UNIVERSITY OF TURKU

# ABSTRACT

- [ ] Bachelor's thesis
- [x] Master's thesis
- [ ] Licentiate's thesis
- [ ] Doctoral dissertation

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|---|---|---|---|
| Subject | Information Technology | Date | 01.06.2021 |
| Author(s) | Romain Attié | Number of pages | 68 + appendices |
| Title | Designing of a Quality Audit Methodology for IT Support Service: Development of a quality audit criteria. | | |
| Supervisor(s) | Dr. Joris Hulstijn, Prof. Patrick Rousseau | | |


## Abstract

In today's business landscape, IT Support has become a key service due to the increasing prominence of information technology in companies. In addition, many companies decide to outsource their IT services, partly to ensure its quality. However, despite the implementation of contracts and Service Level Agreements between the parties, which formalise all the conditions for the successful delivery of this service, IT service quality is nevertheless not guaranteed.

This thesis therefore focuses on monitoring the quality of a Service Desk through an audit methodology in order to increase its quality.

Indeed, this thesis is a Design Science research based on a case study conducted within a company with the aim of developing a solution, based on an audit methodology, to measure the weak points of its IT support service in order to later elaborate an action plan to improve its quality. To this end, quantitative surveys among users and service providers were conducted in order to develop an audit criteria norm for the company under study.

This research produced a number of key findings. Firstly, it was found that the main factors influencing service quality are behaviour of service providers, competence of service providers and the surrounding environment such as different management and communication tools. It was also determined that for this case study, a lack of quality results in a lack of communication between users and providers, long waiting times, as well as undelivered service. Furthermore, the audit methodology for the research was inspired by the ITIL best practice, and more specifically its section on Continuous Service Improvement. The final solution is represented in the form of an analysis grid with several checkpoints. In the case, these checkpoints are selected through the analysis of the questionnaires, representing the potential weak points of the support service to be monitored. These checkpoints are measured through indicators, and if they are confirmed to be below the threshold, recommendations for remedial action are proposed.

Finally, this analysis grid was validated by the involved company and accepted for a test implementation. The aim is that this audit report will be reproduced on a regular basis and that the analysis grid will evolve as the IT Support Service improves.



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|---|---|
| Key words | IT Service Support, Quality Audit Methodology, ITIL, Service Desk, Monitoring, Audit Criteria |

UNIVERSITY OF TURKU
Turku School of Economics

# DESIGNING OF A QUALITY AUDIT METHODOLOGY FOR IT SUPPORT SERVICE.

## Development of a Quality Audit Criteria

Master's Thesis
in International Master in Management
of Information Technology - IMMIT

Author:
Romain Attié

Supervisor(s):
Dr. Joris Hulstijn (1st)
Prof. P. Rousseau (2nd)

01.06.20
Turku

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

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## COMMON KEYWORDS

| Keyword | Abbreviation | Meaning |
|---|---|---|
| Analysis Grid<br>Audit Criteria<br>Norm | / | Analysis Grid, Audit Criteria and Norm can be used interchangeably. They represent the final artefact of this research, i.e., the norm that enables to test the compliance of the service for the audit methodology. |
| Service Quality Management | SQM | It is an internal team of the company under study. The one that initiated this research. |
| Quality of Service | QoS | Detailed in the literature review. |
| End User Portal | EUP | User platform for the IT support service under study. |
| Service Now | SNOW | Supplier platform for IT support service under study. |

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# ACKNOWLEDGMENT

I would like to express my gratitude to IAE Aix-Marseille, University of Turku and Tilburg University for giving me personal and professional development through the IMMIT programme.

Secondly, I would like to sincerely express my thankfulness to my supervisor, Dr. Joris Hulstijn, for providing me with support, knowledge and motivation to write this thesis.

Then, I would like to thank CMA-CGM for allowing me to develop this research within their company. And more particularly the manager of the SQM team, who has always been confident in my work, has always made herself available to support me in this project, and has always been willing to provide assistance if needed. Additionally, I would like to thank the entire SQM team for accompanying me in my daily tasks within the company and for always being available when needed.

Finally, I would like to extend my thanks to my family and friends, who have been there to support and motivate me, even in these more complicated times of COVID.

# 1 INTRODUCTION

## 1.1 Background

The field of information technology is today a vital element in the life of a company. According to Gartner (2020), worldwide IT spending in 2020 reached $3.6 trillion and will increase by 4% in 2021. Among these expenditures figure approximately $1 trillion spent each year since 2019 on IT services.

In order to focus on their core business, an increasing number of companies decide to outsource their IT services. Outsourcing also makes it possible to reduce costs and to have highly qualified resources even in the short term (Dhar & Balakrishnan, 2006). However, even outsourced services remain the responsibility of the company purchasing them. Furthermore, Park and Kim (2005) found that the main problem with outsourced versus in-house services concerns the quality of the service. Indeed, the study of Michell and Fitzgerald (1997) showed that only few providers implement quality systems to monitor Service Level Agreements (SLA). Ho and Wei (2016) also stated that such agreements will not be effective if they are not carefully designed, but also if they are not effectively supervised.

Implementing good Service Level Agreements (SLA) in the contract negotiation phase is a very good first step, but if there is no way to ensure that they are respected and of good quality, it may be useless. Indeed, SLAs contain Service Level Objectives (SLOs). These objectives can be availability, throughput, response time, and so on. SLAs are usually included in contracts in order to formalise the different obligations between several parties. They are therefore generally preferred to simple human judgment because they are easily understandable by IT staff, they are easily measurable and therefore more reliable (Marques, Sauvé, & Moura, 2009).

In order to ensure control over an outsourced product or service, IT auditing has become an essential part of the process (Brandas, 2010). According to Gantz (2013), the purpose of an IT audit is to investigate the processes, IT assets and controls at multiple levels across an organisation to assess the level of compliance with the appropriate audit criteria (standards or requirements). Indeed, developing the audit criteria against which the service being measured should be compliant ensure its effectiveness (Benjamin, 2008).

## 1.2 Research purpose

### 1.2.1 Case description

The IT support service of the company under study is partly internal, but mostly outsourced to several service providers. Its objective is to help the employees, called users, to meet their IT related concerns. Its organisation is structured as a Service Desk, i.e., there is a single point of contact between users and service providers in order to meet their needs, whether in terms of incident resolution or any other service request.

The company's concern is therefore to increase the quality of this IT support service in order to increase user satisfaction and improve processes. For this reason, they seek to develop an artefact to measure, monitor and improve the weak points of the support processes in order to be able to take the necessary actions to improve the overall quality of the service. Their aim is to continuously improve this artefact according to the evolution of the service in order to be able to renew the improvement process on a regular basis. This is why they require an audit methodology to be established so that the method is more formal and adds real added value to their service.

The aim of this research is therefore to develop an audit criteria artefact which could then be used to conduct a Service Quality Audit Methodology to test the compliance of its various quality of service checkpoints.

### 1.2.2 Research Question

The research question for this study is the following.

*How to design an IT Support Service Quality Audit Methodology?*

In order to be able to answer this Research Question, it is necessary to break it down into several sub-questions (SQ). This will help to better organize the research and make it easier to find the answers.

- SQ1: What are the current good practices regarding Quality of Service of IT services, and in general regarding IT Auditing?
- SQ2: What is the company's current situation with regard to the IT support service process and service quality level?
- SQ3: What is therefore the appropriate audit criteria norm to be developed to meet the company's expectations?

- SQ4: Is the developed solution validated by the experts of the company's service quality management department?

*Sub-Question 1*

Prior literature on service quality and IT auditing was the first fundamental step in conducting this research. Indeed, the literature review allowed the development of a conceptual model and hypotheses relating to the factors influencing the quality of a service, as well as the consequences of a lack of quality for users. In addition, it allowed for a review of aspects related to audit methodology such as measurement, monitoring and improvement for service quality.

*Sub-Question 2*

The second sub-question concerns the current situation in the company under study. The company involved is CMA-CGM, a French container ship owner based in Marseille, France, ranked among the four largest shipping companies in the world. More specifically, the department concerned is Service Quality Management (SQM), whose role is to ensure the efficiency of the IT support service and provide added value to users and service providers. This sub-question is addressed in Chapter 4 (Case Development). In a first step, a detailed presentation of CMA-CGM is provided, describing first some key figures and its main mission before zooming in more specifically on the IT aspects by describing the IT support service, as well as the role and mission of the SQM division. In a second step, the different processes of incident resolution and service request are explained. Only one service provider is chosen for this study in order to make the analysis process simpler and to ensure that the solution could be tested more quickly and efficiently. The contract and Service Level Agreements in place with this provider were also studied in order to be able to represent the current situation as accurately as possible.

*Sub-Question 3*

The Literature Review and the current situation within CMA-CGM allowed the construction of two quantitative questionnaires, addressed respectively to the users and the service providers of the support service. Their first objective was to test the different hypotheses and the conceptual model created in order to check whether they are in line with the service studied. Their second objective was to investigate the weaknesses of the support service in order to determine the direction of the final solution for the audit methodology.

Then, the analysis of the results allowed the elaboration of the audit criteria artefact. This was developed in the form of an "analysis grid" consisting of checkpoints. In

addition, these checkpoints are complemented by indicators to monitor their performance. Finally, recommendations for action to be taken in the event of a proven dysfunction are proposed for each checkpoint.

*Sub-Question 4*

The last sub-question concerns the validation of the proposed solution, namely the analysis grid. To this end, the analysis grid was thoroughly reviewed by the manager and the data officer of the SQM team to ensure its compliance with the methodological expectations of the audit in view of its implementation for a test phase.

## 1.3 Methodology

The methodology used for this recherche is Design Science. Design Science Research guidelines developed by Hevner, March, Park, and Ram (2004) assisted in structuring this study. Indeed, Design Science Research is defined as the evaluation of artefacts to solve identified organisational problems (Hevner et al., 2004).

In order to properly develop the artefact, this research is also based on a case study with questionnaires for data collection (Zainal, 2007). This step is fundamental in order to develop a solution adapted to the IT support service and to the company under study, namely CMA-CGM.

The methodology chosen is therefore design science research, based on a case study with surveys for data collection, resulting in an artefact.

# 2 LITERATURE REVIEW

The aim of this literature review is to explore the existing literature on the different areas of this research. Aspects of outsourcing and contracting were first examined in order to understand the role of service providers in the delivery of IT support services within CMA-CGM. Secondly, the aspect of service quality and different models representing it were reviewed in order to develop a conceptual model suitable for the research. Next, the topic of measuring, monitoring and improving service quality was reviewed, in order to introduce the concept of an audit methodology. Finally, the literature review directly addressed the topic of audit methodology, but focused on service and quality, but also on audit criteria, which is of great importance for the final solution.

## 2.1 Outsourcing

Outsourcing means the transfer of all or part of an organization's function to an external partner. It can involve some entire functions of the organization, the infrastructure or simply operational processes. Most of the literature on this topic was published between 1990 and 2010. According to Grossman and Helpman (2005), outsourcing is not just about the simple purchase of a product or service, but rather about a real strategic collaboration between the two parties.

The main reasons for outsourcing are to reduce costs, to focus on the core business, and to inject into client organisations new high-quality resources such as skills, specific expertise or superior technology to improve performance (Lacity, Khan, Yan, & Willcocks, 2010). On the other hand, they have shown that customers will be reluctant to outsource their activities if there are business risks, high costs or high uncertainty about the outcome.

Regarding IT outsourcing, it originated in the 1960s and 1970s, when the computer age was beginning and the equipment was very expensive and large (J.-N. Lee, Huynh, Chi-wai, & Pi, 2000). Nowadays, IT is among the most widely outsourced tasks. Indeed, Panko (2019) conducted a study showing that the most outsourced business processes in small companies were finance and IT at 37% each. Furthermore, BackOfficePro (2019) – a Business Process outsourcing company – shows that IT has the highest outsourcing proportion among all types of organisations with 28%.

Various types of outsourcing are possible, namely onshore, nearshore and offshore. Firstly, onshore is when teams work on site or at a relatively short distance, within the

same national territory. Secondly, nearshore is when teams are mostly outside national borders, but relatively close, with a similar culture and a small time-difference. Finally, offshore is when the teams are very far away geographically, for example on another continent, with a time difference requiring an adapted project organisation and whose culture and language are most often different. An organisation can also opt for a hybrid solution. Indeed, if it is looking for several different specializations, if it wants a continuous service, or if it wants to put them in competition and not have a single dependency, a hybrid solution combining the different types of outsourcing may be the best approach.

Furthermore, cloud computing, a model of providing and consuming IT capacity on a pay-as-you-go basis, is having a major impact on outsourcing service providers, who need to integrate this offering in order to remain competitive in the market (Dhar, 2012). For example, SaaS (Software as a Service) is the co-delivery of resources, services and expertise that allows companies to fully outsource an aspect of their information system and treat it as an operating cost rather than an investment (Satyanarayana, 2012).

Naturally, there are many risks to IT outsourcing, such as poor management, inexperienced staff, inappropriate technology use, hidden costs, etc. However, according to Lacity, Khan, and Willcocks (2009), although the supplier may be in charge of solving the different risks, it is the client who bears the ultimate responsibility for these risks and who must take action in the event of a deficiency. Furthermore, they state that there are almost as many risk mitigation practices as there are risks. Their advice is therefore to treat each specific risk individually.

Moreover, the customer / service provider relationship can be seen as a partnership, linked through a contract that shapes it by establishing all the conditions that need to be fulfilled in order for the relationship to be successful. Indeed, successful outsourcing is most often due to a well-managed contract (M. K. Lee, 1996) (see next section).

## 2.2 Contract

Williamson (1979) made a major contribution to the evolution of economics by seeing it as a "contracting node" based on transaction costs. His theory of transaction costs demonstrated that saving on transaction costs (cost due to an economic exchange) is better than relying on chance or intuition.

Originally, the purpose of a contract is an agreement between one or more parties in order to create legal obligation(s). In reality, companies do not set up contracts only for its legal part, but rather in order to achieve their objectives. Indeed, contracts are also

tools for risk and opportunity management, value creation, partnership, profitability, as well as competitive advantage (Haapio & Siedel, 2013). Furthermore, Muhammad, Saoula, Issa, and Ahmed (2019) confirmed this by stating that contract management is directly associated with business performance.

Brown and Potoski (2003) stated that contract management is relatively complex, often due to the high transaction costs of negotiating, setting up and monitoring the contract between the parties involved. In addition, when implementing an outsourcing contract, it is important to avoid being overly dependent on the vendor, and to allow for sufficient flexibility to adapt to potential changes in the environment (Barthélemy & Quélin, 2006). Managing the risks of an outsourcing contract can also be done through a pricing strategy. The two most common ones are fixed price and time and materials contracts (Gopal, Sivaramakrishnan, Krishnan, & Mukhopadhyay, 2003). The “fixed-price” contract is useful when the project is stable and will not change during development, when the timeframe and number of working hours are strictly determined prior to its commencement, and when the contract pricing includes all known risks that may arise during the execution of the project. On the other hand, the “time and materials” contract is useful when changes during development may occur, when tasks and requirements may change during the course of the project, and when the client wants to pay only for the actual work performed. In this case, additional costs may arise from extra work due to risks being realised or new, more significant objectives being achieved. However, not all risks can be managed ex ante by these tariff schemes. Chen and Bharadwaj (2009) also present continuous monitoring during the contract, as well as ex post contingency plans or conflict resolution as effective mechanisms.

Studying an actual contract enables to discover the processes and agreements that have been agreed between the different parties, notably in terms of service quality. Thus, it is necessary to review what is present in the literature in terms of Quality of Service.

## 2.3 Quality of Service

According to Echaudemaison et al. (1989), a service consists of "the provision of a technical or intellectual capacity" or "the supply of work directly useful to the user, without transformation of material". Gorla, Somers, and Wong (2010) define quality of service as a service delivered to users with responsiveness, reliability, empathy and assurance. Indeed, they state that service quality is reflected in user satisfaction in terms of delivery time, the courtesy of service providers to users, and their knowledge to deliver an “error-

free" service. The quality of a service is therefore closely linked to the satisfaction of the service's users. Furthermore, De Ruyter, Bloemer, and Peeters (1997) suggest that quality of service is an antecedent of service user satisfaction.

Prior literature addresses Quality of Service (QoS) and some researchers have developed conceptual models aiming to demonstrate the influencing factors of QoS.

### 2.3.1 Influencing factors of Quality of Service

In order to present the different influencing factors on the quality of service, different conceptual models present in the literature have been studied.

A conceptual model is represented as a diagram linking proposed causalities between a set of concepts (Earp & Ennett, 1991). Furthermore, Elangovan and Rajendran (2015) stated that a conceptual model can be developed either from empirical data or from previous studies. Indeed, a model is a representation of the real world, and diagrams facilitate the understanding of logical order of causality by showing relationships between several factors.

#### *2.3.1.1 A model on service attributes form Haywood-Farmer (1988)*

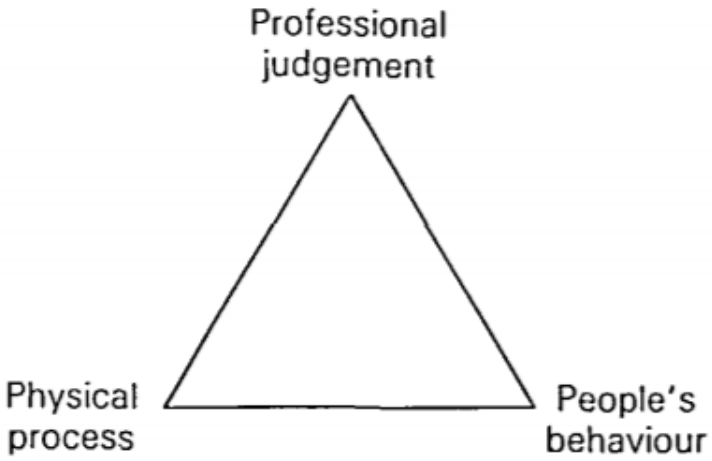



**Figure 1. Service attributes model (from Haywood-Farmer, 1988)**

Haywood-Farmer (1988) first modelled three types of service attributes: "Physical Facilities, Processes and Procedures", "People's Behaviour and Conviviality" and "Professional Judgement" (cf. Figure 1).

First, "Physical Facilities, Processes and Procedures" represents the facilities, equipment, processes and procedures that aim to facilitate the service. Next, "People's

Behaviour and Conviviality" represents the way in which the service is managed, in the relationship and intention of the service provider towards the customer. Finally, "Professional Judgement" relates to the ability of the support team to have the right skills to successfully resolve the customer's problem. This modelling is not necessarily related to IT services, but to any type of service delivery.

#### *2.3.1.2 SERVQUAL model from Parasuraman, Zeithaml, and Berry (1988)*

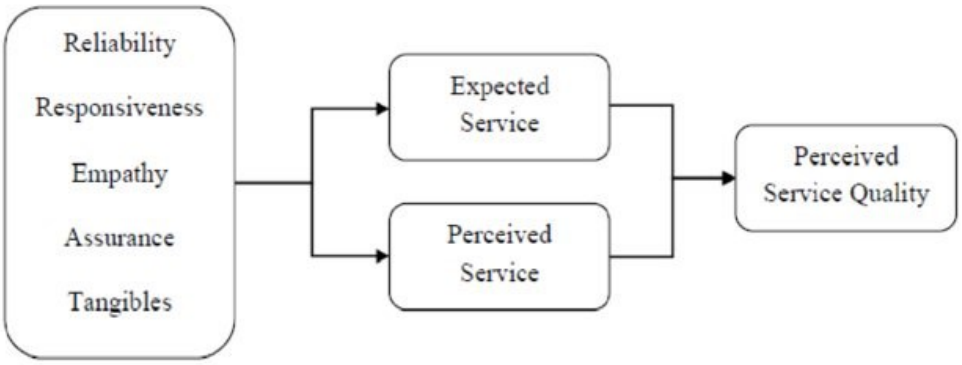



**Figure 2. SERVQUAL model (from Parasuraman, Zeithaml, and Berry, 1988)**

This second model is more focused on the quality influencing factors of a service than the previous one. Indeed, Ghotbabadi, Feiz, and Baharun (2015) put forward this model (cf. Figure 2) representing service quality, originally designed for service marketing research, called SERVQUAL (for SERVice QUALity). This model, created by Parasuraman et al. (1988), introduced five dimensions to cover the quality of a service, namely Tangible, Reliability, Responsiveness, Assurance and Empathy. Tangible represents the physical aspect, whether it is the equipment, the facilities or the software for IT. Reliability represents the ability to perform the service reliably and accurately. Responsiveness represents the willingness to help customers and provide a fast service. Assurance represents the knowledge and courtesy of the employees and their ability to inspire confidence. Finally, Empathy represents the ability to pay individual attention to the customer. Furthermore, these five dimensions influence the expected service and the perceived service, which together represent the perceived Service Quality.

#### *2.3.1.3 Hierarchical model of service quality from Brady and Cronin Jr (2001)*

Although relatively old, the two previous models have been widely studied, used and adapted. Indeed, later Brady and Cronin Jr (2001) introduced a hierarchical conceptual

model based on the SERVQUAL model, as well as other models dealing with service quality (cf. Figure 3).

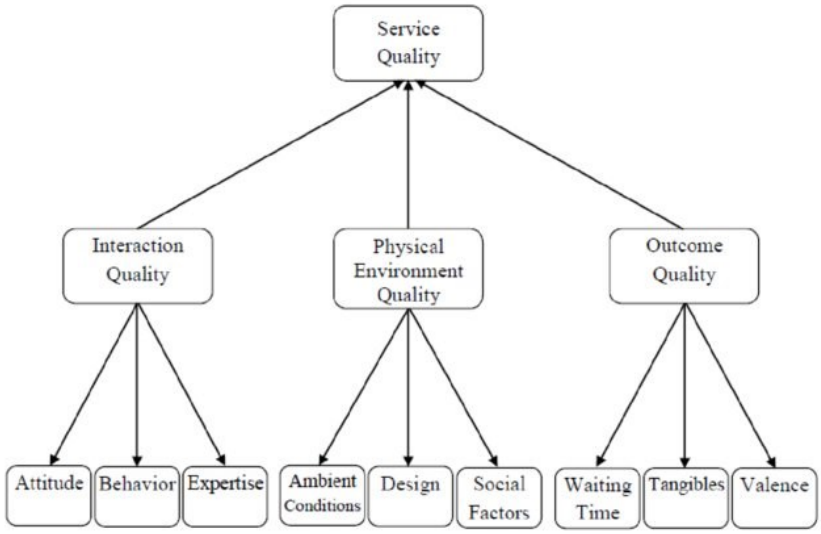



**Figure 3. Hierarchical model of service quality (from Brady & Cronin, 2001)**

This hierarchical model contains primary quality dimensions (interaction, environment & outcome) and sub-dimensions. First, interaction dimension represents the functional quality, meaning the quality of the interaction between users and support teams. Second, the environment dimension represents the environment of the service. And lastly, the outcome dimension represents the technical quality, which is the solution resulting from the service. In addition, there are nine sub-dimensions influenced by the five SERVQUAL model one that aim to capture how users perceive service performance and quality. Ghotbabadi et al. (2015) refer to the same model, and state that these dimensions and sub-dimensions may change depending on the type of service and the case study.

### 2.3.2 Conceptual model development adapted to the research

These three previous models, although different, share many similarities. The aim is to build on them to create a conceptual model to facilitate the design of the artifact of this research.

**Table 1. Service Quality conceptual model similarities**

| Influencing factor | Figure of reference | Reference Researcher(s) | Can be grouped as |
|---|---|---|---|
| People's Behaviour and Conviviality | Figure 1 | Haywood-Farmer, 1988 | Behaviour |
| Responsiveness | Figure 2 | Parasuraman et al., 1988 | |
| Empathy | Figure 2 | Parasuraman et al., 1988 | |
| Interaction Quality | Figure 3 | Brady & Cronin Jr, 2001 | |
| Professional Judgement | Figure 1 | Haywood-Farmer, 1988 | Competence |
| Reliability | Figure 2 | Parasuraman et al., 1988 | |
| Assurance | Figure 2 | Parasuraman et al., 1988 | |
| Physical Facilities, Processes and Procedures | Figure 1 | Haywood-Farmer, 1988 | Environment |
| Tangible | Figure 2 | Parasuraman et al., 1988 | |
| Physical Environment Quality | Figure 3 | Brady & Cronin Jr, 2001 | |
| Outcome Quality | Figure 3 | Brady & Cronin Jr, 2001 | Consequence |

As summarised in Table 1, the different variables found in the literature can converge and be summarised into four distinct variables.

Firstly, the variables "People's Behaviour and Conviviality", "Responsiveness", "Empathy" and "Interaction Quality" (cf. Figure 1, 2, 3 & table 1) can all be adapted to the behavioural aspect that a service provider has on the end user.

Secondly, "Professional Judgement", "Reliability" and "Assurance" (cf. Figure 1, 2 & table 1) can directly relate to the expertise / skills of a service provider to deliver the service correctly.

Thirdly, "Physical Facilities, Processes and Procedures", "Tangible" and "Physical Environment Quality" (cf. Figure 1, 2, 3 & table 1) can all relate to the environment surrounding a service, with regard to the different tools (software & hardware) available to the service providers, but also to the end users.

Finally, "Outcome Quality" (see Figure 3 & table 1) focuses more on quality outputs resulting from the behaviour and competence of service providers, as well as the environment surrounding the service. It can therefore represent the consequences during or after the service is delivered.

Furthermore, the nine sub-dimensions of the hierarchical model (cf. Figure 3) represent the user's perception of quality and are likely to change depending on the type of service and the case study (Ghotbabadi et al., 2015).

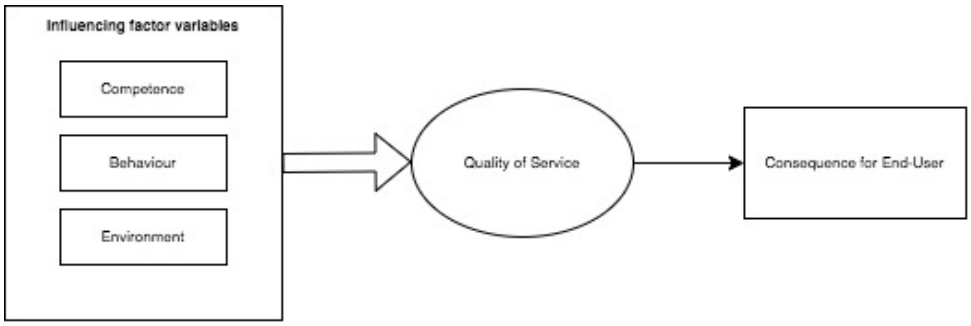



**Figure 4. Combination of prior conceptual models of service quality**

Figure 4, conceptualised in terms of previous service models, is represented as a causal model. Indeed, the quality of service is influenced by different variables, which have consequences on the service end-users.
Furthermore, in a cause-and-effect relationship, dependent and independent variables can be represented. These variables have a causal relationship, meaning that the independent variable has an influence on the dependent variable.

The dependent variable is represented by the expected effect, in other words the response or outcome variable. It is therefore represented by the Quality of Service in Figure 4. However, the independent variable is represented by the expected cause, which is the predictor or explanatory variable. Several have been identified in this section, namely Competence, Behaviour and Environment.

Furthermore, the lack of quality of a service can have consequences for the end-users (cf. right side of model, Figure 4). Indeed, the quality of service perceived by users is directly linked to their satisfaction, so the consequences of a lack of quality directly impact their satisfaction (Kim, Eom, & Ahn, 2005).

Gorla et al. (2010) describe that the main expectations of users are that the service is delivered on time, that the delivery is 'error free', and that communication with the support teams is healthy. Indeed, a lack of service quality leads to a long waiting time, which reduces user satisfaction (Sarkar, Mukhopadhyay, & Ghosh, 2011). A service failure, i.e., when the service is not delivered, is also a consequence of a lack of service quality that directly impacts user satisfaction (Hess Jr, Ganesan, & Klein, 2003). And a lack of effective communication between the different parties, represented more precisely by the lack of shared information, is also represented by a lack of quality (Sharma & Patterson, 1999).

The literature therefore presents the consequences for users of a lack of quality: long waiting time for the service, non-delivery of the service, and lack of communication between users and provider.

Moreover, as empirical data can also be used to adapt a conceptual model to a particular case (Elangovan & Rajendran, 2015), these three consequences found in the literature can be adapted to the case of CMA-CGM through data.

Indeed, when a user makes an escalation request because he/she faces an issue with the support service (explained in detail in the company presentation section), the Service Quality Management team member managing it has to provide a reason on the service management software. These reasons include "Processing delay", "Solution provided is not satisfactory" and "Communication issues with support team", which correspond to the consequences found in the literature. The expected consequences in this case can therefore be predict as a too long wait for resolutions, unresolved tickets, and a lack of communication between the two parties.

It is therefore feasible to develop a conceptual model, based on previous literature, which has been adapted to CMA-CGM due to the consequences that a lack of quality can cause to the end users (cf. Figure 5).

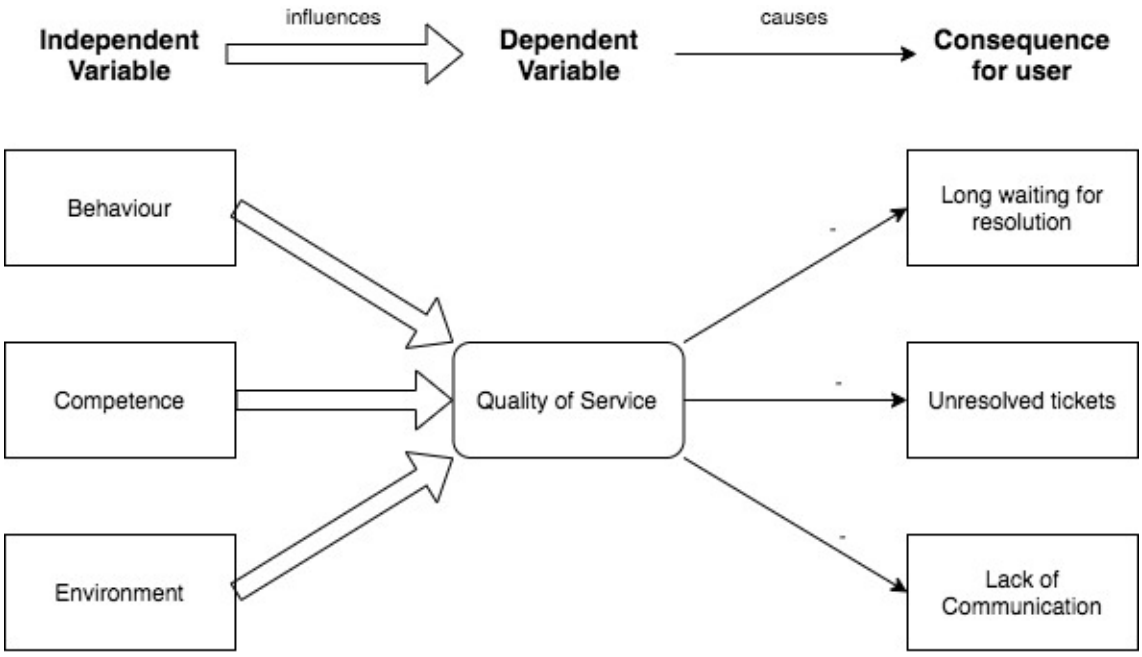



**Figure 5. CMA-CGM Support Service Quality Conceptual Model**

The "-" character on the three right arrows shows that these consequences are due to a lack of quality of service, e.g., a negative correlation.

In addition, the construction of this conceptual model can introduce 6 hypotheses, representing the relationships of the six arrows of the model (see Figure 5). These hypotheses should be tested in the Result section to ensure the consistency of the model.

H1: Behavioural aspect of service providers influences Quality of Service.

H2: Resolution competence of service providers influences Quality of Service.

H3: Supportive Environment influences Quality of Service

H4: Poor Quality of Service leads to a long wait for resolution.

H5: Poor Quality of Service leads to unresolved tickets.

H6: Poor Quality of Service leads to a lack of communication between users and support teams.

Now that Quality of Service has been reviewed, and the factors that influence it and the causes it may have for end users have been conceptualised, it is important to address the subject of its measurement, monitoring and improvement.

## 2.4 Quality of Service Measurement, Monitoring and Improvement

According to Franceschini, Galetto, and Turina (2009), measurement involves the implementation of a Performance Measurement System (PMS), and more precisely via performance indicators. Indeed, companies that have implemented a well-developed PMS have achieved better results in terms of customer, financial and market performance (Evans, 2004). In a business context, the term performance is linked to the results and achievements of a firm in relation to its objectives. It was originally focused on fiscality before expanding to encompass innovation, flexibility or even quality of service (A. Neely, 1999).

Many different Performance Measurement Systems exist. A company must therefore choose the one that is best suited to the performance criteria it wants to measure. Sorooshian, Aziz, Ahmad, Jubidin, and Mustapha (2016) have studied the most popular systems, and among the most used are "Balance Scorecard" (Kaplan & Norton, 2007), "Performance Prism" (A. D. Neely, Adams, & Kennerley, 2002) and "Theory of Constraint" (Goldratt, 1990).

Each PMS focuses on a few dimensions which are then monitored through controls and performance indicators. The four dimensions of Balance Scorecard are customer, finance, internal processes, and learning/development (Kaplan & Norton, 2007). In contrast, Performance Prism has five, which are stakeholder satisfaction, stakeholder contribution, strategies, processes and capabilities (A. D. Neely et al., 2002). Finally, the four

aspects of Theory of Constraint are processes, quality, capacity and inventory (Goldratt, 1990).

An indicator is an evaluation tool, based on a measurable or assessable element, aimed at monitoring the evolution of an item (e.g., process) in relation to a reference. Regarding service quality indicators, Vuk (2012) divides them into two classifications, internal and external indicators. As their names suggest, internal indicators allow for the monitoring of an organisation's own processes, while external indicators are more general and allow to monitor those of external partners. He also states that these indicators provide a quick overview of the quality level of the services implemented, as well as their evolution over time. Indeed, this makes it possible to discover the weak points of the processes and to select priorities in order to increase the quality.

However, the main concern with the PMS method is the difficulty in implementing it due to the complexity of choosing good performance indicators that represent the chosen system well (Franceschini et al., 2009). Also, Mangold and Babakus (1990) considered the measurement, control and improvement of service quality as difficult to achieve.

In order to measure, test and monitor the Quality of Service of CMA-CGM IT support department, it is necessary to review the concept of audit methodology, which is intended to guide the construction of the artefact of this study.

## 2.5 Audit Methodology

In this section, the aim is to understand why an audit methodology can be useful for this research.

### 2.5.1 IT Audit and Service Quality Audit

Originally, an Audit is the examination of an organisation's financial report in order to control the validity of its financial statements. Nowadays, audits are also applied to other objects such as IT systems, processes and even whole departments.

According to Gantz (2013), the purpose of an IT audit is to investigate the processes, IT assets and controls at multiple levels across an organisation to assess the level of compliance with the appropriate standards or requirements. Its objective is to understand, evaluate, but above all improve a company's IT uses in order to measure and correct its performance in order to meet their objectives.

Furthermore, regarding IT services, Peppard (2003) states that they can be classified into four different categories, namely "Applications services", "Operational services", "Value-enabling services" and "Infrastructure services". And regarding service quality, Peppard (2003) divides it into two aspects, technical quality and emotional quality. Technical quality is based on the final rendering of the service, whereas emotional quality is based on the user's valuation towards the delivery of the service.

In more detail, the "Value-enabling services" category covers IT Support Services. And in terms of IT Support Service, another important term originating from the Information Technology Infrastructure Library (ITIL) is Service Desk. Indeed, ITIL defines it as the single point of contact (SPOC) between the IT service provider and the users for daily activities. A typical IT service desk manages incidents (service interruptions) and service requests (routine service-related tasks) while handling user communications about events such as outages or planned service changes. Originally, its purpose was simply to ensure that the service was delivered as quickly as possible, but now stronger functions and other capabilities, including monitoring service quality, are a major aspect of it (Tang & Todo, 2013).

Regarding Service Desks, O'Brien (2016) conducted an audit to measure their effectiveness and suitability to users. He used different methodologies to analyse the need for improvement in order to develop and test different solutions. The audit of a service desk can be general, but can also be focused on specific points, such as security or quality.

### 2.5.2 Service Quality Audit best practices

There are many good practices in terms of quality and service auditing. It is therefore relevant to outline the main ones through prior literature.

#### *2.5.2.1 ISAE 3402 standard*

ISAE 3402 (International Standard on Assurance Engagements) is a standard implemented in 2011 and developed by AICPA (American Institute of Certified Public Accountants). It enables users of outsourced services to obtain assurance concerning the reliability of the internal control system for their services.

ISAE 3402 is divided into two different levels of control. Firstly, there is the Type I report, which attests to the adequacy of the design of a system of internal controls, and the operational existence of these internal controls, (i.e., if they have been implemented). Then there is the Type II report, which attests to the operational effectiveness of the

internal control over the entire period under scope. This evaluation for Type II report must be carried out over a period of six months.

This standard can therefore be useful to validate the effectiveness of the audit methodology implemented. Its main problem is its recentness (2011), so it is difficult to find literature and case studies about it.

#### *2.5.2.2 ITIL (Information Technology Infrastructure Library)*

ITIL is a collection of best practices for IT Service Management (ITSM).

It is among the most popular and widely used in the industry (Iden & Eikebrokk, 2013; Müller & de Lichtenberg, 2018) and has been developed to help organizations manage IT services at lower cost and of higher quality (Galup, Jing, Dattero, & Conger, 2007; Jack & Scott, 2008).

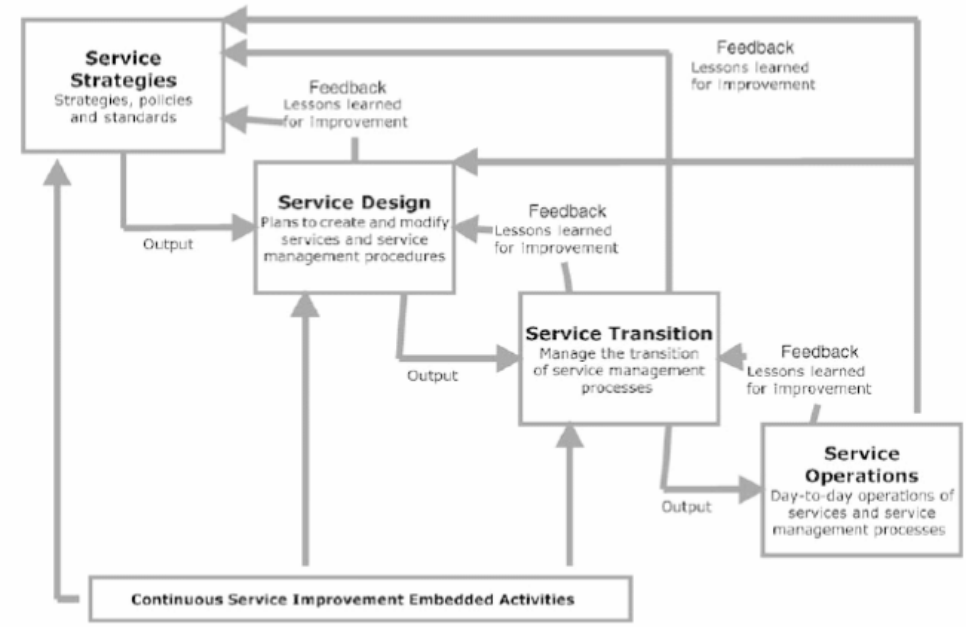



**Figure 6. ITIL Continuous Feedback Loop (from Moeller, 2010).**

The entire ITIL framework is divided into five phases: “Service Strategy”, “Service Design”, “Service Transition”, “Service Operations” and “Continual Service Improvement” (AXELOS., 2011; Cartlidge & Hanna, 2007) (cf. Figure 6).

There are several "theories" underlying ITIL. These include the Theory of Constraints, which consists of identifying the constraint of a system, with the aim of maximising its performance (Goldratt, 1990), and Process Aware, which is essentially based on process models (Dumas, van der Aalst, & Ter Hofstede, 2005).

In addition, the ITIL framework directly addresses its good practices for Service Desk management, which is the focus of the research. Indeed, the two main tasks of a Service Desk are Incident Management and Service Request Management. Also, the growing importance of this service due to technological development and stricter requirements enabled the Service Desk to evolve from being reactive to proactive (Tang & Todo, 2013). To this end, ITIL suggests the implementation of new functions such as the Knowledge Base (knowledge database to assist both users and suppliers), VIP support (to provide more in-depth support for VIP users), reporting service (to provide accurate and timely reports), and Customer Satisfaction Survey (to obtain feedback on users' real needs in order to improve the service).

Performing an audit methodology on a Service Desk is therefore viable but requires testing it to a norm.

### 2.5.3 Audit criteria selection

The five stages of the audit cycle are audit preparation, audit criteria selection, performance measurement, improvement and sustaining improvement (Benjamin, 2008). Indeed, establishing an audit methodology for the quality of a service involves assessing its compliance with audit criteria. It is therefore important to choose them well so that the level of performance is measured against an appropriate norm. In practice, they are commonly derived from a wide range of sources, such as ITIL, ISO standards, COBIT & COSO control frameworks, etc.

Nevertheless, Hearnshaw, Harker, Cheater, Baker, and Grimshaw (2003) found that if quality is assessed with inappropriate audit criteria, then quality improvement actions will be ineffective. For this reason, some researchers have decided to develop their own audit criteria in order to fully accommodate the item being audited (Ruppertsberg, Ward, Ridout, & Foy, 2014). Furthermore, the measurement of service quality compliance can be done by means of a checklist, where the checkpoints to be verified can be identified by means of qualitative or quantitative approaches (Ma, Pearson, & Tadisina, 2005), such as conducting questionnaires on service quality to the parties affected (end-users and service providers).

### 2.5.4 Alternative ways of service quality improvement

Developing an audit methodology is very formal, which enables it become a strong and added-value strategy for continuous improvement (Benjamin, 2008). However, there are less formal alternatives that can lead to a similar result.

Indeed, the Six Sigma DMAIC method is a continuous improvement approach. Six Sigma is a structured management method for improving the quality and efficiency of processes (Antony, 2006). DMAIC is a data driven Six Sigma life cycle approach to process improvement projects (Sokovic, Pavletic, & Pipan, 2010). As its name indicates, DMAIC consists of five phases, namely Define (posing the problem by defining the symptoms), Measure (quantifying the extent of the problem), Analyse (determining the causes of the problem), Improve (identifying the solution(s) to the problem) and Control (verifying and sustaining the improvement over time).

Furthermore, there is the Lean methodology, which is the search for performance (in terms of productivity, quality, time and cost) through continuous improvement and the elimination of waste, with the aim of satisfying the customer. However, according to Bhasin and Burcher (2006), Lean should be seen as a philosophy and not a process.

## 2.6 Conclusion

This literature review firstly allowed to reconsider what a service is and how researchers have modelled its quality in order to describe its different influencing factors (Brady & Cronin Jr, 2001; Haywood-Farmer, 1988; Parasuraman et al., 1988). It also allowed to compile the different variables of each model (cf. table 1) in order to design a conceptual model for the research, which is intended to guide this paper in order to achieve our final artefact.

In addition, internal empirical data from CMA-CGM enabled the estimation of the three most important consequences for end-users caused by a lack of service quality, which allowed the conceptual model to be adapted to the research (cf. Figure 5). It is also supported by six hypotheses only in order to verify its veracity and to proceed to the results in the best conditions.

Next, the notions of measurement, monitoring and improvement of the quality of service have been reviewed as these aspects are of primary importance for the proper development of the solution to be designed for the research. In particular, the aspect of

indicators which allows to measure points to be monitored in order to evaluate an object, such as the quality of a service.

Finally, the notion of audit methodology was reviewed, being a formal method to undertake the measurement, monitoring and improvement of CMA-CGM's IT support service. Furthermore, requiring a formal method to be carried out on a regular basis, CMA-CGGM was in any case requesting the development of an audit-based methodology. For this reason, good practice in service quality auditing, as well as the selection of audit criteria (norm) were also reviewed. Two alternatives to audit practice were also discussed (DMAIC and Lean) in order to understand how they work in relation to an audit methodology. They are generally simpler to implement but lack the formality of auditing. This is the reason why CMA-CGM is imposing the audit methodology aspect on this study and the artefact to be build.

# 3 METHODOLOGY

The methodology chosen is design science research, based on a case study with surveys for data collection, resulting in an artefact.

## 3.1 Research Design

The predominant methodology of this research is design science research. Indeed, Hevner et al. (2004) stated that design science aims to evaluate artefacts and to solve identified organizational problems. And a specific problem is highlighted in this research with a clear and precise solution to be provided. In addition, Hevner et al. (2004) have established seven guidelines that help to comply with the requirements of this methodology.

The first guideline, "Design as an Artifact", focuses on describing the artefact related to the research topic in order to address the organizational problem being studied. The second guideline, "Problem Relevance", aims to identify technological solutions to unsolved business problems. The third guideline, "Design Evaluation", allows to demonstrate the "utility, quality and effectiveness" of the artefact through evaluation methods. The fourth guideline, "Research Contributions", concerns the contributions that the research will make, whether in relation to the artefact, the foundations and/or the methodologies. The fifth guideline, "Research Rigor", addresses the rigorous methods that must be used on the artefact. The sixth guideline, "Design as a Search Process", concerns the finding of available resources in order to achieve the research objectives, while respecting the laws of the environment. And finally, the seventh guideline, "Communication of Research", concerns the presentation of the research, which must be understood by both IT and management people.

The construction of the artefact therefore involved the investigation of theories related to the different influences that can exist on a service delivery. These investigations were not necessarily linked to a service desk, or even an IT department. However, the models found were adapted to the needs of the research in order to create hypotheses. The knowledge contribution of this research can therefore be characterized as "Exaptation", which is the extension of known solutions to a new problem (Gregor & Hevner, 2013).

In order to properly develop the artefact, this research is also based on a case study with surveys for data collection. Indeed, case study research allows for the study of phenomena in real life situations (Zainal, 2007), which allows for a detailed and in-depth analysis on a limited number of subjects. Furthermore, Zainal (2007), defines several

types of case studies, including the instrumental case study, which is the study of a singular case, such as a company, in order to address a particular problem, such as increasing the quality of an IT support service.

## 3.2 Research Organisation

The purpose of this section is to explain the different steps undertaken leading to the creation of the artefact. It is intended to detail the methodology so that similar research can refer to this section to review the different steps.

#### *3.2.1.1 Process identification*

Once the service provider has been chosen for the study, the next step was to learn about its processes and operations. A first overview was described in the company presentation. In fact, this part was presented in the form of a funnel. In other words, the primary missions of the company were explained before zooming in on the IT support department to explain how it works. Then, in order to be more precise and rigorous, a study of all the contracts set up between the two parties was made. Indeed, the contracts specify in detail the processes and controls in place. The purpose of this step was to know in detail the processes and the running of the service provision.

Then, once a clear picture of the Service Desk operation was achieved, the weak points of the processes had been investigated. Indeed, in order to find these weak points, it is important to know the feelings of the service users, but also of the suppliers.
To obtain this input, two questionnaires were developed to firstly verify the validity and reliability of the hypotheses derived from the built conceptual model, in order to also and above all identify which aspects to focus on when designing the artefact.

#### *3.2.1.2 Weak point measure*

The two questionnaires were therefore separated into several sections covering different topics.

For the user questionnaire, there are three distinct sections. The first is the preliminary questions, which aim to collect information about users in order to be able to segment them in the analysis. The second is about quality of service, focusing on the different aspects of the conceptual model (environment, behaviour and competence). Finally, the third is on processes, in order to discover the parts of the process that do not meet the users' expectations and where there is room for improvement.

Concerning the supplier questionnaire, there are four sections, and it is constructed slightly differently than the previous one. The first section is similar and concerns preliminary questions aimed at segmenting the audience. Then the other three sections are aligned with the second section of the user questionnaire focusing on the different variables. Indeed, the second section deals with the environment aspect by asking questions about the resources in place (the question on Quality of Service is also asked in this section). The third is on the behavioural side, focusing on the relationship with users and the means to reach them. Finally, the last one is about competences to meet the users' expectations.

In terms of audience selection, decisions were needed in order to make the questionnaires as efficient as possible.

For users, respondents should first know the support service and have already used it. In addition, as the aim of the survey is to discover weak points, a selection can be made by surveying only people who have had problems with the service. In order to meet these criteria, the audience was users who have gone through the escalation process. Indeed, the role of the IT support department is to manage tickets corresponding to Service Requests or Incidents (this process will be explained in detail during the company presentation). As a result, if a user feels that there is a management / process issue with their ticket, they can "escalate" it to a dedicated internal CMA-CGM team in order to unblock the situation. Choosing this audience made it easy to discover specific trends on weak points without having to investigate all users in the company.

For service providers, respondent identification was done differently. Indeed, in order to obtain a representative sample, its selection was made by a manager within the service provider's organization. This enables a direct collaboration with the service provider to ensure a representative sample of all the different levels of support and the different types of support teams.

Furthermore, prior to the release, pilot tests were conducted to get feedback on the construction and content of the questionnaires. This allowed to test and improve it before its launch. The final form was then launched during a two-week period with a relaunch in the second week.

#### *3.2.1.3 Result of Survey*

CMA-CGM uses Office 365, hence the survey had to be conducted on Microsoft Forms. In order to analyse the results, Microsoft Forms offers a first view with

automatically made graphs (cf. Appendix 1 & 2), but there is also an option to upload the results on Excel.

The user questionnaire included 11 questions, 10 of which were closed. The supplier questionnaire was composed of 16 questions, of which 15 were closed. The only open question in both questionnaires was not mandatory and was intended to give the respondent the opportunity to add anything else in order to improve the processes.

Therefore, a simple analysis in Excel revealed trends in the weak points sought. The only complexity was to deal with the open questions. For this purpose, it was necessary to read the comments one by one in order to create a new column composed of keywords, which were analysable. Indeed, the two samples were not very large (204 for users and 11 for suppliers) so it was manageable. Furthermore, SPSS software was used in order to test the validity and reliability of the two questionnaires.

#### *3.2.1.4 Proposed artefact*

The next step in this study was to design the artefact solution. This solution was in the form of an analysis grid composed of several checkpoints related to the different findings of this research, as well as indicator to describe how to measure them, and recommended actions in case of validated checkpoint.

This analysis grid has made it possible to obtain a quality " norm " for which it would be necessary to verify the compliancy of the IT support service, namely the realisation of the audit methodology. The further objective will be to extend this audit methodology to other service providers, but also to internal teams. The idea is to perform this quality audit every year and to implement an action plan at the end of each cycle in order to continuously improve the quality of CMA-CGM's IT support service.

#### *3.2.1.5 Validation*

Lastly, the final stage of this study was to validate the proposed solution. For this purpose, the manager and the data officer of CMA-CGM's SQM team had to review the analysis grid developed during this research in order to assess whether it met their expectations and if it could be implemented for a test phase. This mean that the validation is considered successful if the analysis grid is validated for a test implementation. The validation process occurred at the end of the study once the solution is fully developed and during a meeting with the involved stakeholder.

# 4 CASE DEVELOPMENT

Now that we have gone through prior literature, it is time to start studying the current situation at CMA-CGM. Indeed, it is essential to study the different contracts already in place with the service providers, and the service level agreements (SLAs) already in place and all the other controls, in order to be able to understand the different aspects and processes of service management in place.

## 4.1 Company Presentation

CMA-CGM, which, once translated from French, means “Maritime Chartering Company - General Shipping Company”, is a French container ship owner based in Marseille, France. CMA was founded in 1978 by Jacques Saadé, and merged with CGM in 1996 to become CMA-CGM. It is now ranked among the top four largest shipping companies in the world.

In terms of key figures for 2019, CMA-CGM has 755 agencies across 160 countries, with 110,000 employees and with a global revenue of 30.3 billion USD. More specifically, the company uses 509 ships, serving 285 shipping routes in 420 different ports. Its fleet slot capacity is 2.705 million TEU for a total transported volume of 21.6 million TEU (CMA-CGM). TEU (Twenty Equivalent Unit) is a unit of measurement for terminals and container ships based on the volume of a 20-foot container. It is used to simplify the calculation of the volume of containers in a terminal or ship.

Furthermore, CMA-CGM has acquired numerous brands and subsidiaries in order to serve its customers worldwide in the best possible conditions. There is APL in Singapore, ANL in Oceania, CNC for the intra-Asian market, Containerships in Europe, Comanav in North Africa, Mercosul in South America, CMA Ships for ships and crew management, CMA Terminals & Terminal Link for terminal construction, procurement and operations, and finally CEVA Logistics for logistics and supply chain worldwide (CMA-CGM).
The acquisition of CEVA Logistics has also enabled the company to further develop its intermodal services and door-to-door solutions. Indeed, CMA-CGM also has land-based solutions for regional and transcontinental connections, whether by train, barge or truck. 7.3 million TEUs were transported by intermodal in 2019.

Furthermore, its Comanav subsidiary provides intra-Mediterranean services to the Maghreb. Indeed, thanks to Ro-Ro vessels (called ROROs), CMA-CGM can transport goods in a faster, simpler and even safer way. Ro-Ro vessels are therefore smaller vessels,

with the specificity of loading and unloading goods by towing between the shore and the quay. This offer reaches 6 ports located in Morocco, Tunisia and Algeria. There are 7 weekly departures for 3 RORO vessels and 57,559 TEU carried in 2019.
In order to further complete its supply chain capabilities, a new division, CMA-CGM Air Cargo, has been created. It is very recent as it was launched in 2021. For the time being, only one route is open linking Europe to the United States, more precisely Liège (Belgium) to Chicago (USA). About 10 weekly departures from each airport are planned for the moment. This allows air freight to be added to the supply chain, enabling a complete offer to its customers, for faster and more agile deliveries.

Beyond transport, CMA-CGM offers CMA CGM +, a range of value-added services for greater customer focus. CMA CGM + is divided into three distinct categories, CARE, BOOST and ACT. CARE aims to protect, guarantee and secure customers' goods. BOOST aims to develop the visibility, potential and performance of its customers. And ACT aims to minimise the impact of its activities on the environment.

In order to better understand CMA-CGM's business, it is interesting to investigate a basic customer process (cf. Figure 6).

First, the customer in charge of the shipment or a freight forwarder calls CMA CGM to request a quote. Then, the Sales & Operations Planning representative (agent and global accounts) gives the tariff as received from the line ratemaker. If accepted, the customer creates a booking and gives shipping and documentation instructions.

From this stage onwards, the cargo's journey can begin. The first task to be managed is the filling of the cargo and the positioning of the container. Then, the land transport is organised (forwarder or agent). Indeed, the containers are transported to the container yard a few days before being loaded onto a ship. On D-day, the ship reaches the port, and a crane proceeds with the loading and unloading of the containers. The ship can then set sail for its arrival destination. Once at the port of arrival or the place of delivery, the container is received, unpacked and shipped back.

Following these processes, the agent issues the invoices. And finally, at the end of the journey, the management controller establishes the profitability and financial results of the line.

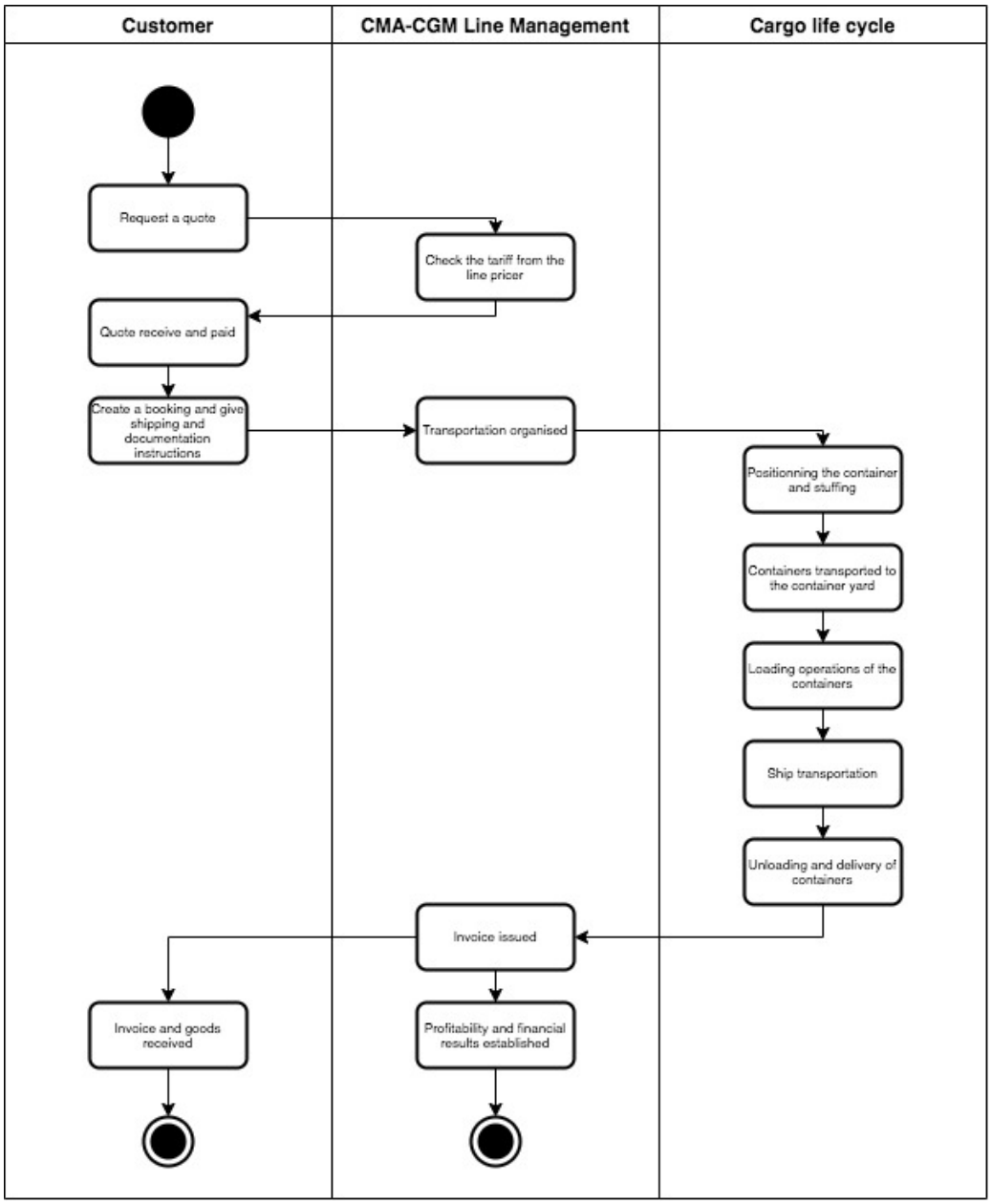



**Figure 7. Basic CMA-CGM Customer Process**

CMA-CGM's core business is therefore line management. This central unit includes 4 different departments that have a direct impact on its activity. There is the Commercial division, the Cargo Flow division, the Operations division and the Finance / Business Control division. Then, in order to complement this activity and to enable it to perform fully and efficiently, CMA-CGM has set up the Operational and Support Business Lines (cf. Figure 8).

In Operational Business Line, there are several divisions. The first is "Vessel", which is responsible for managing chartering, CMA vessels, terminals and equipment,

bunkering, but also its Quality / Safety / Security / Environment (QSSE). Then there is the "Logistics" division, which deals with the purchase, location and management of containers. The next division is "Customers", managed by the agency network and they deal with global accounts. Finally, there is the "Transportation" division, which manages mostly the intermodal aspect and the door-to-door offer.

The Support Business Line is also divided in multiple divisions. These include "Agency Management", "Communication", "HR / Administration", "Finance / Accounting / Audits", "Legal dept / Pool dept / Insurance", "IT – Systems", and “Travellers’ club”.

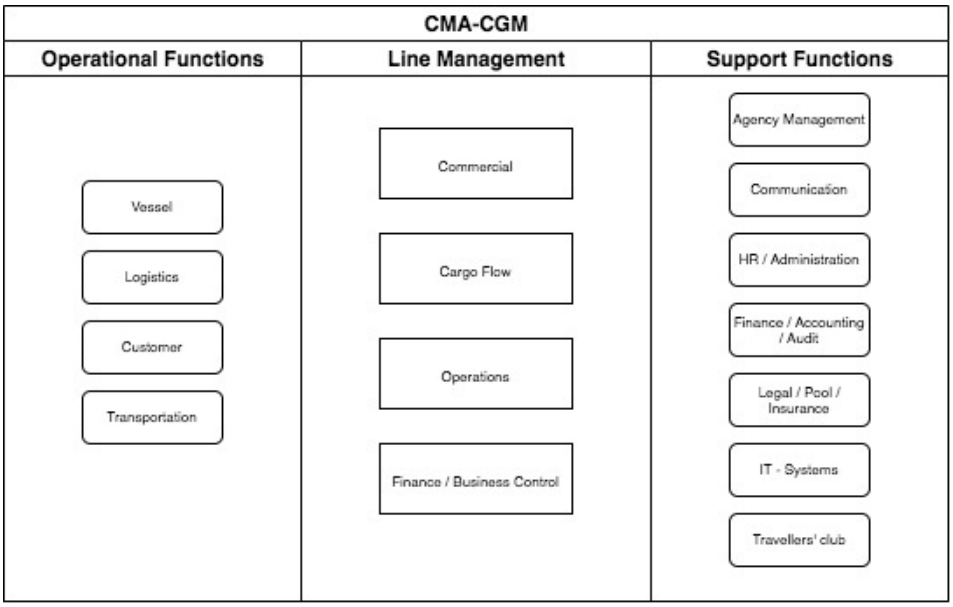



**Figure 8. CMA-CGM Organisational Chart**

For the research and the case study, the division that is important to develop and understand is "IT - Systems" of the Support functions business unit. Indeed, this is the department that contains all of CMA CGM's IT. The IT division is further divided into 10 different sections. There are "Transversal IT", "Business Relationship Management", "CIO Office", "Core IT", "Cloud Transformation", "Operations", "APAC Sustainability", as well as 3 different regional divisions. Finally, the section of interest for the subject is "CIO Office", which is itself divided into 5 branches. There is "Contract Management", "Governance & Performance", "Support Quality Management", "Software Asset Management" and "Data Integrity". This research is carried out for the "Support Quality Management” (SQM) branch, whose role is to define, implement and manage an end-to-end user support strategy.

It is important to recall that IT support services exist because end-users of IT equipment or business applications sometimes face issues for which they need assistance or access. At CMA-CGM, and generally in companies, when a user faces a problem, he/she has to create a ticket (see ITIL). For this purpose, a dedicated platform has been implemented, named EUP (End User Portal). From it, the user is able to create two different types of ticket, "Incident" and "Service Request". An Incident occurs when there is an interruption to a previously functioning IT service. The ticket should be created even if, for example, the incident is blocking or not, can be worked around or not, or impacts a single user or several. On the other hand, if the user requires support for a feature that has never existed before, then it is not an incident but an improvement or a change request. The priority of an incident is defined according to the combination of the impact (how many users are affected) and the urgency of the feedback required (from immediate to the forthcoming). A “Service Request” therefore concerns everything that is not an incident. It might be a request for an access to an application, a data extraction, a material order, and so on.

The ticket handling process differs slightly depending on whether it is an incident or a service request (cf. Figure 9 & 10). Once submitted, the ticket is routed to one or more support groups depending on the number of tasks created to respond to the request. Indeed, a service request ticket can have one or more tasks, sequential or in parallel, to handle dependent or independent actions for its resolution. In contrast, an incident ticket has no tasks and is assigned to a single support group.

Concerning the life cycle of a ticket, it is composed of several statuses. The first is “Open”, before being “In Queue”. It is then “Assigned” to a support team and a person responsible for its resolution. There are also optional statuses, namely “Pending User”, “Pending Vendor” or “Pending for transport”. Once resolved, the ticket is at the “Resolved” stage. The user then has 10 days to reopen it if not satisfied with the resolution. However, if it has not been reopened within 10 days, it will be “Closed”. It can be “Closed Complete” or “Closed Incomplete”. Each time a support team performs an action on a ticket, they are expected to enter a visible comment for the end user to inform him/her about the progress of the action. In addition, when the ticket is resolved, a resolution note is added for the end user's attention. Furthermore, during the life cycle of the ticket, some work notes can be added for internal communication between the support teams. Knowing how ticket management works is very important for this thesis as it is at the heart of the audit methodology research.

In order to control the quality of this ticket management, CMA-CGM established the SQM (Service Quality Management) department. Referring to the Service Operation phase of ITIL, this team was created to ensure the effectiveness of the support service and to provide value to users and service providers.

Indeed, the SQM team is responsible for ensuring that the IT support services provided are of a good quality. It must therefore implement and monitor all support processes. The SQM division manages five different scopes.

1. "Support Processes". The SQM team is responsible for defining and implementing the support processes for all IT systems covered by the End User Portal and Service Now. For any new tool deployed, the SQM team helps to define the support process and to implement it. On the other hand, for any existing process, the SQM team provides expertise to analyse and evaluate it. If an improvement or adjustment is to be made, the change is implemented with the agreement of the concerned stakeholders.
2. "Quality Reporting & Dashboard". This scope is dedicated to reports on support activities carried out by all support actors, such as Infosys, IBM or CMA-CGM. It also implements reports on tickets in order to analyse which are the sensitive points of the IT systems.
3. "SNOW Tool". Indeed, Service Now is the ticketing tool that hosts the support processes for CMA-CGM Group's tool, but also End-User Portal. The SQM team oversees improvements and corrections to this tool.
4. "Customer Relationship & Customer Management". Monthly calls with representatives are set up to discuss weak points regarding support services. Indeed, the SQM team is always available to assist its internal customers.
5. "Transformation & Project". The SQM team undertakes transformations and projects to ensure the integration of all support processes and systems to ensure that everything is fully transparent to users. Their role is also to automate as many support processes as possible to minimise the time spent resolving requests. Lastly, continuous improvement projects and action plans are implemented to improve the user experience with support and the End User Portal.

Each member of the SQM team has separate responsibilities to cover all aspects of the department. However, one common task unifies them all, namely escalation. Escalation

is the possibility for an end-user to get help if they are dissatisfied with the support provided (or not) for a support request. Indeed, managing an escalation consists of taking action with the support teams concerned by the dissatisfaction so that the end user obtains the expected service as quickly as possible. Furthermore, the traceability of an escalation allows to follow its support, and the time spent by the SQM team on this activity. It also facilitates follow-up until the problem is resolved.

As CMA-CGM is an international group, this escalation service must be available in all time zones (24 hours a day) from Monday to Friday. The distribution of the SQM team is therefore divided across the world. Seven team members are in France, two are in Singapore, one is in India, and there is one member in the United States, which is an SQM member only for the escalation task. The team manager is in France and can assists others SQM members in case of difficulties or very urgent cases. Otherwise, three French members manage the escalations from 10:00 to 14:00 (UTC+1), and the three other French manage them from 14:00 to 18:00 (UTC+1). After that, the US member takes over from 18h00 to 01h00 (UTC+1). Then, the Singapore members manage the escalations from 01:00 to 06:30 (UTC+1). Finally, the loop ends with the member in India taking over from 06:30 to 10:00 (UTC+1).

In order for all SQM members to access escalation requests and progress, a single point of contact has been created for users, which is an SQM group email. Furthermore, as soon as an escalation request is received by the team members, the person who will handle it will notify the other team members in a private conversation on the Microsoft Teams application, by sending the ticket reference.

It is important to remember that the SQM division is not responsible for resolving tickets. Indeed, the resolution of tickets is performed by numerous distinct groups, depending on the nature of the ticket. Some groups are internal to CMA-CGM, but most are service providers. The respective service providers are Infosys, IBM, APL and Interway. The distribution of the “Incident” and “Service Request” tickets managed by these different groups represents 33% for CMA-CGM, 10% for IBM, 51% for InfoSys, 1% for APL, and 5% for Interway.

As a quality team, the SQM team initiated this research to develop an audit methodology in order to improve the quality of the IT support service by testing its compliance with the quality audit criteria developed through this research.

## 4.2 Current situation & processes

In order to design, implement and test an audit methodology to increase the quality of our IT support services, it is important to know the current situation of CMA-CGM. Indeed, CMA-CGM developed very detailed contracts with its different providers in order to establish all the conditions binding the different parties. As part of the research, a contract with a supplier will be studied and analysed to understand what has already been put in place and to find out what service processes have been implemented for ticket management.

Regarding the case selection, the service provider chosen for this study is Infosys. It is the most representative because it is the service provider managing the largest number of "Incident" and "Service Request" tickets (see ITIL), which represent the scope of the SQM team, and which are the most revealing of the Quality of Service because they deal directly with the users. Indeed, automatically opened tickets that do not concern the user are not considered. Only tickets opened by a user will be studied. According to these criteria, Infosys manages the largest number of tickets with 51%. In addition, a healthy relationship is established with Infosys with a shared vision focusing on quality. The contract binding CMA-CGM and Infosys is divided into many different documents, including all the necessary conditions for the partnership to run successfully. Naturally, the contracts studied are strictly confidential and key figures, measures and SLAs should not be disclosed to ensure that this research is freely available.

The main objective of this section is to explore in detail the different ticket resolution processes implemented in order to understand the current state of the department's workflows. Moreover, the processes for "Incident" and "Service Request" tickets are handled differently. They must therefore be addressed separately.

### 4.2.1 Incident process

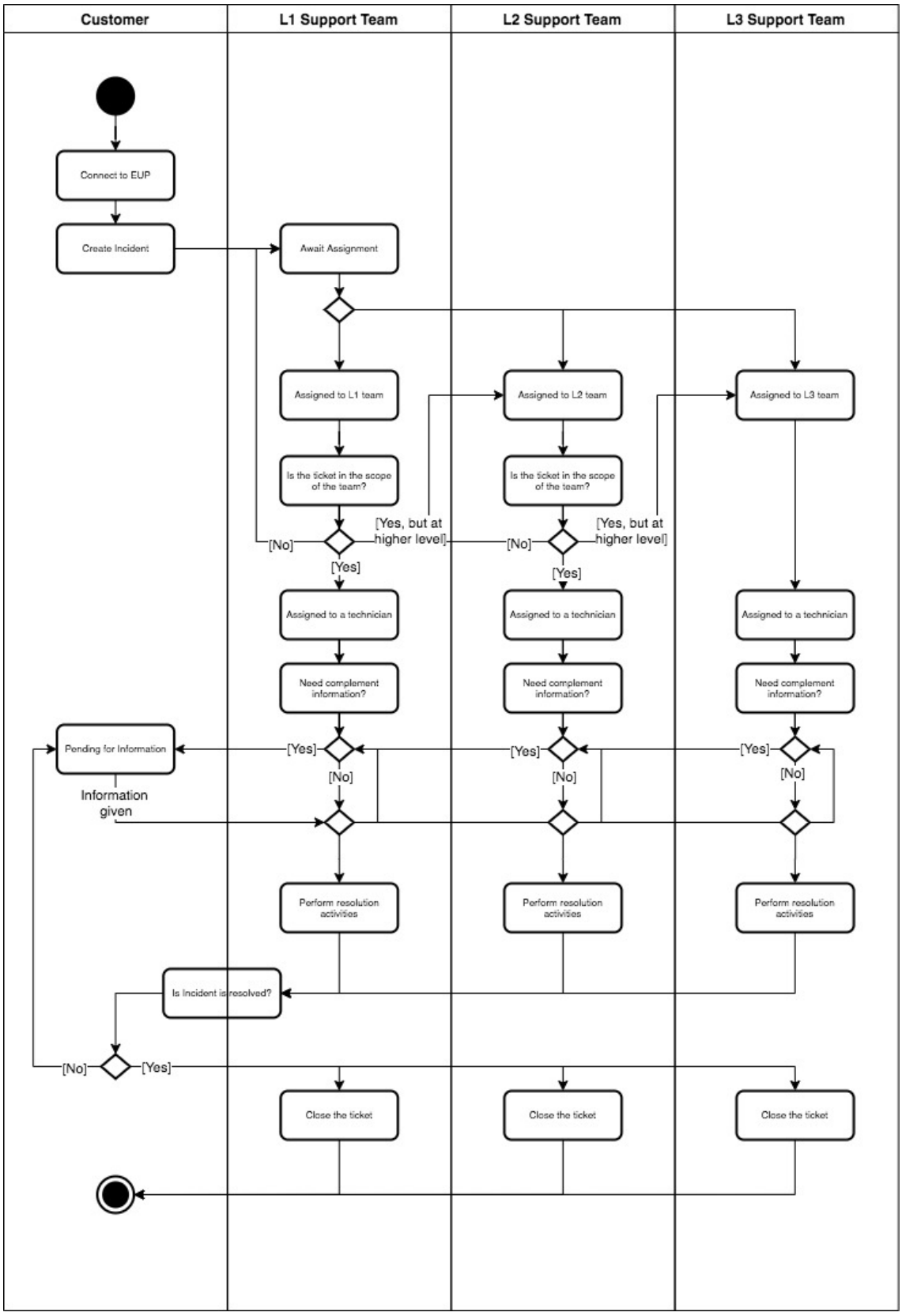



**Figure 9. Incident process Activity Diagram**

Incident management has a specific life cycle that is important to know in order to increase its quality. Its description aims to be straightforward by explaining the basic workflows in order to get a clear overview (cf. Figure 9).

When an incident occurs, the user must first create a ticket on the platform developed for this purpose, namely EUP (End User Portal). To do this, he/she must select the corresponding form and enter all the information required for its resolution.

Next, once submitted, the ticket will be automatically assigned to a support team. This can be either directly to the team in charge of the resolution depending on the form used, or to a first level team in charge of the distribution of tickets. Specifically, there are three different levels of support. Firstly, Level 1 teams perform basic incident handling, where resolutions are well documented and specific to the problem for example. Secondly, Level 2 teams handle more problematic situations, where some expertise is required. Finally, level 3 teams are the most skilled and handle the most complex situations.

Then, once assigned to a support team, the ticket is then attributed to a technician who becomes responsible for its resolution. A check is then made to see if the ticket is within their scope and if they have the necessary skills to resolve it. If so, resolution is performed. If not, there are several options. Either the ticket is transferred to the next level that has more expertise, or it is directly transferred to another support team concerned with the issue, or, if the person doesn't know where the ticket should go, they send it back to the team in charge of dispatching the tickets.

Afterwards, as soon as the resolution is done, the person in charge of the ticket will ask the user if the problem has been properly fixed. To do this, the ticket will be set to "Pending User" on Service Now to ask the user. The user will then be able to answer the question on the EUP portal. If it is successfully resolved, the ticket will be closed. If not, other solutions will be investigated to resolve it.

### 4.2.2 Service Request process

The first step in submitting a Service Request is also to open a ticket on EUP by filling in the corresponding form. Next, the ticket is automatically sent to the team in charge of resolution, depending on the form, or it is sent to the first-level team in charge of distribution. Also, the distribution team can handle the resolution of certain tickets (e.g., access, password management)

Afterwards, the ticket becomes "Open" as soon as it has been taken over by a technician. It then becomes "Work in progress" when the technician starts working on it. The ticket can also be on hold during the process. It will be in "Pending User" when further information is required, and "Pending for approval" when a manager's approval for the request is needed.

Finally, the ticket will be "Resolved" when a resolution has been provided to the end user. At this point, the ticket can still be reopened for 10 days. To validate, requester must close the ticket, else within 5 days the status will be definitively auto closed (cf. Figure 10).

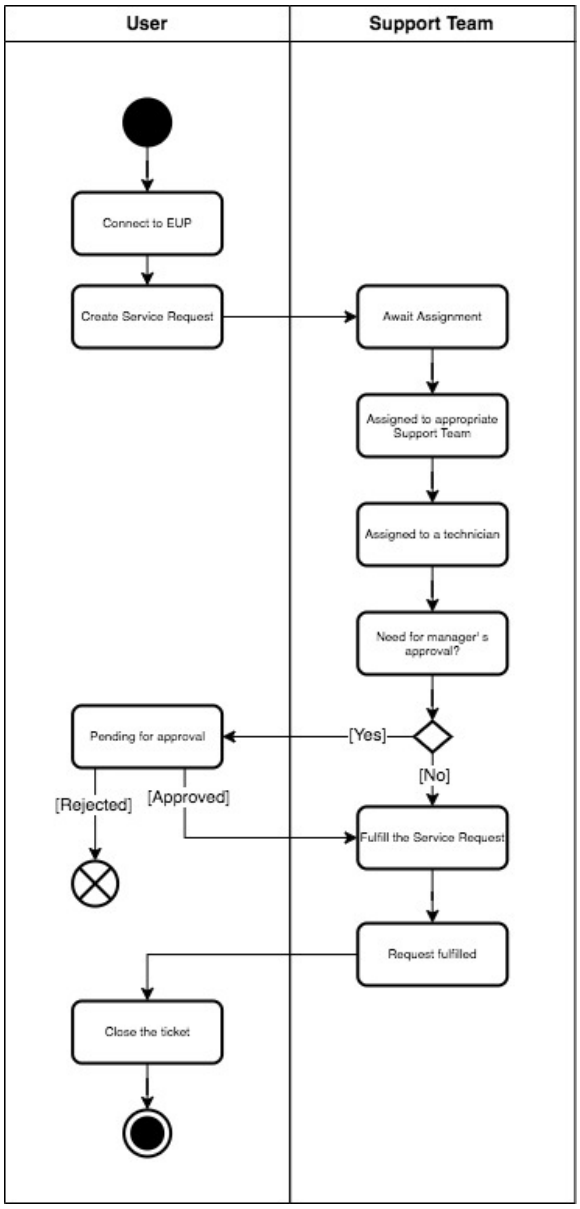



**Figure 10. Service Request process Activity Diagram**

### 4.2.3 Common processes

Now that the life cycle of service request and incident tickets have been described, it is important to discuss some of the general processes that complement them (cf. Figure 11).

First, there is the VIP process. Indeed, users classified as VIP, often from top management, need faster support, with a more complete follow-up. For this reason, when they are created, the tickets are directly marked as VIP and are directly managed. A notification is sent to the technician, who must then update the status every hour on Service Now. In addition, a reminder is sent automatically every two hours to the technician, the group resolution manager and the general management of the service provider. Furthermore, a report on active VIP tickets is produced every 4 hours, and the CMA-CGM SQM team must regularly check that everything is going well and remind the support teams when a ticket is taking too long to be handled. Lastly, communication with VIP users in case of delays should also be done by the SQM team.

Secondly, a Knowledge Base is implemented, designed to create a community between IT groups and end-users and to share as much information and best practices as possible. Written articles may be linked to:

- Processes of Ticket processing by support groups (up to date)
- Communications for end-users
- Tips to share with End Users or support groups
- All information can be shared for End Users and/or IT groups

The EUP Self Help must be updated regularly and centralize any information that can help end users and/or support groups. Furthermore, all support groups (Infosys, IBM, CMA-CGM, etc.) should provide monthly articles for Publication in the Knowledge Base. Also, all articles must be reviewed and approved for publication by the Support Quality Management Team.

Next, these processes are subject to Service Level Agreements (SLA), agreed when the contract is designed. SLAs differ according to the priority of the ticket, the type of form used, and the support team in charge of resolving it. Regarding the priority, it is determined according to the impact and urgency of the ticket. It is initially determined by the user before being validated or modified by the technician in charge. Naturally, the SLA clock will be paused when a certain ticket is assigned to another group or is in the "Pending" or "Resolved" state. In addition, when the ticket reaches the "Closed" state, the

SLA will stop. Furthermore, as in any SLA specified in a contract, financial penalties are provided for non-compliance with the agreements.

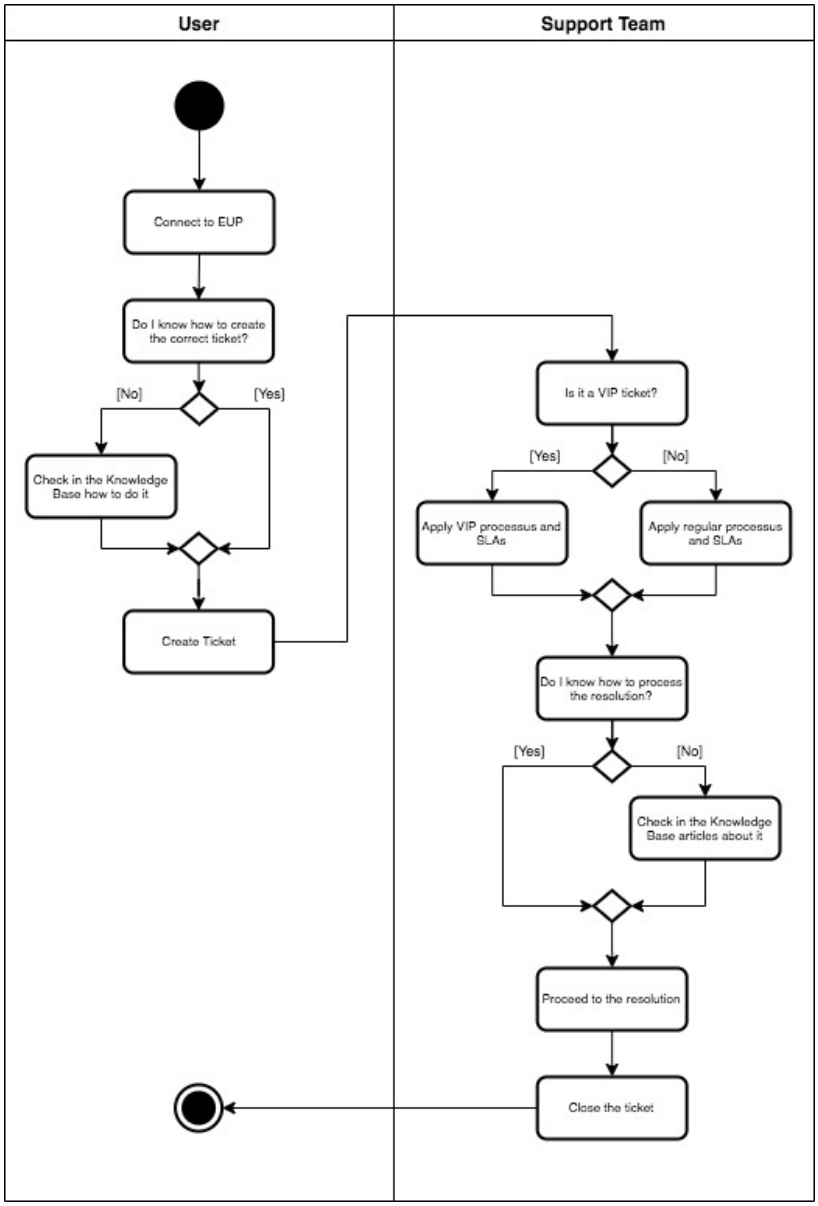



**Figure 11. Common processes Activity Diagram**

Finally, as the number of SLAs is large with many factors to consider, SQM Team implemented a weekly scorecard with several KPIs that the service providers have to meet (cf. table 2). Indeed, KPIs are considered an effective approach to process monitoring and defect detection in large organisations (Zhang et al., 2017). This scorecard aims to monitor the ticket management activity on a regular basis in order to be able to analyse and understand the bad scores and find solutions to improve performance.

**Table 2. Support Quality Management KPIs**

| **Support KPIs Long term** | **Value is OK if** |
|---|---|
| Resolution time (All Service Request tasks) – SR | Value > 85% within 2 days<br>\|SR\|_t+2 =< 0.85* \|SR\|_t |
| | Value > 95% within 5 days<br>\|SR\|_t+5 =< 0.95* \|SR\|_t |
| Resolution time (Incidents) – Inc | Value > 80% within 2 days<br>\|Inc\|_t+2 =< 0.80* \|Inc\|_t |
| | Value > 90% within 5 days<br>\|Inc\|_t+5 =< 0.90* \|Inc\|_t |
| Resolution time (Account requests tasks) – AR | Value > 90% within 2 days<br>\|AR\|_t+2 =< 0.90* \|AR\|_t |
| | Value > 98% within 5 days<br>\|AR\|_t+5 =< 0.98* \|AR\|_t |
| Tickets backlog (All tasks) – TB | Value < 20%<br>\|TB\|_t => 0.20* \|TB\|_t |
| Reopen count (All tickets) – RT | Value < 5%<br>\|RT\|_t => 0.05* \|RT\|_t |
| User reminder count (All tickets) | (% of ticket >= 3 reminders) < 0,5% |

This description of the case study provided a detailed picture of the current situation at CMA-CGM in terms of a general description of the company and, more specifically, of the IT support department, its operation and management processes. The next step is to conduct two quantitative questionnaires, based on the service quality model developed, in order to investigate the weak points of the support processes that negatively influence the quality of service.

# 5 RESULTS OF SURVEY

This chapter aims, firstly, to verify through the analysis of the questionnaires that the conceptual model developed in the literature review actually applies to the IT support service of this study in order to, secondly, develop the quality audit criteria artefact based on the conceptual model and the analysis of the questionnaires.

## 5.1 Validity and Reliability

Before analysing the data and challenging the hypotheses of the conceptual model, it is first necessary to assess the validity and reliability of the questionnaires. Heale and Twycross (2015) define validity as the accuracy with which a construct is measured in a quantitative study, and reliability as the measurement consistency of the instrument.

### 5.1.1 Validity of User Questionnaire

In a first step, the Face Validity type of validation was used to generate a first subjective validation of the questionnaire (Holden, 2010). For this purpose, several criteria related to this questionnaire must be validated by an expert. The data officer of the SQM team was chosen as expert for this validation. Indeed, he is an expert on data collection and fully understands the service, the processes, as well as the audience under study. The different criteria measured are the accuracy of the sample chosen and the questions asked.

Firstly, regarding the participants, it is not considered as representative of the entire population of users of the service, but as representative of users who have experienced issues with their ticket management. Indeed, the sample chosen concerns those who have performed the escalation principle. It is nevertheless considered valid because the aim of the research is to find the weak points of the ticket management process. In addition, the questionnaire was sent to 800 users with 204 responses, i.e., a response rate of 26%. This was considered sufficient to be representative of the population surveyed.

Secondly, regarding the questions, a pilot test was carried out beforehand in order to test the objectivity of the questions and the consistency of the questionnaire. Indeed, the pilot was sent to eight users, as well as to the entire SQM team, for constructive feedback. The main changes made in response to the feedback were the wording and phrasing used to make the questions clearer and more precise for the respondent. In addition, the main questions representing the different variables were duplicated in order to check that they match and that the wording does not influence the respondent in order to remove

duplicates in the final questionnaire. Finally, the questionnaire was only launched once the expert had fully validated its accuracy.

Furthermore, Content Validity was also performed, again with investigator triangulation. Indeed, the SQM data manager, considered as an expert, also contributed to ensure that the items were clear for the users and that they covered the whole construct. To this end, the words used in the questions have been precisely chosen so that the users understand correctly what is being assessed. The conceptual model of the research from Figure 5 is also shown in Figure 12 as a reminder to make this part easier to follow.

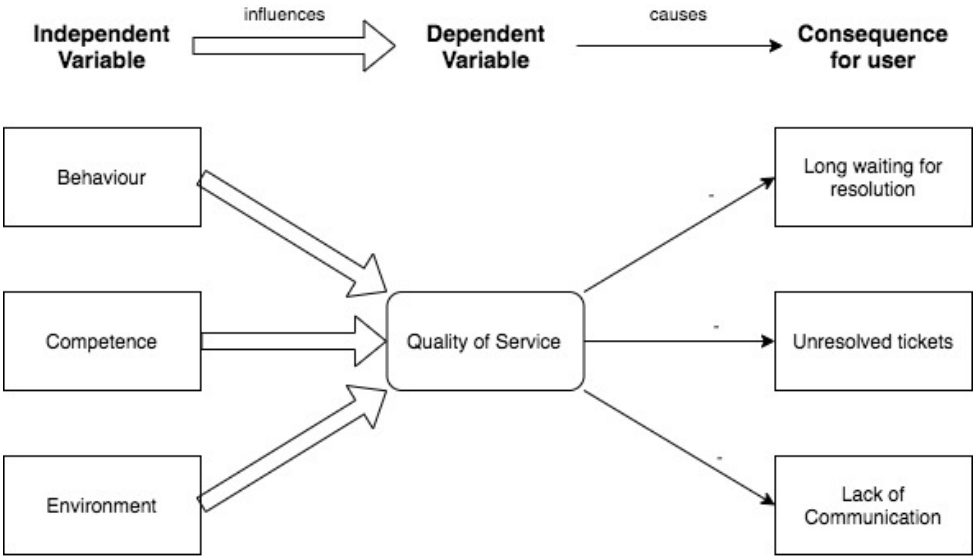



**Figure 12. IT Support Service Quality Conceptual Model (from Figure 5)**

Firstly, for the dependent variable, instead of asking the user to rate the Quality of Service, they were asked to rate the overall quality of ticket management (cf. Appendix 1). This allows the user to know explicitly which service to assess.

Secondly, the independent variables were not presented as "Behaviour", "Competence" and "Environment" but were translated according to the user (cf. Appendix 1). Indeed, "Behaviour" was represented by the willingness to help of support teams, "Competence" was represented by the expertise and skills of support teams to solve tickets, and "Environment" was represented by the use of EUP and the sufficiency of resources for good communication with support teams. These different translations are consistent with the explanations of previous models found in the literature (Brady & Cronin Jr, 2001).

Finally, the last variables representing the consequences of a lack of quality of service for users (Waiting too long for resolution, Unresolved tickets and Lack of

communication) have not been expressed in any other way because they concern them directly and are therefore sufficiently explicit and clear for them to understand.

### 5.1.2 Reliability of User Questionnaire

The reliability of a questionnaire can be measured in different ways. Indeed, the three attributes of reliability are Internal Consistency, Stability and Equivalence (Heale & Twycross, 2015). Internal Consistency reflects the proportion in which all items on a scale measure a construct, Stability reflects the consistency of the results if the instrument is tested multiple times and Equivalence reflects the consistency between the responses of an instrument and an alternative form of it (e.g., through triangulation). In this case study, the most feasible method for measuring reliability is Internal Consistency as the other two forms would be too complicated and time consuming to implement. Moreover, to assess Internal Consistency of an instrument, Cronbach's α method is the most commonly used (Heale & Twycross, 2015).

The Cronbach's alpha coefficient is based on a statistical method, and its value is less than or equal to 1. The reliability of the instrument is generally considered to be "acceptable" at 0.7 or above. In order to calculate it, the data will be interpreted with SPSS software, where the values measuring the different Likert Scale variables, as well as the dependent variable measuring the Quality of Service, will be numerically translated. Furthermore, all Likert Scales have 4 values, whereas Quality of Service is measured on a 5-value scale. It is therefore also necessary to calculate the Cronbach's Alpha based on standardized items, so that the different scales are no longer a problem.

All items related to the different variables were included in the measurement, i.e., a total of 11 (cf. table 5). As shown in Table 3, the Cronbach's alpha on the standardized items is 0.87. It is therefore greater than 0.7, which means that the reliability of the questionnaire is considered acceptable.

**Table 3. Cronbach ’s alpha of User Questionnaire**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| 0.873 | 0.87 | 11 |

Furthermore, in order to go further and test the reliability between variables, the Pearson Correlation between the different items is an effective measure. A p-value is added to certify the reliability of the correlations. According to many researchers, the correlation is significant if the 5% threshold is not exceeded, meaning that the p-value must be less than 0.05 for the relationship to be considered reliable. Pearson Correlation is marked * when its p-value < 0.05 and ** when its p-value < 0.01.

Table 4 represents these measures with the different variables (cf. table 5) that constitute the conceptual model. It includes Quality of Service (QoS), Environment (EUP & IV1), Behaviour (IV2), Competence (IV3), but also the three user consequences Waiting too long, Unresolved tickets and Lack of Communication represented respectively by C1, C2 and C3. The results show that all variables are reliably related to the dependent variable QoS, except for EUP3 which has a p-value of 0.280. EUP3 is the question requesting to evaluate the ease of cancelling a ticket on EUP.

**Table 4. Correlations between variables**

| | | | Environment | | | | | Behav-iour | Compe-tence | Waiting too long | Unre-solved | Lack of commu- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | QoS | EUP1 | EUP2 | EUP3 | EUP4 | IV1 | IV2 | IV3 | C1 | C2 | C3 |
| QoS | Pearson Correlation | 1 | ,292** | ,353** | 0,076 | ,237** | ,676** | ,683** | ,666** | ,628** | ,457** | ,616** |
| | P-Value | | 0,000 | 0,000 | 0,280 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| EUP1 | Pearson Correlation | ,292** | 1 | ,463** | ,266** | ,273** | ,291** | ,245** | ,258** | ,307** | ,142* | ,247** |
| | P-Value | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,043 | 0,000 |
| EUP2 | Pearson Correlation | ,353** | ,463** | 1 | ,425** | ,506** | ,433** | ,352** | ,301** | ,320** | ,189** | ,394** |
| | P-Value | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,007 | 0,000 |
| EUP3 | Pearson Correlation | 0,076 | ,266** | ,425** | 1 | ,524** | 0,099 | ,146* | ,150* | 0,07 | 0,106 | 0,092 |
| | P-Value | 0,280 | 0,000 | 0,000 | | 0,000 | 0,158 | 0,038 | 0,032 | 0,318 | 0,131 | 0,19 |
| EUP4 | Pearson Correlation | ,237** | ,273** | ,506** | ,524** | 1 | ,303** | ,271** | ,215** | ,241** | ,233** | ,253** |
| | P-Value | 0,001 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,002 | 0,001 | 0,001 | 0,000 |
| IV1 | Pearson Correlation | ,676** | ,291** | ,433** | 0,099 | ,303** | 1 | ,754** | ,665** | ,558** | ,354** | ,612** |
| | P-Value | 0,000 | 0,000 | 0,000 | 0,158 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| IV2 | Pearson Correlation | ,683** | ,245** | ,352** | ,146* | ,271** | ,754** | 1 | ,697** | ,514** | ,388** | ,548** |
| | P-Value | 0,000 | 0,000 | 0,000 | 0,038 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| IV3 | Pearson Correlation | ,666** | ,258** | ,301** | ,150* | ,215** | ,665** | ,697** | 1 | ,559** | ,405** | ,595** |
| | P-Value | 0,000 | 0,000 | 0,000 | 0,032 | 0,002 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 |
| C1 | Pearson Correlation | ,628** | ,307** | ,320** | 0,07 | ,241** | ,558** | ,514** | ,559** | 1 | ,356** | ,598** |
| | P-Value | 0,000 | 0,000 | 0,000 | 0,318 | 0,001 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| C2 | Pearson Correlation | ,457** | ,142* | ,189** | 0,106 | ,233** | ,354** | ,388** | ,405** | ,356** | 1 | ,453** |
| | P-Value | 0,000 | 0,043 | 0,007 | 0,131 | 0,001 | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 |
| C3 | Pearson Correlation | ,616** | ,247** | ,394** | 0,092 | ,253** | ,612** | ,548** | ,595** | ,598** | ,453** | 1 |
| | P-Value | 0,000 | 0,000 | 0,000 | 0,190 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

**Table 5. User questions of the different variables**

| Variables | | Related Question for users | |
|---|---|---|---|
| Quality of Service | QoS | How do you assess the overall quality of ticket management? | |
| Environment | EUP1 | How do you assess the use of EUP (End User Portal) for:[1] | Creating a ticket |
| | EUP2 | | Track the progress of a ticket |
| | EUP3 | | Cancel a ticket |
| | EUP4 | | Reopen a ticket |
| | IV1 | How do you evaluate these aspects related to the support teams?[2] | Resources for good communication |
| Behaviour | IV2 | | Willingness to help |
| Competence | IV3 | | Expertise / Skills in resolving tickets |
| Waiting too long | C1 | What do you think of the following statements?[3] | A ticket is quickly resolved |
| Unresolved tickets | C2 | | There are not many unresolved tickets |
| Communication issue | C3 | | Communication with support teams is sufficient for a correct resolution |

1. Rating from "Verry Difficult" to "Very Easy" on a four-point Likert scale.
2. Rating from "Not sufficient at all" to "Very sufficient" on a four-point Likert scale
3. Rating from "Strongly disagree" to "Strongly Agree" on a four-point Likert scale

### 5.1.3 Validity of Supplier Questionnaire

The validation techniques used for this questionnaire (cf. Appendix 2) are identical to those used for the user questionnaire. The same investigator triangulation was also used to consolidate this validation by providing an expert's point of view. Content Validity was first of all performed.

As a first step, the dependent variable was also named differently to fit the providers' point of view. Instead of directly judging the Quality of Service, they were asked whether they are able to achieve the KPIs established with SQM, on a scale from 1 to 5, and from "Not feasible at all" to "Very feasible". This formulation is more precise and specific as it links quality of service directly to their objectives.

Secondly, the independent variables, namely Behaviour, Competence and Environment were also translated to make them accurate for the suppliers. Behaviour is represented by the ease of sharing the complexity of ticket resolution with users and other support teams, as well as the amount of sharing/communication between support teams for proper ticket resolution. Next, Competence is represented by the assessment of their own skills in resolving tickets properly, the availability of training to perform their tasks, and the process of ticket assignment. Finally, Environment is represented by the use of

ServiceNow, as well as more generally by the resources available for proper ticket resolution, effective communication with users, but also with other support teams.

Finally, the variables of consequences for users were not used in this questionnaire because they are directly linked to the SLAs and KPIs the suppliers must respect. It is therefore not considered possible for them to evaluate these aspects, especially as a ticket may travel through several different support teams.

Furthermore, with regard to Face Validity, the sample criterion used is sufficient to make a judgement, although subjective, on the validity of the questionnaire. Indeed, after in-depth discussions with the expert and the various members of the SQM team, it was agreed that this audience cannot objectively assess the Quality of Service and the elements surrounding it, simply because it represents their daily work.

The conclusion leading to the conversation with the SQM team and the expert was therefore not to consider this supplier questionnaire as valid, mainly because of the insufficient number of responses (11) and the potential non-objectivity of the respondents. However, it can still provide added value and insights when proposing the service improvement solution.

### 5.1.4 Conclusion

As the Supplier Questionnaire is not considered valid, it cannot be used to test the conceptual model of this study and the various hypotheses. However, the validity and reliability of the User Questionnaire has been demonstrated. It can therefore be analysed to test both the conceptual model and the hypotheses.
Consequently, the Supplier Questionnaire will be valuable in establishing checkpoints for the analysis grid in order to provide insights into what needs to be measured in this audit methodology.

## 5.2 Hypothesis and Conceptual Model validation

As stated in the previous section, only the User Questionnaire was used in this validation process. This questionnaire aims to test the conceptual model created in order to validate or reject the proposed hypotheses. It included eleven questions, the last of which was open-ended so that the users could add any insights they felt necessary to complete this analysis.

The first four questions were preliminary so that users could be segmented, if necessary, during the analysis. They related to the region of dependency, the number of tickets opened during the year, as well as the proportion of Incident / Service Request opened. Then, the fifth question allowed users to give an overall rating of the quality of the service. Next, the other questions were directly related to the different hypotheses. First, there were questions on the independent variables, namely behaviour, competence and environment. Secondly, the consequences for users caused by a lack of quality were investigated, meaning lack of communication, unresolved tickets, and long waiting times for resolution.

### 5.2.1 Independent variables versus Quality of Service relationship

In order to test the first three hypotheses, it is appropriate to analyse the relationship between the assessment of the behaviour, competence and environment versus the assessment of the overall Quality of Service. Regarding the overall quality of ticket management, the rating given by users has a mean of 3.2 out of 5, a median of 3, a mode of 3 and a standard deviation of 1.1.

Then, regarding the independent variables, "Behaviour" is represented by the willingness to help of providers, "Competence" is represented by the skills of technicians, and "Environment" has been divided into two different assessments. The first is the resources for good communication with the support teams, and the second is the ease of use of the EUP platform in terms of creating a ticket, following it up, closing it and reopening it.

In order to analyse the relationship between the independent variables and service quality, it was necessary to calculate the average score of the overall quality of the ticket management given for each independent variable evaluation (cf. table 6).
Furthermore, in order to check the validity of the first three hypotheses, the table 6 has to be converted into curves having as x-axis the different evaluations of the independent variables (from "Not satisfied at all" to "Very satisfied") and as y-axis the scores of the general quality of the ticket management (from 1 to 5) (cf. figure 13).

**Table 6. Mean ratings of overall service quality versus assessment of independent variables**

| QoS Assessment | Communica-tion resources | Willingness to help | Supplier skills | EUP Use |
|---|---|---|---|---|
| Not sufficient at all | 1,5 | 1,4 | 1,5 | 2,2 |
| Not sufficient | 2,9 | 2,6 | 2,8 | 3 |
| Sufficient | 3,6 | 3,5 | 3,6 | 3,4 |
| Very sufficient | 4,5 | 4,4 | 4,3 | 3,6 |

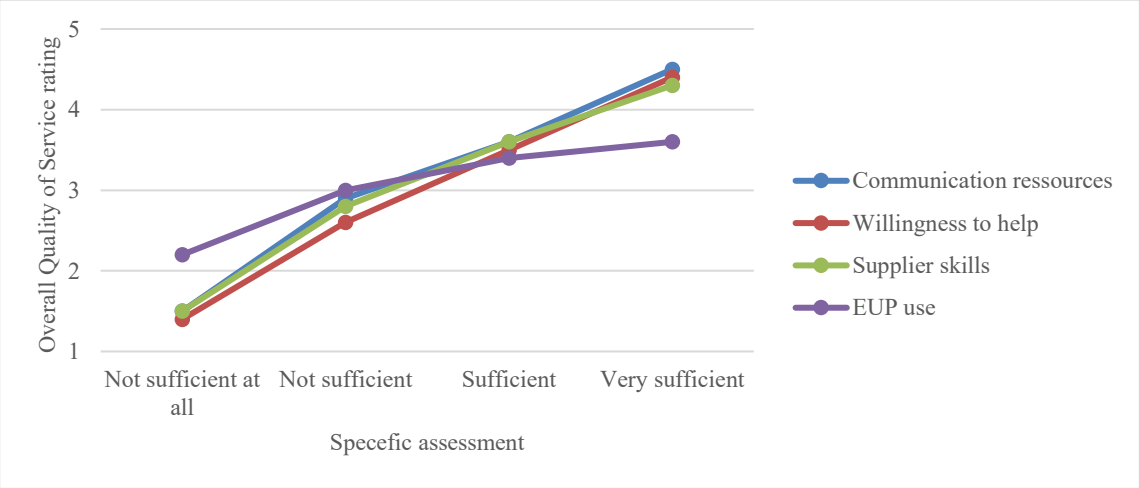



**Figure 13. Impact of independent variables on Quality of Service**

### 5.2.2 Quality of Service versus consequences for user relationship

In order to test the last three hypotheses, it is the relationship between the overall service quality rating and the consequences for users that must be tested.

The testing process is similar to the previous section. That is, the average score of the overall quality of ticket management against each of the different consequences for users should be calculated (cf. table 7). Furthermore, the consequences were represented by sentences to be evaluated from "Strongly disagree" to "Strongly agree".

First, "Long wait for resolution" was translated into “A ticket is quickly resolved”. Second, "Unresolved tickets" was expressed as “There are not many unresolved tickets”. Finally, "Lack of communication between users and support teams" was represented by “Communication with support teams is sufficient for a correct resolution”.

Then, in order to check the validity of the last three hypotheses, table 7 must also be converted into curves having as x-axis the different evaluations of the different

consequences (from "Strongly disagree" to "Strongly agree") and as y-axis the scores of the general quality of the ticket management (from 1 to 5) (cf. figure 14).

**Table 7. Mean ratings of overall service quality versus consequences for users**

| QoS Assessment | Waiting time | Unresolved ticket | Communication |
|---|---|---|---|
| Strongly disagree | 1,7 | 1,6 | 1,8 |
| Disagree | 2,9 | 2,9 | 2,8 |
| Agree | 3,8 | 3,5 | 3,7 |
| Strongly agree | 4,3 | 4 | 4,3 |

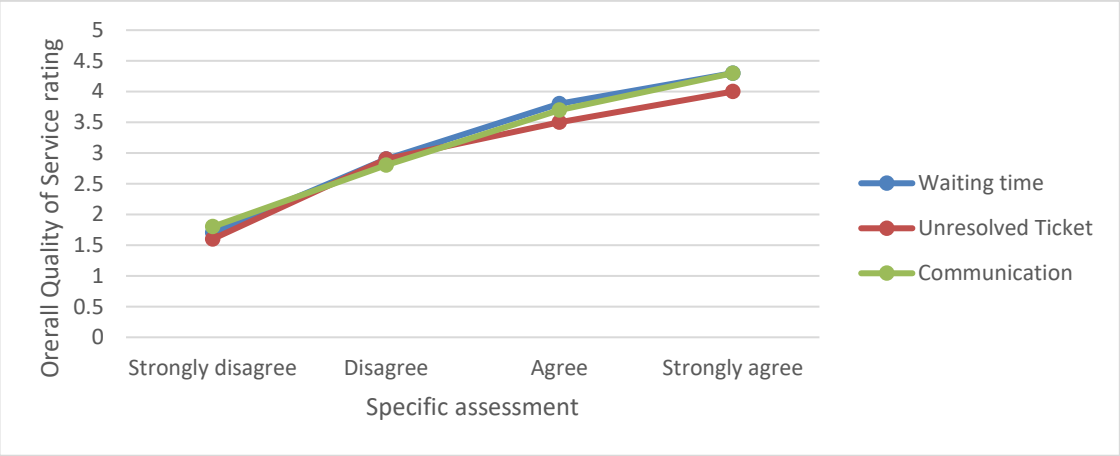



**Figure 14. Impact of Quality of Service on consequences for users**

### 5.2.3 Hypothesis validation

Now that the relationships between independent variables and quality of service, as well as quality of service and consequences for the user, have been established, the different hypotheses can be verified.

Indeed, in order to be valid, the different curves representing the different relationships must be linear. And as can be seen in figures 13 and 14, they are. This means that the independent variables do influence the quality of the service, which causes the described consequences for the users.

Therefore, it seems appropriate to “conclude” that the six hypotheses are valid and that the conceptual model reflects the case study. The only clarification to add is that for the variable Environment, the cancellation of a ticket (EUP3) does not influence the Quality of Service.

H1: Behavioural aspect of service providers influences Quality of Service.

H2: Resolution competence of service providers influences Quality of Service.

H3: Supportive Environment influences Quality of Service (Except EUP3)

H4: Poor Quality of Service leads to a long wait for resolution.

H5: Poor Quality of Service leads to unresolved tickets.

H6: Poor Quality of Service leads to a lack of communication between users and support teams.

### 5.3 Further Analysis

Subsequently, once the hypotheses are validated, a more in-depth analysis provides more insight into the hypotheses in order to provide direction on the checkpoints to be implemented in the analysis grid of the audit methodology.

The first worthwhile item to address is question 8 of user questionnaire, which is "Which points did not meet your expectations?". This is a multi-choice question, containing "Waiting too long for resolution", "Unresolved tickets", "Lack of communication", "none", as well as "Other", allowing the user to add whatever they feel is necessary.

The first element to be noted is the proportion of votes according to the elements. Indeed, 64.2% of the respondents ticked the waiting time too long, followed by 40.7% of the respondents who judged a lack of communication, followed by 31% of the respondents noting the unresolved tickets. There were also 16.2% of respondents who answered "None", and 19.1% who put "Other". This shows that the main concern of users is firstly the long waiting time for ticket resolution, followed by the lack of communication with the support team, ending with unresolved tickets.

In addition, out of the 83 people who answered “Lack of communication”, 61 also put "Waiting too long for resolution", i.e. 73.5%. This means that there is potentially a link between these two consequences. Similarly, of the 63 people who answered "Unresolved tickets", 51 also put "Waiting too long for resolution", i.e. 81%. There is therefore also a possible link between these two consequences.

Finally, the last element to be analysed on this question is the "Other" box, which had to be converted into keywords in order to be properly investigated (cf. Appendix 3). It gives more details about the independent variables and the consequences for the users. It will therefore be useful during the construction of the analysis grid for the audit methodology.

Secondly, it is interesting to investigate the relationship between the overall quality of service compared to the preliminary questions. The preliminary topics are region of

affiliation, the number of tickets opened since the beginning of the year, and the proportion of Incident/Service Request created. After analysis of all fields, all calculated overall quality of service means are between 3 and 3.6 out of 5. This means that the region of affiliation, the number of open tickets and the proportion of Incident/Service Requests do not influence the Quality of Service perceived.

Thirdly, there is a question about the effectiveness of the Reminder and Escalation processes. The results show that users rate the effectiveness of the escalation process at 69.1% effective or very effective and the reminder process at only 44.1% effective or very effective. The problem is that at the time of this study, the Reminder button was bogging down, making it difficult to judge its real performance. It is therefore under review and placing checkpoints on it will be complicated. On the other hand, the escalation process can be improved, and there are still 22.5% of respondents who do not find it effective, and 8.3% who do not find it effective at all.

Finally, the last question of the questionnaire, which is an open-ended question, aims to complement the research by obtaining more insight into the different independent variables and consequences for the users. To analyse it, the added comments will be translated into keywords in order to be able to analyse them properly and identify the different trends (cf. Appendix 3). This question will be crucial and very useful when setting up checkpoints for the audit criteria.

## 5.4 Solution Development

The aim of this research is to design an artefact to obtain quality audit criteria in order to establish a quality audit methodology for the IT support service within CMA-CGM. For this purpose, a “checklist” (Ma et al., 2005), referred to here as an analysis grid must be built in order to implement different checkpoints and indicators enabling the subsequent actions to improve the quality of service (Vuk, 2012). In other words, in the analysis grid, a checkpoint is what needs to be monitored in order to know if it is really deficient, an indicator is how to verify that the checkpoint is deficient, and the recommended actions are proposals for action to be implemented if the checkpoint is verified as deficient.

Furthermore, this analysis grid will be divided into three main categories represented by the independent variables, namely Behaviour, Competence and Environment. In addition, each checkpoint will be directly linked to the main consequence that it aims to reduce, which are “Lack of communication”, “Unresolved ticket” and “Waiting too long for resolution”.

The purpose of this section is to present this analysis grid by justifying the choices made thanks to the data collected from the two questionnaires, as well as the knowledge of the different processes acquired during this research. Open-ended questions are a major asset here, as they allow for more detail and clarification of weak points of the processes. Indeed, Appendices 3 and 4 present the keywords extracted from the different comments of users and service providers written in the open questions.

**Table 8. Analysis Grid**

| Checkpoint number | Variable | Related Consequence | Checkpoint (What) | Indicator (How) | Recommended Action |
|---|---|---|---|---|---|
| CP1 | Behaviour | Lack of Communication | Request for information already given by the user | Check "Pending User" actions made soon after ticket creation | Making attachments more prominent in Service Now<br><br>Provide the technician access to user information |
| CP2 | | Lack of Communication | Ticket not updated regularly | Check average time between updates on tickets according to different priorities | Supplier must write an "Additional Comment" at a regular time interval according to priority<br><br>Implement new KPIs between supplier and SQM team<br><br>Predefined update choices in Service Now |
| CP3 | | Waiting too long | Unjustified change of priority | Check priority changes against other similar tickets where it has not been changed. | Priority changes must be justified<br><br>Priority policy |
| CP4 | | Unresolved ticket | Ticket close for no reason (except KPI compliance) | Check "Closed Incomplete" tickets that was close to the end of SLAs | Add an "Extended Resolution Time" option on Service Now, with different possible justifications in a drop-down list |
| CP5 | Competence | Waiting too long | Tickets incorrectly assigned to appropriate support teams | Check for identical transition from one group to another<br><br>Check for reassigned tickets without any action | Reviewing the ticket allocation policy in relation to incorrectly assigned forms |
| CP6 | | Waiting too long | Incorrect use of the Knowledge Base | Isolate tickets with similar issues that take a long time to be resolved<br>Check whether there is any documentation on their creation and resolution<br>If so, calculate the number of views in relation to the number of tickets concerned. | Create the missing documentation<br><br>Promote the good documentation to the users and the concerned support team |
| CP7 | | Unresolved ticket | Unresolved identical tickets | Check unresolved tickets that was created with the same form and with the keyword "form" in the resolution note | Update misused forms, as well as those that should have been used |
| CP8 | Environment | Lack of Communication | Adequacy of the communication channels used by the support teams | Investigation directly with the different managers of each support team | Establish Microsoft Teams as the mandatory communication channel with users |
| CP9 | | Lack of Communication | Unnecessary escalation and reminder processes | Check escalation done because "Incorrect use of EUP"<br><br>Check reminders sent while "Pending" state | Do not allow reminder when "Pending" status<br><br>Allow the user to easily access their ticket updates |
| CP10 | | Waiting too long | Request from Manager Approval too long | Already verified | Send a "Yes / No" button directly to the corresponding manager |

The detailed explanation of each checkpoint is now presented below.

***Checkpoint 1 – Request for information already given by the user***

The first checkpoint concerns the requests for information from the support teams already given by the user. Indeed, when analysing in more detail the comments related to the keyword "Communication issue", which appears 21 times in the open question of the user questionnaire, it can be found that several users have mentioned this point. In order to verify this, the indicator chosen is to select a sample of tickets where the first action performed is "Pending User" within a short period of time after it has been assigned, and to analyse if it is true. If the checkpoint is true, the recommended actions for the action plan are to make the attachments more visible in Service Now, but also to give the technician the possibility to access user information such as department, software accesses, or even region of affiliation. In addition, several technicians mentioned in the supplier questionnaire a lack of information given by users when creating a ticket. As a result, a specific information field can also be added to the forms where this issue is recurrent.

***Checkpoint 2 – Ticket not updated regularly***

This second checkpoint concerns a major issue stated many times in the questionnaire, which is that tickets are not updated regularly. Indeed, this was the one that appeared most often in the "Communication issue" keyword, detailing that users are not updated regularly and cannot know the status of their ticket in terms of resolution, which most often reduces their satisfaction and leads them to escalate their tickets to the SQM team. The audit indicator is to calculate the average time between updates on tickets according to different priorities. If they are deemed too long, the recommendations for action are to set up new weekly KPIs between SQM and the supplier in order to continuously check that this criterion is respected and to give regular reminders to the teams not respecting this action. However, it was found that 36.4% of suppliers found it difficult to share the complexity of ticket resolution with users. Communication must therefore be kept simple. The user wants updates to ensure that the ticket is being handled, not the precise technical details of the resolution. Predefined update choices can also be an option for the action plan.

***Checkpoint 3 – Unjustified change of priority***

Then, the next checkpoint concerns the unjustified change of priority by suppliers. Indeed, when creating a ticket, the user must enter the priority of the ticket according to different criteria, but the technician can then change it if he/she feels that it has been wrongly

chosen. In order to measure this checkpoint, the indicator is to check tickets where a change in priority has been made against other similar tickets where it has not been changed. In effect, this will show whether the priority changes are justified. Of course, it is not possible to check all tickets where the priority has been changed. It will therefore be necessary to select a representative sample of all support teams. Finally, the main recommendation in case of verification of this checkpoint is that the technician should write a justification on the ticket follow-up if the priority is changed. Furthermore, in order to avoid disputes, a priority policy can be written in detail and shared in the Knowledge Base accessible to users and suppliers.

***Checkpoint 4 – Ticket close for no reason***

The last checkpoint related to the "Behaviour" variable concerns tickets closed without reason, according to the user. Indeed, this issue was found through the " Other " field of the question concerning the dissatisfaction points in the user questionnaire. Indeed, a keyword "Unresolved ticket" could be found although it was already in the possible choices of the question. It was therefore described that many tickets are closed without reason. The hypothesis that this is in order to comply with the SLAs of their contract was even raised each time. The indicator to be set up is therefore to check the tickets that have been put at the "Closed Incomplete" stage when the SLA term was almost over. In order to deal with this situation if the checkpoint is validated, the recommended action is to add an "Extended Resolution Time" option in service Now, with different possible justifications in a drop-down list. This would allow the technician to continue the resolution without having to close the ticket and the user reopening it afterwards. Of course, the SQM team will have to monitor the use of this new option in order to act based on its usage to improve ticket monitoring.

***Checkpoint 5 – Tickets incorrectly assigned to appropriate support teams***

The first checkpoint relating to the "Competence" variable concerns tickets incorrectly assigned to support teams. Indeed, Appendix 3 shows that this issue was raised three times in question 11 and twice in question 8 of the user questionnaire. The fact that a ticket is wrongly assigned in the first instance increases the time it takes to resolve it, and therefore decreases customer satisfaction. In addition, service providers gave an average rating of 3.82 out of 5 for the ticket assignment process, which is correct but can be improved. In order to verify this, the indicator is to check the identical transition of tickets from one support group to another, as well as the tickets reassigned without any action being taken.

If this checkpoint is true, the recommended action to be taken is to revise the ticket assignment policy in relation to the incorrectly assigned forms.

***Checkpoint 6 – Incorrect use of the Knowledge Base***

The next checkpoint concerns the use of the Knowledge Base. This point is quite extensive as the Knowledge Base has multiple uses and is directly addressed to both users and providers. On the user side, the open question revealed six claims about it. The main issues raised were the lack of documentation for similar and regular incidents/service requests, as well as documentation on how to choose the right ticket creation form and how to fill it in properly. Furthermore, on the supplier side, it can be noted that they rate their expertise/competence to resolve tickets properly at 4.18/5. However, they rate the availability of necessary training for the proper performance of their tasks at 3.82. Of course, the validity and reliability of the supplier questionnaire has been rejected, but it can be speculated that the difference between these two scores may be due to the lack of documentation in the Knowledge Base. The measurement indicator is therefore to isolate tickets with a similar issue that take a long time to be resolved and check whether there is documentation on its creation and resolution method. If so, calculate the number of views in relation to the number of tickets concerned. Finally, if this checkpoint turns out to be true, the recommended action is to first create the missing documentation, and then promote the good documentation to the users and the concerned support team.

***Checkpoint 7 – Unresolved identical tickets***

Another identified issue concerns identical unresolved tickets. Indeed, "unresolved tickets" is a consequence included in the conceptual model. Through my tasks in the SQM team, it was noted that many tickets were unresolved because they were created with the wrong form. In addition, six comments in question 8 of the user questionnaire represented by the keyword "Unresolved ticket" in Appendix 3 also relate to this occurrence. Therefore, in order to ascertain this checkpoint, the appropriate indicator is to check tickets at the "Closed Incomplete" stage that have been created with the same form and have the keyword in the resolution note "form". This will help to categorise forms that are often incorrectly used. The recommended action is naturally to update misused forms, as well as those that should have been used, so that they are clearer and more efficient for the user.

***Checkpoint 8 – Adequacy of the communication channels used by the support teams***

The first checkpoint of the Environment variable is the adequacy of the communication channels used by the support teams. Indeed, the keyword "Communication channel" appears three times in question 11 and once in question 8 of the user questionnaire. Specifically, it is described that some support teams use the Skype application to communicate directly with the user in order to obtain more detailed information about tickets, whereas the internal application at CMA-CGM for calls is Microsoft Teams. If this is true, it represents a real problem as users do not necessarily have Skype installed on their professional devices and are therefore obliged to invest time in installing it and logging in or even in some cases creating an account. The supplier questionnaire, on the other hand, does not reveal any indication of this issue, especially as the resources available for effective communication with the user are judged at 90.9% to be sufficient or very sufficient. An effective indicator to measure this checkpoint is to investigate directly with the different managers of the different support teams in order to identify which channel their team uses to call users when they need it. If it turns out that they are not using Microsoft Teams, the recommended action would be to impose Microsoft Teams for any direct exchange with a user. Especially as they all have the Office 365 license.

***Checkpoint 9 – Unnecessary escalation and reminder processes***

The next checkpoint directly concerns the SQM team. Indeed, it often happens that users perform the escalation process by asking to speed up the resolution while the ticket is in the "Pending User" state because the technician is requesting additional information from the user. This means that the user is escalating without even looking at the progress of the ticket. Furthermore, nothing relevant was found in the analysis of the data regarding the escalation principle. It is only described that it is very effective or not effective enough, without giving further details. Also, on the supplier side, it was stated in the open question that many users perform the "Reminder" process while the ticket is in "Pending for Transport" because the fix is scheduled for the next few days. There is therefore a potential problem with the user's view of the ticket tracking. In order to check this, the indicators would be to count the number of users performing the escalation and reminder processes while their tickets are in the "Pending" state. And if the number turns out to be significant, several actions are possible. Firstly, when a ticket is in the "Pending" state and the user clicks on the Reminder button on the EUP, a message explaining that it is not possible because the ticket is "Pending" may be displayed. Then, regarding the

escalation process, the aim is to find out why some users are not aware of the progress of their ticket. For this purpose, a sample of users who have performed an escalation with the reason "Incorrect use of EUP" can be contacted directly in order to understand the reason why they have not seen the latest update and thus undertake the necessary measures.

***Checkpoint 10 – Request from Manager Approval too long***

Finally, the last checkpoint of this analysis grid relates to the ineffective "Manager Approval" claims for Service Request tickets. This point was only raised by two users in the questionnaire, but the explanations given are quite interesting. Indeed, this process takes time because the approval request is first sent to the user, who then makes the request to his/her manager, in order to finally attach the manager's answer as an attachment in EUP. They therefore recommend shortening this process by sending a notification directly to the manager with a "Yes" or "No" button to click. There is no indicator on this checkpoint because this Manager Approval process is already verified. The action recommended by the user is also very interesting if it is feasible.

This analysis grid (cf. table 8) therefore represents the proposed solution in terms of audit criteria for a quality audit methodology of the IT support service. In order to be implemented for a test phase, it had to be validated to ensure that it corresponds to the expectations of the SQM team and that its implementation is feasible for all checkpoints (see next section).

## 5.5 Validation

The final part of this research is to obtain a validation of the developed artefact solution aiming at monitoring and increasing the quality of the IT support service through an audit methodology. Indeed, this study was initiated by the SQM team of CMA-CGM, it is therefore necessary that they validate the proposed analysis grid.

The two validation criteria are its feasibility and its acceptance for implementation in a test phase. For this purpose, a meeting was organised with the manager and the data officer of the SQM team in order to assess one by one all the proposed checkpoints, their indicators, as well as the suggested actions in case of deficiency.

The aim of this part is therefore firstly to report the assessment completed on the feasibility and relevance of each checkpoint, in order to then judge whether the analysis grid will be implemented for a test phase.

The report of the validation checkpoint by checkpoint can be found below, and the updated analysis grid is presented at the end (cf. table 9).

***Checkpoint 1 - Request for information already given by the user***

The first checkpoint was considered interesting to measure (accepted).

However, the performance indicator was not considered reliable. Indeed, the "Pending User" action is not necessarily performed quickly after the creation of a ticket and is not even necessarily the first action performed. It was therefore rejected and replaced. In order to obtain reliable monitoring, the replacement indicator is to investigate a sample of all "Pending User" tickets and determine the proportion of requests for information already given.

Finally, in terms of recommended actions, making attachments more visible in Service Now was not considered necessary as the support teams already know where they are (rejected). Instead, issuing procedural reminders to the teams identified as making these unnecessary requests for information was deemed the most feasible and necessary procedure (replacement). In addition, providing the technician with direct access to certain user information will depend on what is found during the investigation (accepted).

***Checkpoint 2 - Ticket not updated regularly***

The second checkpoint was also considered interesting to monitor (accepted).

In addition, the performance indicator was more detailed. Indeed, the level of update has been divided into two, with reactive update, when the user requests one, and proactive update, performed without the user requesting it (improved). The priority is therefore to focus on reactive updating, which is crucial for customer satisfaction. This can be measured by investigating tickets where a comment has been written by the user or a reminder has been sent, but no response has been given by the support team. Then the proactive update is more difficult to control because a user comment is considered as an update in the possible reports to produce. The solution is to treat the proactive update independently of the reactive one and count the number of days of tickets without an update and investigate those who haven't received one for several days.

Finally, all recommended actions have been accepted for this checkpoint. They have just been duplicated to accommodate the reactive and proactive update.

***Checkpoint 3 - Unjustified change of priority***

The third checkpoint was accepted, although considered complicated to implement. Indeed, Infosys support teams can only change the priority once the ticket has been closed.

It is the other service providers who can change it at any time. The impact of this checkpoint is therefore less important with Infosys because once the ticket is resolved, the user is less concerned about whether the priority has changed.

Nevertheless, monitoring of the justification for priority changes can be performed to ensure that this is controlled. To this end, this point should be checked with the contract management department that manages the SLAs and is therefore supposed to control it (replacement).

The recommended actions were therefore accepted and remain unchanged.

***Checkpoint 4 - Ticket close for no reason***

The fourth checkpoint was accepted, despite some required modifications.

Indeed, two main indicators are possible and necessary to measure it. The first is to measure the proportion of reopened and closed incomplete tickets that occurred near the end of the SLA (accepted). And the second is to investigate tickets that are cancelled quickly to ensure that they have not been created to reduce the average resolution time of a support team (added).

Finally, the recommended action of adding an "Extended Resolution Time" option is not useful as there are SLA Waiver's that can be used to justify tickets not resolved in time (rejected). The new recommended action is thus simply to remind the spotted teams how SLA Waiver works and to investigate whether there is a lack of capacity in the team or other reasons that justify the difficulty in complying with SLAs (replacement).

***Checkpoint 5 - Tickets incorrectly assigned to appropriate support teams***

The fifth checkpoint, together with these indicators and recommended action, were accepted and considered relevant. Nevertheless, it was also advised to do some data mining with the reassignment variable in order to discover trends that could be addressed and improved (added).

Furthermore, an additional action was introduced. Indeed, as soon as a support team reassigns a ticket, they must write a comment justifying their choice. There can thus be many comments on the same ticket, making it difficult to understand. A new recommended action could be that the last person to reassign a ticket should summarise the whole situation of the ticket and not just his own.

***Checkpoint 6 - Incorrect use of the Knowledge Base***

The sixth checkpoint was considered, although complicated, very interesting (accepted).

Indeed, the most complicated evaluated part is in the recommended actions and is the promotion of good documentation for users and support teams through the Knowledge Base. To achieve this, they need to be taught how to use the Knowledge Base correctly and its added value needs to be demonstrated. This can also be done by developing and promoting the SQM page of the company's social network, Yammer, which regularly publishes updates and best practices on the use of the Knowledge Base. Otherwise, all recommended indicators and actions have been validated.

***Checkpoint 7 - Unresolved identical tickets***

Checkpoint 7 was also accepted with extended discovery potential.

Hence, the measurement indicator was more precisely specified. Indeed, when a ticket is closed unresolved, the technician in charge must justify it in a "Resolution Code" field with several options in a drop-down list. As a result, it is possible to know the number of unresolved tickets due to the fact that they were created with the wrong form (added). In addition, the other justifications can also be investigated in order to detect if there are any other unresolved trends (added).

***Checkpoint 8 - Adequacy of the communication channels used by the support teams***

Regarding the eighth checkpoint, the manager and the data officer of SQM were surprised that the support teams were potentially using other communication channels than those used by the users. The checkpoint, the indicator and the recommended action were therefore directly accepted.

***Checkpoint 9 - Unnecessary escalation and reminder processes***

This ninth checkpoint was considered interesting, especially as it directly concerns the activity of the SQM team (accepted).

In addition, a new indicator was added, which is to measure the number of tickets closed because they were in "Pending User" states for 7 days. Investigating these tickets to find out if it is because the ticket was resolved or because the user did not see the update notification is also an interesting insight.

However, the recommended action of not allowing a reminder to be sent when the ticket is in "Pending" state is already in production so this action can be removed (rejected).

***Checkpoint 10 - Request from Manager Approval too long***

Finally, regarding checkpoint 10, as it is already considered as " verified " in the result part, the indicator should therefore consist of checking if it is possible to reduce the time of this manager approval process (added) in order to implement an action such as the proposed "Yes/No" button. This can be done by consulting a dedicated support process team within Infosys to discuss the potential options for improvement. The checkpoint was therefore also accepted.

After extensive discussion and improvement of all the checkpoints in this analysis grid, they were all finally accepted for a test implementation that will start a few days after the end of this thesis (cf. table 9).

However, the section that was felt to be missing and could not be clearly defined and added to the analysis grid was the precise quantification of each indicator. In other words, at what level the checkpoint measurement should be considered insufficient. Indeed, being a "beta version" of the audit ‘norm’ intended to be improved and more accurate over time, it was considered appropriate to provide an initial quantification of the various indicators during the test phase. And it is subsequently, based on the results of the previous analysis grid, that the following will have quantified indicators to determine when actions should be taken in the action plan.

The final artefact of this research is therefore presented below in table 9.

## Table 9. Updated Analysis Grid

| CP N° | Variable | Consequence | Checkpoint (What) | N° | Indicator (How) | N° | Recommended Action |
|---|---|---|---|---|---|---|---|
| CP1 | Behaviour | Communication issue | Request for information already given by the user | Id1 | Investigate a sample of tickets with "Pending User" state. | A1 | Provide "procedural reminders" to the affected support teams. |
| | | | | | | A2 | Provide the technician access to user information. |
| CP2a | | Communication issue | Ticket not updated regularly (reactive update) | Id2 | Check the number of tickets where the user has written a comment or sent a reminder but has not received a response. | A3 | Supplier must write an "Additional Comment" at a regular time interval according to priority or when a user asks for one. |
| CP2b | | | Ticket not updated regularly (proactive update) | Id3 | Investigate the proportion of tickets where the number of days without updates is significant. | A4 | Implement new KPIs between supplier and SQM team. |
| | | | | | | A5 | Predefined update choices in Service Now. |
| CP3 | | Waiting too long | Unjustified change of priority | Id4 | Check with the contract management team whether these priority changes are controlled and justified. | A6 | Priority changes must be justified. |
| | | | | | | A7 | Priority policy consolidated. |
| CP4 | | Unresolved ticket | Ticket close for no reason (except KPI compliance?) | Id5 | Check the proportion of reopen and close incomplete tickets that were near the end of the SLAs. | A8 | Remind the spotted teams about SLA Waiver use and investigate why they are not SLA compliant. |
| | | | | Id6 | Investigate cancelled tickets quickly after their creation. | | |
| CP5 | Competence | Waiting too long | Tickets incorrectly assigned to appropriate support teams | Id7 | Investigate for identical transition from one group to another. | A9 | Reviewing the ticket allocation policy in relation to incorrectly assigned forms. |
| | | | | Id8 | Data Mining on "Reassigned Count" variable. | A10 | The reassignment comment must summarise the whole picture of the ticket. |
| CP6 | | Waiting too long | Correct use of the Knowledge Base | Id9 | Isolate tickets with similar issues that take a long time to be resolved.<br>Check whether there is any documentation on its creation and resolution.<br>If so, calculate the number of views in relation to the number of tickets concerned. | A11 | Create the missing documentation. |
| | | | | | | A12 | Promote the good documentation to the users and the concerned support team. |
| CP7 | | Unresolved ticket | Unresolved identical tickets | Id10 | Check for unresolved tickets that have the "Resolution Code" specifying creation with the wrong form. | A13 | Update misused forms, as well as those that should have been used. |
| | | | | Id11 | Investigate "Resolution Code" variable to check the unresolved trends. | | |
| CP8 | Environment | Communication issue | Adequacy of the communication channels used by the support teams | Id12 | Investigation directly with the different managers of each support team. | A14 | Establish Microsoft Teams as the mandatory communication channel with users. |
| CP9 | | Communication issue | Unnecessary escalation and reminder processes | Id13 | Check escalation done because "Incorrect use of EUP". | A15 | Allow the user to easily access their ticket updates. |
| | | | | Id14 | Check tickets closed due to "Pending User" state for 7 days. | A16 | Make the "Pending User" state more prominent in EUP. |
| CP10 | | Waiting too long | Request from Manager Approval too long | Id15 | Check with the appropriate team whether this process can be optimised. | A17 | Send a "Yes / No" button directly to the corresponding manager. |

# 6 DISCUSSION

This chapter discusses the relationship between the results of this research and prior literature, particularly the conceptual model developed. Furthermore, this chapter concludes with the limitations encountered in this research.

## 6.1 Results compared to Quality of Service model

The aim here is to discuss the different influencing factors as well as the consequences of the quality of service found in the literature review compared to the results of our research.

#### *6.1.1.1 Behaviour on Quality of Service*

Firstly, Behaviour variable was represented by the "willingness to help of support teams" towards users. In addition, the assessment of this criterion is correlated with the users' rating of the overall quality of ticket management. As a result, the second hypothesis is supported by the analysis of these two parameters.

However, it is debatable whether the criterion of willingness to help fully represents the Behaviour variable. Indeed, other criteria could have been added such as attitude or cultural aspect. Nevertheless, it was considered more important to measure the willingness to help and sufficient in the context of a support service.

Finally, the Behaviour variable was also addressed in the supplier questionnaire in order to provide more details for the design of the analysis grid. The criterion addressed were the sharing of ticket resolution complexity with users or other support teams, the amount of sharing/communication between support teams, and the amount of information provided by users.

#### *6.1.1.2 Competence on Quality of Service*

The second variable, Competence, was simply presented to users as Expertise / Skills of support teams in resolving tickets. As well, the evaluation of this variable presented a very good correlation with the evaluation of the quality of service, demonstrating a priori the truth of the third hypothesis.

In addition, in order to get more insight regarding this variable, service providers were asked several questions related to it. Indeed, they were asked to evaluate the capacity of their team in relation to the number of tickets, their expertise/skills to solve the tickets correctly, the availability of training to perform their tasks, as well as the allocation of

tickets to their team. It is true that the objectivity of these evaluations is questionable as they were requested to evaluate their own skills. It is maybe not insignificant that there were not enough responses to make the sample sufficiently representative of the total population.

Finally, also concerning the potential non-objectivity of suppliers, some results seem contradictory. For example, they rated their skills at 4.18 out of 5, but the adequacy of necessary training for correct performance of their tasks at 3.82. However, these two assessments are supposed to be equal, because if your skills are very good, there is no need for training to perform your tasks properly.

#### *6.1.1.3 Environment on Quality of Service*

The environment variable is the most tangible. It is represented by the EUP (End User Portal) and Service Now platforms, as well as the means of communication such as email or Microsoft Teams. Also, "resources for resolving tickets" is stated for the service providers.

First of all, it was found that the variable Environment has a direct influence on the quality of service, as the ratings given by users to the ease of use of EUP and the sufficiency of resources for good communication are directly related to the ratings given to the overall quality of ticket management (cf. Figure 13).

Nevertheless, it can be seen that the curve representing the use of EUP is less linear than the curve for communication resources. This may mean that the use of the EUP platform has less influence on the quality than the communication resources in the environment. Furthermore, in terms of EUP use, the variable EUP3 (Cancel a ticket) was not considered reliable when calculating its p-value. Indeed, it was found that the average scores given for QoS are between 3 and 3.3 depending on the different judgements on the cancellation of a ticket. We can therefore safely assume that this action has no influence on the quality of service.

#### *6.1.1.4 Consequences related to a lack of Quality of Service*

Finally, the last interesting point to discuss concerns the consequences related to the lack of quality of service. The conceptual model included three of them, which were considered as being the most significant and impacting on the quality of service and user satisfaction. They were addressed in two questions in the user questionnaire, first, a multi-choice question where all three consequences could be selected, but the user could also

add a consequence in an "Other" field, and second, in a Likert-scale question ranging from strongly disagree to strongly agree.

These consequences have led to three hypotheses which, according to the results, seem to be valid (cf. Figure 14). Also, according to the results, it is even possible to say the order of importance of the different consequences. First of all, the long waiting time is the most represented consequence (131 times ticked in the dissatisfaction points and 53.4% of respondents did not agree or did not agree at all with the fact that a ticket is quickly resolved). Then, the second most represented consequence is the lack of communication (83 times ticked in the dissatisfaction points and 42.2% of respondents disagree or strongly disagree that the communication with the support teams is sufficient for a correct resolution). Finally, the last and least represented consequence is unresolved tickets, which means non-delivery of the service (63 times ticked in the dissatisfaction points and 39.2% of respondents not agreeing or not at all agreeing with the fact that there are not many unresolved tickets).

An interesting new line of enquiry is whether there are direct relationships between the influencing variables on the consequences. For example, it would be interesting to study the extent to which the behaviour variable is involved in the consequence of lack of communication. Moreover, if the behaviour variable has a strong influence on the lack of communication, can this consequence become a sub-variable of influence on the quality of service.

#### *6.1.1.5 Results & Analysis Grid development*

Regarding the design of the analysis grid, some questions in the questionnaires were actually not necessary and did not provide any added value or insight. Indeed, for the user questionnaire, the question about the effectiveness of the Reminders and Escalations processes could not be properly treated because the Reminder process is under repair at the time of the study and the Escalation process is not directly related to this audit methodology but to a different mission of the SQM team. For the supplier questionnaire, the question concerning the difficulty of managing tickets according to priority does not offer any added value to this study and it is quite logical that, in general, the higher the priority, the more difficult the ticket is to manage.

## 6.2 Limitation

Naturally, this research is subject to several limitations which it is important to describe.

The first limitation encountered in this research is the lack of literature and theoretical background on the implementation of a quality audit methodology on an IT support service, such as a service desk. It was therefore necessary to combine several topics such as "service methodology audit", "IT support service quality monitoring" and "IT service desk design" in order to be able to cover the topic in its globality.

Secondly, in terms of the results, the main limitation concerns the questionnaire sent to the service providers. Indeed, it obtained only 11 answers, which is clearly not enough to be representative of the population studied for a quantitative questionnaire. It would have been more effective and interesting to conduct qualitative interviews with several members of different support teams in order to obtain clear, precise and justified insights regarding the difficulties of service providers in successfully performing their tasks.

Next, only Infosys was studied in this study. However, other service providers work with CMA-CGM and their processes, SLAs and difficulties may be different from those of Infosys. In addition, a part of the IT support service is managed by CMA-CGM teams, which, for example, are not subject to SLAs, which strongly changes the way of management. It will therefore be necessary to be careful when democratising the audit methodology to the entire IT support service and it is possible that some slight adjustments will have to be made to adapt it to the entire service.

Finally, unfortunately, the results of the test period of the audit methodology on Infosys are not reported in this study. This could have been useful for researchers doing studies on this subject and could have allowed someone wanting to implement a similar audit methodology to know about them in order to have more insight about its efficiency.

# 7 CONCLUSION

## 7.1 Research Case

This design science research based on a case study is covering the implementation of a quality audit methodology for an IT support service within a company, CMA-CGM. It has been divided into several research questions that are addressed throughout this report.

Firstly, current good practice in terms of Quality of Service and IT auditing has been reviewed in the literature. When a service is outsourced to a service provider, the contract between the two parties is very important because it formalises the conditions and measures regarding the quality of service to be achieved. For this purpose, Service Level Agreements allow to define all the conditions necessary for the good functioning of the service and the penalties in case of non-respect of these agreements. In addition, it is essential to monitor the performance of service providers to ensure that everything is going well and that there are no weak points that reduce the quality of service and user satisfaction. To this end, developing an audit methodology permits the quality of the service to be measured and corrective action to be taken where necessary. Accordingly, several conceptual models dealing with quality of service, its various influencing factors and consequences for end-users, as well as the benefit of developing an audit methodology and constructing audit criteria to ensure proper monitoring, were reviewed.

Secondly, the current situation regarding the Quality of Service of IT support has been investigated. For this purpose, a comprehensive description of the company was first undertaken, as well as the discovery of the different ticket resolution processes, namely Incident and Service Request. In addition, two quantitative questionnaires were conducted in order to investigate potential service processes with a lack of quality. The three main concerns of users regarding the lack of quality of the support service are the long waiting time for resolution, the high number of unresolved tickets, and the lack of communication between users and support teams.

Then, once the good practices had been studied and the current situation examined, the objective was to find the appropriate audit criteria norm to be developed to meet the company's expectations. In the context of this study, ITIL best practices were the most complete and useful support to address this audit methodology. Indeed, it is already well implemented at CMA-CGM thanks to the setting up of a Service Desk to manage IT Incidents and Service Requests, and this research is part of the continuous improvement

phase of the framework. In addition, the analysis of the questionnaires in the Result section allowed the identification of the points to be monitored in order to improve the quality of the Service. A conceptual model was also built to help the research direction with the implementation of an audit methodology.

Furthermore, in order to monitor quality and improve the weak points of the support processes at CMA-CGM, an analysis grid was designed based on the conceptual model and the analysis of the results of the two questionnaires. This option was chosen because it represents a checklist serving as audit criteria for the audit methodology. In addition, it makes the methodology more formal than a simple continuous improvement framework and allows for a quality norm resulting directly from the perceived quality of the users and suppliers of the support service through the analysis of the questionnaires. Indeed, this analysis grid is structured as a series of checkpoints to be verified with quality indicators in order to know if these checkpoints correspond to the quality expectations or if they need to be improved. If they do not correspond to expectations, actions to be taken are recommended in order to increase their performance and meet quality expectations, and thus increase the quality of the IT support service. This represents the research artefact and consists of a total of ten checkpoints.

Finally, the last step and research sub-question consisted in validating if the implementation of this analysis grid is feasible and if it is agreed by CMA-CGM for a test phase. It was therefore presented and fully reviewed for each checkpoint during a meeting with the manager and the data officer of the SQM team. After some modifications and improvements, it has been accepted for a test phase that will start right after the achievement of this thesis.

## 7.2 Research contribution

This research provided several contributions, both on an academic level (theoretical), and on a more operational level for CMA-CGM (practical).

### 7.2.1 Theoretical contribution

First of all, from a theoretical point of view, this research enabled the development of a new conceptual model, adapted from different previous research, to address quality of service in an IT support service division. Indeed, this new conceptual model suggests categorizing the main influencing factors of service quality into three distinct variables,

namely Behaviour, Competence and Environment. In addition, it suggests in the context of this study the three main consequences of insufficient service quality, namely long waiting time, undelivered service (e.g., unresolved ticket), and lack of communication. The aim is to reuse this model, leaving the three influencing factors unchanged, and adapt the different consequences to the type of service studied.

Furthermore, this conceptual model has been tested on a "Service Desk" type of service, a domain not yet very present in the literature. Indeed, establishing an audit methodology to measure and increase the quality of an IT support service is not common. Generally, when it comes to an IT service, research focuses more on the risk and security part than the quality part.

Finally, this research has allowed the development of an artefact to be used as an audit criteria to test whether the quality of a support service is compliant during an audit methodology.

### 7.2.2 Practical contribution

Moreover, this research provides practical contributions, which will directly benefit the company under study, CMA-CGM. Firstly, it clarified the three factors that influence the quality of service. This can help to take them all into account and not just focus on one or two. The conceptual model developed is exactly adapted to the CMA-CGM support service.

Secondly, this model has allowed the development of an audit methodology in order to increase the quality of the support service. Moreover, the two questionnaires realized can be included in the audit methodology as a preliminary step to the improvement/modification of the analysis grid.

Then, an analysis grid was built for the SQM department, consisting of quality checkpoints, their indicators to measure their veracity, and finally recommended actions in case of non-compliance in order to improve the service. This analysis grid is also intended to be constantly evolving in order to be adapted to the evolution of the service. Indeed, the audit methodology is intended to be carried out every year, with an analysis grid that could evolve by removing the points that have become compliant, continuing to measure the points that are still not compliant, and adding new concerns found through new questionnaires or experience and analysis of the current situation. The quantification of indicators will then be added to this analysis grid after the test phase in order to make this audit criteria norm more accurate and efficient.

## 7.3 Further research

Finally, this study introduces various further research that can be conducted.

Firstly, additional research could cover the testing and implementation phase of the audit methodology, also indicating the improvements made throughout the research process. This would complement this research and also further measure and evaluate the effectiveness of the audit methodology developed.

Additionally, further research could address the subject of audit methodology for the quality of IT support services in a company where this department is completely internalized. Indeed, several differences and complications could be addressed such as the fact that the service is not subject to any SLA.

Finally, further research could address an audit methodology for IT support services based on risks and security. Indeed, an analysis grid could be developed in order to address security and risk issues, with mitigation and recovery actions to be taken into account.

# REFERENCES


Antony, J. (2006). Six sigma for service processes. *Business process management journal*.

AXELOS. (2011). *Introduction to the ITIL Service Lifecycle*: TSO.

BackOfficePro. (2019). Advantages of Outsourcing You Might Not have Thought of. Retrieved from https://www.backofficepro.com/blog/advantages-to-outsourcing-you-might-not-have-thought-of/

Barthélemy, J., & Quélin, B. V. (2006). Complexity of outsourcing contracts and ex post transaction costs: an empirical investigation. *Journal of Management Studies, 43*(8), 1775-1797.

Benjamin, A. (2008). Audit: how to do it in practice. *Bmj, 336*(7655), 1241-1245.

Bhasin, S., & Burcher, P. (2006). Lean viewed as a philosophy. *Journal of manufacturing technology management*.

Brady, M. K., & Cronin Jr, J. J. (2001). Some new thoughts on conceptualizing perceived service quality: a hierarchical approach. *Journal of marketing, 65*(3), 34-49.

Brandas, C. (2010). Risks and audit objectives for IT outsourcing. *Informatica Economica Journal, 14*(1), 113-118.

Brown, T. L., & Potoski, M. (2003). Managing contract performance: A transaction costs approach. *Journal of Policy analysis and Management, 22*(2), 275-297.

Cartlidge, A., & Hanna, A. (2007). The IT Infrastructure Library An Introductory Overview of ITIL® V3 Version 1.0.

Chen, Y., & Bharadwaj, A. (2009). An empirical analysis of contract structures in IT outsourcing. *Information Systems Research, 20*(4), 484-506.

CMA-CGM. CMA CGM en chiffres. Retrieved from https://www.cmacgm-group.com/fr/groupe/notre-groupe/chiffres-clefs

De Ruyter, K., Bloemer, J., & Peeters, P. (1997). Merging service quality and service satisfaction. An empirical test of an integrative model. *Journal of economic psychology, 18*(4), 387-406.

Dhar, S. (2012). From outsourcing to Cloud computing: evolution of IT services. *Management Research Review*.

Dhar, S., & Balakrishnan, B. (2006). Risks, Benefits, and Challenges in Global IT Outsourcing: Perspectives and Practices. *Journal of global information management, 14*(3), 59-89. doi:10.4018/jgim.2006070104

Dumas, M., van der Aalst, W., & Ter Hofstede, A. (2005). *Process aware information systems* (Vol. 1): Wiley Online Library.

Earp, J. A., & Ennett, S. T. (1991). Conceptual models for health education research and practice. *Health education research, 6*(2), 163-171.

Echaudemaison, C.-D., Bazureau, F., Bosc, S., Cendron, J.-P., Combemale, P., & Faugère, J.-P. (1989). Dictionnaire d'économie et de sciences sociales. *Les références*.

Elangovan, N., & Rajendran, R. (2015). *Conceptual model: A framework for institutionalizing the vigor in business research.* Paper presented at the Proceedings of Third National Conference on Indian Business Management. https://doi. org/10.13140/RG.

Evans, J. R. (2004). An exploratory study of performance measurement systems and relationships with performance results. *Journal of operations Management, 22*(3), 219-232.

Franceschini, F., Galetto, M., & Turina, E. (2009). Service quality monitoring by performance indicators: a proposal for a structured methodology. *International Journal of Services and Operations Management, 5*(2), 251-273.

Galup, S., Jing, Q., Dattero, R., & Conger, S. (2007). *Information technology service management: An emerging area for academic research and pedagogical development*.

Gantz, S. D. (2013). *The Basics of IT Audit: Purposes, Processes, and Practical Information*. Rockland, MA: Elsevier Science & Technology Books.

Gartner. (2020). Gartner Says Worldwide IT Spending to Grow 4% in 2021. Retrieved from https://www.gartner.com/en/newsroom/press-releases/2020-10-20-gartner-says-worldwide-it-spending-to-grow-4-percent-in-2021

Ghotbabadi, A. R., Feiz, S., & Baharun, R. (2015). Service quality measurements: a review. *International Journal of Academic Research in business and social sciences, 5*(2), 267.

Goldratt, E. M. (1990). *Theory of constraints*: North River Croton-on-Hudson.

Gopal, A., Sivaramakrishnan, K., Krishnan, M. S., & Mukhopadhyay, T. (2003). Contracts in offshore software development: An empirical analysis. *Management Science, 49*(12), 1671-1683.

Gorla, N., Somers, T. M., & Wong, B. (2010). Organizational impact of system quality, information quality, and service quality. *The Journal of Strategic Information Systems, 19*(3), 207-228.

Gregor, S., & Hevner, A. R. (2013). Positioning and presenting design science research for maximum impact. *MIS quarterly*, 337-355.

Grossman, G. M., & Helpman, E. (2005). Outsourcing in a global economy. *The Review of Economic Studies, 72*(1), 135-159.

Haapio, H., & Siedel, G. J. (2013). *A Short Guide to Contract Risk*. Farnham: Routledge.

Haywood-Farmer, J. (1988). A conceptual model of service quality. *International journal of operations & production management*.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-based nursing, 18*(3), 66-67.

Hearnshaw, H., Harker, R., Cheater, F., Baker, R., & Grimshaw, G. (2003). Are audits wasting resources by measuring the wrong things? A survey of methods used to select audit review criteria. *BMJ Quality & Safety, 12*(1), 24-28.

Hess Jr, R. L., Ganesan, S., & Klein, N. M. (2003). Service failure and recovery: The impact of relationship factors on customer satisfaction. *Journal of the academy of marketing science, 31*(2), 127-145.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS quarterly*, 75-105.

Ho, C.-T., & Wei, C.-L. (2016). Effects of outsourced service providers' experiences on perceived service quality: A signaling theory framework. *Industrial management + data systems, 116*(8), 1656-1677. doi:10.1108/IMDS-01-2016-0015

Holden, R. R. (2010). Face validity. *The corsini encyclopedia of psychology*, 1-2.

Iden, J., & Eikebrokk, T. R. (2013). Implementing IT Service Management: A systematic literature review. *International journal of information management, 33*(3), 512-523.

Jack, W., & Scott, C. (2008). LEAN INFORMATION TECHNOLOGY SERVICE MANAGEMENT: BOTTOM-UP PROCESS IMPROVEMENT THAT ADDRESSES THE BOTTOM LINE. *Contract management, 48*(5), 22.

Kaplan, R. S., & Norton, D. P. (2007). Balanced scorecard. In *Das Summa Summarum des Management* (pp. 137-148): Springer.

Kim, Y. J., Eom, M., & Ahn, J. H. (2005). Measuring IS service quality in the context of the service quality-user satisfaction relationship. *Journal of Information Technology Theory and Application (JITTA), 7*(2), 6.

Lacity, M. C., Khan, S., Yan, A., & Willcocks, L. P. (2010). A review of the IT outsourcing empirical literature and future research directions. *Journal of information technology, 25*(4), 395-433.

Lacity, M. C., Khan, S. A., & Willcocks, L. P. (2009). A review of the IT outsourcing literature: Insights for practice. *The Journal of Strategic Information Systems, 18*(3), 130-146.

Lee, J.-N., Huynh, M. Q., Chi-wai, K. R., & Pi, S.-M. (2000). *The evolution of outsourcing research: what is the next issue?* Paper presented at the Proceedings of the 33rd Annual Hawaii International Conference on System Sciences.

Lee, M. K. (1996). IT outsourcing contracts: practical issues for management. *Industrial Management & Data Systems*.

Ma, Q., Pearson, J. M., & Tadisina, S. (2005). An exploratory study into factors of service quality for application service providers. *Information & management, 42*(8), 1067-1080.

Mangold, W. G., & Babakus, E. (1990). Monitoring service quality. *Review of Business, 11*(4), 21.

Marques, F. T., Sauvé, J. P., & Moura, J. A. B. (2009). SLA Design and Service Provisioning for Outsourced Services. *Journal of network and systems management, 17*(1), 73-90. doi:10.1007/s10922-009-9115-7

Michell, V., & Fitzgerald, G. (1997). The IT outsourcing market-place: vendors and their selection. *Journal of information technology, 12*(3), 223-237. doi:10.1080/026839697345080

Muhammad, K., Saoula, O., Issa, M., & Ahmed, U. (2019). Contract management and performance characteristics: An empirical and managerial implication for Indonesia. *Management Science Letters, 9*(8), 1289-1298.

Müller, S. D., & de Lichtenberg, C. G. (2018). The culture of ITIL: Values and implementation challenges. *Information systems management, 35*(1), 49-61. doi:10.1080/10580530.2017.1416946

Neely, A. (1999). The performance measurement revolution: why now and what next? *International journal of operations & production management*.

Neely, A. D., Adams, C., & Kennerley, M. (2002). *The performance prism: The scorecard for measuring and managing business success*: Prentice Hall Financial Times London.

O'Brien, T. M. (2016). *AUDIT REPORT Technology Services IT Service Desk*. Retrieved from https://mail.google.com/mail/u/0/?ogbl#inbox/FMfcgzGkXSWvKNGzLqwmtBHBVBFHxQCR?projector=1&messagePartId=0.5

Panko, R. (2019). Small Business Outsourcing Statistics in 2019. Retrieved from https://clutch.co/bpo/virtual-assistants/resources/small-business-outsourcing-statistics#:~:text=More%20than%20one%2Dthird%20of,to%20do%20so%20in%202019.&text=Our%20data%20shows%20that%20more,plan%20to%20outsource%20in%202019.

Parasuraman, A., Zeithaml, V. A., & Berry, L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *1988, 64*(1), 12-40.

Park, J.-Y., & Kim, J. S. (2005). The impact of IS sourcing type on service quality and maintenance efforts. *Information & management, 42*(2), 261-274. doi:10.1016/j.im.2003.08.005

Peppard, J. (2003). Managing IT as a Portfolio of Services. *European Management Journal, 21*(4), 467-483.

Ruppertsberg, A. I., Ward, V., Ridout, A., & Foy, R. (2014). The development and application of audit criteria for assessing knowledge exchange plans in health research grant applications. *Implementation Science, 9*(1), 1-6.

Sarkar, A., Mukhopadhyay, A. R., & Ghosh, S. K. (2011). Improvement of service quality by reducing waiting time for service. *Simulation Modelling Practice and Theory, 19*(7), 1689-1698.

Satyanarayana, S. (2012). Cloud computing: SAAS. *Computer Sciences and Telecommunications*(4), 76-79.

Sharma, N., & Patterson, P. G. (1999). The impact of communication effectiveness and service quality on relationship commitment in consumer, professional services. *Journal of services marketing*.

Sokovic, M., Pavletic, D., & Pipan, K. K. (2010). Quality improvement methodologies–PDCA cycle, RADAR matrix, DMAIC and DFSS. *Journal of achievements in materials and manufacturing engineering, 43*(1), 476-483.

Sorooshian, S., Aziz, N. F., Ahmad, A., Jubidin, S. N., & Mustapha, N. M. (2016). Review on performance measurement systems. *Mediterranean Journal of Social Sciences, 7*(1), 123-123.

Tang, X., & Todo, Y. (2013). A Study of Service Desk setup in implementing IT service management in enterprises.

Vuk, T. (2012). Quality indicators: a tool for quality monitoring and improvement. *ISBT Science Series, 7*(1), 24-28.

Williamson, O. E. (1979). Transaction-cost economics: the governance of contractual relations. *The journal of Law and Economics, 22*(2), 233-261.

Zainal, Z. (2007). Case study as a research method. *Jurnal kemanusiaan, 5*(1).

Zhang, K., Shardt, Y. A., Chen, Z., Yang, X., Ding, S. X., & Peng, K. (2017). A KPI-based process monitoring and fault detection framework for large-scale processes. *ISA transactions, 68*, 276-286.

# APPENDICES

## Appendix 1. User Questionnaire Report

1. What is your region?

| | |
|---|---|
| Africa | 20 |
| America | 44 |
| Asia | 69 |
| Europe | 62 |
| Oceania | 9 |

2. With whom are you under contract?

| | |
|---|---|
| CMA-CGM group | 194 |
| Contractor | 7 |
| Third Party Agent | 3 |

3. How many tickets have you created since the beginning of the 2021 year?

| | |
|---|---|
| 1 | 7 |
| Between 2 and 5 | 48 |
| Between 5 and 10 | 43 |
| Between 10 and 15 | 35 |
| More than 15 | 71 |

4. What proportion of Incident / Service Request tickets did you create?

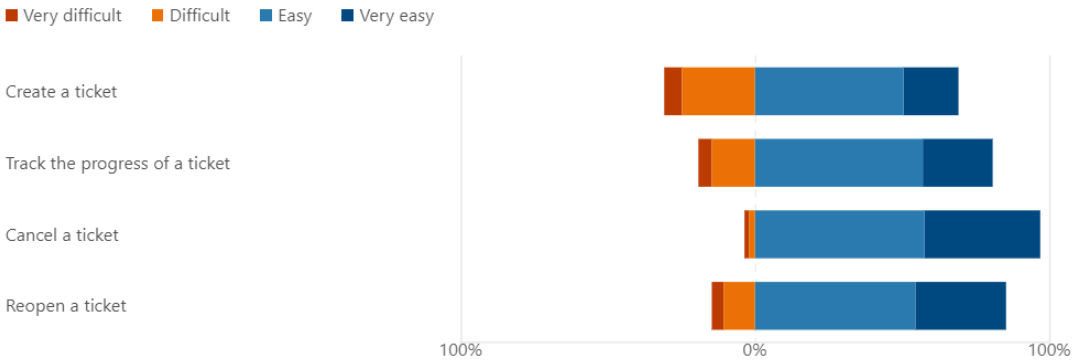
| | |
|---|---|
| 100% / 0% | 29 |
| 75% / 25% | 27 |
| 50% / 50% | 66 |
| 25% / 75% | 60 |
| 0% / 100% | 22 |

5. How do you assess the overall quality of ticket management?

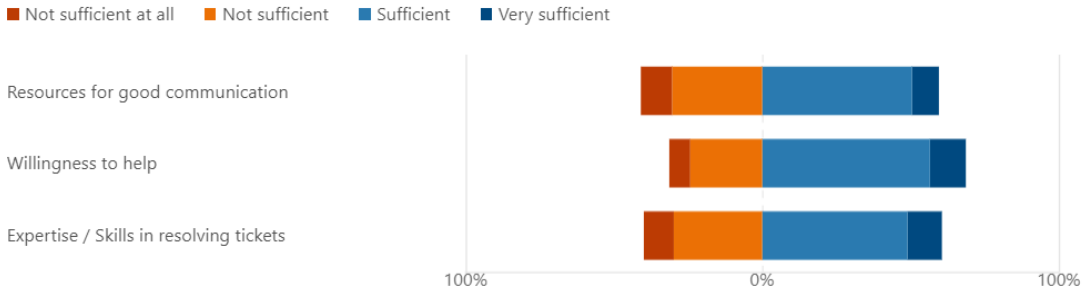
204
Réponses

★★★☆☆
Note moyenne : 3.24

6. How do you assess the use of EUP (End User Portal) for:



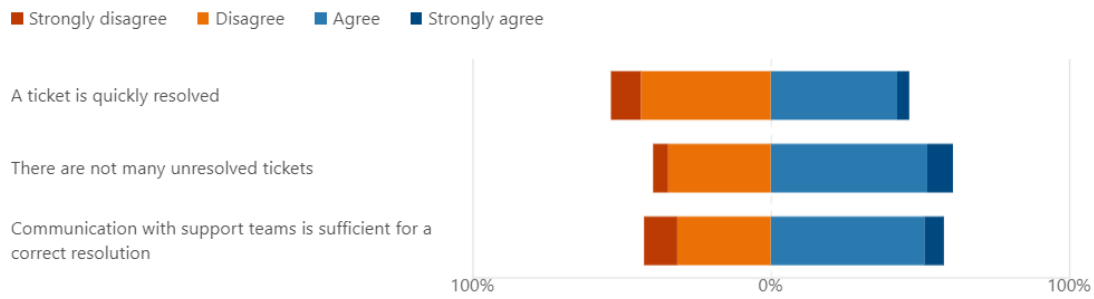

7. How do you evaluate these aspects related to the support teams?



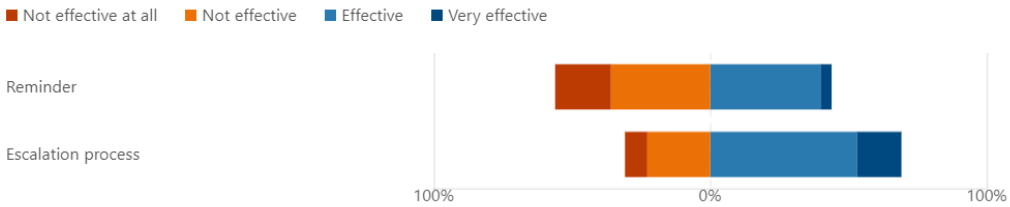

8. Which points did not meet your expectations?

| | |
|---|---|
| Waiting too long for resolution | 131 |
| Unresolved tickets | 63 |
| Lack of communication | 83 |
| None | 33 |
| Autre | 39 |

9. What do you think of the following statements?




10. How do you assess the effectiveness of:




11. Do you have anything else to share with us to improve the quality of the support service? (not mandatory)

80
Réponses

Dernières réponses
""

## Appendix 2. Supplier Questionnaire Report

1. In which region are you located?

| | |
|---|---|
| Africa | 0 |
| America | 0 |
| Asia | 10 |
| Europe | 1 |
| Oceania | 0 |

2. What type of tickets do you process?

| | |
|---|---|
| Incident | 0 |
| Service Request | 0 |
| Both | 11 |

3. What kind of group(s) do you belong to?

| | |
|---|---|
| L1 | 3 |
| L2 | 4 |
| L3 | 5 |

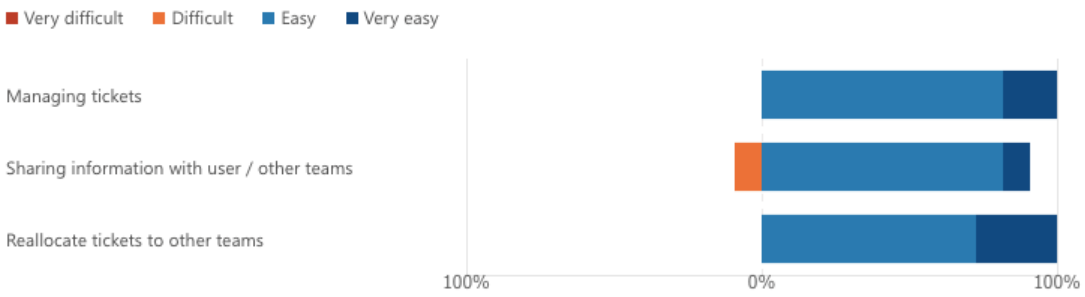
4. What type of team(s) do you belong to?

| | |
|---|---|
| Technical | 1 |
| Functional | 8 |
| Both | 2 |

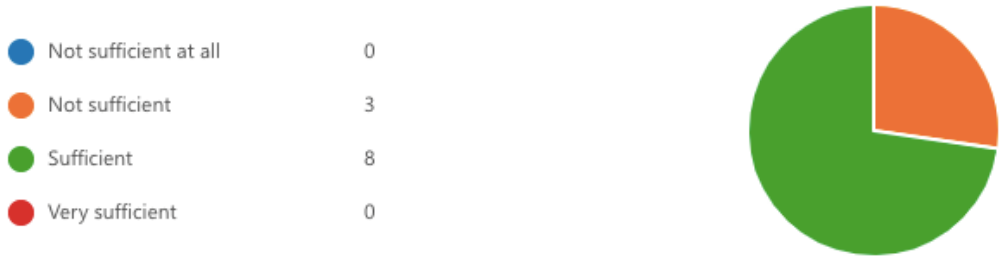
5. How many tickets have you managed since the beginning of the year 2021?

| | |
|---|---|
| Less than 50 | 3 |
| Between 50 and 100 | 1 |
| Between 100 and 150 | 1 |
| Between 150 and 200 | 1 |
| More than 200 | 5 |

6. How do you assess the use of ServiceNow for:




7. How do you evaluate the capacity of your team for the number of tickets?



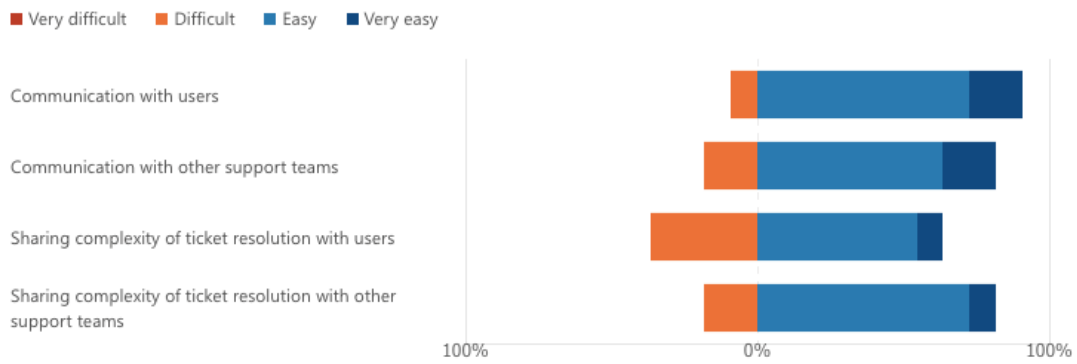

8. How do you evaluate the resources made available for:


9. Are you able to meet the KPIs set up with SQM?

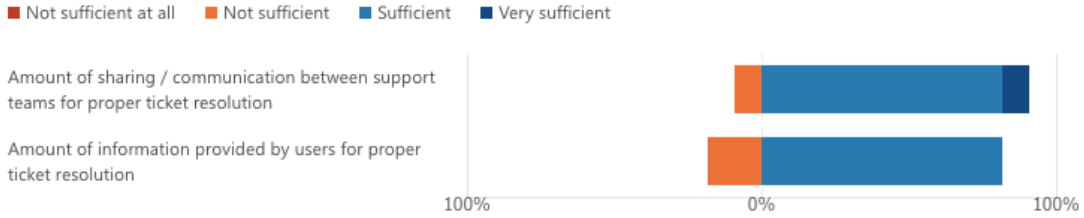
11
Réponses

4.09
Moyenne

10. How would you assess the ease of these actions?




11. How would you assess the sufficiency of these actions?




12. How do you assess your expertise/competences for solving tickets properly?

11
Réponses

4.18
Moyenne

13. How do you evaluate the availability of necessary trainings for the proper performance of your tasks?

11
Réponses

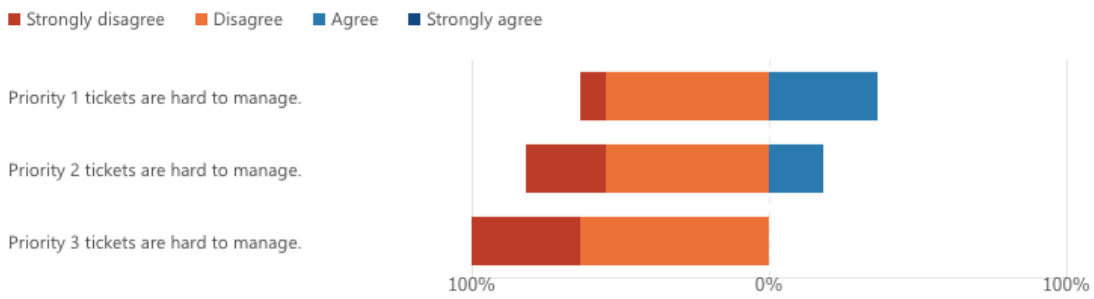
3.82
Moyenne

14. How do you evaluate the ticket assignment to your team?

11
Réponses

3.82
Moyenne

15. Answer these statements:




16. Do you have anything else to share with us to improve the quality of the support service? (not mandatory)

5
Réponses

Dernières réponses
*"Get reviews from end user community about requirements periodic...*

**Appendix 3. Keywords for open questions in User Questionnaire**

| Q11. Open Question | | Q8. 'Other' dissatisfaction points | |
|---|---|---|---|
| Item | Count | Item | Count |
| Ticket from problem | 8 | Ticket from problem | 2 |
| EUP Use | 9 | EUP use | 3 |
| Reminder problem | 3 | Reminder problem | 1 |
| Communication channel | 3 | Communication channel | 1 |
| Communication issue | 21 | Communication issue | 9 |
| Comprehension issue | 9 | Comprehension issue | 3 |
| Unresolved ticket | 1 | Unresolved ticket | 3 |
| Priority management | 2 | Priority management | 2 |
| Technician name | 6 | Technician name | 1 |
| Tickets blocking in queue | 4 | Tickets blocking in queue | 1 |
| Lack of willingness to help | 3 | Lack of willingness to help | 3 |
| Lack of skills | 6 | Lack of skills | 3 |
| Processing delay | 11 | Processing delay | 3 |
| Ticket assignment issue | 3 | Ticket assignment issue | 2 |
| Cultural barrier | 1 | Cultural barrier | 1 |
| Need multilanguage | 1 | Need multilanguage | 1 |
| Manager Approval unnecessary | 2 | Manager Approval unnecessary | 1 |
| Processes too technical | 3 | Reoccurring problem | 1 |
| Knowledge Base related | 4 | | |
| Long password management | 2 | | |
| Not testing the resolution | 2 | | |
| Escalation process | 4 | | |

**Appendix 4. Keywords for open questions in Supplier Questionnaire**

| Q16. Open Question | |
|---|---|
| Item | Count |
| User sends reminders while the ticket is "Pending" | 1 |
| Lack of information given by the user | 2 |
| L1 and L2 support teams do not clarify the situation before transferring the ticket. | 1 |
| L1 and L2 support teams do not verify the situation before transferring the ticket. | 1 |
| Explanation with users and other support teams complicated | 1 |
| Limited resources in L3 tickets | 1 |
| Lack of screenshot of the issue | 3 |
| Automatic email when escalation is entered into Service Now software | 1 |
| Improve the ergonomics of the end user portal | 1 |