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IMPLEMENTATION OF APQP AS A DEFECT PREVENTION MEASURE IN AN AERONAUTICAL INDUSTRY ORGANIZATION

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Abstract: *This scientific paper aims to address advanced product quality planning in the aerospace industry company. The aim consist to highlight the relevance of implementation of measures to prevent defects in the organization in terms of APQP methodology. The first part of the study addressed some introductory aspects of this concept, along with a description of its main elements. The second part contains personal points of view through which the importance of advanced quality planning of the products used in project management was highlighted.*
Key words: *organization, APQP, aerospace industry, prevention, defects*

1. INTRODUCTION

The organization in which the research was carried out is one of the main producers of extruded parts for the aeronautical industry. Among the most important we can mention Airbus, Boeing, Bombardier, these being the final manufacturers of aircraft. The organization has evolved over the years, so it has arrived to produce the entire technological flow, from the preparation of alloys to assembly.
The organization's quality policy aims at making safe products of the highest quality and delivering them on time to internal and external customers. This can be done by meeting customer requirements, complying with applicable specifications and standards, and continuously improving the quality management system. At the same time, compliance with applicable laws and regulations and continuous improvement of the work of each employee is required in order to reduce the number of inconsistencies, conduct programs to inform employees about the importance of quality, and clearly define quality. targets and goals. for all employees, solving team challenges to emphasize the knowledge and experience of each employee, making decisions based on objective data, promoting a culture of quality for all employees so that they know that they must comply with all established internal procedures.

2. ABOUT QUALITY AND TOTAL QUALITY

Quality is a set of characteristics of a product, activity, process, organization, person called entity, which gives them the ability to meet the requirements expressed or implied.
The product considered in accordance with this standard can be any good material resulting from a manufacturing process or any intangible good, which can be a service of any kind.
Quality management is the set of activities of the general management function that determines the quality policy, objectives and responsibilities and implements them within the quality system through tools such as quality - planning, control, assurance and improvement.
Total quality is the set of principles and methods brought together in a global strategy implemented within the organization to improve:

- Quality of products and services;
- Quality of its operation;
- The quality of its objectives.

Quality refers to the actual quality of the product or service offered, while total quality refers to

the entire activity of an organization to which it should do to decisively influence not only the opinion of their intermediaries or end consumers but their entire Reputation. Here are included all the functions of the organization, all the collaborators, the customer-supplier relations, the improvements, the whole life cycle of the product from its conception to its destruction [1].
In the analyzed organization, among the measures taken to improve quality, there is the application of the APQP system for new or modified products.

3. ADVANCED PRODUCT QUALITY PLANNING

Advanced Product Quality Planning (APQP) is a process developed in the late 1980s in response to the development of automotive tools in the Far East, in particular the response of major American automakers to tools that simplify production. and quality developed by Japanese automakers, a committee of experts gathered around the "tidal triad" of the American auto industry: Ford, GM and Chrysler.
APQP borrowed several military industry risk analysis tools. APQP is now a mandatory requirement in the automotive industry for all suppliers of the top three manufacturers in the US when developing new products. AIAG now includes, in addition to Ford, GM and Chrysler, as well as Japanese manufacturers such as Totyota, Honda, Nissan and most of their suppliers [2].
Major aviation players will form a committee and develop a similar standard for use in the aerospace industry by the end of 2016, the AS9145 APQP/PPAP aviation standard published in 2017 [3].
The purpose of advanced product quality planning (APQP) is in the following areas [4], [5]:

- provides a structured approach with a defined outcome to ensure that new products meet the needs and desires of customers;
- use project management to obtain timely and quality product delivery by tracking key project deliverables;
- use a cross-functional approach to support effective participation and communication;
- develop proactive and preventive thinking.

The proof of APQP implementation in the work package is the production part approval process file.
On fig. 1 shows a conceptual illustration of advanced product quality planning [6].

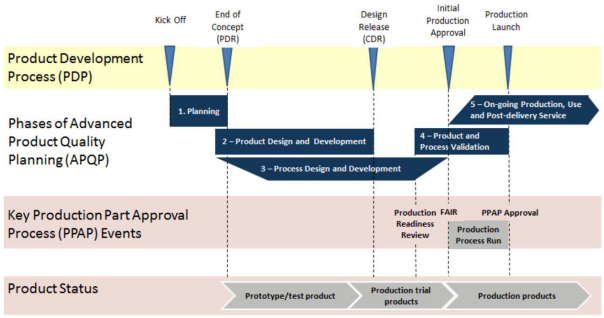

Fig. 1. Conceptual illustration of advanced product quality planning

Advanced product quality planning includes 75% preliminary design and 25% implementation in production to determine the degree of customer satisfaction and continuous improvement [7].
The benefits of an advanced product quality planning system are not without cost. Improved product quality planning requires sufficient time and resources and, at the same time, a trained team to effectively achieve the goal [8].
Advanced product quality planning cannot be successful without three main pillars. On fig. 2 shows a clear illustration of this. So, the pillars:

- Organizational commitment and management support;
- Multifunctional team;
- Efficient APQP project planning.

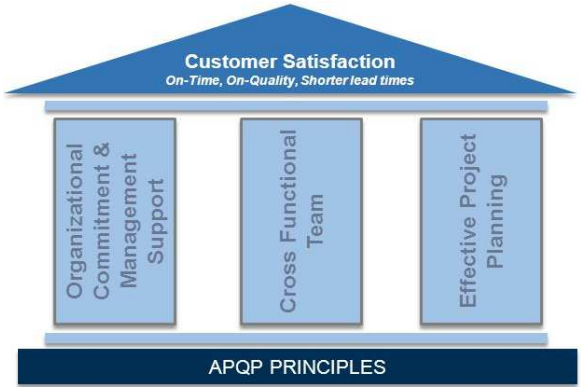

Fig. 1. Main pillars of APQP

APQP principles can only be applied within organizations with the involvement of the entire organization. Thus, the APQP principles are based on three pillars, which include the commitment of management to ensure that the cross-functional team is involved in the planning of APQP projects.

4. THE PREVENTION CONCEPT

The highest-level management assumes the implementation of the total quality management system, for which it must allocate financial and human resources. It will appoint a quality manager, who will form its implementation team. Financial expenses can be called quality expenses, they represent 12-15% of the total production expenses. The highest-level management is the guarantee that the system will be implemented and will work, it will intervene whenever there are blockages [9], [10].

The implementation of APQP is a measure to avoid errors, it is desirable that the work be done first. APQP is a structured method to ensure that the necessary measures are taken to meet the needs and requirements of customers, the system is based on the rationalization of product quality, has a preventive approach. APQP connects the customer with the designer and supplier so that everyone knows what they want and how the product should look like in the end.

Non-quality means products with quality problems, including recoverable and non-recoverable non-conformities [11], [12]. The group of elements that make up non-quality may include: scrap where there are material and labor costs, re-inspections, retests where there are labor costs, losses suffered by the organization due to lower product prices due to poor quality is also a measure of non-quality, penalties incurred by the manufacturer as a result of non-fulfillment of forward contracts, expenses in the service of spare parts and labor [13], [14]. All these elements of non-quality produce financial losses within the organization and they must be kept under control, most companies do not calculate these losses, these losses are calculated when the organization implements total quality management [15], [16]. Non-quality can also be called super-quality when it is not required by the customer, because the product must strictly fall within the limits required by the customer, which pays the customer.

Total quality management considers how a quality-oriented organization operates, based on the participation of all its members and aimed at long-term success through customer satisfaction, as well as benefits for all members of the organization [17]. Total Quality Management is a business management philosophy that deals with continuous improvement and customer satisfaction, is a continuous development management system consisting of values, methodologies and tools, the purpose of which is to increase internal and external customer satisfaction with reduced resources.

The principles of total quality and total quality management involve:

- Preventive attitude, preferential to corrective attitudes;
- Harmonization of the influences of all factors: suppliers, customers, etc.
- Development of an adequate information system;
- The harmonious association of managerial management with participatory management.

4.1 Preventive, preferential attitude towards corrective attitudes and implementation of APQP

This is a preventive action because certain steps must be followed before starting production:

- planning - the initial data of the project are collected and the structure of the project is established (requirements for the product and process, main participants, main tasks and planning deadlines);
- product design and development - the product is designed taking into account all identified requirements and risks;
- design and development of processes - production processes are developed taking into account all identified requirements and risks;

- product and process validation - check if the process produces the specified product at the required rate;
- production - improvements continue using lessons learned from new APQP projects.

Also, as a preventive action is the use of visual cues in certain work phases, so the operator knows exactly what he has to do, the implementation of 5S is a preventive action because the operator will have on the worktable only what is strictly necessary to carry out his work in good conditions.

4.2 Harmonization of influences of all factors - suppliers, customers

Factors are agreed between customers and suppliers considering the requirements of both parties and in a transparent manner so that the customer can check the supplier to ensure that the product is manufactured in accordance with the requirements and standards. The customer is open to the supplier if he encounters production problems, incomplete or incorrect documentation.

4.3 Development of an adequate information system

For an organization to achieve total quality, it must have a well-established computer system so that the relationship between the buyer and the supplier is constant, the client at any time knows the status of each order and the presence of certain qualities. he has problems with them. Every organization must have an internal system where they can track the status of production orders, processing options, available capacity, and so on.

4.4 The harmonious association of managerial management with participatory management

Participatory management means that employees contribute to and influence decisions that affect the organization. Appointed managers have ultimate responsibility and accountability for decision making, but employees who are affected by these decisions are actively required to provide information, analysis, suggestions, and recommendations in the executive decision-making process. The benefits of this type of management are that employee loyalty will increase if they feel useful and needed, if they feel respected, and if they feel their opinion matters.

Managerial management is when the manager gives directions on what to do and how, and subordinates are informed of what is expected of them and how they should carry out their work.

There must be a harmony between the two leadership styles, so operators must be encouraged to come up with ideas for improvement so any newly implemented way of working will be more easily assimilated by operators knowing that they also participated in that improvement, but operators must he knows the directions that the organization will follow in the next period, important management decisions to which they do not have access, they are only informed about them.

5. CONCLUSIONS

In authors opinion, the total quality starts from the management at the highest level, they being responsible for ensuring the necessary conditions / resources to reach the level of zero defects performance.

The total quality starts from entering the factory and more than that I would say that even before entering the factory.

The total quality starts from outside the factory both from the perspective of the quality of life led by the employees and from the perspective of the quality of the products supplied.

The concept of prevention adopted by the organization aims at advanced planning of the quality of the supplied products, which means nothing but prevention.

From the traditional method of industrialization of products within the organization, it was passed to the industrialization of products following the APQP methodology.

This consists of a 5-step / large-phase approach, in which certain activities are performed depending on their applicability.

Total quality management in the organization, for this it must commit that it will unlock financial and human resources that will deal with this implementation, will intervene whenever blockages occur, will state the quality

policy at the organization level, will set up the department of quality that will handle implementation, will appoint the director of this quality department, will promote quality improvement activities, train staff and recognize their merit.

For adherence to the promotion of the quality of all staff, at all functions and at all levels, all staff must be educated in quality, either by pursuing individual objectives or by continuous improvement working groups, involving staff from all departments and all levels. , so that all staff are involved.

In order for there to be a rational action to improve quality, the following data need to be collected:

- defining quality in quantitative terms;
- measuring the quality, by purchasing data within the level of non-conformity, of the delivered products, by reporting to the customer's needs, searching and
- analysis of the causes of non-compliance using classical methods and tools (brainstorming, consensus, Pareto diagram, cause-and-effect diagram, etc.), elimination of the causes of non-compliance with the help of preventive action plans that provide for supervision over the elimination of the occurrence of the same effects due to the same the same factors.

It is important not to incur unnecessary expenses, ie not to improve the quality more than necessary, when the customer's requirements are met the product is considered to be compliant.

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Implementarea APQP ca măsură de prevenire a defectelor într-o organizație din industria aeronautică

Această lucrare științifică are în vedere abordarea planificării avansate a calității produselor într-o organizație industrială din domeniul aerospațial. Scopul este de a evidenția importanța implementării unei măsuri de prevenire a defectelor în organizație prin prisma metodologiei APQP. În prima parte a studiului s-au abordat câteva aspecte introductive privind acest concept, alături de descrierea elementelor principale a acestuia. Cea de a doua parte conține puncte de vedere personale prin intermediul cărora s-a evidențiat importanța planificării avansate a calității produselor utilizate în managementul de proiect.

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