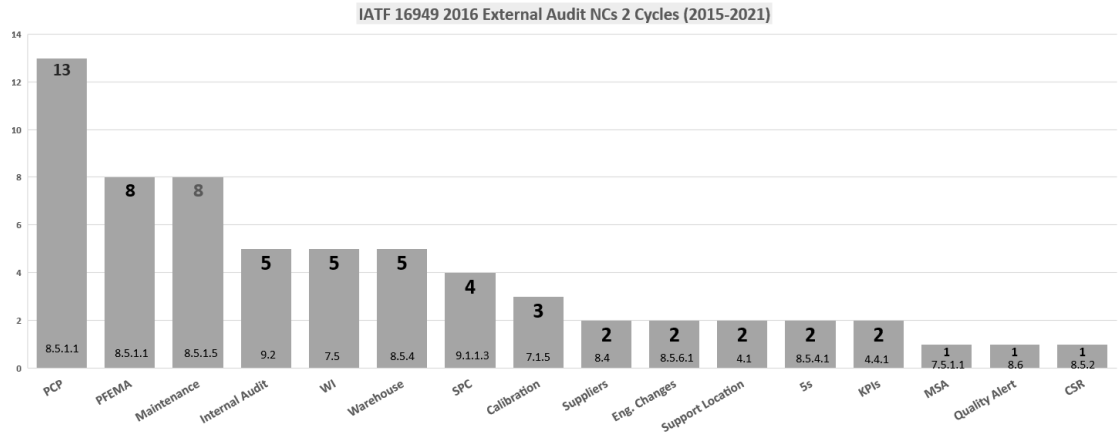
Table 6
Project execution

Phase 5		**Project execution**		
Phase description		**Integration and standardization**		
No.	**Description of activities**	**Variables involved**	**Proposed techniques**	**Estimated goals**
9	Share requirements assessment tool and requirements for execution of the project.	Project tool.	Communication	1 week upon completion of the Previous activity.
10	Generate cross matrix of requirements and Requirements.	Standards and Standards.	Planning	1 week upon completion of the Previous activity.
11	Unification of Quality, Environment and Safety Manuals.	Documentation of the systems.	Execution	2 weeks upon completion of the previous activity.
12	Updating of the document control procedure for integration.	System procedures and instructions.	Analysis	6 weeks upon completion of the previous activity.
13	Standardization of processes and risk assessments for the quality, environmental and safety systems.	Processes of System.	Analysis and execution.	4 weeks upon completion of the previous activity.
14	Implement lessons learned from previous phases of the project	Continuous improvement	Feedback	3 weeks upon completion of the previous activity.

Results

Once analyzed the 29 changes of the ISO 9001:2015 - IATF 16949:2016 standards and their requirements of the quality system we take as a sample the 2 cycles of 3 years with the certification of the organization where this research is carried out the results are observed in Figure 3.

Figure 3
Results of external audits IATF 16949:2016



The non-conformities identified by the certification body under the IATF 16949:20106 & ISO 9001:2015 standard are mostly under point 8 of the standard where the organization's compliance is evaluated for operation, control, customer requirements for quality, control of non-conforming product, as well as its environmental compliance, regulatory, statutory and process safety requirements.

Table 7 shows the results of minor non-conformities obtained in the external audit cycles by requirement of clause described by the certifier in the company under the applicable requirements according to the IATF 16949:2016 standard and "Frequently Asked Questions (FAQ)". (IATF, 2019).

Table 7
Non-conformities as audit results external audit IATF 16949:2016

IATF 16949 2016 External Audit NCs 2 Cycles (2015-2021)			
Year	**Process**	**Requirement**	**Summary**
2016	Quality systems Manufacturing	8.2.2.4 7.6.2 / 7.5.1.4/ 8.5.1.2	SPC Job Setup / Process Control Plan / Maintenance
2017	Supplier Quality Manufacturing Production Quality Quality System Quality Manufacturing	7.4.1 7.3.1.1 7.5.1.4 4.2.3.1 / 4.1 8.2.2 8.2.2.1.1 7.6 / 7.5.1	Suppliers PFMEA / Maintenance Engineering changes Support location Score card Customer Internal audit process Calibration / PCP
2018	Manufacturing & Assembly Product/Process Change HR01 Employee Hiring Product Development Process Infrastructure Maintenance Manufacturing - Molding Manufacturing - Assembly	8.5.1.1 / 8.5.1 8.3.5.2 5.3.2 8.2.3.1.2 / 8.5.1.5 10.2.1/ 9.1.1.2 8.3.2.1 / 10.2.4 7.1.4.1 / 8.5.1	PCP / Maintenance PFMEA Job description PCP / Maintenance PCP / SPC PFMEA / Maintenance Non conforming products / Work instructions
2019	Manufacturing - Assembly Management Calibration	7.1.3.1/ 8.5.1.2 4.4.1 7.1.5.3.2 / 8.3.3.3	Safety ID / Sample board Key performance indicators Calibration / Special Characteristics
2020	Manufacturing - Assembly Calibration Materials Manufacturing - Assembly Calibration	8.5.6.1 / 8.3.3.3 8.6.2 / 7.5.3.2 8.5.4.1/ 8.3.2.1 8.7.1.1 7.1.5.1.1	PCP/ Special characteristics Full lay out / Scope Storage of materials/ PFMEA PCP MSA
2021	Alps Logistics QMS Molding Engineering	8.5.4.1 4.3.1 / 9.3.1 8.5.2 /6.1.2.3 / 8.5.1.5 / 9.1.1.1 8.6.1 / 8.5.1.1 / 10.2.4	Alps Logistics QMS Engineering Molding

With the evaluation of regulatory requirements without including in detail the specific requirements of customers and results of the quality system, the complexity of alignment and compliance is observed, where the design of a matrix as a tool for integration and standardization of customer requirements for Quality, Environment and Safety can be used as an improvement, harmonizing at the highest level the management of these standards in the organization.

The following is the main cover page and the fields of the tool design for evaluation in the different phases.

Matrix design as a tool for the evaluation of quality, environmental and safety requirements for an automotive company.

Table 8 shows the main general information cover page of the tool.

Table 8
Cover page requirements evaluation matrix

QMS - EMS - OHSM Evaluation Matrix Requirement			
General Information			
Reason for evaluation:			
Evaluation date:			
Completed by:			Department:
Responsible of verification:			Department:
Organization name:			Department:
Contact information			
Top management responsible:			Department:
Street / Production site (city) **Production site (postal code)** **Country:**			Quality management Operation management Human resources
Authorized person of organization:			
Phone:			
Mobile:			
E-mail:			
Management Systems evaluation			
Last 3rd party audit date	ISO/9001 -	IATF 16949 -	ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 45001 - ISO 45001 - ISO 45001 - ISO 45001 - ISO 45001 - ISO 45001
Certificates	ISO/9001 -	IATF 16949 -	ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 14001 - ISO 45001 - ISO 45001 - ISO

	45001 - ISO 45001 - ISO 45001 - ISO 45001 - ISO 45001
Issue-date:	
Conducted by:	
Result POSITIVE / NEGATIVE	

For presentation and communication of the evaluation of the results of the management systems matrix, see Figure 4.

Figure 4

Customer requirements evaluation matrix

Evaluation Matrix Quality, Enviromental and Safety systems

Requirement QMS

	Chapter / Section	ISO 9001:2015	IATF 16949:2016	Chapter / Section
1		Introduction		
2	0.1	General		
3	0.2	Quality management principles		
4	0.3	Process approach		
5	0.3.1	General		
6	0.3.2	Plan-Do-Check-Act cycle		
7	0.3.3	Risk-based thinking		
8	0.4	Relationship with other management standards		
	1	Scope		

Requirement

EMS		OHSMS	
Chapter / Section	ISO 14001:2015	Chapter / Section	ISO 45001:2018

For each of the sections, the details to complete in this tool are included to achieve a global view of ISO 9001, IATF 16949, ISO 14001, ISO 45001 requirements for "The most common standards related to the automotive industry". (NQA, 2021). Example of the filling of the above table by applicable standard:

Figure 4
Customer requirements evaluation matrix

Requirement					
QMS			EMS		OHSMS
ISO 9001:2015	IATF 16949:2016	Chapter / Section	ISO 14001:2015	Chapter / Section	ISO 45001:2018

Continuing with the applicability for quality, environmental and safety management systems in the different international standards.

Customer Specific Requirements ※:CSRs applicability				
GM	FCA-STELLANTIS	FORD	BMW	VW Group

Requerimientos especificos del cliente donde se utilizará la herramienta de evaluación.

Evaluation of results to define actions and priorities to achieve the goal of the management systems requirement.

JUDGMENT Satisfactory (S) Actions necessary (A)	SCORE RESULT GREEN(G) Yellow (Y) RED (R)	PRIORITY Low (L) High (H) Urgency (U)

Score	Requirement	Result
Yes Green	(0) High/ low risk questions	High result / meet expectations and intent of questions
(No) Low Risk	(1) or more low risk questions	Marginally meets expectations and intent of question
(No) High Risk	(1) or more High risk questions	Unacceptable result and does not meet expectation and intent of question / No plan or indequate.
N/A	Items does not apply	Items does not apply

The summary of results for communication with management on compliance in percentage is shown in table 10.

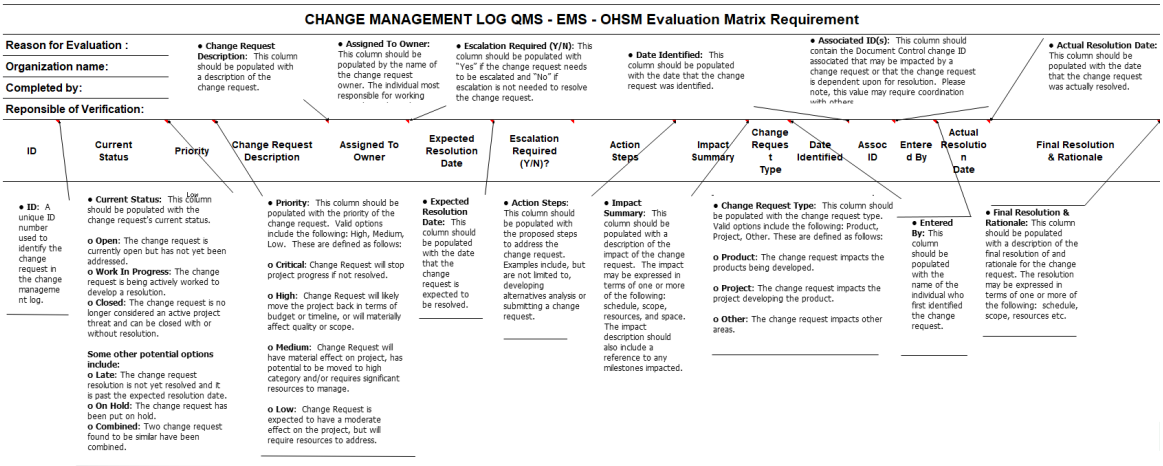
Table 10
Evaluation summary by applicable section

Summary Section Evaluation Matrix Requirement				
Requirement Section		Meet Expectation		
		QMS	EMS	OHSMS
4	**Context of the organization**	Evaluation Global Score (G,Y,R)		
4.1	Understanding the organization and its context			
4.2	Understanding the needs and expectations of interested parties			
4.3	Determining the scope of the QMS			

4.4	Quality management system and its processes	
5	**Leadership**	Evaluation Global Score (G,Y,R)
5.1	Leadership commitment	
5.2	Policy	
5.3	Organizational roles, responsibilities, authorities	
6	**Planning**	Evaluation Global Score (G,Y,R)
6.1	Actions to address risks and opportunities	
6.2	Quality objectives and planning to achieve them	
6.3	Planning of changes	
7	**Support**	Evaluation Global Score (G,Y,R)
7.1	Resources	
7.2	Competence	
7.3	Awareness	
7.4	Communication	
7.5	Documented Information	
8	**Operation**	Evaluation Global Score (G,Y,R)
8.1	Operational planning and control	
8.2	Requirements for products and services	
8.3	Design and development of products and services	
8.4	Control of externally provided processes, products and services	
8.5	Production and service provision	
8.6	Release of products and services	
8.7	Control of nonconforming outputs	
9	**Performance evaluation**	Evaluation Global Score (G,Y,R)
9.1	Monitoring, measurement, analysis and evaluation	
9.2	Internal audit	
9.3	Management review	
10	**Improvement**	Evaluation Global Score (G,Y,R)
10.1	General	
10.2	Nonconformity and corrective action	
10.3	Continual improvement	

As part of the evaluated results, Figure 5 includes the actions and follow-up from a systematic perspective.

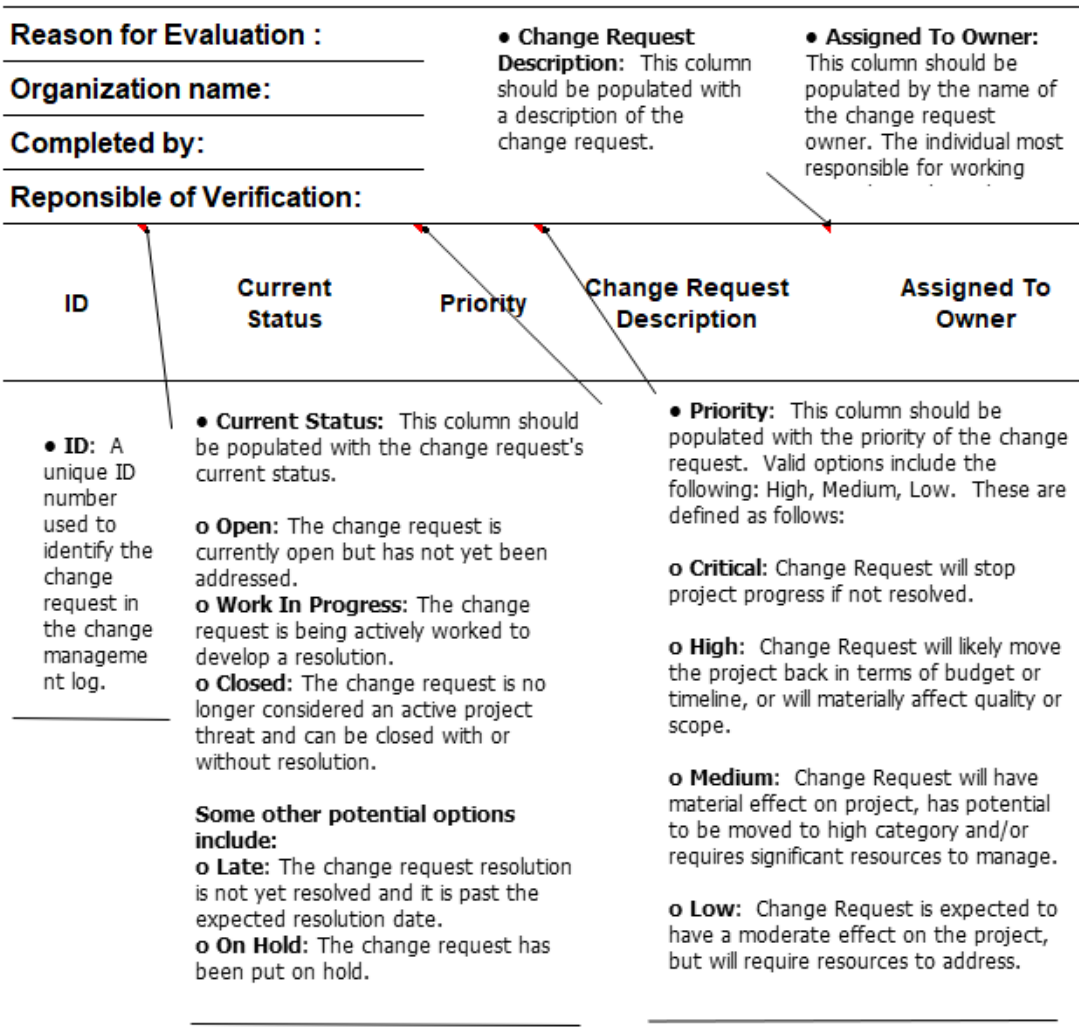
Figure 5
Follow-up of actions by applicable system



The following sections are shown in detail for a detailed view of the follow-up of actions in the initial sections for those responsible, where the general data of the system, actions and escalation for defined dates are included against the compliance status for the follow-up of dates and escalation.

Figure 6

Follow-up of actions by applicable system



The following part of the follow-up design for the conclusion of the actions taken for the items evaluated in the management systems matrix presented.

Figure 7
Follow-up of actions by applicable system

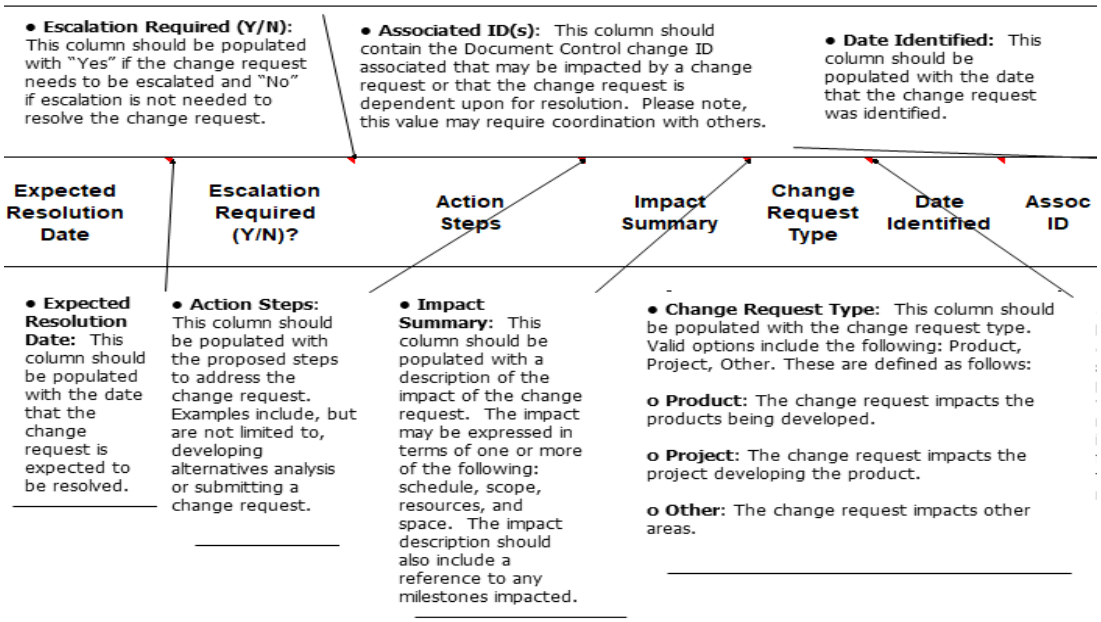


Table 12 presents the integration of the systems as a matrix that is part of the tool for the evaluation of quality, environmental and safety requirements, which also includes the harmonization of management requirements confirmed with the current operation of the organization where this study was carried out.

Table 12
Integration matrix for quality, environment and safety

Integrating Processes between QMS- EMS - OHSMS	
Process integration matrix	
Process Name	**QMS, EMS, and OHSMS**
Strategic Planning	4.1 Understanding the organization and its context 5.1 Leadership and commitment 5.2 Policy 6.2 Objectives and planning to achieve them
Determining Customer / Interested Parties expectations	4.2 Needs and expectations of interested parties 5.1.2 Customer focus
Business Review	9.3 Management review
Internal Auditing	9.2 Internal Audit 9.1.2 Evaluation of compliance (EMS & OHSMS)
Corrective and Preventive Actions	10.2 Nonconformity and corrective action
Customer Complaints	8.2.1 Customer communication
Continual Improvement	10.3 Continual improvement
Document Control	7.5 Documented information
Quality Records	7.5 Documented Information
Recruiting and Training	7.1.2 People 7.2 Competence 7.3 Awareness
Marketing	7.4 Communication
New Product Development	8.2 Determination of requirements of products and service
Risk Identification Prioritization	6.1 Opportunities to address risks and opportunities
Mange the Change	6.3 Planning of changes
Managing Organizational Knowledge	7.1.6 Organization knowledge 8.5.6 Control of changes
Process Control	4.4 Quality Management System and its Processes 8.1 Operational Planning and Control
Storage and Distribution	4.4 Quality Management system and its processes 8.1 Operational planning and control 8.5.4 Preservation (QMS only)

Facilities Planning	4.4 Quality management System and its Processes 8.1 Operational planning and control 7.1.3 Infrastructure (QMS only)
Purchasing	8.4 Control of externally provides products and services
Material Control	8.5.2 Identification and traceability (QMS only) 8.5.3 Property or external parties (QMS only) 8.6 Release of products and services
Manufacturing Process Control	8.5.1 Control of production and service provision (QMS only)
Post Delivery Processes	8.5.5 Post-delivery activities
Control of Nonconforming	8.7 Control of Nonconforming processes, products and services

Discussion and conclusions

Organizations are currently facing a very important challenge, to achieve efficiency and effectiveness objectives, but with limited resources, less implementation time, difficult knowledge management, stricter and more complex requirements, to name a few.

The matrix as a tool for the evaluation of quality, environmental and safety requirements gives us the guideline to make the management of the organization more efficient, by eliminating the duplication of documents, non-applicable controls and repetitive training, it also allows us to minimize the workload and efforts that are generated due to the analysis of each of the systems as isolated sections and not as a whole as presented here in the previous chapters.

The integration of systems in the evaluation tool allows maintaining an effective approach to decision making by senior management. With the correct application of these concepts, the time required to evaluate requirements in projects produces significant savings that are summarized in advantages for the organization.

Project management with strict execution times has arrived to organizations, a new order of applying concepts of integration and standardization, the use of tools in the face of the urgent sense of contribution to face the current crises of components, logistics, act on the main safety factor for employees, environmental impacts and maintain the quality of products, as part of this important industrial transformation, which, in our experience allows the use of such tools as a solution to this problem that we face the administrators of management systems.

The conclusion of the methodological aspects of this instrument provides a standardized identification of potential risks for each situation and the risks associated with similar processes or products based on the results of evaluation by severity of requirements, a non-compliance with greater severity requires a systematic identification of occurrence and increase early detection of events that impact the fulfillment of customer requirements and product quality and if there are specific customer requirements that must be managed by determining systematic action plans that provide an efficient and effective monitoring of results.

With this tool you can also observe the compliance with the service requirements, which are established in the relevant functions and levels within the organization, the organizational objectives of the certifications required by customers and the industry can also be measured consistently and compared with the defined quality policy.

The matrix as a tool for the evaluation of quality, environmental and safety requirements

also allows to establish and maintain the communication of aspects at the different levels and functions of the organization.

The development of this tool has also allowed the conclusion of advantages by phases identified in this design and standardize the work style with greater management of goods or services, saving time in the execution of work tasks and saving resources that translate into positive economic impacts.

Simplifying operations allows strengthening and advancing the organization's competitiveness by avoiding repetitive operations or unproductive activities.

The application of changes in standards and requirements are increasingly with a shorter implementation time allowed; To address the evaluation of requirements and standards from the high-level perspective of the organization is necessary the use of an evaluation tool as an integrative solution, standardized, allowing the application of lessons learned and describes from the multiple inputs of the processes a clear definition of multiple tasks to multidisciplinary project teams but maintaining an effective approach to processes and their proper interaction, this compliance gives us a benefit as mentioned above in the expectations of our customers and the ability to maintain without significant deviations a successful and operational quality system.

A key to managing requirements efficiently is to use the approach of commonality and interrelated expectation among them.

Another advantage of using this tool is the ability to receive, document and respond to the results to the different departments in a systematic and standardized way through a higher level of standardization in project management which translates into less response time for the requirements; More satisfaction of our customers which in turn strengthens the organization and ensures additional value as an integrating system for business objectives.

The implementation of this tool also allows the quality system manager to evaluate the requirements and simultaneously the methodological execution of tasks allowing to maintain a feedback to the design of the projects in the corresponding phases.

To conclude, to maintain a sustainable compliance approach to the organization's duties is to think outside the box by creating added value with a clear focus on evaluation through the use of innovation tools as part of a solution to the changing global requirements and dynamic and increasingly stringent requirements in relation to quality, environment and safety.

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