

THE INTERVIEW RESEARCH METHOD TO STUDY THE SORTING PROCESS IN THE PLANTS OF A GLOBAL AUTOMOTIVE COMPANY

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Abstract: The sorting process, in the technical documents, can also be found under the following names: inspection, control, sorting or verification. All different forms refer to the same activity of supplementing production by ensuring and validating the conformity of the products made. The sorting process within the industry plays an important role, representing the last chance to ensure the conformity of the manufactured products. This article presents an investigation method – the interview, through which the inspection process in the component factories of a global company in the field of the automotive industry was evaluated. This investigation is part of a large project to improve and standardize the product verification process at a global level.

Keywords: sorting, interview, automotive industry, research

1 INTRODUCTION

In the books based on the study of quality management, the following ideas were identified as definitions and basic principles of the sorting process: the first being represented by Kimball who says: "Inspection is the art of comparing materials, products, or performance with established Standards" (Sharma D.C., 2017).

Another definition of this process is the one given by Alford and Beatly: "Inspection is the art of applying tests preferably by the aid of

measuring instruments to observe whether a given item or product is within the specified limits of variability" (Kiran D.R., 2016)

The main objective of this research is to identify what is the approach to the sorting process in the company locations, continuing through the development and applicability of the new process by defining a procedure, standardizing the documentation and monitoring the process.

The expected result is to have an overview of all the studied company locations and a new

needs-based sorting process that brings the desired benefits.

2 THE OBJECTIVES OF THE SORTING PROCESS

The sorting process is used to help a company's managerial decisions to accept or reject a process to support the required quality standards, having as main objectives (Kiran D.R., 2016) (Raghavendra N.V., 2013):

- Identifying errors in a manufacturing process and solving them by reporting to the concerned department;
- Stopping the production of defective goods if they do not meet the accepted quality standards;
- Ensuring that inferior quality products are not delivered to the customer, thus affecting the following marketing markets, thus ensuring the relationship with the customer;
- Helping the company to increase its reputation and quality by maintaining good quality standards;
- Supports product development departments by documenting and recording product performance information
 - Reducing the total cost of production;
 - The purchase of raw materials, good quality equipment that leads to the final quality assurance;
 - Collecting information for further decisions and analysis;
 - Satisfying regulatory or procedural requirements imposed by industry-specific standards;
 - If quality problems are identified, it helps to: identify the problem, prevent its recurrence by implementing corrective and preventive actions in the causative process, and if possible, eliminate the triggering problem;
 - The increase of the production company in the competitiveness class in the developed field by eliminating the blocking phases and adopting

new and more suitable techniques for production.

3 STUDY OF SORTING PROCESS IN HIRSCHMANN AUTOMOTIVE FACTORIES

3.1 About Hirschmann Automotive

The study of the research work was carried out within the global company in the automotive field: Hirschmann Automotive SRL. The company has been active in the field for over 60 years, having 12 locations worldwide. The headquarter is in Austria, and 6 other production plants distributed on all continents: Romania, Czech Republic, Germany, Morocco, Mexico and China and several sales offices, where they work on the progress of the automotive industry with more than 7000 people.



Figure 1. Hirschmann Automotive locations globally

One of the company's main strategies is to be a global player and offer customized products to its customers. The company successfully meets the most difficult challenges in connectors, cable assemblies and sensor systems. In addition, he is an expert in high voltage applications for electric vehicles.

Standard products such as contacts and connector systems, sensors and cable assemblies alongside over-injection technologies together with products customized to customer needs ensure efficiency and endurance under

the most extreme conditions and areas of a vehicle.

3.2 Research – Sorting process in Hirschmann locations plants

The sorting process in Hirschmann Automotive has been present since the establishment of each factory, being adapted and developed according to needs.

In 2019, at the beginning of the project, it was under discussion to visit each location and study how the sorting works, which was accomplished for the factory in Kenitra, Morocco in October 2019. The remaining factories, being planned for 2020 - a year in which due to the Covid- 19 all travel was limited, and at the company level they were prohibited.

In order to solve this situation and advance the project, it was discussed and decided by the project team, the approach of a structured interview in which the sorting coordinators and quality managers will participate, towards the idea of having at the end some relevant questions and answers that can be compared and used for the development and standardization of the researched process. This interview-based approach was applied because although it has a defined structure of questions in a clear and standard way, it allows the interviewees to answer at their own pace and when necessary to develop the discussion towards the clarification of the discussed topic.

The interview is superficially defined as an interaction between two people on a particular occasion, where one acts as an interviewer and the other as the interviewee. The interview is a neologism from the English language: "interview". If this word is separated "inter-view", its understanding becomes easier and is more understandable. "view" - meaning in Romanian: view, so that "inter-view" means a change of "views" between two people conversing about a theme or topic of common interest.

The purpose of the interview is to converse with each representative member of the Hirschmann Automotive location to identify the variables and the relationship between these variables, constituting the main starting point for the standardization project following the collection of information regarding the sorting process approach.

3.2.1 Establishing objectives

The main objective of the interview is to identify using the same set of questions for all members what the current status of the sorting process in all Hirschmann Automotive plants, including what are the major similarities and differences between the plants, to which is added the confirmation of the main need for improvement and standardization.

Another objective of this interview is the creation and foundation of the relationships between the members of the project.

An additional objective would be to develop the experience of the project manager who is responsible and must know the approach to the sorting process in all factories of the Hirschmann Automotive group.

Following the discussions in the interviews, clear evidence is expected to emerge that there are major differences between the factories and that there is no standard to confirm the need to define a standard and its continuous improvement.

The exploratory purpose of this survey method is to identify the variables and the relationship between them, each question constituting an item in the structure of the measuring instrument.

3.2.2 Establishing working hypotheses and questions

Living in this world of continuous development, mainly through the development of technology, the approach of online interviews was chosen, then it was decided by the project

team and company management that an interview and visit to each factory would have a better result.

The type of interview approached in the research being a structured one, having the advantages:

- to be flexible by being able to get specific answers to each question
- higher rate of answers, ensuring answers are obtained by clarifying the question and the topic studied
- ensuring control over the sequence of questions, which has a positive impact on the accuracy of answers
- deepening of more complex situations, by reformulating and discussing the subject.

To ensure the collection of relevant information for the standardization project, a list of questions was created that were applied during the interview. The type of content of the questions in the interview are not of one type, on the contrary - we find factual questions - through which the respondents directly express their observations, opinion type questions - the respondents express their opinion on a defined aspect and not finally, knowledge-type questions - to validate current knowledge on the analyzed subject, namely - the sorting process. As a type of questions, we come across both closed and open questions.

The interview is unique, this involves only one interview between the investigator and the person included in the sample.

In the research carried out, the investigator was the author of the research, and the interviewees: the quality managers of the location. Before scheduling the interviews with the participants, a general briefing was carried out through an email that briefly presented the idea of the project to standardize the sorting process, the role of the interview, the expected results, the manner of the interview, its duration and the duration of all interviews. So that all participants are informed of their significant role in this research and are prepared for the

interview, and then for participating in the development of the project, its testing and implementation in the factories they represent.

Of all the locations of the Hirschmann Automotive group, relevant for the evaluation of the sorting process are the following: Romania, Morocco, Austria, Czech Republic, Mexico and China, as they have integrated the product inspection process.

3.2.3 Defining questions for the interview

This type of interview is not complex in terms of design, and the resulting information can represent some indicators that could also be observed or verified at the scene.

To define the structure of the interview in a structured way, with the help of basic questions: "Where?", "Who?", "Why?", "How?", "What?", "How much?". From my point of view, these questions should be asked before any important project or action, with the help of these simple questions we can evaluate the route and identify the destination we tend to reach.

Starting from the elementary questions, the next step was to define the interview questions based on the main resources identified with the turtle diagram in the previous chapter, including introductory questions before identification and content questions:

- "Where?" - Sorting area - the place that is defined to be used strictly for this product inspection process
- "Who?" - Human resources - Area coordinator, if any; operators designated for inspection; the other support functions - logistics employees, quality engineers
- "How?" - Equipment - all material resources used: tables, chairs, boxes, lamps and special measuring and checking equipment
 - Documents - All forms and documents used to perform the sorting
- "How much?" - Time, Costs and Reporting - All sorting activity is perceived as a service added to the products, because it is not a manufacturing process that adds anything

physically to the products, precisely for this reason, this process is "measured" by operator verification time on a specific product/quantity, then converted into costs and reporting these amounts to management and customers when appropriate.

- "How?" – Communication with production and the action plan – Sorting results need to be communicated to the sorting area so that it can evaluate the results and take the necessary actions to identify and eliminate the causes that led to the cause of the defects.

The basis of the conducted interview is composed of 21 questions, the first ones being to identify the people completing the questionnaire, such as: name, position and factory represented.

Open-ended interview questions are designed to develop answers based on the topic addressed, with an attempt to clarify as precisely as possible what the question refers to, without offering suggested answers. Initially, the interview was constructed with closed questions, but this led to a series of Yes/No answers, after which a discussion was required to develop the answer choice. Of all, only two questions were closed, but with a precoded answer in which the interviewees had to rate on a scale from 1 to 5 the mentioned idea.

3.2.4 Conducting the interviews

As previously mentioned, the limitation of travel due to the Covid-19 pandemic has led to the need to hold part of the interviews online, as previously mentioned. Therefore, the questionnaire of the interviewees was also carried out online.

Each interview, whether it was on location or online, began with the investigator going through the following stages:

- Personal presentation
- Presentation of the project
- Presentation of the objective and purpose of the interview. Proceeding through the

prepared questions and noting the answers to each question.

In the following, the interviews with the members of the Hirschmann Automotive factories are presented.

Interview 1: October 2, 2019 - Târgu-Mureș, Romania

The first interview took place in the location in Romania, Târgu-Mureș, together with the sorting coordinator (the only one at the time from the entire Hirschmann Automotive group) and the quality manager.

Interview 2: October 22, 2019 – Kenitra, Morocco

The second interview was held at the factory location in Kenitra, Morocco with the quality manager. In addition to going through the interview questions, the sorting process in the production area, where it was located at the time, was analyzed.



Figure 2. Sorting station in Kenitra, Morocco

Interview 3: November 18, 2019 – Rankweil, Austria

Interview #3 was conducted in the factory in Rankweil, Austria. This interview was attended, as in the previous case: the quality manager responsible for the production area.

Interview 4: January 8, 2020 – Vsetin, Czech Republic

The last physical interview was conducted in the Czech Republic at the beginning of 2020, before the spread of the Covid-19 pandemic. As in previous cases, the points prepared for the interview and the visit to the sorting area were discussed. Below, you can see a sorting location, located in the production area:



Figure 3. Sorting station in Vsetin, Czech Republic

Interview 5: February 13, 2020 - online

The first online interview was with the factory in San Miguel, Mexico. Although the visit to this location was also planned for June 2020 (later canceled due to the pandemic), the interview was held online, to support the standardization project. The interview lasted for an hour, with the help of the platform available for everyday work, together with the quality leader.

Interview 6: 09 September 2020 – online

The last interview in the series is with the quality leader from the Nantong, China location, it was conducted online with a delay of about 6

months due to the global quarantine due to the Covid-19 pandemic.

This delay affected the progress of the project as time. But also, as a support from the management because after the partial recovery from quarantine all the factories were concerned with the return of production and the focus on productivity, less on the improvement projects.

3.2.5 Results interpretation

The project coordinator had the responsibility to ensure the collection of all responses, and where necessary to clarify the questions.

Within the project, all the answers to each question were analyzed individually and discussed in the project meetings, to simplify the understanding of the answers, since all the answers are in English and use specific Hirschmann terms, the answers are to be presented for each factor:

- Sorting area

In all six factories, there was at least one sorting area. In some, such as Romania and Morocco, there are also 2 areas dedicated to sorting, and in the others only one, which is either in the warehouse or in the production area. In addition to these, special sortings are added for X-Ray machine inspections or that impose rules such as ESD (Electrostatic Discharge) or Cleanliness (minimum product cleanliness requirements), but which are not valid and present in all factories .

The last question regarding the inspection area refers to the desired objective for the sorting area in the factory in question. The answers to this question are so diverse and different, which shows very clearly that every factory wants something additional and standard, some of the answers would be: "Organized, flexibility, documented, traceability, statistical analysis (cost for scrap, hours , order, part, part status)" – Organization, flexibility, documentation, traceability, statistical analyses

- "Assure the 100% inspection and don't have any escape to the customer (catch the NC in

house). It is important to have a systematic process including formats, training, timing, etc." - Ensuring 100% leak free inspection to customers. It is important to have a systematic process that includes formulas, training, timing

- "Reduce the number of the claims, Perform daily analysis regarding the sorting findings, Control the efficiency of the implemented actions" - Reducing the number of complaints, carrying out daily analyzes on the sortings carried out, checking the effectiveness of the implemented actions

- Human Resources

To the questions regarding the human resources participating and belonging strictly to the sorting process, the answers are divided into two large categories: those who have both a sorting coordinator and dedicated and specialized operators for sorting and the category in which there is no coordinator and no dedicated operators, in this case there are cases where the operators checking the products change daily.

If there are dedicated operators for product inspection, they have been selected together with the human resources department in the production area based on work results, skills tests, after which they have been trained on all the products/processes to be checked in the sorting area.

The last question, which as in the previous cases refers to the objective of the factory in terms of the factor in question, human resources in this case, had the same result from all members: to have dedicated operators only for the sorting area.

- Equipment

Workbenches and test equipment are essential in all cases. In factories where there is a sorting area, they also have dedicated sorting tables and only checks are performed on them. In the case of factories where there is no sorting area, it goes without saying that there are no special check tables for this activity, depending on the situation.

For this category, when asked about the need for carts, magnifying glasses, measuring equipment and microscopes, boxes, etc. all 6 responses confirmed that they lack these vital resources to achieve effective sorting.

- Documents

The first question in this category asks the respondents to say what documents they apply in the sorting area, and the answer from everyone is the same: "local documents", i.e. local documents.

In this category, one of the questions was about the idea of digitization of the sorting instruction, and most of the answers, except for one answer, had a value of 5/5.

- Time, Costs and Reporting

Whenever this activity, of sorting, is mentioned, from the management side comes the idea of resources involved, mainly economic, whether they are expressed in sorting quantities, sorting hours, quantities with defects that have been discarded. To the short question: "What were the results of the last year for the sorting process?", come complicated answers. These answers are complicated because when you read them you feel an uncertainty of the answer, and in most cases it comes because the participants do not have the necessary information to answer. For this reason, 4 participants said they did not have the necessary data to answer, 2 participants filled in the sorting quantities.

In the next question, all participants confirmed that they analyze sorting costs on a monthly basis.

Also in this category, one of the questions of the interview, in which I participate people had to write when a product is removed from the sort, that is, after the feature is no longer checked, everyone's answers were different. In some cases this is not defined, in other cases it depends on influences such as cost comparison sorting or how many products need to be checked or whether certain improvement actions have been implemented and are

effective. Continuing with improvement actions, the respondents had to say if there is an action plan and communication between the sorting area and the quality, production and logistics departments. In most cases, there is communication between departments, but defect analysis for defect improvement is done only in a factory. According to the answers in the interview, the defects are recorded, in some cases they are discussed in frequent meetings, but there is no standard and efficient system for this step.

Following the questionnaire, except for one factory where the entire manufacturing chain is technological, and the potential for deviation from standards is minimal, all factories completed the answers to the questions.

On the first three elements: the sorting area, human resources and equipment, it is obvious that out of necessity all factories were forced to have these three resources available in one form or another, but enough to carry out their activity towards the fulfillment of the current objectives: sorting and delivery of compliant products to customers.

Regarding the last resources surveyed, it is very easy to see that it is not a general standard, there is no system that helps factories firstly to document the activity, and then to evaluate it, finally to improve the processes that imposes the need for sorting and which at the same time would streamline both production and the costs currently allocated by the insufficiently monitored sorting system.

Although it is the last question in the interview: "Choose 3 elements that you consider priority for the standardization of the sorting process: procedure, equipment, documents used, reporting method, personnel management, organization of the sorting area, communication between the sorting area and production, others.", this had a significant role in the progress of the standardization project, because it determined the first steps in the standardization of the sorting process, namely:

The documents used, followed by the procedure and the reporting method.

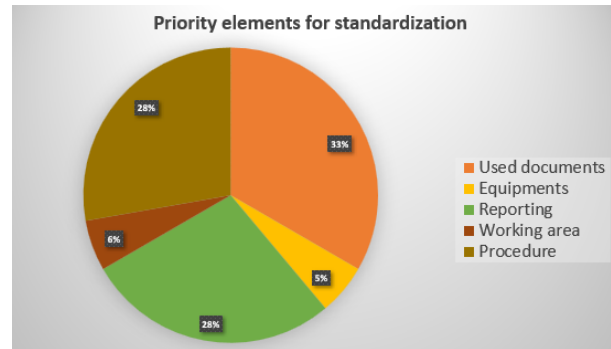


Figure 4. Results of next elements for standardization

3.2.6 Research conclusion

According to the results of the 21 questions in the interview, in all factories most products are checked only visually, a few exceptions are in factories in Romania and Morocco where products are checked with the help of an X-Ray machine in exceptional cases. The big difference that appears in several questions in the questionnaire is related to the documents, that is, each factory uses its own version of the instruction for sorting and documenting quantities, hours and costs.

Through a primary analysis of this interview, it is evident the need to standardize how to apply a sorting instruction, then how the resulting data is collected, analysed and used in action plans for improvement. The major problem in this standardization process is the application of local documents in each plant, which indirectly leads to differences in the application of methods, of different interpretation both by global management and by common customers between plants.

Following the interviews, the lack of a methodology for documenting the sorting results in all factories was obvious. The qualitative analysis of the questionnaire shows us, the fact that all the people that were a part of the questionnaire accept and want the need for

improvement through standardization, even digitalization of the process towards the development of the process, the quality of the products, the increase of customer satisfaction and the increase of profitability.

Using the interview method as an information gathering tool, we identified some advantages and disadvantages.

Benefits:

- Imposing and ensuring standardization of response conditions
- The flexibility to see in 4 out of 6 cases what these sorting areas look like
- Documentation of all responses in a common location, with the possibility of comparing them
- Ensuring control over the formulation and sequence of questions
- Accomplishing the proposed objective in a short period of time

Disadvantages:

- The impossibility of consulting the mentioned documents in the two factories where the trip was limited
- Answers may be influenced by the condition of the person questioned
- The vagueness of some answers imposed by the language in which the questionnaire was composed, different in all cases from the mother tongue.

In conclusion, the interviews carried out achieved the proposed objective at the beginning, that of identifying the current stage of the sorting process in the Hirschmann Automotive factories based on the main factors: inspection area, human resources, equipment, documents, time-costs-reporting and confirming the need for improvement and standardization globally.

4 CONCLUSIONS

The main and most significant objective of this study was to analyze, compare and summarize the state of approach to the sorting

process in the Hirschmann Automotive factories globally, towards the definition and proposal of a standard model to meet the requirements and needs of the factories.

The study carried out was in the form of interviews with the group's manufacturing plants, some of them were carried out through a site visit, and others through an online discussion after the emergence of the Covid-19 pandemic.

As a conclusion, we can say that the applied research method, that of the interview, in this case was effective and the objective was achieved. The great advantage being the fact that the interviewed people know the subject discussed and it was in everyone's interest to actively participate in this study towards the realization of the global standardization project.

I believe that this study can be used as an example by other companies in similar situations, even if is another subject and different adaptations are needed.

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