POLITECNICO DI TORINO

Master of Science in Engineering and Management

Master's Degree Thesis

Implementation of the 8D methodology in a Tyre Manufacturer Company

Supervisor:

Domenico Augusto Maisano

Candidate:

Carolina Perez Cabrera

March 2020

Table of Contents

1. ABSTRACT

This paper analyses the actual usage of the 8 Disciplines methodology (8D) on Prometeon Tyre Group S.r.l case study, during an internship. The author aims to improve the company Rolling Follow Up (RFU) by the design and implementation of the 8D. The involved areas are Research & Development and the Manufacturing sites with the leadership of the Product Evaluation Manager on Milan use the RFU as a tool to follow up all the issues that are present during the design and production.

The 8D is a method used in Quality Management as a tool to identify, solve and prevent issues during the production process. This methodology attempts to ensure the required quality, optimization and safety of the final products, the general objective was a full implementation and deployment of a new RFU, additionally user manual to standardized the process and flow of information.

The results showed that employees prefer to work based only on their experience and avoid the common methodology to arrive to a correct solution. This was reviewed and two proposals were designed, one was to establish a new extended format of the 8D methodology and the other stablish a new web-application following this methodology, the latter one received a positive feedback from the involved areas and was implemented as requirement of a Company standard.

Key words: 8 Disciplines, Quality Management, Rolling follow UP, Tyre Industry, Product Evaluation

2. ACRONYMS AND ABBREVIATIONS

8D or G8D: 8 Disciplines, global 8 Disciplines

R&D: Research and Development

S.rl: Società a Responsabilità Limitata (Limited Liability Company)

RFU: Rolling Follow Up

OEM: Original Equipment Manufacturer

IATF: International Automotive Task Force

AGRO: Agricultural Tyres

OTR: Off The Road

DOT: Department of Transportation

4. INTRODUCTION

Due the globalization nowadays all the industries face a highly competitive market, that on case of the Automotive Industry the keys to expand their markets are the loyalty of the clients, the perception of them and innovation on the products.

The focus of this document is on tyres and rubber industry which consist mostly on the manufacture revenues generated through the sales of Original Equipment Manufacturer (OEM) and aftermarket tyres for passenger cars (Cars), commercial vehicles (heavy trucks, buses, agricultural machinery) and motorcycle. Truck aftermarket segment is the most lucrative segment this suggest that key countries with booming economies boost business which requires getting goods from one place to another. Prometon Tyre group S.r.l is the leading Company of an enterprise group that manufactures and distributes under license agreement with Pirelli Tyre S.p.A. an entire range of products branded for Truck, Bus, Agricultural and OTR machinery.

The thesis consists of 10 chapters, on which the general objective of the project will be the full implementation and deployment of the new Rolling Follow up, according to the 8 Disciplines methodology and setting up a manual on a web application of the Company with the aim to improve the quality standards.

An important input to improve the quality on the industry is the perception of the customer, considering that the complaints are expensive, both as direct and indirect costs, if this information can be transformed into knowledge about the market, gives valuable amount of capital for enterprises. To explore this capital companies must design, build, operate and continuously upgrade systems for managing complaints. The 8D is a method used in Quality Management as a tool to identify, solve and prevent issues during the production process attempting to ensure the required quality, optimization and safety of the final products.

5. THE ENVIRONMENT

This chapter is dedicated to the company presentation, its participation on different countries, governance, sustainability and an emphasis on the Quality department. The thesis takes place on Prometeon Tyre Group Headquarter located in Milan, Italy.

5.1. Tyre Industry Overview

The tyres and rubber industry consist on the manufacture revenues generated through the sales of Original Equipment Manufacturer (OEM) and aftermarket tyres for passenger cars (Cars), commercial vehicles (heavy trucks, buses, agricultural machinery) and motorcycle. The global tyres and rubber market had a total revenue of $612.1 billion in 2018; the truck aftermarket was the segment most lucrative in the same year, equivalent to the 36.8% of the overall market value. As can been seen on figure 1. (MarketLine, 2019)

Table 1. Global Tyre &Rubber market category segmentation: $billion, 2018 (MarketLine, 2019)

Category	2018	%
Truck aftermarket	225.3	36.8%
Motorcycle aftermarket	196.9	32.2%
Car aftermarket	132.7	21.7%
Car OEM	39.0	6.4%
Motorcycle OEM	13.7	2.2%
Truck OEM	4.5	0.7%
Total	612.1	100%

SOURCE: MARKETLINE   MARKETLINE

Sales' tyres are correlated with the Gross Domestic Product (GDP) of a country; the correlation is proportional since as demand of vehicles increase also the demand of the tyres. Truck aftermarket segment is the most lucrative segment this suggest that key countries with booming economies boost business which requires getting goods from one place to another, for long distances the rubber meets the road overloaded in different applications carrying goods or persons; truck tyres are also a major contributor to maintenance costs. The industry has made decisive steps in the past decade in terms of

volume; an example of this is that the market has even improved from the highest replacement market volume ever in terms of shipment. (Fletcher, 2018)

Most of European Institutions Tyres and Rubber goods producers should follows and homologate their products according to the European Tyre & Rubber Manufacture's Association (ETRMA), this association is responsible for standardization, Tyre technical performance and technical regulation for Tyre, rims and valves; in favor of health, safety and environment protection, transport, road safety and access to third markets in coordination with the European public authorities, on the figure 1 you will find the ETRMA's members at 2018.

Figure 1. ETRMA's Members

The global market is made up of large companies and an increasing list of smaller competitors, as mentioned before. There is an increasing number of brands coming out from China in the recent years, that are not yet winning customers on the OEM markets, but had customers on the replacement market, reason that the OEM market is dominated by large companies' leaders while aftermarket is more fragmented. This is controlled somehow by tariffs, such as those imposed by the U.S International Trade Commission,

this intensifies rivalry in the global market, as the greater the number of players, the stronger they will have to compete for share in the market. (ETRMA, 2017)

5.2. Company History

The history, as on figure 2, of Prometeon Tyre Group take place on 1872 when Giovanni Battista Pirelli founded a limited partnership, "G.B. Pirelli & C.", in Milan to produce elastic rubber items. G.B. Pirelli & C. was liquidated and Pirelli & C., a limited shares partnership was established. Later on, the company starts creating a Division Structure by Products – division from Consumer and Industrial – during the period Pirelli use the R&D centers, plants, laboratories and suppliers on all division products segmented by areas. On 2015, Industrial Division starts splitting from Pirelli Consumer, with the investment of a Chinese's Company begins the segregation from Pirelli to the new Company Prometeon Tyre Group S.r.l., thanks to the license agreement between Pirelli and Prometeon today Prometeon Tyre Group have the possibility to acquire some services and software from Pirelli to warranty the quality on Pirelli brand products and Prometeon brand products.

Figure 2. Prometeon History

PIRELLI WAS FOUNDED — 1872

1896 — PIRELLI TRUCK

GIANT TYRES
Started to be used in military campaigns — 1911

1950 — CINTURATO
Technology:
A turning point in tyre industry

ZERO DEGREE STRUCTURE
An exclusive patent — 1981

CHEMCHINA — 2015

2016 — PIRELLI INDUSTRIAL
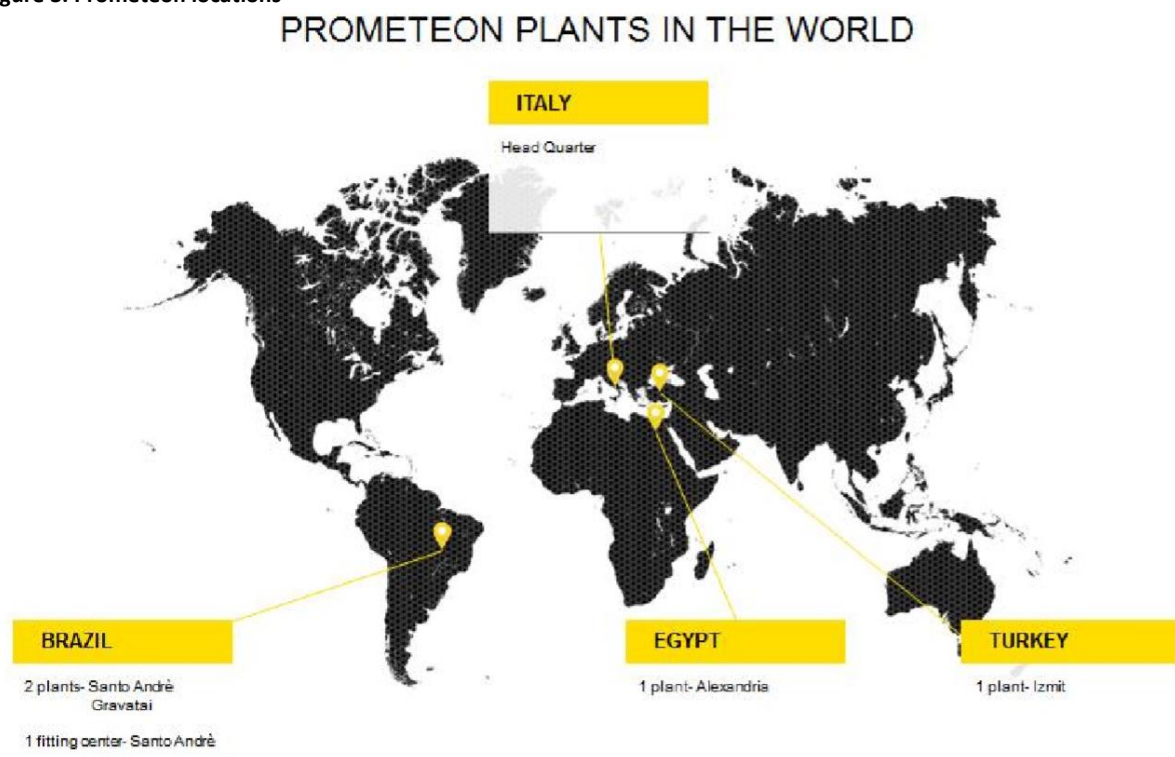
PROMETEON — 2017
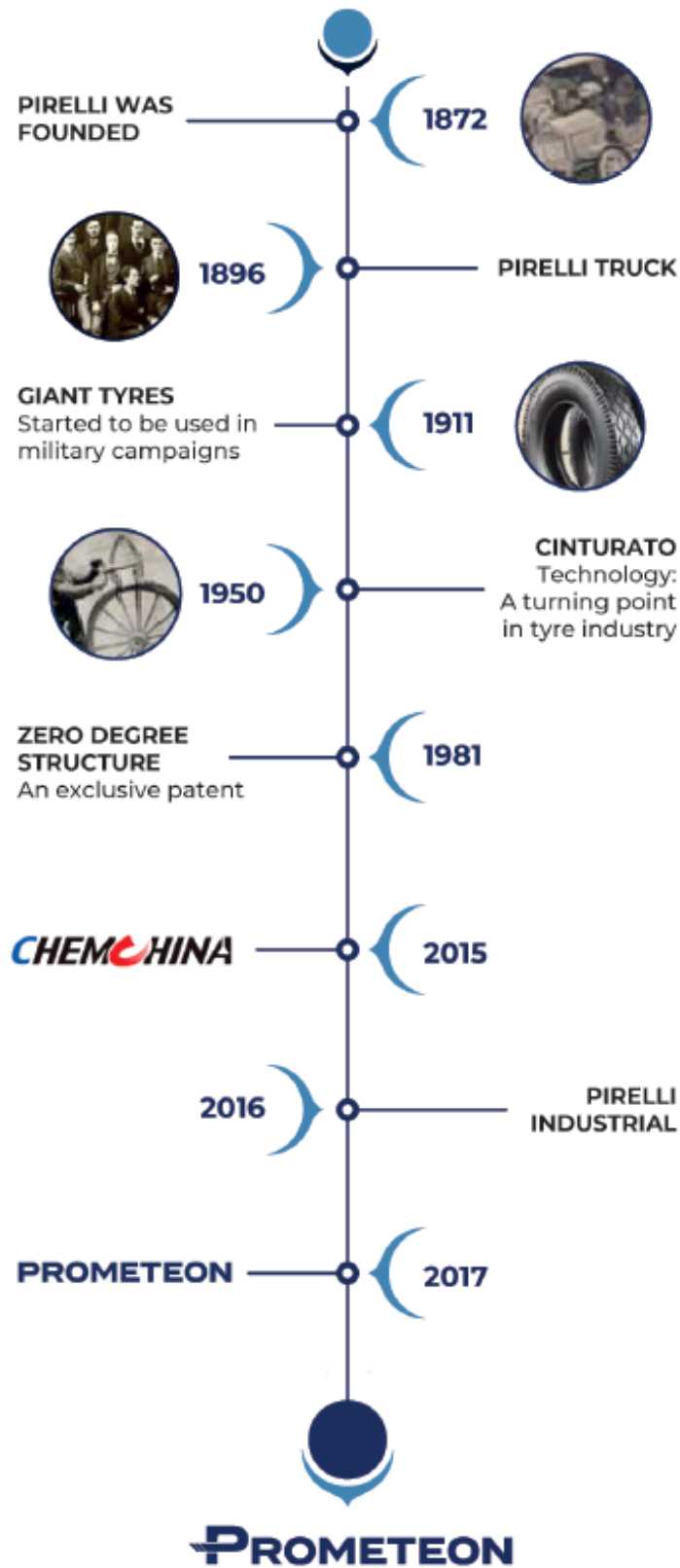
PROMETEON

5.3. The Company

Prometeon Tyre Group is the leading Company of an enterprise group that manufactures under license agreement with Pirelli Tyre S.p.A. with more than 100 years' experience and distributes in the Industrial Tyre sector, offering an entire range of products branded for Truck, Bus, Agricultural and OTR machinery.

The group has participation on 4 countries on which there are 4 manufacturing sites in Egypt, Turkey and Brazil; 2 Research & Development centers in Italy and Brazil; 2 Local Research & Development in Turkey and Egypt. Prometeon collaborates with the Chinese's company "Aeolus" to warranty the quality and gain other markets, but they have control of the Pirelli branded products.

The Head Quarter is in Italy and there is a fitting center in Brazil (LATAM), as it is show on Figure 3. With more than 7,000 workers Prometeon group is committed with all the employees doing activities based on respect of human rights, governed by its Values and Ethical Code and comply with sustainability Model.

Figure 3. Prometeon locations

PROMETEON PLANTS IN THE WORLD

ITALY
Head Quarter

BRAZIL
2 plants- Santo Andrè
Gravataí
1 fitting center- Santo Andrè

EGYPT
1 plant- Alexandria

TURKEY
1 plant- Izmit

5.4. Governance of the Company

Corporate compliance is defined as the conformity of the organization's activities with laws, regulations, producers and conduct codes, to prevent the risk that the organization's activities fail.

As it is mentioned on the "*Company Humans Rights Policy*", it respects and protects the fundamental human rights laid down by the laws and regulations of each country where it operates applicable international standards, including:

- The United Nations International Bill of Human Rights, consisting of the Universal Declaration of Human Rights, International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights;
- The United Nations Convention on the Rights of the Child;
- The ILO Declaration on Fundamental Principles and Rights at Work and the relevant applicable conventions;
- The European Convention on Human Rights;
- The United Nations Convention against Corruption.

The Group seeks the active support of all the employees in putting the principles and aims contained in the Equal Opportunities Statement into practice like the following:

- Acknowledge and promote the importance of individual differences in all company;
- identify and eliminate any forms of discrimination that may hinder equal access to employment opportunities;
- guarantee genuine equality of treatment of all company employees in every sector, role and level of seniority and in all positions of responsibility, thereby acknowledging the results and potential of all individuals foster diversification in individual professional choices.

Prometeon Tyre Group is engaged in the identification, assessment, prevention and mitigation of human rights violation risks, promptly implementing corrective actions if these events occur, In particular:

Raises employees' awareness, through information and training, and in conducting corporate activities with respect for human rights;

Manages its supply chain in a responsible manner including respect for human rights in the supplier selection criteria, in the contractual provisions and in the checks carried out by Audit.

Prometeon Tyre Group reserves the right to terminate relations with suppliers in cases where there is clear evidence of supplying conflict minerals and however in case of any violation of Human Rights.

The company provides to Stakeholders a dedicated channel (the "Group Whistleblowing Policy Complaint Procedure" published on the Prometeon Tyre Group website) for reporting any situation, also anonymous, that in breach of this Policy poses or could pose a risk of Human Rights violation.

5.5. Sustainability

Prometeon Tyre Group is committed to promoting, developing and implementing a sustainable and responsible procurement and use of natural rubber throughout its entire value chain.

From upstream to downstream, the natural rubber supply chain includes Producers/Farmers, Dealers, Processing Plants, Trading Companies, and Manufacturers. Also, the group is positioned at the last step of the chain, as a tyre Manufacturer that does not own either natural rubber plantations or processing plants.

Within this context Prometeon Tyre Group strives to be an active player in global efforts towards natural rubber sustainability, and to this aim will work together with its value chain and industrial sector to enhance transparency and further develop processes and instruments to enhance traceability, using a risk-based approach.

5.6. Quality

The scope of Prometeon Tyre Group is the design, development, production, distribution and sales. The Quality Management System implemented at central level and in all Prometeon affiliated companies is structures in order to be compliant with the ISO9001 and IATF 16949 requirements. The type of products, services and the customers are showed in the figure 4 according to the Quality Manual of Prometeon Tyre group.

Figure 4. Prometeon's context definition

Figure 5 shows the flow chart of the Quality System in the Company and the connection between the different departments.

Figure 5. Flow chart of the Company
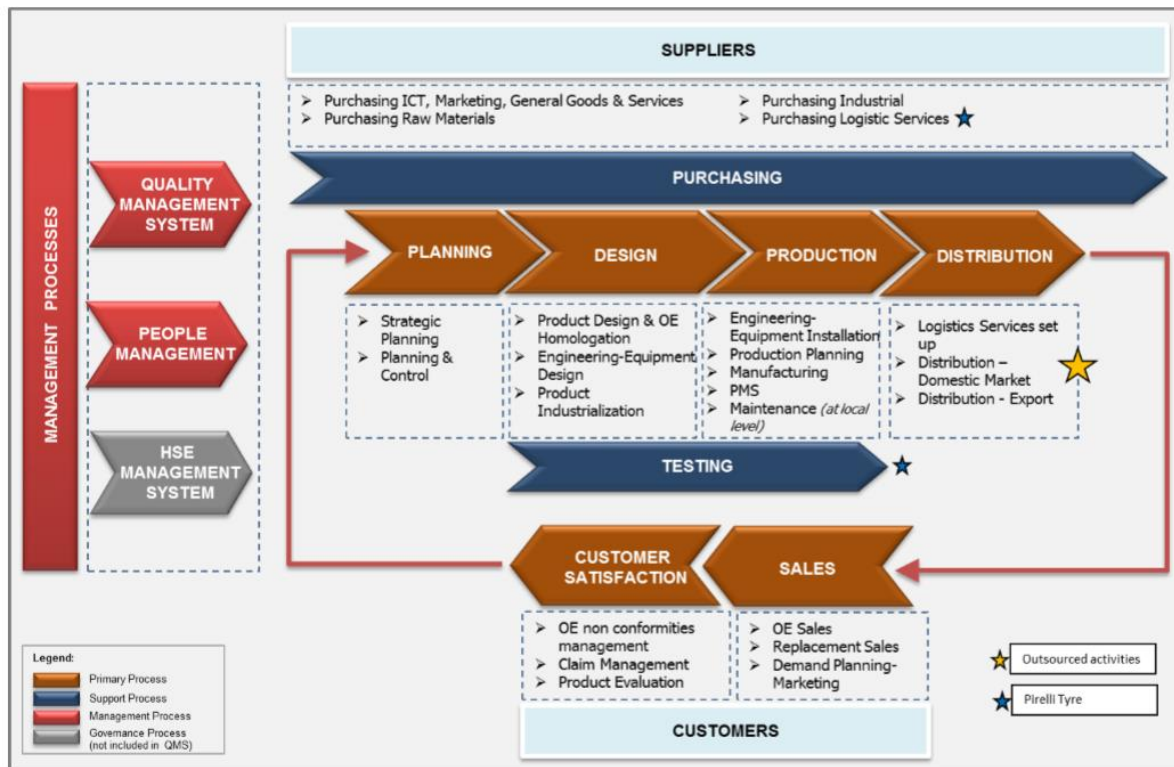
The main activities outsourced in Italy are the followings:

Distribution process: handling, storage, stacking, conservation and delivery of the finished product. The Logistics of these companies are monitored in terms of service using indicators such as % of noncompliance and % delays in the delivery. Periodic audits are also carried out on the state of conservation of the finished product and on the warehouses managed by those suppliers.

Testing is a service/activity provided by Pirelli Tyre S.p.A. Those activities result in a continuous and constant collaboration and contact between the related departments.

The quality standards of the Prometeon Tyre Group are realized through a "total" Quality Management System that is dynamic, designed to avoid risks and undesired effects, gather development opportunities and evaluate the effective achievement of our targets, ensuring continuous and sustainable improvement. Prometeon Top Management has a strategic role in the full implementation of this Policy ensuring the involvement of all

personnel and of those who collaborate with Prometeon, supported by the continuous guidance of the Group Quality Department.

5.7. Company products

The Pirelli branded range includes high performance products designed to improve the efficiency of each fleet, increasing driver and passengers' comfort and optimizing running costs. Therefore, each product developed is engineered with high quality and safety.

Tyres are developed with the objective to offer the right solution considering the type of transport and road surface, in view of maximum benefit for the customer. Those parameters have a direct effect on all tyre selection variables, both technical (materials utilized, design, etc.) and financial (wear, running costs, length of first life and useful life, etc.). The combination of application and vehicle type provides optimum tyre specifications for each use.

Currently, the portfolio's company of finished products is divided between Truck&Bus and AGRO&OTR. The classic division between "on/off-road" has been split into different areas of use, classified according to the growing severity of the road surface on which the vehicle usually travels like in table 2; each finished product needs to be marked as figure 6.

Table 2. Products Segmentation for Trucks and Bus

Classification	Description
W (winter)	Products designed for use over long and medium distances (H and R) under critical weather conditions (below 4°C) and on snow-covered surfaces.
H (low severity On)	Products designed for long-haul transport vehicles on motorways or arterial roads with very low specific tread-wear conditions.
R (medium severity)	Products designed for all-around transport vehicles travelling on slightly abrasive surfaces, including winding/hilly roads and urban traffic.
C (high severity)	Products designed for use on urban and suburban passenger vehicles in stop & go traffic conditions, low average speed, continual changes in the road surface (asphalt, concrete, cobblestones) and high degree of abrasion.
G (ON/OFF)	Products designed for mixed use vehicles on the road, on construction sites and under slightly-aggressive tread-wear conditions.
Q (OFF)	Products designed for vehicles used solely on construction sites, in quarries and mining operations with highly-aggressive tread-wear conditions.
F (multi-purpose)	Products designed for vehicles used in demanding off-the-road situations on various types of surface (asphalt, track, muddy or grassy terrain, sand).

Figure 6. Tyre Markings
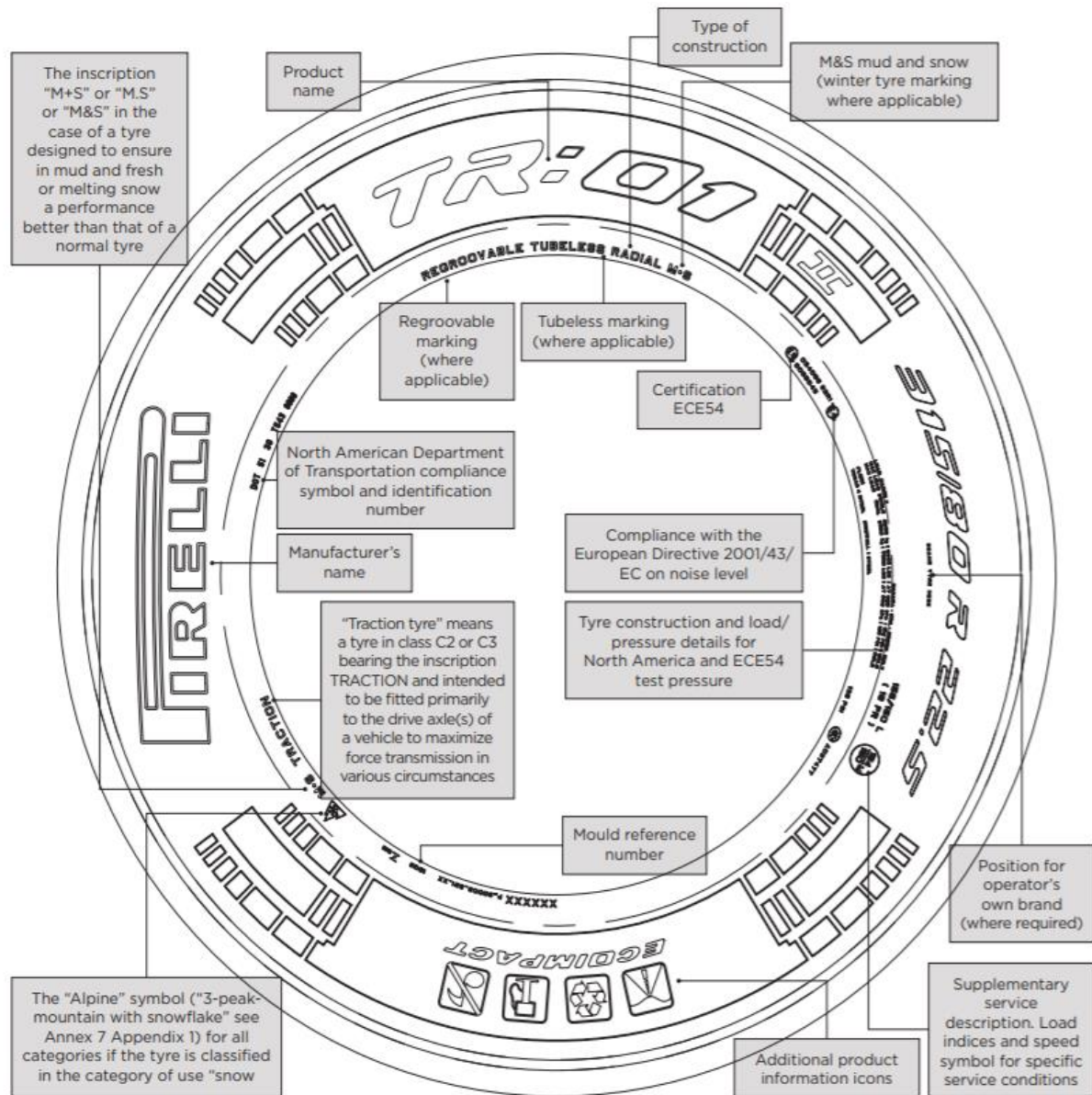
Most of the Prometeon's production at this moment are Pirelli branded products (Tier 1 and 2), but as part of the segregation between Pirelli and Prometeon. The company launched their own products lines like ANTEO that is for Tier 2. In reference to business, there can be multiple tier, which are connected in a supply chain command to the OEM, the tier 1 companies offer the most advanced process in the supply chain, making the best products for their clients, but also a tier 1 company could have tier 2 products which the supply chain doesn't have the same advanced process.

6. INTERNSHIP ACTIVITIES

The Internship was development on the area of Quality on Prometeon Tyre Group located on Milan the figure 7 shows the organizational chart.

Figure 7. Quality Organization Diagram
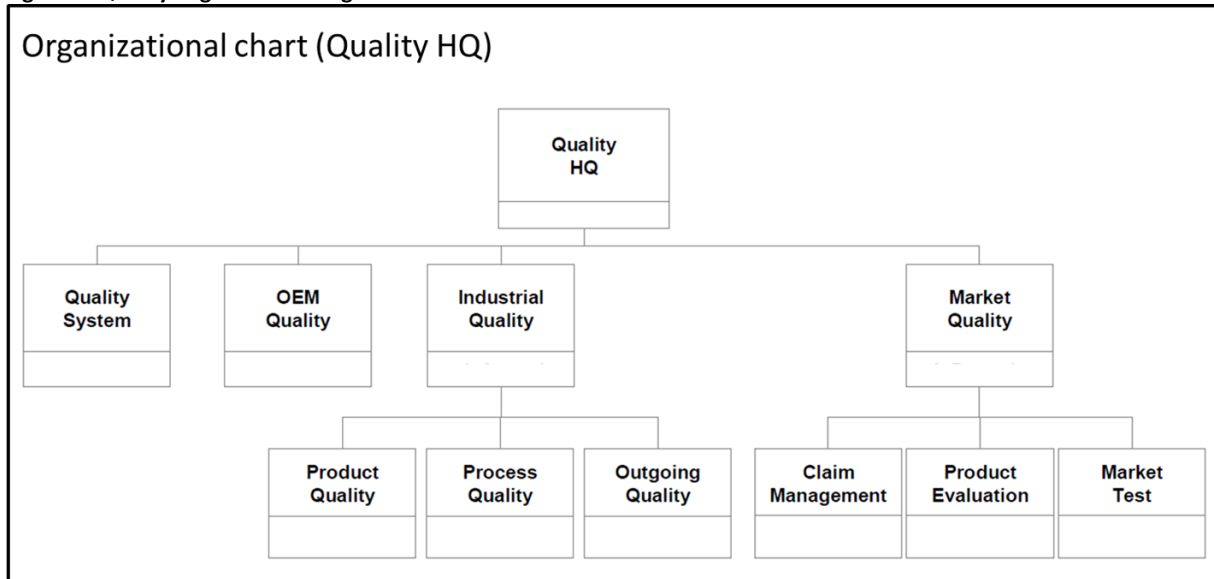
As Product Evaluation Intern, the main activities during the internship were the analysis of problems on the market and follow the implementation of corrective actions to ensure continuous maximization of customer satisfaction and reduction of complaints following the Quality Standard MR084.

The main purpose of this standard is to define the objectives and activities of Product Evaluation on the markets, to standardize all the technical information on the trend of claims and on the performance trend of claims and on the performance trends of Pirelli products according to customer markets, also in comparison with competitors, to ensure the continuous improvement of Pirelli and Prometeon products.

The definitions of the work doing during the internship are:

- Follow the annual visit plan by product line based on the business requirements, defined with R&D or Marketing;

- Collect and evaluate information from the markets, focusing on the perception of replacement customers, ensuring the quality of the products in terms of Design, Manufacture, Delivery and Service;

- Evaluate statistical data of the complaints from the markets to generate corrective actions when is necessary;

- Analyze the lists of complaints on a monthly basis;

- Obtain samples of the claimed products for further analysis;

- Organize technical samplings, which means compile the summary of all the available data of the complaints, to be presented to all the relevant functions;

- Insert and monitor the main issues from the replacement market, using the Rolling Follow Up, on the excel file and on the new software.

During the internship was possible to learn from different division of Quality as:

- Claim Management: is the first source which receives the data directly from the market and transform it into information for the company. Example: the claims from the market into claim codes for the company;

- Quality system: is the area in charge of ensuring that all areas follow the quality standards according to ISO9001 and IATF 16949;

- Industrial quality: in charge to ensure the quality of the products, making internal audits on plants and improvements of the process on plants.

7. CURRENT SITUATION OF THE COMPANY

As mentioned before, content 1.2, Prometeon Tyre Group is facing segregation from Pirelli Tyre S.p.A, there are some problems that the company faces: Reduction of Human resources on all countries were have participation, reduction of investments and expenses and the need reduce the outsource Pirelli Tyre S.p.A services. Both companies shared the same web-applications and data bases, and the licenses are of Pirelli, made sense that Prometeon outsource some of these applications. Nevertheless, are some limits on which by strategic decisions Prometeon is investing their resources in adapt the software that were made to satisfy the needs from consumer industry to industrial technologies and innovations, meanwhile Pirelli is moving on with new technologies.

To face this situation the company and employees are working to reduce the cost by improving their activities and finding new alternatives to have the same level as competitors; to prove the point and for further reference on this document is necessary to expose one example made by Quality area.

7.1. Quality Community

One of the workers in Quality has an initiative to implement a Quality Community, a web application on SharePoint by Microsoft Office, this action cost lower than other specialized software or the payment to create one customized. The main idea of this is to share official documents between HQ Milan, plants or areas whom will be interest on the following areas and topics of Quality:

- Quality system;
- OEM Quality;
- Industrial Quality;

- Market Quality;
- Material Quality;
- Agro;

- Benchmarking;
- Retreading;
- Trainings.

Inside of each folder can be found, reports, trainings, manuals, products, markets information and description of some processes. This action has the opportunity to use different features at a lower cost and also helps to standardize the flow of information between the different areas. For the focus of this project figure 8 shows the label of

Market Quality which contains activities and reports for Claims Management, Product Evolution, Rolling Follow Up and Market test, to improve the Product evaluation activities two proposals were discussed to the development of the thesis.

Figure 8. Market quality home page of the Quality Community
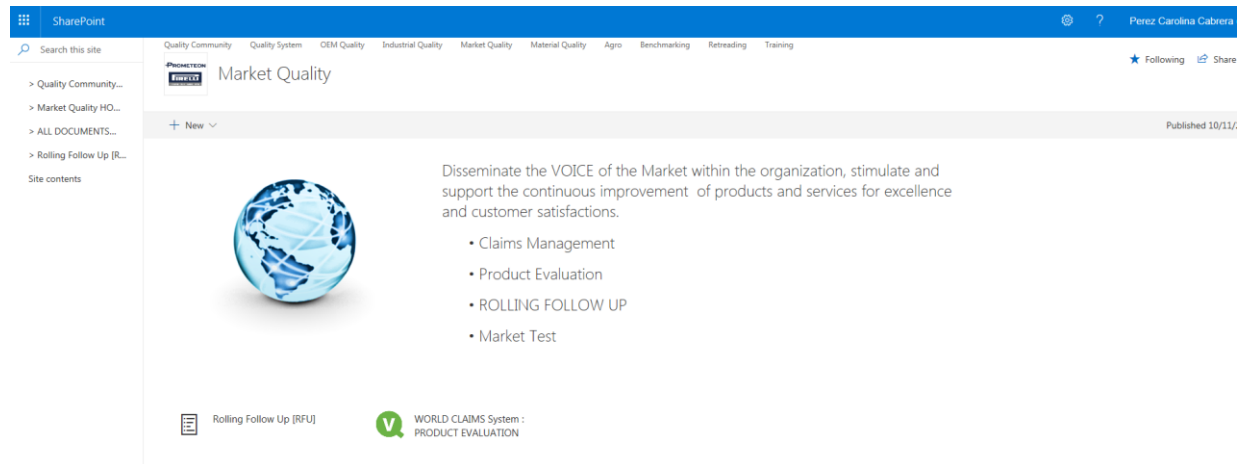
7.2. Proposed projects from the company

This section is to introduce the main projects that the company suggests to develop the thesis.

7.2.1. Bonding system

The Company use this software to do Quality blocks at warehouses for the final product given by different the reasons like as for an audit, bad lot, failure from the plant or as a request for further analysis.

The steps for this process are:

- The block is needed if there is a problem or is necessary to do an audit;
- It is asked to fill all the fields (DOT, size, plant, reason of the block, responsible of the block, commentaries);
- It is sending a notification by mail of the block to all the responsible;
- Who may be interest in this block according to the market will follow it;
- Someone manually would need to block the products on SAP manually.

The main problems are:

- That there isn't a good traceability for the products to be blocked and get lost on the warehouse or are sold;
- The system is not connected automatically with SAP;
- The notification of the block is just an email that can be missing out.

What is expected to achieve?

- Reduce stock management impact on Warehouse;
- Increase containment action effectiveness;
- Improve communication between Warehouses.

7.2.2. Rolling Follow Up

There is a format in excel where the company follows the corrective actions according to the type of claims on the market, there is a flow of information between Local product evaluation and Headquarter, where corrective actions status is updated.

The main problems are:

- It is an excel file, in a shared database where is difficult the traceability of the information and updates;
- Difficult to follow up each activity for each plant and claim type.

What is expected to achieve?

- Improve the method, dataflow and platform;
- Search for new ways of sharing the information;
- Standardize 8D worldwide.

7.3. Selection criteria of the project

Under the circumstance of the segregation, to improve the Bonding System was too difficult for a thesis and internship, for the difficult communication with Pirelli IT (one of the outsource services). This was the first argument on which it was decided to no follow

this project; other one was the lack of economically resources to implement a new software on the different warehouse and plants.

Another argument is that as part of the Product Evaluation duties was the follow up of the improvements which the measure of effectiveness is to reduce the amount of claims arriving from the market, this is a daily task, so implement the 8 Disciplines methodology will be helpful for daily activities for the responsible of Product Evaluation, helping in the traceability of the improvements, know the responsible and follow up of the effectiveness. Also, it was known by the Market Quality Manager and the Product Evaluation Manager that this was first priority and necessary to implement inside the Quality Community.

8. PROJECT DEFINITION

8.1. Analysis of the actual Rolling Follow Up

One of the activities for Product Evaluation manager, in this case as an intern, was the Rolling Follow Up. Inside the document are all the activities relative to solve a problem of a specific market or product that are produced on the same plant, the intent is to follow a simple format of the 8 disciplines methodology as seen in table 3, but it is partially efficient.

Table 3. Actual file excel format

Item (Claim reference/8D reference)	Issue	Size	Factory	Market	Containment action	Root Cause	Done Activities	Preventive Action	Corrective Action and Recommendations	Resp.	Progress %											Remarks
Ongoing Activities (RFU)											Initiator:	Product Evaluation Manager									Last update : Date	
											10	20	30	40	50	60	70	80	90	100		

The 8D is followed to find the root cause, preventive, containment and corrective actions in order to find the best solution of the issue. The justification that this is partially efficient is that this format not follow actually the 8D format, is missing the correct definition for each action and the respectively due dates of the actions and responsible, also there is lack of training or documentation on 8D methodology.

8.1.1. Criticalities

- Not follow the actual 8D format;
- Excel format, where difficult to attach new documents (like analysis, photos, etc.);
- Need to be standardized and work at the end of 2019 start of 2020;
- Training is needed to all the Product Evaluation managers where Prometeon has presence and all the areas which maybe need the collaboration (ex. R&D).

8.2. Project objectives

8.2.1. General Objective

The general objective of the project will be the full implementation and deployment of the new Rolling Follow up, according to the 8D methodology and setting up a manual which

describe "how to use the RFU" on the new application and in order that there aren't missing information to improve the quality standards.

- Study deeply the current situation first at HQ Milan;

- Participate on 8D methodology course and measure the result with certification of the abilities on the theme. (Certification on annex A);

- Collect and analyses the data from the company;

- Planning of training adequately to the personnel of Quality from the different markets;

- Integrate the new improvements to the RFU of the new Quality Community;

- Implement an 8D methodology to improve the RFU and measure the efficiency.

8.3.   Methodology

8 Disciplines

The Global 8 Disciplines (GD8) or 8 Driplines (8D) methodology is designed to detect and correct problems mainly in production process, but currently is used in other departments like logistics or even accounting. The method is implemented in an enterprise when defects are detected; this is often reported by the customer and applies mainly to faulty products or services. (CzOTO, 2019).

This methodology involves team working in order to solve problems, structured by 8 steps to help focus on the facts, instead of opinions. Its effectiveness depends in developing proper actions in order to eliminate root cause and implementing permanent corrective actions, contributes on the control that allowed the escape point of the problem. (WCE, 2010)

According to the material given on the accreditation course by "Cubo Consulenza", the 8D Manual "Understand the problem Use a team approach Share the lessons learnt" by Results Consortium Limited and the book "Introduction To 8D Problem Solving Including

Practical Applications and Examples", the next information about the 8D method is summarized. The G8D process follows the next 9 steps (D0-D8):

- D0 – Prepare for the Ford Global 8D Process

In response to a symptom, evaluate the need for the G8D process. It is necessary, to provide an **Emergency Response Action** (ERA) to protect the customer and initiate the G8D process.

- D1 – Establish the team

Establish a small group of people with the process and/or product knowledge, allocated time, authority and skills in the required technical disciplines to solve the problems and implement corrective actions. The group must have a designated a Team Leader and initiates the team building process.

- D2 – Describe the problem

Describe the internal/external problem by identifying "what is wrong with what" and detail the problem in quantifiable terms

- D3 – Develop the Interim Containment Action (ICA)

Define, verify and implement the **Interim Containment Action** (ICA) to isolate the effects of the problem from any internal/external customer until **Permanent Corrective Actions** (PCAs) are implemented. Validate the effectiveness of the ICA

- D4 – Define and verify root cause and escape point

Isolate and verify the **root cause** by testing each possible cause against the problem description and test data. Also isolate and verify the place in the process where the effect of the root causes should have been detected and contained but was not (escape point).

- D5 – choose and verify Permanent Corrective Actions (PCA's) for Root Cause and Escape Point

Select the best permanent corrective action to remove the root cause. Also select the best permanent corrective action to address the escape point. Verify that both decisions will be successful when implemented without causing undesirable effects.

- D6 – Implement and validate Permanent Corrective Actions

Plan and implement selected Permanent Corrective Actions. Remove the ICA. Validate the actions and monitor long-term results.

- D7 – Prevent Recurrence

Modify the necessary systems including policies, practices and procedures, to prevent recurrence of this and similar problems. Make recommendations for systemic improvements, as necessary.

- D8 – Recognize Team and Individual Contributions

For steps D2 and D4 some quality tools are possible to be use in under to help on the development of the 8D, describing the problem, identification of the root cause and escape point, some of the tools are listed below:

- o 5W;
- o Ishikawa diagram "Fish bone Diagram";
- o Pareto diagram;
- o IS / IS Not diagram;
- o What is wrong with what to describe the internal and external problem;
- o FMEA;
- o Relationship matrix between objectives and actions.

The 8D methodology allows to satisfy customer complaints; i.e. to solve the problems, reduce the overall cost of quality and to improve the customer satisfaction in an effective way. The improvements and reduction of variability on the process can be achieved by integrating and managing the quality data in a management system and by the organization of tasks and methods. A faster and more qualified reaction to complaints reduce and prevent problem recurrence representing cost savings whenever a complaint

appears or is avoided. Customer complaints are expensive, both as direct and indirect costs; this information transformed into knowledge about the markets, gives valuable amount of capital for enterprises. To explore this capital companies must design, build, operate and continuously upgrade systems for managing complaints. (WCE, 2010)

According to one expert on the subject, the biggest abuse in the implementation of the 8D methodology involves using it solely as a one-page problem-reporting effort, figure 9, and requiring to be written whiting 24 hours, this is because some steps may take few hours while other can take weeks. Therefore, are cases where the problems can occur only with unique conditions, which requires for extensive studies and experiments, this is especially on manufacture issues. (WCE, 2010)

The 8D is recommended to be finished before 30 days, whenever this is not possible is necessary to present any updates on root cause if has not been determined or verified; plan to continue the process; timeframe for completion of the process.

Figure 9. 8D report traditional format

G8D REPORT

					Date Opened:	Last Updated:
Title:						
Product/Process Information:			**Organisation Information:**			
DØ Symptom(s):						
DØ Emergency Response Action(s):					% Effective:	Date Implemented:

D1 Team: Name Dept Phone Champion: Team Leader: Team Members:			**D2 Problem Statement:** **D2 Problem Description:**	

	% Effective:	Date Implemented:
D3 Interim Containment Action(s): Verification / Validation:		

	% Contribution:
D4 Root Cause(s) and Escape Point(s):	

	% Effective:
D5 Chosen Permanent Corrective Action(s): Verification:	

D6 Implemented Permanent Corrective Action(s):	Date Implemented:
D7 Prevent Actions:	Date Implemented:
D7 Systemic Prevent Recommendations:	Responsibility:

	Date Closed:	Reported by:
D8 Team and Individual Recognition:		

5W Quality Tool

This tool is part of the Six Sigma, used to describe and analyzes a given problem with the use of questions starting with the W (why, what, who, where, when), it doesn't matter the amount of times the question is due until it helps to understand what is causing the issues. Because these questions are open and not allows to have a "yes" or "no" answers, this tool creates the conditions for the proper identification of the problems under analysis. (QPI, 2018)

The benefits of using this tool is to identify the root cause of the problem, determine the relationship between different root causes of the problem, is a simple tool that can be completed when the problem involve human interactions or day-to-day business life without using statistical analysis. (ISIXSIGMA, 2016)

Ishikawa

The Ishikawa or "Fishbone-Diagram" is a technique useful to identify the problem, work out the major factors involved, identify the possible causes; normally group different categories to identify the involved factors which are People, methods, machines, material, measurements and environment. (IManEE, 2016)

Ishikawa Diagram is a simple graphical instrument to understand the causes that produce quality defects and is used to analyze the relation between a problem and all possible causes. (IManEE, 2016)

IS/IS NOT Table

Another tool that is used to identify and describe the problem making the following question "What is wrong with what?" during the course of the 8D method this technique was explained. This table is to found the boundaries of the problem in terms of what IS and what IS NOT following the 5W's (what, where, when and how big).

9. PROJECT PREPARATION

This chapter explains project planning based on the 8D stages and deliverables needed to carry out the project, according the material provided on the 8D course.

9.1. D0/D1– Prepare material/Define team

At these stages is necessary to the find the main problems, symptoms and stablish if is necessary to implement any ERA and stablish the team and principal responsible.

Symptoms: on the actual format is difficult to identify the activities already done, the start and finish date of each activity, this cause delates on closing RFU.

ERA: it is not necessary to make an ERA every month is updated the excel file and all the documentation is archived on a community folder, however soon will start the transition to the Quality Community web application.

Figure 10. Flowchart of the actual process for the RFU
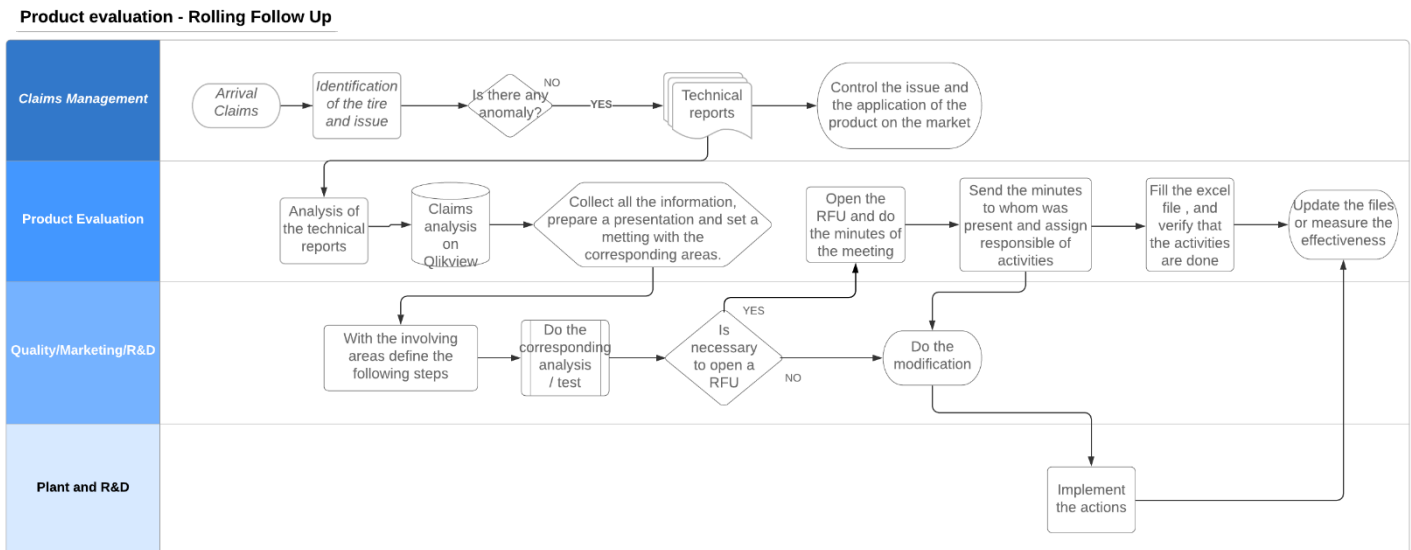
Upon a period of time when the actions are taken and shows a positive or negative result, it come the decision about to close the item or the need to open a new one. For countries like Brazil, Turkey and Egypt are Local Quality, R&D teams which have the same work flow internally, this is because on this country are the location of the plants. Other countries only have local quality but they not take action on the RFU unless they are to contain the issue with the customer.

The responsibility to improve the actual process is led by Product Evaluation Intern with the supervision and guidance of the Market Quality Manager, Product Evaluation Manager for a short time (1 month and a half) because medical leaving and the collaboration of the involved areas.

9.2. D2 – Description of the problem

By implementing some quality tools like the 5W, IS/ IS NOT Table and Ichikawa diagram is possible to describe the main problem

5W tool

Why is necessary to improve the actual RFU? There is not a proper follow of the actions and doesn't use the 8D methodology.

Why is not a proper follow? The method used is an excel file where is stablished format follows partially the 8D methodology; also, there is a limited number of persons who can see the actions done, with this only few persons can modify it.

Who need to use it? All the areas who participate on each RFU, for example Quality with the collaboration of R&D need to do meetings to define the analysis to take decision of the actions to be made on the production and the plants need to send the date when the action was implemented.

Where is need the RFU? Actually, all is managed by mail and the P.E Manager with some responsible of R&D each month update on Excel file on HQ Milan. On the other hand, the Plants and the Local R&D with local Quality do another RFU of little actions on a different excel file where Quality Milan don't participate and can't follow this action.

Why is this necessary? Every time a product receives a huge number of claims or exist the risk that claims increment is necessary to do some improvement on the product, the RFU is a tool which helps to follow this improvement and see later (after 1 or 2 years) the effectiveness of the actions.

What is wrong with the actual RFU? On the actual RFU exist a lot of information on the table, that includes activities that were made or need to be done and are not classify or have a due date; other issue is that the information is not standardized and not globalized.

Why the information is not standardized? On the actual process is missing culture of 8Dmethology, this is because employees jump on conclusions and manage the issues as previous experiences even if this is not similar. In addition, the lack of training or manuals doesn't ensure a correct follow up of the activities.

Ishikawa diagram

Figure 11. Fishbone diagram
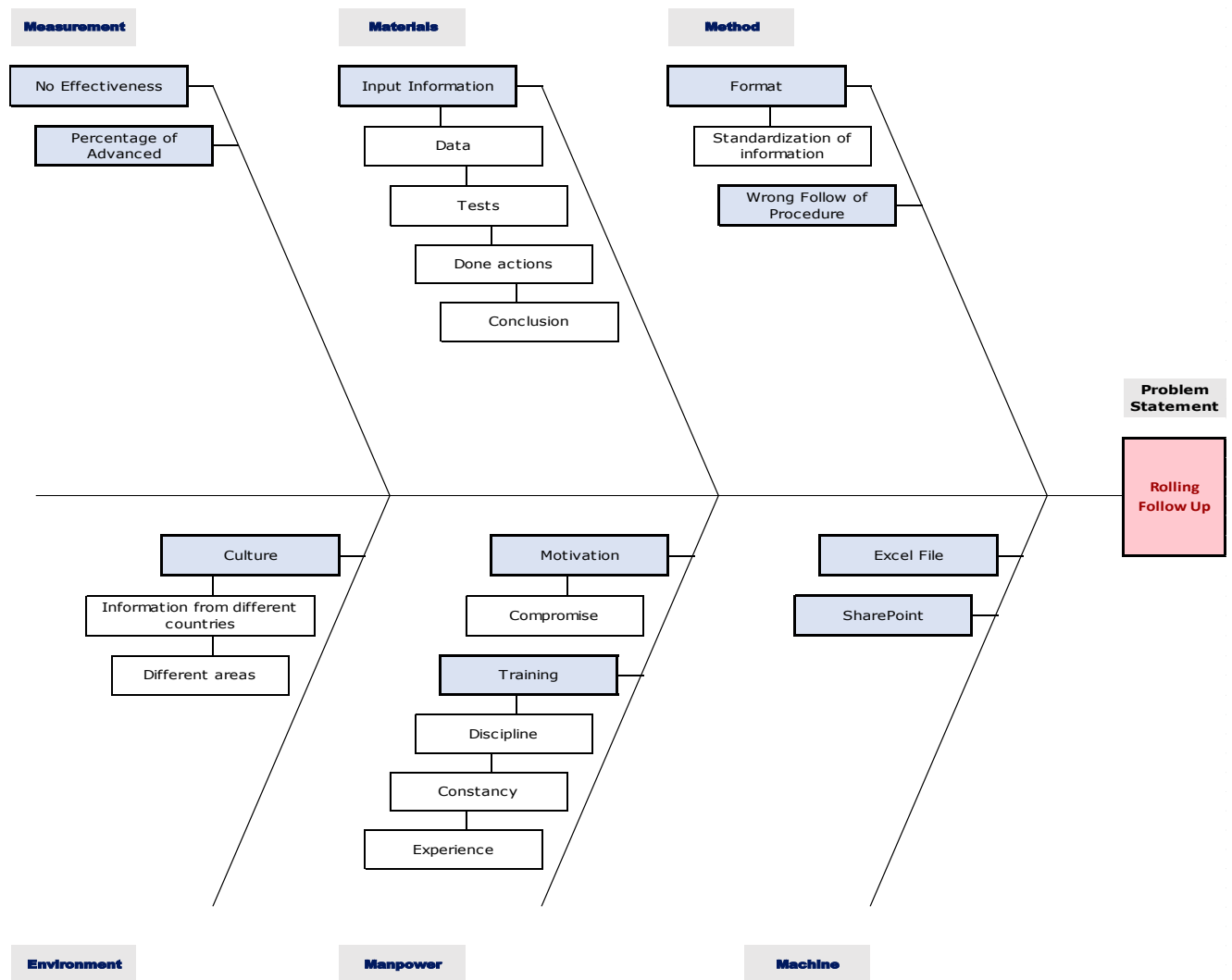
IS and IS NOT table

IS CORRECT	IS NOT CORRECT
• Identification of plant, market and issue	• Clear description of the problem or taken activities
• Preventive, containment, and corrective actions	• Overdue notifications
• Root cause	• 8D method standardized
• Main responsible of the actions	• Standardized information
• Documentation	• Not all the actions have documentation (test, sample sampling, mails, etc.)
• Status of the tasks	• Not notification of the last person who edited (excel file)
	• Date of start or finish of activities
	• %effectiveness
	• Follow of the action after closure

Problem statement: The actual RFU do not help to make an easier follow up of all the actions made on the different items

Problem description: It is tough to follow up the RFU on the **excel file**, the **information** is not standardized every time an **item is open or updated,** making jumps of steps to identify the correct problem and the right solution **time**.

9.3. D3 – Implement Interim Containment Actions

This is the only "D" that is not obligatory, in this case the justification is that as the Excel file is updated only by the product evaluation manager with the collaboration of one R&D person monthly it works to follow up the actions opened. But the idea is that on the future the product evaluation manager only follows the activities open by local Quality of ach country.

9.4.   D4 – Define and verify Root Cause and Escape Point

In order to understand what is the real problem it was necessary to evaluate if all the columns inside the excel file help to identify the problem table 4.

Table 4. Evaluation of the actual excel file

Columns	Description
ITEM (CLAIM REFERENCE/8D REFERENCE)	This is used as identification of each RFU open on the different plants
ISSUE	According to a Claim Code manual each issue that can be present on the market is classified, this column helps to identify the Claim code on which the market is complaining.
SIZE	It is necessary to identify over with products the actions are taken or involved this is necessary to write the material description and the IPCode (Specific code for each pattern)
PLANT	It is important to have it, for identify on which plant actions of improvement are taken.
MARKET	Help to identify which markets have the same problem
CONTAINMENT ACTION	It is important as is part of the 8D methodology, on the actual process the information is not clear
ROOT CAUSE	It is important as is part of the 8D methodology, on the actual process the information is not clear
DONE ACTION	This column causes confusion between done actions, preventive actions and corrective actions, don't believe this is important to have it as a column, possible it makes the confusion. But it is

	necessary to have a register of all the activities, test, meetings that were done during the process
PREVENTIVE ACTION	It is important as is part of the 8D methodology, on the actual process the information is not clear
CORRECTIVE ACTION AND RECOMMENDATIONS	It is important as is part of the 8D methodology, on the actual process the information is not clear, it is necessary to have what are the corrective action by DOT, NdM, NdVM, BIP, BPP, new IPcode, for search the improvements and validate the actions. On the actual process the information is not clear
RESPONSIBLE	Yes, important to know who need to follow and is responsible
% of Complete	Yes, to see the actual status of the RFU
Remarks	Not necessary if the follow is constantly (minimum see it once a week) or write the following actions to achieve the solution

As the main idea is that the RFU should be understandable for the relevant involved functions and departments to ensure the adequate analysis of specific issues. During the internship and based on the experience of the Product Evaluation manager it was agree to that the manly involved functions are:

- Product evaluation (HQ and Local), as it was described before the main activities that this area is proportionally related to the RFU.
- Claim Management, this translate the claims from the costumers to technical information for the PE.
- R&D, if the arriving claim is related to a compound problem or a wrong production of the market, this area should be intervening on the corrective actions.
- Industrial Quality, if the claims are related to a production problem this area should be intervene on the corrective actions.

- Market test, in some circumstances the company implement market test were Normal Production tyres and prototypes are on the market previous agree with the customer to monitor the performance of the tyres.

After this was defined it was necessary to do some interviews to HQ Milan's managers to know what the indispensable information they need to have is, the following table shows the results, when there is an "x" is because the information is important to have it.

Who will see the information inside and what information is needed?

Table 5. Summary of the interviews

	Areas				
Information	**Product Evaluation**	**Claim Manager**	**R&D**	**Industrial Quality**	**Market Test**
TASK NUMBER	x	x	x	x	
ISSUE	x	x	x	x	
SIZE	x	x	x	x	x
IP CODE	x		x	x	x
PRODUCER NUMBER OR NAME	x		x	x	
MARKET	x	x	x		
CONTAINMENT ACTIONS	x		X	x	
ROOT CAUSE	x		x	X (when is involve a plant defect)	
DONE ACTIVITIES	x		x	x	
PREVENTIVE ACTIONS	x		x	x	
CORRECTIVE ACTIONS	x	x	x	x	
RESPONSIBLE	x		x	x	
REMARKS			x		
START DATE	x			x	
FINISH DATE	x			x	
% OF COMPLETE			x	x	

EFFECTIVENESS	x	x	x	x	
ITEM STATUS	x		X	x	
PRIORITY				Refer to the plant	
NDM	x			x	
NDVM	x			x	
DERROGA	x			x	
DATE OF CHANGE (NEW DOT)	x	x		x	

After this interview the following comments and observations were arise:

- It exists a misunderstanding between containment and corrective actions, due missing information between both.
- The manager of R&D said that for him it was difficult to understand the information, also that the he doesn't find when the actions take place.
- The manager of Industrial quality said that for him is need to be clear on which IPcodes the actions are taken and the plant of production, since there are the same IPcodes produced on different plants.
- Some of the manager's interview don't work or consult the actual RFU.

After all this analysis can be conclude that the root cause is that the actual rolling follow up don't help to track the information needed, and the problem is on the excel file that can be update for more than two people at the same time and don't do the correct analysis leaving all depending on experiences.

9.5. D5/D6 – Choose and verify Permanent Corrective Actions (PCA's) for Root Cause and Escape Point / Validate PCA's

This step of the 8D asks to evaluate different activities that can be done to solve the problem from the root cause to prevent its occurrence.

On this special situation, there were two alternatives to improve the RFU, since the root cause was that the people implementing the RFU don't do any analysis to find the main cause of the issue and most of the time arrive to wrong or right conclusion using their

experiences, with the possibility to waste time and money, other situation is that the actions take cannot be retraceable.

9.5.1.   <u>First alternative</u>

One of the proposals was to create a new format which follows the 8D methodology and force the people of the involved areas to do the respectively analysis to arrive to correct root cause and escape point.

The action was taken and a new format on a excel file was development (*annex 1*) with the manual of "how to use", the main idea is to fill the document and then upload it on the Quality Community to help the traceability and to know how solve future cases. To try its efficiency some examples were implemented about some different issues on the countries of China and Turkey.

China's Case

As mentioned before the culture was an important factor, the China's factory was already implementing the 8D methodology on a different way, the problem of this case was that the customers were claiming for small cracks around the barcode label (this label helps on the traceability on warehouse and plant of the tyres), no functional impact are reported. At the end of the 8D all the steps where described on a PowerPoint Presentation, when the proposal of the new format was presented the information on the PowerPoint presentation was transferred into the new format and other analysis where asked to do, the feedback was positive, The Quality's manager of China said "I like the G8D format you have introduced as so detailed" and some recommendations were made. Like modify the table on the D5 (<u>Annex 1, D5 Decision Making Worksheet</u>).

Turkey's Case

This case was that the customers were claiming for new type of issue of uneven wear on the central rib of the Tyre which is a estrange case, this is a known issue but most of the time is show on the lateral ribs (for this at know is difficult to solve). In contrast from the previous case in Turkey was found some constraints.

- They never here about the 8D methodology, even that, unconsciously some activities are implemented.
- Different than China the idea here was to work together to fill the information.

When the new format and the manual was sent to Turkey, a meeting was fixed to clarify the doubts, but the feedback was negative. They comment that for them it was to detail the required information, for some parts they do not understand what is asked, and that this format will take a lot of time.

The diversity of culture of these countries was reflecting on the results and conclusion of the alternative, after this experiment the following conclusion emerge:

- On Brazil and Egypt will deal with the same problem of Turkey since they never work with the 8D method before.
- From China and Turkey was received the same feedback that the new format is too detailed and maybe that some analysis is unnecessary depending on the issue.
- The time dedicated to fill the new format will be longer at the begging while the skill is development.
- There will be a duplication of the information between the excel file and the Quality Community columns.
- Is not possible to know who the last person who modifies the document was.

9.5.2.   Second alternative

The main idea is to use the Quality Community to facilitate the traceability and communication between the involved areas over the countries where are plants and the Quality departments. The base was already done but the main problem is that follows the same format of the previous excel file, as mentioned before which doesn't follow the 8D Methodology, so a second alternative to solve this problem was to modify the RFU on the community and again do a manual to "how to use" annex 2, the diagrams of the other file (fishbone, "is and is not" analysis, etc.) were leaved as optional when are required to

clarify the information. As before some examples were implemented to define the efficiency and validate the actions the counties were Turkey and Brazil.

Turkey's case

The main issue this time for the Turkey market was a circumferential splitting on the Tyre, the information was filled immediately on the dashboard with a positive feedback with the following comments.

- Easier to filled

- Clary information

- The manual helps to standardize the information that should be on the dashboard

Brazil's case

On Brazil they have their own system for the RFU, at the same time this software is from Pirelli and will be cut off on the short future also this doesn't function on other countries and is not possible to see the actions taken.

The main issue was cracks on joints (wish can be risky for the uses) the RFU was implemented and some actions were taken and described on it, this case is not closed yet and the actions take time to evaluate if function or not.

On conclusion the second alternative was accepted for both countries, at the end was a discussion with the Market Quality manager to review the results and feedbacks. This new methodology to do the RFU will be a way to make "OFFICIAL" the documentation for the audits held by third parties and to ensure the period of time to solve the problems exiting on the market in order to give a fast response.

9.6. D7/D8 – PREVENT RECURRENCE / RECOGNIZE TEAM AND INDIVIDUAL CONTRIBUTIONS

In order to prevent future misunderstanding with the other areas the manual will be updated frequently like as a standard and the definition and activities of the Product Evaluation were re-defined on the MR084. Also, it was defined a list of users which have access to edit the RFU on the Quality Community, to be controlled by Product Evaluation

HQ all the new updates of the corrective actions and to follow on a future if the actions were right or wrong.

It was fixed a meeting to thank all the mangers that collaborate on the development of this project and was shown the results.

10. CONCLUSIONS

After all this analysis can be conclude that the root cause is that the RFU don't help to track the information needed, and the problem is on the excel file that can be update for more than two people at the same time and don't do the correct analysis leaving all depending on experiences.

During the internship the 2 proposals were tested and the final solution was the second alternative, which was using the Quality Community to facilitate the traceability and communication between the involved areas over the countries and the Quality department. After a the test run and with a discussion between the Market Quality manager to review the results and feedbacks, it was concluded to add this manual on one of the Quality standards referring to the documentation for the audits held by third a party and to ensure the period of time to solve the problems exiting on the market in order to give a fast response.

To prove on a 100% the efficiency of this manual is early to arrive on a conclusion since some evaluation and corrective actions take times to show results, even this until the date of this document, the flow of information between the involved areas flows faster than before of its implementation and the traceability and verification went easier.

The experience on during the stage was full of knowledge and learning, additionally a new job offer was proposed on the Company, after the thesis and the internship on Product Evaluation. I value this first work experience in a positive way, since allow me to know several aspects of the business and put into practice concepts of quality learned in my academic career. To conclude I want to thanks to Prometeon Tyre Group and the persons involved inside the Company for the opportunity of this project and to my Academic tutor for his support.

11. ANNEX

Annex 1 – 8D new format

ROLLING FOLLOW UP

Tool that will follow the G8D methodology

G8D Method

The methodology involves team working using quality management tools in order to solve problems, following the G8D steps:

D0. Prepare for the Global 8D process

D1. Establish the team

D2. Describe the problem

D3. Develop the Interim Containment Action (ICA)

D4. Define and verify Root Cause and Escape Point

D5. Choose and verify Permanent Corrective Action (PCAs) for Root Cause and Escape Point.

D6. Implement and Validate (PCAs)

D7. Prevent recurrence

D8. Recognize Team and Individual Contributions

The 8Ds' objective is to face the problems and discover the weakness in the management systems that permitted the problem to occur in the first place, in manufacturing, many chronic problems can occur only with a unique set of conditions which calls for extensive studies and tests that needed the support for all the different departments.

In order to do the respectively analysis for each 8D phase an **8D Report**.

<u>Steps needed in order to carry out the activity are the following:</u>

First it is important to standardize level of importance for the potential issues. On the 8DReport is necessary to fill the next information:

- **Tracking number:** The Initials of the plant and the sequential number
    - o Gravatai: GR-01
    - o Izmit: IZ-01
    - o Santo Andre: SA-01
    - o Alessandria: AL-01

- o   Yanzhou: YA-01
- **Start day; Due date; expected end day.**
- **Responsible:** It will me the same as the team leader and the person in charge of the RFU
- **Claim code:** the main code from the claims arriving that is first identify according to the "Prometeon Claim Code"
- **Baby claim:** Any accepted claim presented within 12 months of production is regarded a premature failure and is allocated high priority. (Yes/No answer)
- **New product:** A product recently launched (usually within a year from introduction into the market) is a high priority. (Yes/No answer)
- **Amount of IPCode involve:** When more articles present the same claim code, the priority of the issue is changed:
    - o   more than 3 IPcodes involve (3).
    - o   2 IPcodes involve (2).
    - o   1 IPcode involve (1).
- **Quantity of claims on the last years:** according to the claim code and product the Product Evaluation Technician should consider a period of time and a reasonable quantity of claims arriving to declare if there is an important issue to discuss. (Number of claims arriving for the main Claim code)
- **List the IPcode/tread/size involved**
- **Producer/Market:** where is the problem? Is the only plant?

D0 - Prepare for the Global 8D process

On the steps the idea is to describe the symptoms and response to it, evaluate the need for the G8D. If necessary, provide Emergency Response Action (ERA) to protect the clients.

- Symptoms=perceived abnormality
- The things that can been seen from the market are the way to describe the symptoms, example:
    - o   Vibration claims
    - o   Sounds
    - o   Presence of a bulge on the sidewall
- Examples for ERA could be:
    - o   Change of the product

- o Change warranty policy

- o Change of plant production/systematic reinforcement

- o Product release

- o Technical Sampling is NOT an ERA

For each Response activeness should be a due date and a percentage of effectiveness of the action after implemented.

D1 - Establish the team

Stablish a group of people (2-7) with the product and process knowledge, allocated time, authority and skills in the required technical disciplines to solve the problem and can implement the corrective actions.

For D0 and D1 is necessary to follow the following format like on Table 1.

Table 1. D0-D1 Table

Tracking number:		Priority:	####	Start date:		End date		Last update:	
Responsible:				Due date:		Advanced or overdue	days	By:	

1st Claim code:	##	Producer(s):
2nd Claim code:	##	Market(s):

Fill the following information:

Baby claim or claim after modification		Qty of IP codes with the same claim		IPCode:	Tread:	Size:
New product		Qty of claims on the last year				

D0 - Symptoms

DØ Symptom(s):
1) _____
2) _____
3) _____
4) _____
5) _____

DØ Emergency Response Action(s): Containment actions
1) _____
2) _____
3) _____
4) _____
5) _____

(Due date) (Effectiveness)

D1 - Team

	Name	Department	Mail	Phone (Optional)
Team leader: 0				
Team members:				

D2 - Describe the Problem

Describe the problem by identifying "What is wrong with what?" and detail the problem in quantifiable process, it can be describe following IS – IS NOT Analysis like in table 2 answering to each question described, if is Not Applicable with (N/A).

Table 2. D2 "Is/Is not table"

D2 - Describe the problem

Problem statement - What is wrong with what?

| Problem description		IS	IS NOT
What?	What tire(s) is/are?	IPCode - Size - Tread	Similiar sizes or treads that could have the same defect but do not
	Description of the defect?	Why is the reason the client is complaining?	What are other reasons of complains but there aren't?
	Claim code(s)	Which is the claim code taht reflects the complaining?	N/A
Where?	On which part of the tire?	The defect is found on which part(s) of the tire	On which part of the tire the defect can be seen and is not?
	On which region or/and market?	Describe the region/markets/customers who are complaining	Which other region/market(s)/customers has the samen conditions and aren't complaining?
	On which part of the process?	The issue is found on the manufacturing/warehouse/at the use	The issue can been seen on the manufacturing/warehouse/use but is not
When?	When was the first defective tire?	On which season/year/month was found the tire(s) DOT of the first claim/Lot?	On which season/year/month can be found the same defect but is not
How much/many?	How many affected tires?	Amount of tires that have the defect	Which other sizes/IPCodes have the same structure/compound/produce in the same machine etc and not present the defect
	Trend	What is the trend? (increasing, decreasing, stable, cyclical)	N/A
	Incidence percentual	Percentual of Qty claims/ production or sales volume	N/A
Problem statement		Summary of the information above	

Another helpful tool is the Ichikawa diagram (Fishbone diagram) to keep the team focused on the causes of the problem, rather than the symptoms.

Steps for the fishbone:

1. Agree on the problem statement (effect), be clear and specific describing the problem but not in terms of a solution (e.g., we need more of something).
2. The categories of causes of the problem are the branches from the main arrow.
3. Brainstorm all the possible causes of the problem. Ask "Why does this happen?" as each idea is given (listen all the ideas without criticism), the facilitator writes the causal factor as a branch from the appropriate category (places it on the fishbone diagram). Causes can be written in several places if they relate to several categories.
4. Again asks "Why does this happen?" about each cause. Write sub-causes branching off the cause branches.

5. Continues to ask "Why?" and generate deeper levels of causes and continue organizing them under related causes or categories. This will help you to identify and then address root causes to prevent future problems.

Diagram 1. Ichikawa diagram
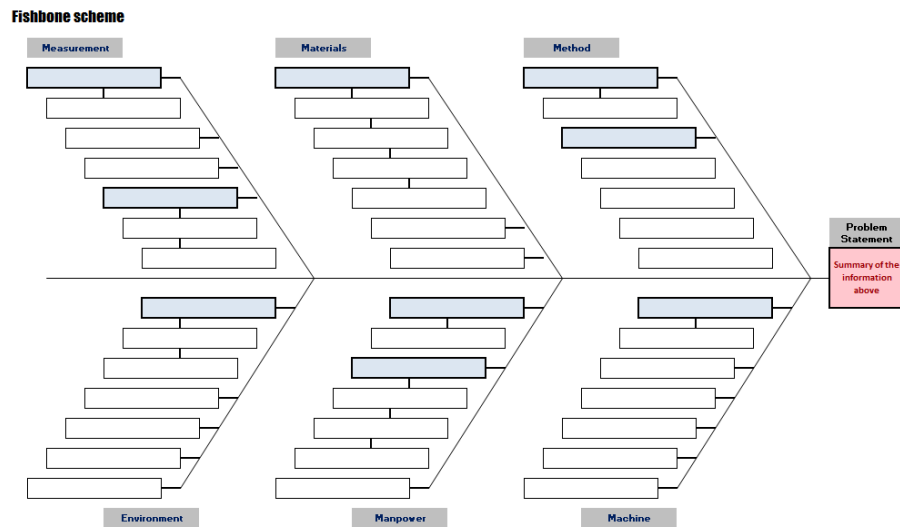
D3 - Develop the Interim Containment Action (ICA)

Define, verify and implement the Interim Containment Action (ICA) to isolate the effects of the problem and protect the customer, until Permanent Containment Actions (PCA) are implemented. For this is necessary to register all the actions taken and it responsible, the table 3. Is a tool to have a follow of these activities, if is Not Applicable with (N/A).

Table3. ICA Table.

D3 - Interim Containment Actions
Temporary actions to solve the problem

No.	Activity and Description	Ipcode/tread	Market/Plant	Start Date	Due Date	Overdue or Delay	Responsible	% Effective	Units	Documentation or Remarks
1										
2										
3										
4										
5										

D4 - Define and verify Root Cause and Escape Point

This step has two main function:

- Find the Root cause: single reason for the problem.
- Find an Escape point: control point in the production process or part of the time line that is closest to the root cause where the defect is originated.

Isolation and verification of the root cause requires verification of all possible causes taking into account the "description of the problem" that is formulated in discipline D2 and repeat the process and analysis taking in consideration the ICA that affect the process, then feel the table 4.

Table 4. Root cause and Scape point

D4 - Root Cause
After implemented the ICA - List all possible causes of the problem following the IS and IS NOT methodology

Does anything change on the problem?	What can be the root cause?	Is there an escape point?

This discipline enables showing weaknesses in the production process and sometimes suggesting corrective actions and recommendations to be implemented in further disciplines.

D5- Choose and verify Permanent Corrective Action (PCAs) for Root Cause and Escape Point.

Once is the root cause and the scape point are identified, the next step is to select the best PCA to remove the root cause and address the scape point in order verify that both decisions will be successful when implemented without causing undesirable effects.

The method that will be used for decision-making process is:
Priority decision (table 5)

- Describe the final result
- List decision criteria (givens and wants)
  - Givens: are the minimum criteria of success and are mandatory, measurable and realistic
  - Wants: desirable features
- Determine relative importance of wants (from 1 to 10)

- Evaluate alternatives against decision criteria

- Analyze the risk

- Make final decision

Table 5. Decision making worksheet

D5 - Decision making worksheet

Final result:		Alternantives					
Criteria		A1			A2		
Givens		Givens - information		Y/N	Givens - information		Y/N
Wants	Importance	Want - information	Importance	Pts	Want - information	Importance	Pts

D6 – Implement and Validate (PCAs)

When the root cause and the alternatives are chosen is necessary to do a flow up of them, the table 6 shows the all the data needed to measure the effectiveness of the PCA, plant where were done, IPcodes involve and NDM or NdVM, if is Not Applicable with (N/A).

Table 6. Traceability od PCA's

D6 - Permanent Corrective Actions
Actions that improve the products involve

No.	Description of the activity	Ip codes/ tread	Tread(s)	Sizes	DOT	NdM/NdVM	Plant	Market(s)	Responsible	Effectiveness
1										
2										
3										
4										
5										

D7 - Prevent Recurrence

After all the analysis done, make a brief description specifying how this issue and the root cause can be prevented. In this step is important to upload the 8D report on the Rolling Follow Up in the Quality Community webpage, to serve as an advice to other plants that can have the same issue. The document should be upload named: "Tracking number _8DReport_CC"

D8- Recognize the team

The final "D" and the most important, recognize the team's collective efforts in solving the problem and celebrate completion of team's task.

Annex 2 – 8D on RFU – Quality Community

Quality Community : Home page

http://proweb.applications.pirelli.com/co/QualityN/SitePages/HOME-PAGE.aspx

Quality Community : Market Quality Page

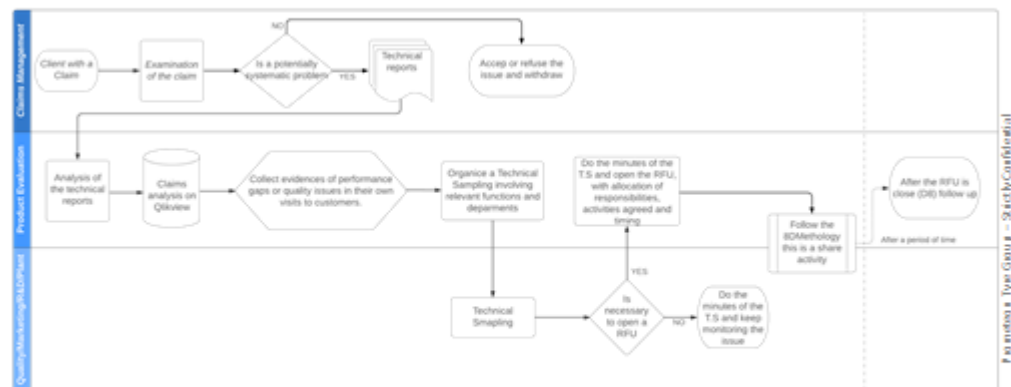## Quality Community : Home page

ALL DOCUMENTS, dedicated page to UPLOAD/MODIFY /EXPLORE and VIEW files, organised in FOLDERS

Quality presence

Product Evaluation work flow

Product evaluation - Rolling Follow Up

1. Product Evaluation Technicians receive information of all warranty claims and collect evidences of performance gaps or quality issues in their own visits to customers. Based in these evidences, Product Evaluation Technicians collect samples of products that support a request of improvement /corrective action.
2. Product Evaluation technicians evaluate statistical data of complaints in order to support the request of improvement / corrective action.
3. Product Evaluation organises technical samplings, involving relevant functions and departments to ensure the adequate analysis of specific issues, compiles summary of technical sampling meetings, including the description of the issues, available data, definition of needed additional analysis, allocation of responsibilities, activities agreed and timing, for each step (D phase) of the problem solving process.
4. Include the issues and activities in the Rolling Follow-Up Application from the web-application (Quality Community, that follow the 8D Methology)

Rolling Follow Up - page

Gantt Chart – Done manually by HQ Milan

Descriptions and actions of the RFU open
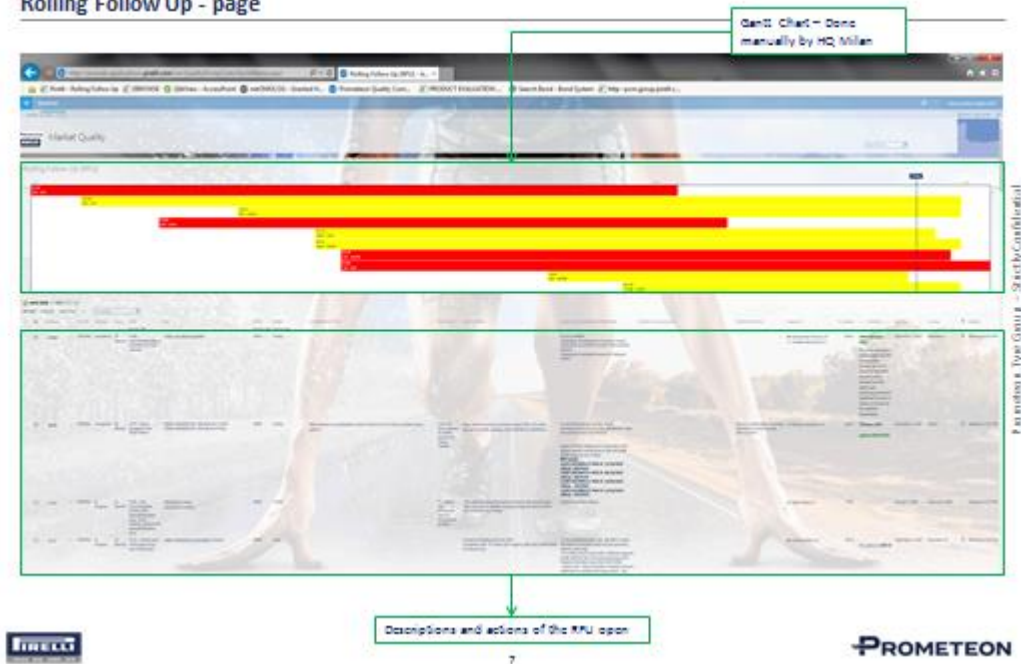
RFU

An improvement done about the Rolling Follow Up:
* Start following the 8D methodology.
* This new format started on HQ Milan on July'2019.
* All the issues that where on the RFU HQ Milan's excel file, were moved to this format and start the follow up and is compiled by PBv manager with the collaboration of the involved areas.
* It is possible to see the attached files and the whole activities done

How to open a new RFU

2 ways to open an RFU

Will direct you to a new page

How to fill the RFU

It is possible to see the attached files and the whole activities done

Start date of the RFU and
The expected due date of the RFU

- Symptoms = perceived abnormality
- The things that can been seen from the market are the way to describe the symptoms, example:
    Vibration claims
    Sounds
    Presence of a bulge on the SW

Priority (low/normal/high)
and status
(complete/process/not started)

Sizes involved on the following format:
"IPCodeS – Material Description"

Tracking number: The initials of the plant and the sequential number
Gravatai: GR-01
Izmit: IZ-01
Santo Andre: SA-01
Alessandria: AL-01
Acolus: AB-01

Responsible of the RFU the leader of the project

Status of complete (%)

Plant where actions are taken

Market that are complaining:
Example
EGYPT
EUROPE (SPAIN–ITALY)
TURKEY
MEA

How to fill the RFU

Define, verify and implement the Interim Containment Action (ICA) to isolate the effects of the problem and protect the customer, until Permanent Corrective Actions (PCA) are implemented. For this is necessary to register all the actions taken and date implemented.
Example:
Increase of technical support to Customers – 15/11/18

Implement the Permanent Corrective Actions to remove the root cause and solve the issue without causing undesirable effects. For this is necessary to register all the actions taken, the iPcodes involved and date of implementation (DOT or NDM#)
Example:
NDM 19141: Change tread to SCOT-UFA, change Vulcanization schedule (DOT4518)

CONTAINMENT ACTION

ROOT CAUSE
Find the Root cause: single reason for the problem.

DONE ACTIVITIES
Activities extras to find the correct actions:
Describe the actions and the date of implemented

PREVENTIVE ACTION

CORRECTIVE ACTION/RECOMMENDATION

After all the analysis done, make a brief description specifying how this issue and the root cause can be prevented, to prevent the occurrence.
Example:
It was extended to all the sizes 24.5 – NDM#/85P#

REMARKS
If necessary to clarify something
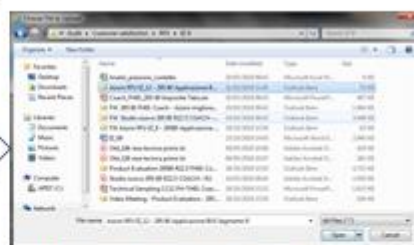
11

PIRELLI · PROMETEON

How to fill the RFU and add files as support of the RFU

This button helps to add support documents like tests, analysis, presentations and/ or mails.
After click the following case opens:

Click on browse

Select the file → click on Open → click on OK

REMARKS

ISSUE

VALIDATE Corrective Actions

RFU TYPE

For an easy search is important to write the Claim code as the following example: "CC49 - Concentrated/Diffuse Undulations on the Sidewall"

When the alternatives are chosen is important to measure the effectiveness of the PCA's, date of validation after actions implemented
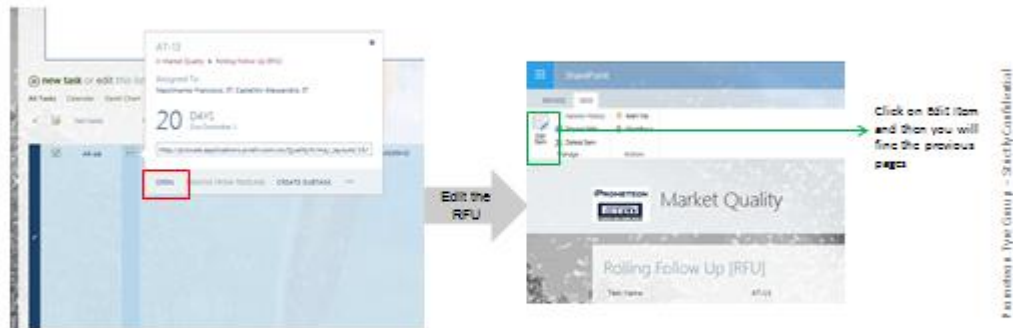
Central is for RFU open by HQ Milan
Local for RFU open by Local Quality

When is done click on SAVE!

12

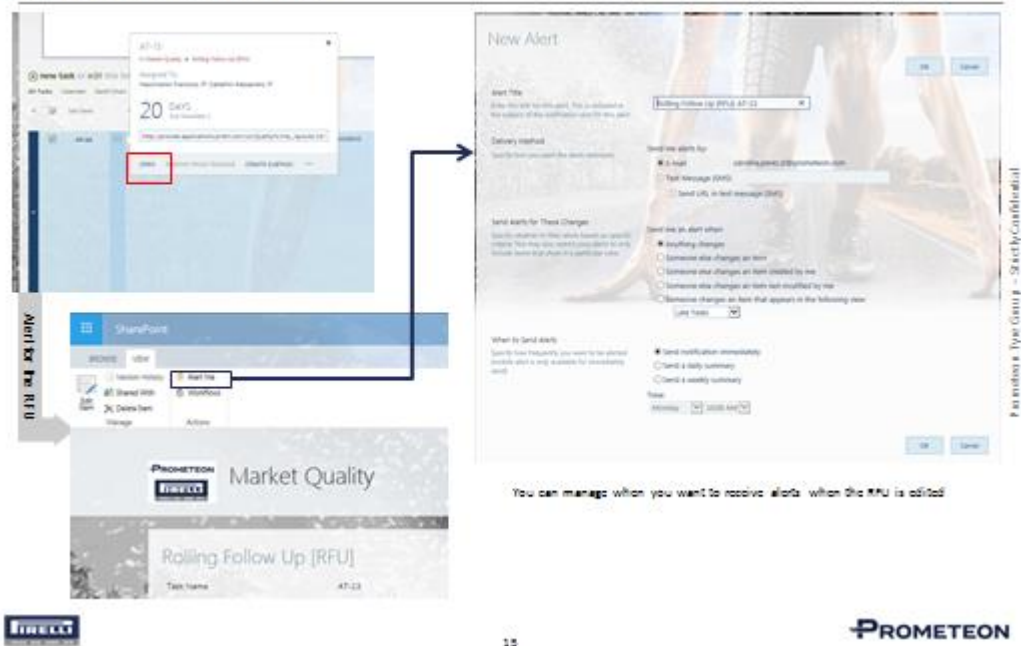PIRELLI · PROMETEON

How to Edit a RFU

Edit the RFU

Click on Edit item and then you will find the previous pages

How to receive alert for a RFU

Alert for the RFU

You can manage when you want to receive alerts when the RFU is edited

Si attesta che il giorno
18 aprile 2019

GUBO
Società di Consulenza Aziendale S.r.l

CAROLINA PEREZ

ha seguito con profitto il corso:

"Metodologia di Problem Solving 8D"

Cubo Società di Consulenza Aziendale Srl

BEDAUX

12. REFERENCE

Scientific publications:

(MarketLine, 2019) Market Line Industry Profile: Tyres & Rubber in Global." Tyres & Rubber Industry Profile: Global, Mar. 2019, pp. 1–37. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=bth&AN=136076926&lang=es&site=ehost-live.

(WCE, 2010) A. Riesenberger & D. Sousa "The 8D Methodology; An Effective Way to Reduce Recurrence of Customer Complaints?" – Proceedings of the World Congress on Engineering 2010 Vol III, 2 July. 2010

(CzOTO 2019) "Solving Selected Quality Management Problems with The Use of The D4 Discipline Algorithm of The G8d Method" – Sciendo volume 1, issue 1, pp. 996-1003, 28 Jan. 2019.

(ETRMA, 2017) Statistics "European Tyre &Rubber Industry" March, 2017, http://www.etrma.org/uploads/Modules/Documentsmanager/20180329---statistics-booklet-2017---alternative-rubber-section-final-web.pdf

(QPI, 2018) Knop, Krzysztof and Mielczarek, Krzysztof. 2018. "Using 5W+1H and 4M Methods to Analyze and Solve the Problem with the Visual Inspection Process". MATEC Web of Conferences 185, 03006. DOI: 10.1051/matecconf/201818303006

(IManEE, 2006) Luca Liliana "A new model of Ishikawa diagram for quality assessment", 2016, University" Constantin Brâncuşi" of Targu-Jiu, Str. Eroilor, No.30, Romania

Websites:

(Fletcher, 2018) "State of the Commercial Truck Tyre Market: Present & Future." Maintenance - Work Truck Online, 6 Nov. 2018, www.worktruckonline.com/318677/state-of-the-commercial-truck-Tyre-market-present-future.

(ISIXSIGMA, 2016) Editorial iSixSigma "Determine the root cause: 5 whys", https://www.isixsigma.com/tools-templates/cause-effect/determine-root-cause-5-whys/

Governance Web page of Prometeon Tyre Group https://www.prometeon.com/it-it/company/governance.php

Courses:

Material given during the course "Metodologia di Problem Solving 8D" on April, 2019. Cubo Società di Consulenza Aziendale Srl.

- Material course based on the following manual:

(Results, 2008) Results Consortium Limited "8D Manual - Understand the problem Use a team approach Share the lessons learnt" Essex, England: http://cdn2.hubspot.net/hub/170850/file-18472412-pdf/docs/global_8d_workbook.pdf

- Material course based on the following book:

(D&A, 2017) Donald W. Benbow, Ali Zarghami. "Introduction To 8D Problem Solving Including Practical Applications and Examples". Spiralbound, 60 pages, Published 2017