IMPORTANCE OF KNOWLEGDE MANAGEMENT WITHIN THE APQP PROCESS IN AUTOMOTIVE INDUSTRY

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ABSTRACT: The Advanced Product Quality Planning APQP process is a highly complex knowledge intensive undertaking that defines which actions need to take place and at which times within the product development cycle. The results of this procedure are of great importance to the organizations within the automotive industry and other industrial areas. Efficient and effective products and processes lead to organizational growth and competitiveness on the world stage. It is for this reason that companies must take great care when it comes to extracting and effectively delivering the most amount of knowledge from said, APQP procedure. The more knowledge is present and utilized within a company the better the processes and products it creates, the direct result being increased customer satisfaction and organizational performance. This new and improved knowledge can be achieved thru a number of tools such as the PERT Method, Flow Diagrams, Critical Path Method etc.
KEY WORDS: Knowledge Management, APQP, PERT Method, Model.

1 INTRODUCTION

Advanced Product Quality Planning (APQP) is a dedicated quality planning model, whose main objective is achieving a standardized, easily replicable, all inclusive path for product and process design and development, to be implemented in a varied array of industries. It has found its birth in the automotive industry as a collaborative effort by Ford, GM and Chrysler to close the product quality gap that divided them from their Japanese counterparts. The APQP procedure is divided into five main phases each comprised of a myriad of activities and sub-activities. The way in which it is visually presented can be seen in Fig. 1.

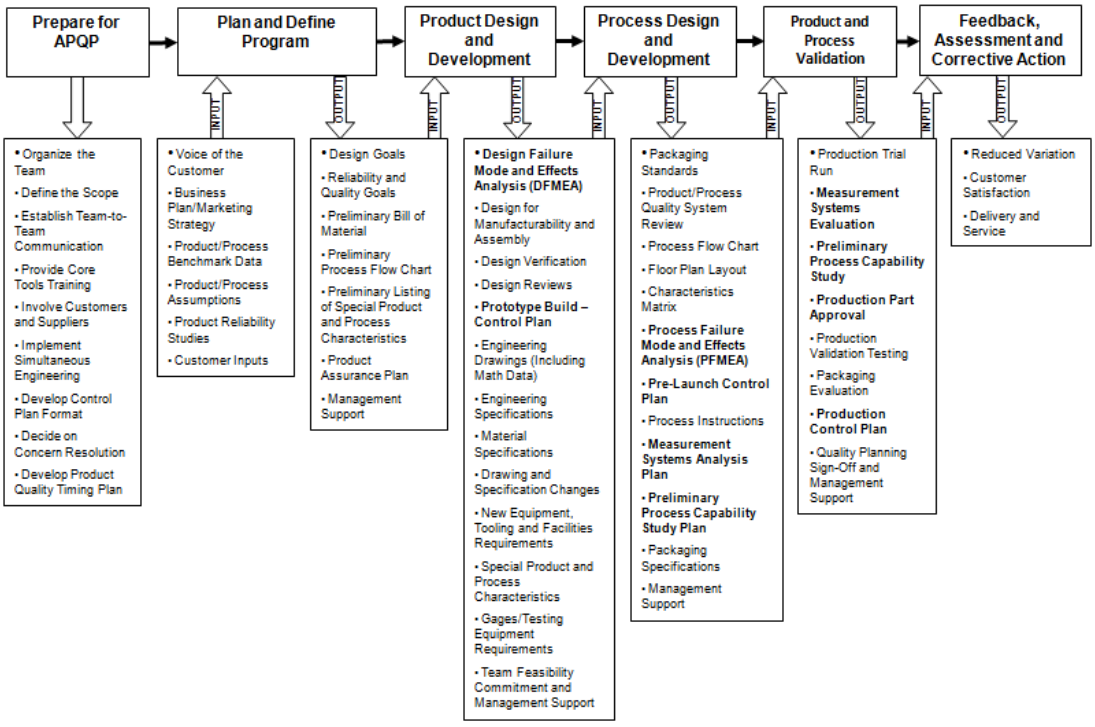

Figure 1. APQP (Docstoc, 2011)

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The main phases as seen in the figure are Plan and Define, Product Design and Development, Process Design and Development, Product and Process Validation, Feedback Assessment and Corrective Actions. The first three of its five phases are devoted to preliminary planning, product design and manufacturing process design. The fourth phase includes the trial production runs, data collecting and the PPAP. The fifth phase is for assessment and for making any production changes that are necessary or that would improve the product.

APQP supports product development teams by outlining tools and methodologies that aid in managing and directing resources in order to identify required changes early in the development cycle, avoid late changes (which are generally more costly), and provide high quality products, on time and on budget. Benefits of the APQP process are considered to be the reduction of the complexity of product quality planning by providing a common format and the provision of a means by which suppliers can communicate with their sub-contractors and/or vendors.

The APQP process is an important part of the product development cycle because it places emphasis on planning at the onset of a program by focusing the team's attention on product and process validation. This focus progresses into a continuous improvement mode after the launch of the product. The focus of this post launch continuous improvement mode is to improve the product, reduce product costs, and increase manufacturing efficiency.

So we can easily state that a well conducted APQP procedure leads to significant benefits for organizations in the automotive field and also in other areas of industry.

One of the most important and worst used resources at the disposal of companies is knowledge. In today's knowledge economy this resource represents the primary source of competitive advantage (Drucker, 1993). Although the importance of organizational knowledge has been acknowledged by most if not all the competitors on the economic stage, it is still very poorly managed.

Knowledge Management is the planning, organizing, motivating, and controlling of people, processes and systems in the organization to ensure that its knowledge-related assets are improved and effectively employed (King W. R., 2009).

Ho (2009) suggested that the goal of knowledge management is to deliver the right knowledge to the right members at the right time so that they can take the right actions and improve performance.

Knowledge management is a part of the field of management studies but it is also closely integrated with information and communication technologies (Mihalca, Uta, Andreescu, & Intorsureanu, 2008). This is because of the critical role that technology plays in enabling and supporting the practice of knowledge management thru information systems and social support (Becerra-Fernandez & Sabherwa, 2008).

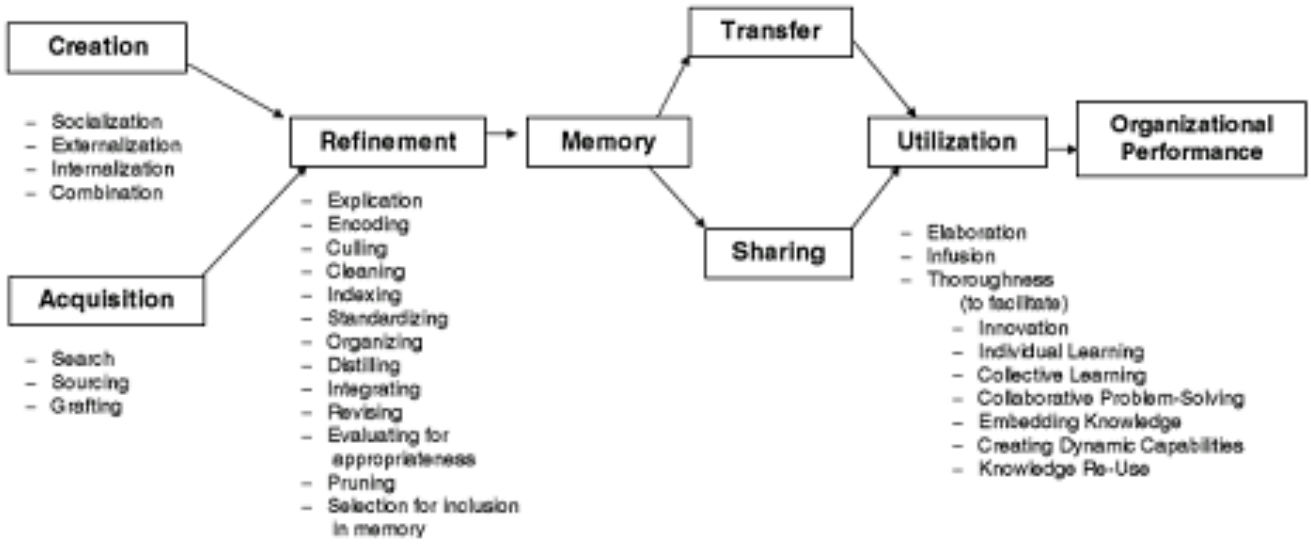

Figure 2. Knowledge Management Process Model (King W. R., 2009)

Others recognize the importance of technology but also caution that knowledge management activities should ultimately be about the human beings and the processes they utilize to capture knowledge (Boomer, 2004). An interesting phenomenon that has been brought about by the development of communication technology (wikis, blogs, tweets) is the development of decentralized, un-hierarchical, increasingly independent `knowledge communities in organizations (McAfee, 2006). These horizontal networks have the capability to cut across organizational boundaries and connect formally isolated professionals facilitating knowledge generation and dissemination (Bate & Robert, 2002)

The processes of KM involves knowledge acquisition, creation, refinement, storage, transfer, sharing, and utilization. These steps are depicted in the Knowledge Management Process Model presented in Fig 2. These activities are crucial in achieving increased organizational performance. For this reason this paper presents a few techniques that increase the knowledge of participants in relation to the APQP procedure.

2 APQP DETALIATION

2.1 APQP Phases

The APQP standardized procedure is composed of five main phases, preceded by a preparation phase.

In the Plan and Define stage the market is carefully scrutinized as to ascertain the exact needs and wants of the customer. Studies need to be conducted in report with costumer needs, proper marketing strategies, competition benchmarking, products and processes etc. These shall be analyzed and translated into requirements and specifications. When the organization is convinced that everything makes sense from a cost, quality and delivery point of view the stage is completed.

In the Product Design and Development based on the knowledge gathered (requirements and specifications), in the previous stage work on the design of the product is undertaken. This represents a laborious and complicated procedure on whose outcome depend the fortunes of a manufacturing organization.

The Process Design and Development stage is realized concomitantly with the previous one. While the organization is designing the product it must also carefully consider the processes by which said product will be brought to fruition. Manufacturing engineers are tasked with the development of processes so as the end product can be realized and delivered in accordance with requirements.

In the Product and Process Validation section the product is being created for the first time using the tools and techniques developed previously. At the end of this phase, once the product and process is validated and controlled properly the PPAP takes place.

The Feedback, Assessment and Corrective Action is the fifth and final phase actually occurs during all previous phases. Every new knowledge gained in accordance to the product and process must be recorded and stored so that the next iteration of this or a similar process (for a similar product) will be faster and also easier for the interdisciplinary project team.

2.2 APQP Flow Diagram

Figure 1 presents the activities of the APQP process in a static manner and does not help in understanding their exact precedence or the ways in which said activities interact and influence one another. For this reason when a first time user comes into contact with the model they acquire a limited amount of knowledge. In order to improve the situation a number of process flow diagrams have been designed by the author.

Their main objective is to provide a roadmap as to the exact precedence and relationship that exists between varied activities within the APQP process.

The modeling of said process flow diagrams has been achieved utilizing a well known and widely utilized modeling language the Business Process Modeling Notation which is present as a communication visual aide and knowledge facilitator in organizations that operate in all industrial areas of interest.

Its objective is to provide a standard for modeling, implementation and execution of business processes. The simple graphical aspect in which the processes are presented is an advantage when it comes to the different stakeholders involved in the planning phase: technical developer, business analyst, business manager etc, which can easily grasp the basic concepts of this modeling technique and thus communication and other misunderstandings are eliminated. Thereby, BPMN provides the opportunity to represent the whole process landscape of an organization and their connection with their activities and information flows.

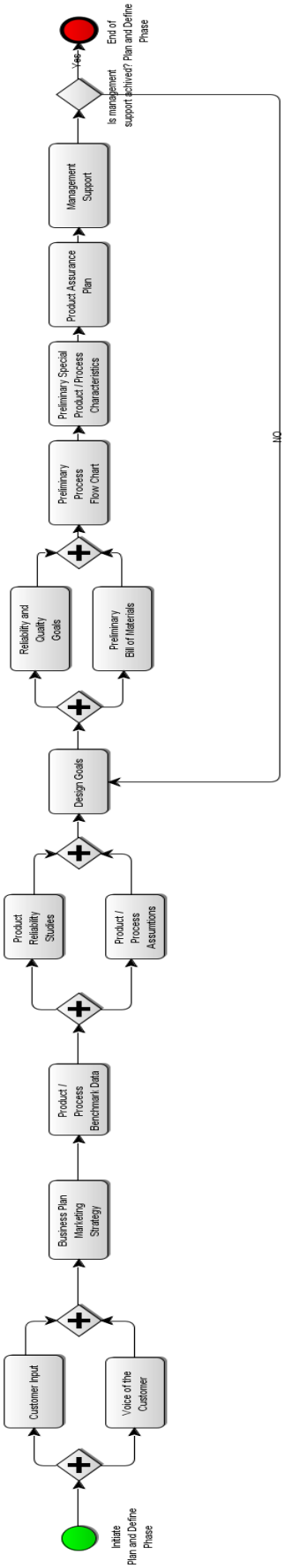

Figure 3. APQP Plan and Define Process Flow

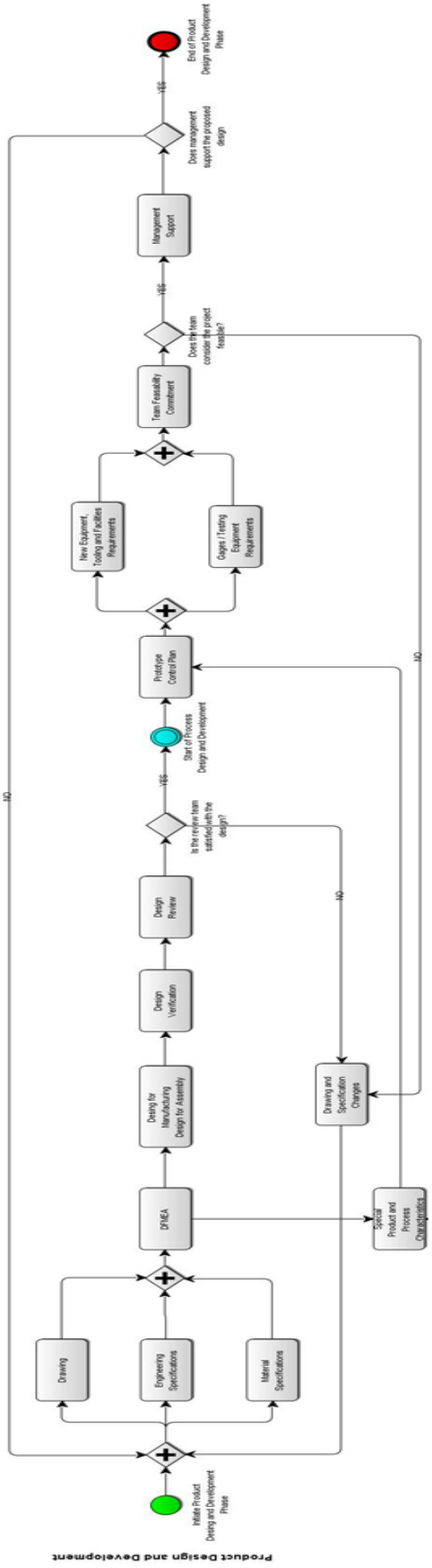

Figure 4. APQP Product Design and Development Process Flow

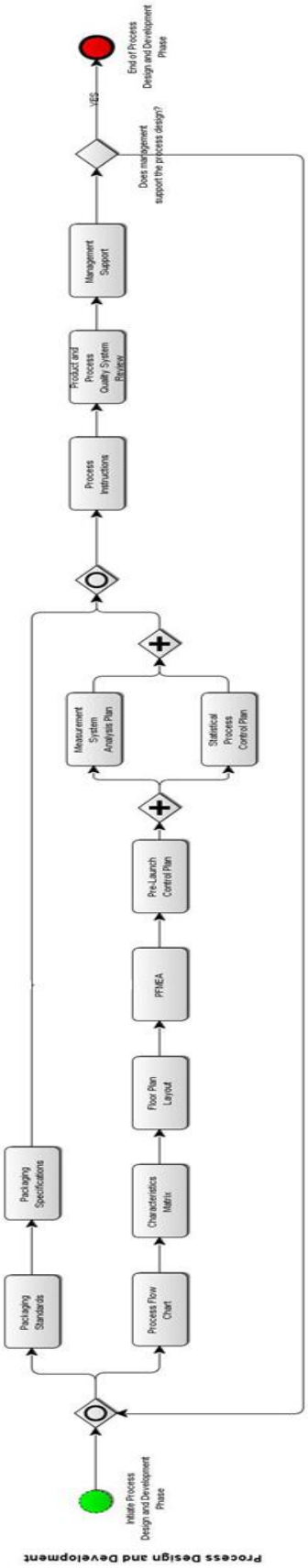

Figure 5. APQP Process Design and Development Process Flow

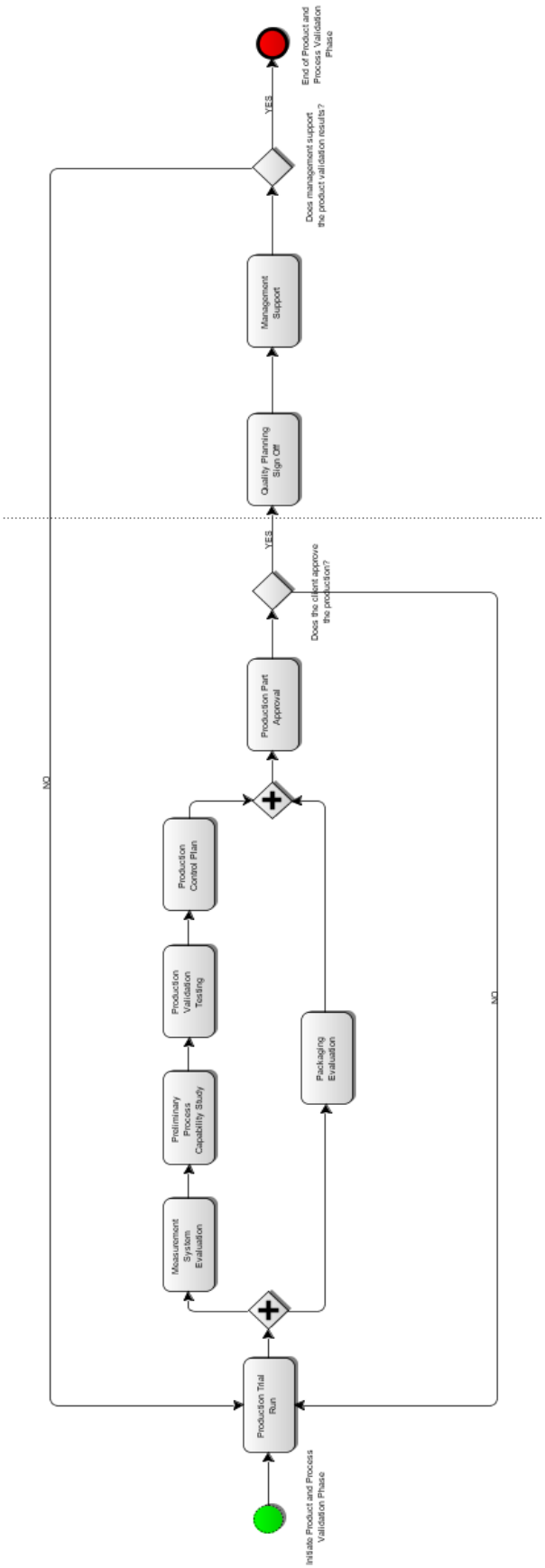

Figure 6. APQP Product and Process Validation Process Flow

2.3 PERT Analysis

The term PERT (Program Evaluation and Review Technique) comes from a technique used to calculate the most likely outcome of a project. Analysis based on PERT network graphs is currently considered indispensable for large and complex projects. It is also an element of planning and control for project management.

Based on the presented process flow diagrams a PERT analysis study was conducted within an automotive industry company from Sibiu. The goal of this study was to further increase the knowledge of organizational stakeholders in relation to the APQP procedure. The utilization of the PERT method will emphasize the key activities of the APQP. These will require special attention and a correct distribution of resources in order to be completed in a timely manner. The analysis shall highlight the provisioned time and money requirements for a particular APQP instantiation. The time and cost utilized in this analysis are related solely to the human factor involved. This is a direct consequence of the importance of the human resource in the development of the APQP procedure and also due to the highly complex structure of production costs. Such an approach to the APQP process shall create a framework for managers and engineers to ascertain the effectiveness of their work. Thus knowledge gathered form past iterations of the APQP procedure shall be used in the creation of new standards and goals for which development teams to strive and shall facilitate evaluation and communication among all parties involved.

In this particular instance as stated before information was gathered for the development process of a particular family of injection heads that are utilized within engines of varied brands of vehicles. Taking into consideration the APQP process flow charts the relationships and precedence of activities that are part of the entire procedure financial and time costs have been determined for each phase of the APQP and also for it's entirety.

The values obtained within the study are structured as follows, APQP Financial Cost of 3565 Euro, APQP Time Cost of 438 hours. These values are benchmarks towards which the APQP Project Team must strive. The level to which they are met shall be an important factor in determining the overall performance of an APQP instantiation. These values shall be considered as the basis for project performance evaluation.

3 CONCLUDING REMARKS

This paper underlines the importance that knowledge and knowledge management has in relation to the APQP process. The more detailed and readily available knowledge is, the more it shall be used to improve organizational products, processes and ultimately overall performance. The development of APQP process flows and the PERT analysis contribute to the ever increasing requirement for knowledge within all facets of organizational life. Establishing clear and easily understandable pathways and goals thru the aforementioned methods and tools is the basis for knowledge improvement and dissemination.

This paper presents the first step required to understand in a more detailed manner the relations between APQP activities and sub activities. The detailed of said activities and sub activities in the form of process flows and provisional costs represent future research directions for study.

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