

**Proposal of a process and tool for the management of quotations for a fiber optic assembly manufacturer****Propuesta de un proceso y herramienta para la gestión de cotizaciones de un fabricante de ensambles de fibra óptica**

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**Abstract**

The current process followed by a fiber optic assembly manufacturing company to quote its products fails to meet the expectations and requirements of both internal and external customers. There is poor document management, as well as problems regarding the flow of information used in the activities carried out in the Quoting department. This creates confusion and results in late deliveries for quotes. In addition to this, there is a lack of correct process measurement, so it is not possible to make a complete analysis. A new Quotation process is proposed as well as a management tool based on the PPAP practice contained within the APQP methodology. The objective is to increase the performance of the department's activities, improve the structure and organization of the knowledge generated during the Quotation process and obtain a platform for the collection of metrics for future process analysis. This will allow the company to meet customer expectations and perform analysis that allow continuous improvement of the process.

**Quotation management, New Product Development, PPAP**

**Resumen**

El proceso actual que sigue una compañía de manufactura de ensambles de fibra óptica para cotizar sus productos no logra cumplir con las expectativas y requerimientos de clientes internos y externos. Existe un mal control de documentación, así como problemas en el flujo de la información utilizada en las actividades llevadas a cabo en el departamento de Cotizaciones. Esto genera confusión y tiene como consecuencia entregas tardías. Aunado a esto se carece de una medición correcta del proceso, por lo que no es posible hacer un análisis completo. Se propone un nuevo proceso de Cotizaciones así como una herramienta de gestión basada en la práctica de PPAP contenida en la metodología del APQP. Como objetivo se busca incrementar el desempeño de las actividades del departamento, mejorar la estructura y organización del conocimiento generado durante el proceso de Cotizaciones y obtener una plataforma para la recopilación de métricas para el análisis del proceso. Esto le permitirá cumplir con las expectativas de los clientes y realizar análisis que permitan la mejora continua del proceso.

**Gestión de cotizaciones, Desarrollo de Nuevos Productos, PPAP**

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## 1. Introduction

In today's competitive market, global competition has driven companies and organisations to develop all kinds of competitive advantages in order to stand out from and differentiate themselves from their peers. In this context, within the manufacturing industry in Latin America, and particularly in Mexico, several companies have developed specialised departments whose objective is to develop new products for subsequent mass production.

A company dedicated to the manufacture of fibre optic assemblies, supplier of important telecommunications companies, has one such strategic business unit for the development of new products for its customers. This has become a fundamental part of the company, as it is in charge of transforming potential customer opportunities into future sales it can count on to continue growing. Therefore, its correct operation and the care of its processes is of great importance for the company.

This company has a Quotations department within this unit, which is responsible for costing and managing the process by which the company determines the correct price of its products to its customers. A number of opportunities have been detected in the department, such as poor control of the documentation generated, as well as problems with the flow of information which generates confusion in what is required and ends up causing delays in the delivery of quotations or incorrect information according to what was initially required. It is considered that the department's performance can be improved.

One of the most commonly used ways to measure performance is through the use of metrics. In this particular case, the company has only one metric for the measurement of the Quotations department. On Time Completion (OTC) Quote measures the percentage of quotes delivered on time to the customer. When analysing the results of this metric and listening to comments from the employees of this department, it is evident that they do not meet the requirements of this metric.

The following article aims to use a project management methodology to generate a new quotation process that meets the requirements of customers in terms of required deliveries, as well as to obtain a tool that supports the management of this process. In this way, the performance of the activities carried out by the department will be improved.

The article will begin with a theoretical framework that will provide a context for the different issues and methodologies that surround this type of approach. This is followed by an argumentation of the methodology to be followed and then the implementation of the methodology in the Quotations department. Finally, the results will be evaluated and a conclusion will be drawn on the effects achieved.

## 2. Theoretical Framework

In the modern manufacturing industry, there are companies dedicated to the manufacture of large-scale assemblies known as contract manufacturers (CMs). These companies use their manufacturing expertise as well as economies of scale to offer manufacturing solutions to their customers as part of the outsourcing model (Arruñada & Vázquez, 2006). Their main customers are the so-called OEMs, who will then sell these products under their own brand names (Padilla-Pérez & Hernández, 2010).

These commercial relationships are generated through bidding processes or requests for quotations as part of the commercial process. Generally, potential customers ask for quotations from a large number of CMs, which they then qualify by considering weighted criteria. The aim of this is to improve their resource allocation, mitigate risks associated with procurement and minimise costs by saving time, money and effort (Taherdoost & Brard, 2019). For CMs, then, it is important to achieve the awarding of as many business opportunities as possible, as a steady flow of new projects will prevent a drop in production volume, while safeguarding their competitive advantages in productivity.

Over time, manufacturing experience has allowed them to accumulate sufficient technological capacity to carry out research and development activities. This has led CMs to incorporate both pre- and post-manufacturing activities into their processes in order to expand. Companies that manage to incorporate customised product development and even market strategy development to complement their manufacturing capabilities are known as original design manufacturers (ODMs) (Tsai-Lin et al., 2021).

In order to make their business model transformation a reality, many CMs have taken on the task of creating specialised technical departments within their organisations that are responsible for supporting all product design processes (Garcia-Alcaraz et al., 2016). These departments carry out new product development (NPD) processes and are responsible for all the management of the development of products required by customers. The development of such departments is seen as a consequence of a global trend within manufacturing companies to increase their involvement in knowledge-intensive activities such as product design (Padilla-Perez & Hernandez, 2010). A variety of methods have been identified to carry out NPD processes with different approaches.

A common method is the use and adaptation of the PMBOK guide published by the Project Management Institute. This has become a guide for companies seeking an orderly project management methodology to apply to the NPD process. The guide identifies a subset of project management fundamentals that are generally recognised as good practice. However, the PMBOK is only a general methodological manual. The organisation concerned must build with the help of it specific and appropriate methodologies for inclusion in its own processes (Project Management Institute Inc., 2017). Project management methodology has been criticised in recent years for its obsession with a phase-based approach, being accused of over-exploiting control (Lenfle & Loch, 2010).

One of them, stage-gate, is an NPD process management method to increase the likelihood of launching new products quickly and successfully. This method provides a guide to steer projects through the various stages of development (Cooper, 2017):

1. Idea generation
2. Scope definition
3. Building the business case
4. Product development
5. Testing and validation
6. Product introduction

The flow of the project through the stages is restricted and controlled by a series of gates. These have a series of requirements, which must be met to allow the flow (Schilling & Hill, 1998). One of the common criticisms of this method is that it is rigid and does not respond to the adaptability required in today's market (Cooper, 2014).

Considering the high competitiveness of the fibre optic assembly manufacturing industry, as well as the high variability and dynamism that characterises it, it becomes relevant to consider new methods for the management of these activities. NPD processes are characterised by a complex interrelationship of activities and large uncertainties about which solution route will be taken, so that the scope of the project cannot necessarily be anticipated (Pons, 2008).

Agile scheduling methods have served as an antithesis to traditional project management methodologies, seen as obsolete to the great uncertainty of the modern marketplace. These methodologies contain simple rules, and address certain principles of flexibility that allow for iterative design, addressing the increasingly demanding needs of clients (Rigby et al., 2016).

It is possible to use these methods either on their own or in combination with traditional methodologies for inclusion in other fields, such as manufacturing. To achieve the implementation of these methods, adaptations specific to the industry of interest must be made (Schuh et al., 2018) (Betta et al., 2019). As organisations design and improve their processes, the combination of these methodologies can happen empirically and without associations to the mentioned agile philosophies, allowing the company to obtain process improvements (Leite & Braz, 2016).

Another possible approach to product development is that of customer quality assurance. Quality planning allows organisations to carry out development activities while ensuring that customer requirements are met.

As part of the IATF 16949 standard, for example, the Advanced Product Quality Planning (APQP) process is envisaged. It provides guidance in the development process. It includes a number of aspects to support quality assurance (International Automotive Task Force, 2016). One of the tools it uses for this is the Production Part Approval Process (PPAP). This tool has positive effects on development processes, such as better control of documentation, cooperation and communication during the development of a new product (Liu & Hornig, 2019).

### 3. Argumentation

In order to choose the appropriate methodology, research was carried out within the literature on the subject. A model proposed for the implementation of a management methodology (Acosta-Villavicencio, 2019) in a company was then taken and adaptations were made to consider a company with an established process whose characteristics and execution times are considered inherently different.

This model considers a due preparation of the organisation, which includes the identification of current processes and activities as well as an initial assessment. It then moves on to an analysis of employees and a selection of methodology or tools to be used to form the new process. Once this base is in place, an adaptation of the current process will be carried out, modifying it as required by the methodology or tools, seeking to meet the specific requirements of the company.

Finally, there is the implementation, where the process will be adapted according to the opportunities found during a first pilot test, thus ensuring compliance with the requirements, adjusted to the restrictions found (Rasnacis & Berzisa, 2016).

Project management in modern companies represents an increasingly complex set of activities. If we look at traditional project management methodologies, we can identify that they contain a number of requirements in their different phases. These requirements can become impediments to project progress when the scope and requirements are not well defined, especially at the beginning of the project.

This inflexibility can generate problems to advance and conclude the project, so it is important to adjust to the conditions in which the company finds itself. In this adaptation process, it is advisable to consider the focus and conditions of the projects in the company and to give the team adequate space to establish structures, roles and to establish a culture of continuous improvement in the process (Schuh et al., 2018).

One way to implement and manage new product development processes, especially when implementing agile project management concepts, is to use technological tools that support and structure the activities. In order to achieve a successful implementation, a number of considerations must be taken into account. The first is that the process should be as transparent as possible, which will lead to an understanding of the needs of everyone involved in the process and a proper understanding of the activities.

A second is the correct definition of roles in order to allocate sufficient resources and tools to enable the relevant activities to be carried out properly. Finally, the implementation plan needs to be properly aligned with the organisation's internal strategies and rules. A design that allows this to happen is valuable and was therefore considered for inclusion as part of the methodology (Borštnar & Pucihar, 2014).

### 4. Methodology

A series of activities are proposed to shape the working methodology. As this is a new project management process, and considering that the company already has an existing process, the adaptation of the current activities is contemplated. The methodology will then generate a new process, ensuring that the outputs of the activities meet the requirements of the client and the needs of the company. For this purpose, 4 phases have been detailed: The preparation of the activities to the new process, the development of the new process, the implementation of the process and a subsequent evaluation that will serve us to measure the effects that this had on the workflows of the department. In figure 1 we can see the phases as well as the detailed activities that were carried out.

A. Preparation

It is necessary to know the current status of the process followed in the Quotations department, for this the current procedure will be identified according to the Quality Management System of the company, the current activities will be observed in search of opportunities and an evaluation of the maturity of the project management processes will be carried out in terms of those carried out in the department.

B. Development of the new process

The first activity in the second sentence will seek to build on current processes and apply existing knowledge, whereby current good practice will be identified. A project management methodology will be chosen that will enable the New Product Development activities to carry out their Quotation processes, ensuring that they meet customer requirements. For this, the current activities will be adapted to comply with the methodology. Finally, metrics will be generated to allow us to measure across the activities that will make up the new Quotations process.

C. Implementation

A planning of the pilot test will be carried out in agreement with the company. Once this is agreed, the new process will be validated to ensure that it meets the identified needs and customer requirements. During this stage, the proposed processes will be allowed to be adjusted to address any observations found. As a final activity of this phase, the new process will be implemented throughout the department. In case the process does not seem to produce the expected results, it is possible to go back to the previous phase of development and adjust the activities to ensure that they can be fulfilled by the department.

D. Evaluation

During the evaluation stage, a management of the methodology will be carried out, making minor adjustments to the activities to ensure that they address what has been observed during implementation throughout the department's activities. A measurement of the metrics will be carried out to ensure that the results presented are in line with expectations.

As a final activity, another assessment of the maturity of the project management processes will be carried out, now considering the new process, where it is expected that the expected results will be observed.

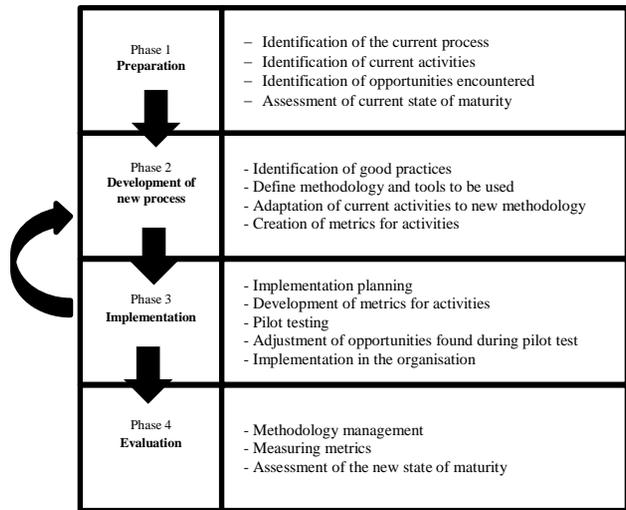


Figure 1 Diagram of methodology to be followed  
*Own Elaboration*

5. Implementation

During the preparation phase, observations were made regarding the processes currently in place in the department. To identify these, a search of the company's information repository for all documented procedures involving quotations was carried out, as well as a survey of employees in the same department to ensure that all applicable procedures were in place.

It is common that not all the activities that are carried out are properly documented, so a further search was carried out to retrieve all the activities that are carried out in the department. When analysing this result, it was found that the activities concerning the analysis of existing quotations that require changes (such as an engineering change, or a re-quote) do not have an applicable documented procedure, so that the actions of the employees in the area vary according to the circumstances and are not always entirely clear, which leads to the delays that have been detected.

Various opportunities were identified, including the lack of clarity of the initial information from which to work in order to modify existing quotations. When the initial maturity assessment was carried out by means of a survey of the department's employees, the results in table 1 were obtained, achieving a final score of 73.3%.

A result of this type was expected, as the company does have processes or practices that allow it to comply with some of the points to be evaluated.

| No. | Area                            | Score         |
|-----|---------------------------------|---------------|
| 1   | Roles and collaboration         | 75%           |
| 2   | Training                        | 67%           |
| 3   | Activities and flow             | 78%           |
| 4   | Decision making                 | 79%           |
| 5   | Knowledge management process    | 80%           |
| 6   | Knowledge management techniques | 72%           |
| 7   | Methods                         | 65%           |
| 8   | Computerisation and software    | 65%           |
|     | Initial evaluation score        | <b>73.30%</b> |

**Table 1** Result of the maturity assessment of the initial state

*Own Elaboration*

The worst performing areas were Methods, Computerisation and software, Training and Knowledge management techniques. This result was considered for the methodology and tools to be used. Some of the good practices carried out in the best scoring areas such as Knowledge management process, Decision making and Activities and flow were also consulted.

Considering the needs of the company and the result obtained in the assessment, it was concluded that a process that complies with the PPAP methodology, included as part of the APQP, would be a viable option.

A tool to support this process was also proposed in the form of a software programmed within the department that allows the control of the active quotations in the department. This software, called COE Performance System (COEPS), has the ability to upload all files pertaining to the quotation and to link re-quotations to their original quotation, so it is possible to maintain an order and structure of the entire history of existing quotations for a product family.

COEPS also has the ability to automatically generate metrics from the information fed from each quotation. From this, the Average Turnaround metric was created, which measures the average number of days in which a quotation is delivered, as well as the automatic Hit Ratio metric, which determines the percentage of quotations that are accepted and go on to receive a purchase order from the customer.

Although COEPS was programmed and started to be used in early phases from December 2021, the pilot test was formalised during February and March 2022. As it is a process based on the current one, which synthesises the work done empirically by the engineers working in the area, this test did not generate problems in the workflow of the department. The new process was followed properly and some adjustments were made to the order of the activities to be carried out.

With regard to the COEPS pilot, modifications were made to the restrictions on entering dates and requirements for closing contributions given the circumstances external factors surrounding a quotation. For example, not all customer information, volumes to be quoted or updated material prices are always available.

Once the adjustments were made, it was decided to release both the process and the tool from its pilot test for full implementation. The complete process can be found in the Annexes section. It is expressed in BPMN.

In it, it can be seen from the initiation of the request for quotation, the dumping of information into the log and a series of decisions that are made that affect the flow of the quotation itself. Subsequent activities include the acceptance or non-acceptance of changes in the case of quotes coming from an engineering change, as well as the different paths taken depending on criteria such as existence of standard operations, required capital expenditure requirements, etc. The process ends with the release of the final quotation to the vendor after final verification; as well as the uploading of all required information into COEPS to secure and preserve all information generated during the process activities.

As for the software, it is accessible from the company's network in any browser and is divided into a number of sections. The main screen of the COEPs can be seen in figure 2. This log allows monitoring of all active quotes, and displays some valuable information such as the Quote No, the name of the project, relevant dates, assignments and daily notes that are added during follow-up meetings.



**Figure 2** Quotes Open Log on COE Performance System  
*Own Elaboration*

Figure 3 shows how by clicking on a quotation, you can see the details, relevant information about the customer and the corresponding salesperson, as well as date data relevant to the quotation.



**Figure 3** Detail of a quotation on COE Performance System  
*Own Elaboration*

For the uploading of all the documentation generated during the process, a tab was enabled in each registered quotation that allows selecting the type of file to be uploaded as well as its path. Figure 4 shows this section, which already contains some uploaded files.



**Figure 4** File upload section in COE PS  
*Own Elaboration*

In order to be able to quantify and observe the improvement, a subsequent measurement of the maturity level of the project management processes was carried out. The same employees were used and it was carried out in the same way. The results are shown in table 2.

| No. | Area                            | Score  |
|-----|---------------------------------|--------|
| 1   | Roles and collaboration         | 98%    |
| 2   | Training                        | 65%    |
| 3   | Activities and flow             | 85%    |
| 4   | Decision making                 | 81%    |
| 5   | Knowledge management process    | 82%    |
| 6   | Knowledge management techniques | 79%    |
| 7   | Methods                         | 70%    |
| 8   | Computerisation and software    | 70%    |
|     | Initial evaluation score        | 77.30% |

**Table 2** Outcome of the post-state maturity assessment  
*Own Elaboration*

## 6. Results

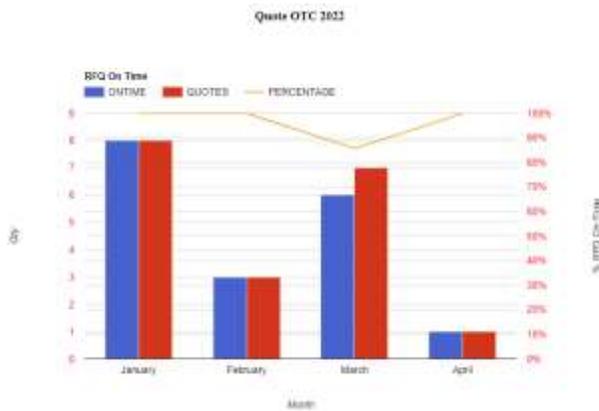
The results of the implementation of both the process and COEPS were remarkable from the pilot test. Thanks to the previous work of uploading past quotations to the system, the system was functional from the first day of testing, which allowed the engineers working in the area to be guided when a re-quote was required.

The implemented process outlines the exact activities to be carried out, allowing for a smoother workflow and greater independence from the area manager.

COEPS allows employees to retrieve the information they need to rely on in a simple way, as they only need to identify the part number affected by the change to find the quotation where the initial information required is located.

The use of the process is also reflected in the flow of quotations, as COEPS can be used to visualise and track daily COE meetings and quickly deal with any issues that may arise. Until April 2022, the annual OTC Quote remains at 95%.

Considering that the aggregate data during 2020 and 2021 averages 85.3% OTC, an improvement of 10.3% is remarkable. The results of this and other metrics can be observed from COEPS. A screenshot of the metrics area in COEPS for Quote OTC is shown in Figure 5.



**Figure 5** Image of the COEPs chart for the 2022 Quote OTC metric  
Own Elaboration

In terms of the results obtained by measuring the maturity levels, there was a 5% improvement in the area of Roles and Collaboration, 7% in the area of Activities and Flow, 7% in the area of Knowledge Management Techniques, and 5% in the area of Methods and Computerisation and software. In the aggregate, there was an overall improvement of 4% from 73.3% to a final score of 77.3%.

Work is currently underway to generate instructions for the use of the tool, as well as to formalise the process within the company's quality management system, which would ensure the continuous use of both elements.

## 7. Conclusions

The implementation of a process suited to the company's needs using a quality approach based on the PPAP method during the Quotations process allows for improved performance. As observed in the maturity assessment, there is a noticeable improvement in most areas.

As observed during the subsequent maturity assessment, the company's project management processes have increased in performance, particularly in the areas that have been worked on. It is expected that as the process becomes established within the organisation, its effects will grow and become more noticeable in measurements.

A favourable effect on the Quote OTC metric can also be concluded, which has been maintained at a higher level than in previous years, also indicating that the existing backlog has been mitigated.

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## 10. Annexes

An image of the new BPMN-mapped Quotations process is added in this section. This new process manages a quotation in the company from the time the request arrives until the formal quotation is printed and sent to the customer via the sales agent.

