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Letícia de Araújo Marchi

Project Management in an Electrical Distribution Application

Center: Supplying a French company set to amplify battery cell production in Europe

Blumenau
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Trabalho de Conclusão de Curso de Graduação em Engenharia de Controle e Automação do Centro Tecnológico, de Ciências Exatas e Educação da Universidade Federal de Santa Catarina como requisito para a obtenção do título de Engenheiro de Controle e Automação.
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Letícia de Araújo Marchi

Project Management in an Electrical Distribution Application Center: Supplying a French company set to amplify battery cell production in Europe

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This work is dedicated to my parents.

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We must accept finite disappointment, but never lose infinite hope. (Martin Luther King, Jr., 1968)

RESUMO ESTENDIDO

No ambiente de negócios atual, os líderes organizacionais precisam ser capazes de gerenciar a tecnologia em rápida evolução, orçamentos cada vez mais apertados, prazos mais curtos e recursos mais escassos. Para se manterem competitivas na economia global, as empresas estão adotando a gestão de projetos, vista hoje, por executivos e gestores, como uma competência estratégica essencial para o sucesso empresarial.

Nos setores industrial e tecnológico, as grandes e médias empresas, principalmente, buscam engenheiros qualificados para gerenciar seus projetos. Um grande desafio para essas empresas é encontrar profissionais que dominem as especificidades técnicas do setor em que atuam e que, ao mesmo tempo, tenham habilidade para gerenciar projetos de alto risco. Os engenheiros de controle e automação possuem não apenas o conhecimento técnico de projetos industriais, mas também uma capacidade de gestão que lhes permite gerenciar projetos em múltiplos setores.

Um gerente de projetos fornece liderança à equipe para atingir seu objetivo, coordenando as atividades dos vários membros da equipe para garantir a execução correta das tarefas no momento adequado. Além de exercer a liderança no planejamento, organização e controle do projeto, o profissional que executa a sua gestão deve possuir um conjunto de habilidades e competências que inspirarão a equipe ao sucesso e a conquistar a confiança do cliente.

Um projeto mal gerenciado ou a ausência de gerenciamento em um projeto pode resultar em prazos perdidos, estouros de orçamento, baixa qualidade, retrabalho, perda de reputação da organização, insatisfação das partes interessadas e incapacidade de atingir os objetivos para os quais o projeto foi realizado. Mesmo com um gerenciamento de qualidade é muito raro encontrar um projeto que tenha sido planejado e executado perfeitamente, sem problemas ou imprevistos, e sem alterações em termos de orçamento, prazo final ou qualidade do produto.

O objetivo deste trabalho é apresentar como e por que métodos e ferramentas de gestão de projetos podem ser aplicados em projetos industriais, visando gerenciar riscos e oportunidades e garantir rentabilidade da empresa, boa comunicação entre as partes interessadas e satisfação do cliente. Para isso, deve-se revisar as melhores práticas e ferramentas de gerenciamento de projetos, entender o escopo dos projetos de distribuição elétrica, entender a metodologia de gerenciamento de projetos utilizada pela empresa, e conhecer e trabalhar com a documentação de projetos.

O trabalho apresenta ferramentas e métodos de gerenciamento aplicados a um projeto real, cujo cliente é uma empresa francesa destinada a ampliar a produção de células de bateria na Europa. O projeto consiste no fornecimento de um sistema de distribuição elétrica composto por painéis de média tensão, transformadores, sistema de barramento elétrico e subestações de distribuição de energia. O trabalho apresentará de forma objetiva, e não detalhada, os aspectos técnicos do projeto. A compreensão técnica é importante para o gerenciamento de projetos de engenharia, mas este trabalho se limitará aos conceitos e elementos básicos utilizados diretamente pelo gerente de projetos que, por sua vez, trabalha ao lado de um líder técnico.

As técnicas e procedimentos de gerenciamento de projetos são aplicados de forma prática no projeto e os principais resultados são apresentados. Além disso, outras contribuições para o ambiente de trabalho, também vinculadas à pesquisa, são apresentadas e discutidas.

Para que o projeto seja bem gerenciado, existe uma grande variedade de ferramentas que podem ser utilizadas por empresas e/ou gestores de projetos. Ao longo da parte prática deste trabalho, para que a metodologia da empresa pudesse ser seguida e respeitada, foram aplicadas ferramentas de gestão de projetos tais como softwares ERP, planilhas de planejamento, ferramentas de comunicação e documentação.

O trabalho foi realizado no contexto de um programa de dupla diplomação, entre a Universidade Federal de Santa Catarina, no Brasil, e o Instituto Politécnico Nacional de Grenoble, na França. A aluna, autora do trabalho, desenvolveu a pesquisa durante um estágio de fim de curso, realizado em uma empresa multinacional francesa. O estágio, utilizado como contexto e ambiente para este trabalho, ocorreu no Centro de Aplicação de Distribuição Elétrica da Schneider Electric, em Grenoble, França, entre 7 de fevereiro e 22 de julho de 2022.

As contribuições da autora no ambiente de trabalho foram importantes, principalmente nas tarefas do dia a dia ao longo da fase de execução do ciclo de vida dos projetos. A carga de trabalho foi intensa, em um período em que o registro de contratos foi quatro vezes maior do que em anos anteriores, representando aproximadamente 6 milhões de euros em apenas 3 meses, o que trouxe a experiência de gerenciar vários projetos simultaneamente e ter uma visão real e acelerada do mundo dos negócios atual.

Palavras-chave: Gerenciamento de projetos; Distribuição elétrica; Projetos industriais.

ABSTRACT

To stay competitive in the global economy, companies are embracing project management to consistently deliver business value. Within the industrial sector, changes happen at an accelerated pace. In this context, project management assumes a strategic position to intensify results. A major challenge for companies in the sector is finding professionals who master the technical specifics of the industry in which they operate, but who also have the ability to manage high-risk projects. This work aims to present how project management can be applied in industrial projects, managing risks and opportunities and ensuring company profitability, good communication between stakeholders and customer satisfaction. A bibliographic review will be presented and an important project in the field of electrical distribution will be used as case study for practical application. The company's project maagement methodology will be discussed and further contributions and results will be presented. This study was carried out in the context of an internship at the Application Center of Electrical Distribution of Schneider Electric, in Grenoble, France.

Keywords: Project management; Electrical distribution; Industrial projects.

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LIST OF ABBREVIATIONS AND ACRONYMS

CADE	Centre d'Application Distribution Électrique
CPP	Customer Project Process
ERP	Enterprise Resource Planning
FAT	Factory Acceptance Test
ISO	International Organization for Standardization
MV	Medium Voltage
PMI	Project Management Institute
RTU	Remote Terminal Unit
SVI	Shunt Vacuum Interruption
VIC	Verkor Innovation Center

CONTENTS

1 INTRODUCTION

Projects are a key way to create value and benefits in organizations. In today's business environment, organizational leaders need to be able to manage increasingly tight budgets, shorter deadlines, scarcer resources and rapidly changing technology. The business environment is dynamic, with a rapid pace of change. To stay competitive in the global economy, companies are embracing project management to consistently deliver business value.

Organizations are increasingly placing value on projects, rather than routine operations, as the pace of economic and technological change constantly accelerates. Thus, project management is seen today, by executives and managers, as an essential strategic competence for business success. Qualified professionals are among the most valuable resources, which makes project managers in increasing demand around the world.

According to Bin & Company (ALLEN; ROOT; SCHWEDEL, 2017), a global consultancy firm, by 2027 most work in organizations will be project-based, where the dominant organizational unit will be agile teams that will provide the necessary skills through a combination of internal and external resources. Traditional managers will be reduced as teams will be self-managed, with formal mentors to help guide careers from project to project. Performance evaluations will be carried out transparently, while mentoring and feedback will be continuous and in real time.

Within the industrial sector, changes happen at an accelerated pace. In order to manage so many processes and be able to create innovative ideas for management, production and logistics, companies are turning to trends to optimize and heat up the economy. In this context, project management assumes a strategic position to intensify results, being essential for industries to remain competitive in the market and outperform the competition.

Industrial projects require specialized knowledge about working in production facilities. A major challenge for companies in the sector is finding professionals who master the technical specifics of the industry in which they operate, but who also have the ability to manage high-risk projects.

Many engineers become project managers with years of experience, and as this is a role that requires some understanding of the field of operations, it is important that the engineering project manager is in fact an engineer. However, in addition to the title of engineer, the candidate must also be able to plan projects, coordinate the purchase of materials, document work, manage budgets and deadlines and have multiple interpersonal skills that are necessary in a good project manager.

Entitled "Project Management in an Electrical Distribution Application Center: Supplying a French company set to amplify battery cell production in Europe", this work aims to present a Control and Automation Engineering end-of-studies work.

The work was carried out alongside an end-of-course internship in a French multinational, which was the research application environment to obtain practical results. A specific electrical distribution project will be used as case study to illustrate the main activities carried out by the student during the internship. However, it is important to clarify that the student's tasks and activities were not limited to this case, and that other projects were also seen and worked on.

1.1 OBJECTIVES

The general objective of this work is to present how and why project management methods and tools can be applied in industrial projects, aiming to manage risks and opportunities and to ensure company profitability, good communication between stakeholders and customer satisfaction.

In order for the general objective to be achieved, some specific goals can be outlined:

- Reviewing project management best practices and tools;
- Understanding electrical distribution projects scope;
- Appropriating a case study in the field of electrical distribution;
- Understanding the project management methodology used by the company in which the case study is contextualized;
- Knowing and working with project documentation;
- Applying the gathered information about project management in the case study;
- Analysing the results of the application.

1.2 JUSTIFICATORY

Poorly managed projects or the absence of project management can result in missed deadlines, budget overruns, poor quality, rework, uncontrolled project expansion, loss of reputation for the organization, dissatisfied stakeholders, and inability to achieve objectives for which the project was undertaken.

Currently, managing projects properly in companies has become the difference between well-managed and structured organizations and those that end up losing space within their market. In the industrial and technological sectors, large and medium-sized companies, mainly, seek qualified engineers to manage their projects. Therefore, within the framework of engineering studies, the administrative and project management content applied to the studied areas is of great importance.

1.3 DELIMITATION OF THE THEME

The work presents project management tools and methods applied to a case study, which consists of an industrial project in the field of electrical distribution. Projects in this application field can be long, which means that this work will not be able to cover the application of project management in all phases of the case study.

The work will objectively, and not in detail, present the technical aspects of an electrical distribution project. Technical understanding is important for project management, but this work will only address the basic concepts and elements directly used by a project manager who, in turn, works alongside a technical leader.

1.4 ADHERENCE WITH CONTROL AND AUTOMATION ENGINEERING

Control and automation engineering is very broad and encompasses process control, industrial automation, information technology, robotics, instrumentation, production systems management, home and building automation, systems integration, among others. The control and automation engineer must work mainly at the interface between the production system and the management system of companies, planning, designing and executing process control and industrial automation systems.

Control and automation engineers have not only the technical knowledge of industrial projects, but also a management capacity that allows them to manage industrial projects in multiple sectors. When working as project managers, they may be responsible, for example, for process integration, quality control, organization of production lines, process standardization, risk management, cost and schedule supervision.

1.5 DOCUMENT STRUCTURE

After this introduction, Chapter 2 presents a bibliographic review about Project Management, its definitions, processes and knowledge areas. Chapter 3 presents the research methodology used in this work, giving the work context and work environment. Chapter 4 illustrates a study case, a real project chosen to apply the research results. Chapter 5 presents the project management methodology used by the company where the work was carried out, also bringing some results of document management. Chapter 6 contains the practical results, from the tools and methodologies applied in the case study. In addition, this chapter also brings other student contributions to the work team. Chapter 7 contains the conclusions of the work.

2 THEORETICAL REFERENCE

Project Management Institute (PMI) is a not-for-profit, for-purpose professional organization for project management. Established in 1969 with headquarters in Philadelphia, Pennsylvania (USA), PMI currently has over 500,000 members in over 180 countries. Globally recognized standards, certifications, online courses, thought leadership, tools, digital publications, and communities are offered by the institute. Among this content is the main PMI standard document, "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", which is a basis upon which organizations can create methodologies, policies, procedures, rules, tools and techniques and lifecycle phases necessary for the practice of project management

Based mainly on the PMBOK, but also on other relevant books and articles on the subject, this chapter brings a literature review on project management, its main definitions and its knowledge areas.

2.1 DEFINITIONS

According to PMI, a project is a temporary effort undertaken to create a unique product, service or result (PMI, 2017). Projects are carried out to meet objectives through the development of deliverables. An objective is defined as a result to which the work is oriented, a strategic position to be reached or a purpose to be achieved, a product to be produced or a service to be performed. A deliverable is defined as any single, verifiable product, result, or capability that must be produced to complete a process, phase, or project. As stated by PMI:

> Project management is the use of specific knowledge, skills, tools and techniques to deliver something of value to people. The development of software for an improved business process, the construction of a building, the relief effort after a natural disaster, the expansion of sales into a new geographic market—these are all examples of projects.

Project management is the application of knowledge, skills, tools and techniques to project activities in order to fulfill project requirements(PMI, 2017). It allows organizations to execute projects effectively and efficiently.

Project management means planning, organizing, coordinating, leading and controlling resources to achieve the project objective (GIDO; CLEMENTS; BAKER, 2018). It is a set of knowledge, skills, tools and techniques that, if managed in a coordinated way, have a great influence on the success of projects. The project efficiency, business success, customer satisfaction, and future preparation are the main dimensions for the project success (BANNERMAN, 2008).

2.2 THE PROJECT MANAGER ROLE

A project manager provides leadership to the team to achieve its objective, coordinating the activities of the various team members to ensure the correct execution of tasks at the appropriate time. It is the project manager's responsibility to lead the planning, organization, monitoring and control of the project and to make sure that the client is satisfied with the scope of the work, which must be completed in a qualitative way, within the budget and within the determined deadline (PMI, 2017).

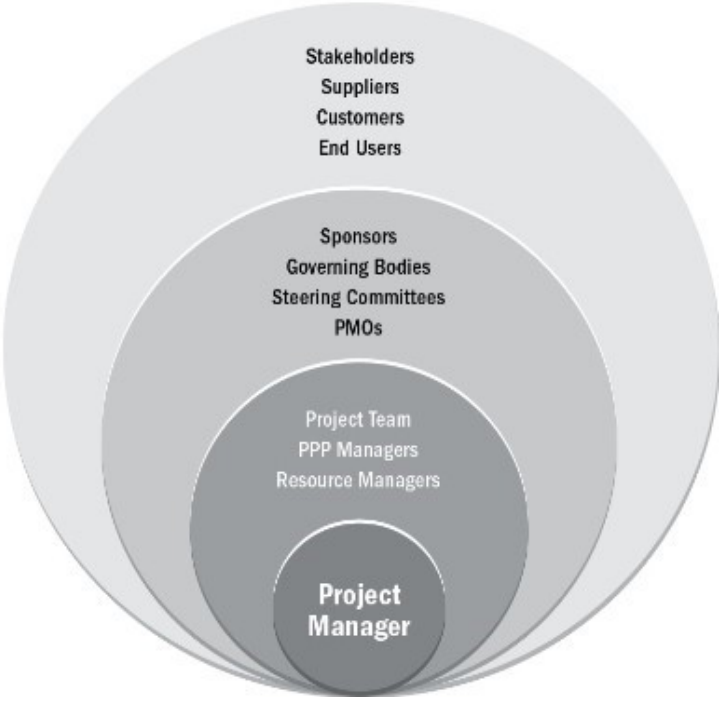
In addition to exercising leadership in planning, organizing and controlling the project, the project manager must have a set of skills and competencies that will inspire the team to success and get customer trust. Effective project managers have strong leadership, problem solving skills, the ability to develop team members, communication and interpersonal skills, negotiation skills and time management skills (GIDO; CLEMENTS; BAKER, 2018).

- **Leadership skills.** Leadership is getting others to do their jobs. The manager needs to create a vision of the outcome and expected benefits for the team, inspiring the people assigned to the project to work as a team, to implement the plan and achieve the objective. A manager must understand what motivates team members and create a supportive environment in which individuals work as a high-performing team and are encouraged to excel. Effective project management requires a participatory and consultative leadership style, in which the manager provides guidance and training to the team.
- **Ability to develop people.** The manager should use the project as an opportunity to add value to the experience base of each one, so that all team members have more knowledge and competence at the end of the project than when they started it. A good manager believes that all individuals are valuable to the organization and can make great contributions through continuous learning. They can, for example, talk about the importance of self-development in team meetings, have them participate in formal training sessions, and identify situations where less experienced people can learn from more experienced people.
- **Communication skills.** Project managers need to communicate regularly with the team, as well as with the subcontractor and suppliers, customers and the top management of the organization itself and other stakeholders. A high level of communication is especially important at the beginning of a project to build a good working relationship with the team and to establish clear expectations with the client and other stakeholders. The manager must create an atmosphere that embraces timely and open communication without any fear of reprisal and accepts different points of view.

- **Interpersonal skills.** Good interpersonal skills enable a manager to empathize with individuals when special circumstances arise with team members. A manager also needs to know how to deal with disagreements and divisions among team members or with stakeholders, situations that may need care to mediate an outcome in which no one loses credibility, relationships do not deteriorate and work on the project is not affected.
- **Ability to deal with stress.** There can be a lot of stress when a project is in danger of not achieving its goals. The project may go over budget, have a schedule delay, have technical problems with equipment, the customer may ask for scope changes, or a conflict may arise within the team over the most appropriate solution to the problem. The manager needs to remain calm and make sure that panic and frustration do not affect the team, the customer, or the top management of the organization.
- **Problem solving skills.** The manager needs to be a good problem solver and must also encourage team members to identify problems early and solve them on their own. Team members should be asked about suggestions for solving the problem, as the manager's ideas do not always represent the only or best way to do things. After the optimal solution is found, the manager delegates the implementation of the solution to the appropriate individuals on the team.
- **Negotiation skills.** Negotiations of a project can be present in interactions with sponsor, customer or senior management of the project organization, subcontractors, suppliers, end users and/or interested parties. In addition to listening effectively, the manager needs to be able to be persuasive and clearly articulate his position on the matter. The gain must be on both sides, which requires the manager to be flexible and willing to enter into a common agreement. In addition, when negotiating with the client, the manager needs to keep in mind that maintaining a good relationship is crucial to having the opportunity for more business or projects with the same client in the future.
- **Time management skills.** To make optimal use of available time, project managers need to have self-discipline, be able to prioritize tasks and actions, and demonstrate a willingness to delegate.

The project manager's skills, competences and capabilities must reflect the roles he performs within his sphere of influence. As shown in the Figure 1, this sphere of influence includes, for example, stakeholders, suppliers, customers, end users, sponsors, government agencies, project management team.

Figure 1 – Project manager's sphere of influence.



Source: Project Management Institute (2017).

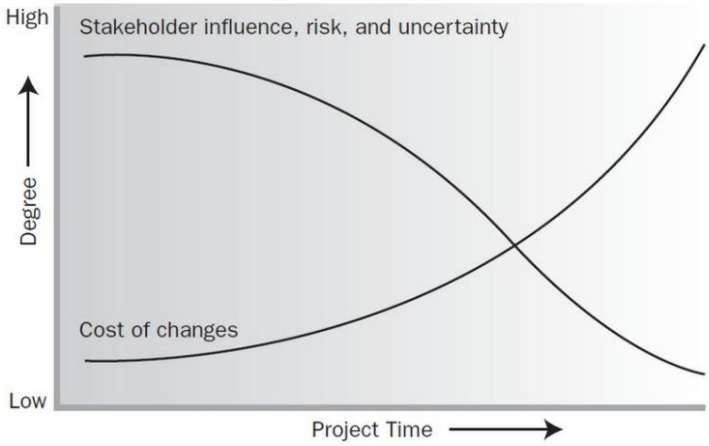
2.3 PROJECT LIFE CYCLE

According to the PMBOK, a project goes through a series of phases from its initiation to its closure, which is called the project life cycle. A project phase is a set of logically related activities that result in the completion of one or more deliverables. The phases are determined by the nature of the project, its application and the management and control needs of the organizations involved, also presenting a defined deadline and control points.

Figure 2 illustrates the cost of change, which generally increases significantly as the project approaches its completion, and the risk curve, which is highest at the beginning of the project. Cost levels are low at the outset and increase as work is performed, while risks decrease throughout the project life cycle as decisions are made and deliverables are accepted. Therefore, the probability that changes will not significantly affect costs and schedule is highest at the beginning of the project and decreases as the project progresses towards completion.

The project life cycle is based on the execution of project management processes, which consist of a series of activities that produce inputs and outputs, using appropriate techniques and tools. The five project management processes are: initiating, planning, executing, monitoring and controlling, and closing.

Figure 2 – Impact of variables over time.



Source: Project Management Institute (2017).

2.3.1 Project Initiation

At project initiation, the initial scope and resources are defined, the stakeholders who will interact and influence the project's outcome are identified, and the project manager is selected. The primary purpose of this process is to align stakeholder expectations with the project objective, inform stakeholders of the scope, and discuss how their participation in the project can help ensure their expectations are realized (PMI, 2017).

To increase stakeholder satisfaction throughout the project, increase the likelihood of successful deliverables, and create a common understanding of satisfaction criteria, it is important to involve sponsors, customers, and other stakeholders in this process.

2.3.2 Project Planning

In the project planning process, the course of action for the successful completion of the project or phase is defined. The overall scope is defined, objectives are established and refined, and the course of action necessary to achieve them is developed. In this process, the components of the project management plan and the documents used to carry out the project are defined. Planning and documentation are iterative and continuous activities, undergoing a constant refinement called progressive elaboration (PMI, 2017).

Planning is the most important and directive phase of the project, the "soul" that reflects in the quality of management and the quality of deliveries. At this stage, everything is planned, in detail, allowing for as much control over the execution as possible (GIACON; FONTES; GRAZZIA, 2017). As more information or project characteristics are identified, additional planning may be required. Also, if there are significant changes throughout the project life cycle, it may be necessary to revisit one or more of the planning processes and possibly some of the initiation processes.

Someone who thinks planning is unnecessary or a waste of time will invariably need to waste time later with rework. Trying to execute a project without a plan is like trying to assemble a piece of furniture without having read the instructions (GIDO; CLEMENTS; BAKER, 2018). When projects go into execution without all the planning details, this usually means an organizational characteristic that can come from a conflict of time and resources, for example (TORRES, 2013).

2.3.3 Project Execution

The execution process fulfills the project's requirements and objectives in accordance with what was planned. Much of the project's budget, resources, and time is devoted to execution, where resources are coordinated, stakeholder engagement is managed, and activities are integrated and executed in accordance with the project management plan.

For a project to be executed, there must be previously a clear definition of its objectives, a detailed and approved project plan, an approved and saved baseline and the commitment of the project team concerning the deliverables and their milestones.

2.3.4 Project Monitoring and Controlling

Project monitoring and control consists of measuring and analyzing project performance at regular periods of time, in order to identify and correct deviations or variations from the project management plan. This process involves tracking, analyzing, and adjusting the progress and performance of the project, identifying any areas where changes to the plan will be needed.

Throughout the execution of the work, it is necessary to monitor and control the progress of the project to ensure that everything is progressing according to plan. This involves measuring current progress and comparing it to planned progress, keeping track of which tasks have been started and completed, how much money has already been spent or committed, and whether project deliverables are meeting expected quality criteria (GIDO; CLEMENTS; BAKER, 2018). If deviations occur during the life cycle, they can be adjusted for operation, production, or they can be closed (TORRES, 2013).

2.3.5 Project Closing

Project closure consists of the processes performed to formally and appropriately complete or close a project, phase, or contract, ensuring that all tasks and all project deliverables have been completed. Upon closure, the project team is disbanded, and the people involved are released for other activities and/or projects.

In the closing phase it is important to evaluate the performance of the project, through the identification of lessons learned and recommendations to improve performance in future projects. Preferably, a knowledge base system should be established that includes

easy access to a repository to retrieve lessons learned and information from previous projects. In addition, sponsor and customer feedback should also be obtained to assess the customer's level of satisfaction and obtain any feedback that may be helpful in further business relationships with that customer and others (GIDO; CLEMENTS; BAKER, 2018).

2.4 PROJECT MANAGEMENT KNOWLEDGE AREAS

According to the PMBOK, Knowledge Area is an identified area of project management defined by its knowledge requirements and described in terms of the processes that compose it: practices, inputs, outputs, tools and techniques. The guide describes 10 Knowledge Areas:

2.4.1 Project Integration Management

Project integration management is about coordinating all the processes across the ten Knowledge Areas and the activities required to identify, define, combine, unify, and coordinate the various processes and activities of the projects. These are integrative and essential actions for the controlled execution of the project from its beginning to its conclusion, successfully managing the expectations of the interested parties and meeting the established requirements.

Integration unifies, consolidates, communicates and interrelates, including choices about resource allocation, balancing competing demands, adapting processes, and managing interdependencies between Project Management Knowledge Areas. The more complex the project and the higher the stakeholder expectations, the more complex the approach to integration required.

According to PMI, in general, Project Integration Management involves the following principles:

- Ensure final delivery dates are aligned;
- Provide a project management plan;
- Manage performance and activity changes in the project management plan;
- Make integrated decisions regarding key changes that impact the project;
- Measure and monitor the progress of the project and take the necessary steps to meet its objectives;
- Collect and analyze data on the results and inform relevant stakeholders;
- Formally close each phase, contract and the project as a whole.

In integration activities, the use of automated and visual management tools, the expansion of the project manager's responsibilities, and the use of hybrid methodologies

can be useful and necessary. Project Integration Management is a specific assignment of project managers, and their responsibility cannot be delegated or transferred. The project manager is responsible for the project as a whole and is the one who has the project overview and who combines the results in all other Knowledge Areas.

2.4.2 Project Scope Management

A scope defines the context, the main inputs and outputs and the main functions of the project to be developed. It contains all the tasks, activities, resources, schedules, decisions and limits of the project that must be carried out to meet the goals and deliverables (ALTHIYABI; QURESHI, 2021). The scope of a product refers to the features and functions that describe a product, service, or result, while the project scope is the work that must be performed to deliver a product, service, or result with specified features and functions (PMI, 2017).

Project scope management is primarily the definition and control of what is and what is not included in the project, to perform the necessary processes and ensure that the project includes all the work, and only the work necessary, to complete it successfully. Scope management processes include collecting, documenting, and managing stakeholder requirements. These processes focus on collaborating with problem determination and identifying business needs, identifying and recommending viable solutions to satisfy those needs, collecting, documenting, and managing stakeholder requirements to meet project objectives, and facilitating successful project implementation.

2.4.3 Project Time Management

The project schedule provides a detailed plan that shows how and when the project will deliver the products, services and results defined in the scope, also serving as a communication tool, as a basis for issuing performance reports and an aid in managing stakeholder expectations.

Some benefits of a schedule are better insight into team performance, time calculation of activities, resource allocation, and overall increased efficiency. The schedule indicates when a task has to be started and completed, presenting a logical and sequential chain, and ensuring that each step of a proposal is delivered within the defined deadline, which consequently prevents urgency and delays from causing negative impacts for the company (ESPINHA, 2019).

Project time management is the set of processes required to ensure that the project is delivered on time. Its main objective is to meet the project deadline, defining the necessary activities and relating them to their duration and resources, organizing them, prioritizing them and fulfilling them within the expected time frame.

A well-managed schedule can avoid delays in deliveries, avoid costs beyond expectations and facilitate the allocation of resources.

2.4.4 Project Cost Management

Project cost management consists of planning, estimating, budgeting, financing, managing and controlling costs so that the project can be carried out within the approved budget (PMI, 2017). There are several types of costs during the execution of the project, some direct, others indirectly linked to its execution. Project cost management is primarily concerned with the cost of resources needed to complete project activities.

Incorrect cost estimates can mainly come from lack of experience, underestimation of certain types of costs, estimates made too quickly, and efforts to get a big contract. In large organizations, which simultaneously implement several projects, the problems encountered can be greater. In many cases, projects do not develop as planned, which requires new or changed estimates (ANIČIĆ, D.; ANIČIĆ, J., 2019).

2.4.5 Project Quality Management

ISO (International Organization for Standardization) is a worldwide federation, which regulates and updates a set of rules and standards with the aim of optimizing processes and establishing internationally recognized quality standards.

Technical standards focused on continuous improvement and the implementation of a quality management system are defined by ISO 9000 (ISO, 2015), which certifies that a business model complies with a series of internationally recognized standards and guidelines to guarantee competent quality management. Among the advantages of ISO 9000 certification are: increased productivity, cost reduction, greater competitiveness, employee engagement and motivation, organization and agility, customer satisfaction and market credibility.

According to ISO 9000, quality means suitability and compliance with previously established standards and requirements. Quality is also defined by achieving organizational excellence and satisfying not only customers, but also employees, suppliers and society in general, not only being linked to its performance itself, but also to the value perceived by the customer and the benefits that it can obtain.

Project quality management includes the processes for incorporating the organization's quality policy with respect to planning, managing, and controlling project and product quality requirements to meet stakeholder objectives (PMI, 2017). Quality management aims to ensure the quality of project deliverables in order to satisfy customer needs, which involves all project activities throughout its life cycle.

PBMOK brings five levels of increasingly effective quality management:

1. Leaving the customer to find the defects, which can result in warranty issues, loss of reputation and rework costs.
2. Detect and correct defects before deliveries are sent to the customer as part of the quality control process.

3. Use quality assurance to examine and correct the process itself, not just special defects.
4. Incorporate quality into project and product planning and design.
5. Create a culture in the organization that brings awareness and commitment to quality in processes and products.

Some quality management tools are data analysis, audits, data collection, inspection, expert opinion, data representation, meetings, problem solving and decision making. An audit, for example, is a structured and independent analysis that seeks to identify inefficient and ineffective policies, processes and procedures in use in the project and not adhering to the policies and procedures of the project and the company. It can be scheduled or happen randomly, being performed by internal or external auditors (MONTES, 2020).

2.4.6 Project Human Resource Management

The project team consists of individuals with assigned roles and responsibilities, who work collectively to achieve a shared project objective (PMI, 2017). Team members can have multiple skill sets, work on a full or part-time basis, and can be added to or removed from the project team as the project progresses.

Given the technological, social and economic influences on organizations, managing people on projects is essential to project success and is of strategic importance to the organization (DWIVEDULA, 2019). Specific roles and responsibilities for project team members are assigned, but involving all team members in project planning and decision making can be beneficial.

Considering that one of the most valuable resources of an organization are the employees who work in it and contribute individually and collectively to achieving its goals, the objective of human resource management is to ensure that the organization can achieve success through people (ILIĆ, 2021). Therefore, human resource management is the management of systems, policies and practices related to people to achieve personal and organizational goals.

Regarding the responsibilities of the project manager, the PMBOK highlights that he is also responsible for developing the skills and competencies of the team, in addition to maintaining and improving the satisfaction and motivation of the team, knowing and complying with professional and ethical behavior, and ensuring that all team members adhere to these behaviors. The project leader must be aware of aspects that can influence the team, such as the working environment, the geographical location of team members, organizational changes, internal and external politics, cultural issues and uniqueness factors of the organization.

2.4.7 Project Communications Management

Proper communication is essential in any sector of a company, but especially in project management. A survey carried out by PMI, with 300 large companies, showed that 76% of project failures were committed due to failures in the information flow. Inefficient communication can cause misunderstandings about what is expected and inconsistencies regarding responsibilities, bringing numerous losses to project management (AEVO, 2020).

Effective communication is one in which the message sent is fully understood by the receiver. In the information age, there is much more data available than we are able to assimilate. Therefore, the project manager's role is to filter all this information and pass on only the essential to each of the interested parties. For this, it is necessary to listen carefully, think objectively, discuss openly with the team and respond quickly. In addition, the project manager must analyze in which channels to expose certain information, such as interactive channels (meetings, conferences, phone calls), assets (letters, emails, reports) or passive channels (e-learning, intranet).

Project Communications Management ensures that the information needs of the project and its stakeholders are met by implementing activities to effectively exchange information. First, there is the development of a strategy to ensure that the communication is effective for the interested parties, and then, the activities necessary to implement the communication strategy are carried out (PMI, 2017).

Project communication is based on efforts to avoid misunderstandings and miscommunications, through the selection of methods, means and messages. Misunderstandings cannot be eliminated, but they can be reduced by using the 5Cs of written communications in composing a traditional written or spoken message:

- Clarity: clear purpose and expression addressed the needs of the reader, helping to build trust with the recipient of the message.
- Cohesiveness: logical and coherent flow, leading the readers through information so that they can see how it logically fits together.
- Completeness: present enough information to prove the idea to be transmitted.
- Conciseness: concise expression and elimination of redundant and filler words.
- Concreteness: being specific in meanings, by using precise words and avoiding terms that are vague or abstract.

Project managers spend most of their time communicating with team members and other project stakeholders. Effective communication builds a bridge between them, who may have cultural and organizational differences, different levels of expertise, perspectives and interests. Furthermore, communication management can be highly influenced by factors such as language, race, age, gender, religion, beliefs and habits (MUSZYŃSKA, 2016).

2.4.8 Project Risk Management

All projects have risks that, when not managed, can deviate the project from its plan and prevent it from achieving the project's defined objectives. These risks can be individual, characterized by an uncertain event or condition that, if it occurs, will have a positive or negative effect on one or more project objectives, or general, which are effects of the uncertainty of the project as a whole, arising from all the sources of uncertainty (PMI, 2017).

Project risk management performs the planning, identification, analysis, response planning, response implementation, and risk monitoring on a project. It is a very relevant process that can be related to many companies' survival, whose objective is to increase the probability and impact of positive risks and decrease the probability and impact of negative risks, optimizing the chances of project success.

2.4.9 Project Procurement Management

The procurement process is an area of interest for organizations responsible for project delivery for better performance in product quality, cost, cycle time, and responsiveness (BUZZETTO; BAULI; CARVALHO, 2020). This process comprises the pre-acquisition phase, the tendering and contract award process, and contract and supplier management.

The selection of a supplier is one of the main activities in the purchasing area. This task is difficult and challenging, fraught with many uncertainties and, if performed incorrectly, can affect the performance of the entire project. The selection of one supplier over another largely depends on the company's preferences and the commitments the supplier is willing to make. In addition, the supplier's performance must be monitored and controlled regularly so that any failures can be identified and corrected, also ensuring the success of the project (BUZZETTO; BAULI; CARVALHO, 2020).

Project procurement management includes the purchase or acquisition of products, services, or results from outside the project team. This process includes the management and control processes necessary to develop and administer agreements such as contracts, purchase orders, memorandum of understanding, or internal service level agreements (PMI, 2017).

Project acquisitions involve agreements that describe the relationship between a buyer and a seller. Agreements can be as simple as the purchase of a set amount of labor hours, or as complex as multi-year international construction contracts. Therefore, the project manager does not need to be an expert trained in procurement management laws and regulations, but must be familiar enough with the procurement process to make intelligent decisions about contracts and contractual relationships.

Depending on the application area, the vendor may be referred to as a contractor,

vendor, service provider or supplier. The purchaser may be the owner of the final product, a subcontractor, a customer, a service requester, or the purchaser. The seller can be viewed during the contract life cycle first as a bidder, then as the selected source, and finally as the contracted supplier or seller. The winning bidder will be able to manage the work as a project (PMI, 2017).

2.4.10 Project Stakeholder Management

Stakeholders are the individuals and organizations involved in the project. The project will meet their needs as they are responsible for playing the agreed role to meet the project objective. In general, the most important project stakeholders are the customers, sponsors, project managers, the project team, and internal and external suppliers (MONTES, 2021).

According to the PMBOK, Project Stakeholder Management identifies all persons, groups, or organizations that may impact or be impacted by the project, analyzes stakeholder expectations and their impact on the project, and develops appropriate management strategies for effective stakeholder engagement in the project. throughout the execution and decisions to be taken. The processes support the project team's work to analyze stakeholder expectations, assess the degree to which they affect or are affected by the project, and develop strategies to effectively engage stakeholders in decision support, planning, and project execution.

It is important to identify the stakeholders in a project as early as possible in its life cycle. A stakeholder registry should be created, including key contact information, expectations, and any known issues. Building a relationship between the project team and each stakeholder is important to the successful performance of a project and the achievement of its objective. Frequent and open communication, trust, respect, an open mind and a positive win-win attitude are key to successful stakeholder engagement (GIDO; CLEMENTS; BAKER, 2018).

2.5 PROJECT MANAGEMENT IN ORGANIZATIONS

Project management allows organizations to link project results to business objectives, compete more effectively in their markets, sustain the organization, and respond to the impact of changing business environments on projects. Therefore, project management, when effective and efficient, should be considered a strategic competence in organizations (PMI, 2017).

When properly applied, project management practices can increase the likelihood of project success. However, each practice must have its applicability individually evaluated and the tools and techniques must be adapted to the context and needs of each organization (TERESO et al., 2019). However, to operate effectively and efficiently, the

project manager needs to understand where responsibility, accountability and authority reside in the organization, respecting the constraints imposed through its structure and governance (PMI, 2017).

As the global environment becomes more complex, organizations are beginning to recognize how to use business analytics to gain competitive advantage by defining, managing, and controlling requirements activities (PMI, 2017).

Modern organizations realize that project management applications are a matter of necessity, not choice. Organizations that initially adopted project management obtained numerous advantages over others, such as faster and easier adaptation to the environment, shorter execution time, structured decision making, specification of responsibilities and focus on customer needs (ANIČIĆ, D.; ANIČIĆ, J., 2019).

2.6 PROJECT SUCCESS

Defining success in project management depends on the stakeholder perspective, the type of project, the time perspective and the organization (BESTEIRO et al., 2014). However, the traditional view of success in projects initially focused on improvements analyzed from the triple constraint triangle: scope, time and cost.

Critical success factors and failures in project management are classified into five groups: project, project manager, project team, organization and environment. The project must have clear objectives, commitment to the end user, and adequate resources. The project manager must have commitment, ability to coordinate and effective leadership. The project team must have commitment, flexibility. The organization must contain top management support, clear job description and project structure. Regarding the environment, the critical factors are the customer, the technological environment and the economic environment.

Communication is considered the most relevant factor for project implementation - without the dissemination of information, it is not possible to direct project decisions. Other critical success factors are customer consultation, customer acceptance, top management support, project schedule, project mission, project execution, problem solving, personnel administration and monitoring and control.

3 METHODOLOGY

This work was carried out in the context of a double degree program, between the Federal University of Santa Catarina, in Brazil, and the National Polytechnic Institute of Grenoble, in France. The student, author of the work, developed the work during an end-of-course internship, carried out in a French multinational company.

Automatic Control and Intelligent Systems is a two-year Engineering Program held by Grenoble Institute of Technology, Grenoble INP, that provides skills in modeling, simulation and control design of cyber-physical systems. Among the skills and knowledge acquired during this course are : analysis, modeling and simulation of dynamical systems; management and industrial engineering; system supervision, monitoring and reconfiguration; design and optimization of controlled systems; acquisition and signal processing and design of embedded control systems. The program leads to many jobs in the energy, transport sectors, as well as in the environment and industrial processes.

MANINTEC (Management, Innovation, Technologies) elective semester is a program managed by the Business & Innovation Committee and open to all INP students. It includes Management, Innovation and Technologies courses, allowing students to work in small teams while developing skills in both Engineering and Management in the domain of technology innovation.

The End of Studies Project internship provides professional experience and allows the students to practice a part of the skills developed throughout their academic path. It aims at the application of knowledge acquired during the Engineering Program, which in the present case encompasses the Automatic Control and Intelligent Systems course and the MANINTEC semester, both attended by the student.

The internship, used as context and environment for this research, took place within the Electrical Distribution Application Center of Schneider Electric, in Grenoble, France, between February 7th and July 22nd, 2022.

3.1 RESEARCH CLASSIFICATION

The research is classified as an applied research, as it creates results in a real project within a company. As for the approach, the work fits as a qualitative research, considering the focus is more on the process than on the result, and that there is the purpose of understanding facts in their subjective character. The research does not start from any pre-defined hypothesis.

The research objectives are exploratory and descriptive, aimed at generating knowledge with practical applicability. Regarding the technical procedures, this research is a bibliographic research, as it is developed from material previously published by other authors.

3.2 PROJECT MANAGEMENT METHODOLOGY

The project management methodology used in this work is a particular and specific methodology of the company Schneider Electric, created in accordance with the Project Management Institute. The methodology is called Customer Project Process (CPP), and will be presented and detailed throughout chapter 4.

3.3 TOOLS FOR PROJECT MANAGEMENT

In order for the project to be well managed, there is a wide variety of tools that can be used by companies and/or project managers. Throughout the practical part of this work, project management tools were applied in the case study, so that the company's methodology could be followed and respected.

3.3.1 ERP softwares

ERP, which stands for "Enterprise Resource Planning", or integrated management system, is a tool that helps the company improve internal processes and integrate activities from different sectors, such as sales, finance, inventory and human resources. Corporate data is centralized on a single platform, which makes it easier to share and also avoids duplication of information.

In the practical part of this work, the well-known SAP platform was used, in addition to other internal platforms such as iSi, FACToTOP and SGV. FACToTOP, for example, is a tool that allows the project manager to register new projects, invoicing and material receipts. As it is connected to SAP, the tool also allows sales administrators and financial controllers to have access to project updates.

Figure 3 shows part of the invoicing screen of FACToTOP, with projects that are close to the billing date.

Figure 3 – FACToTOP internal tool.

SO	SG	N° Projet / Contrat	Libellé Projet	SO	SG	N° SO	Libellé SO	N° Item	Helios	Client Final	Code Facture	REC Method	Date Revisée
FR24	I81	F1-228809841	I81_CEA_CEA poste HTA 2021	FR24	I81	232683918	GAB I81_CEA_TRANSFO 1250KVA SOEL - CEA	10	PSSL2	CEA - GRENOBLE	ZPF2	POC IG	05/07/22
FR24	I81	F1-229259934	I81_SPIE _POSTE HTA N°8 FRAMATOME UGINE	FR24	I81	229259934	I81_SPIE _POSTE HTA N°8 FRAMATOME UGINE	10	PSSL2	FRAMATOME	ZPF2	POC IG	11/07/22
FR24	I81	F1-232807242	I81_SOITEC_SOITEC Bernin 4- poste HTA/BT	FR24	I81	232807242	I81_SOITEC_SOITEC Bernin 4- poste HTA/BT	10	PSLVE	SOITEC SA	ZPF2	POC	11/07/22
FR24	I81	F1-232807242	I81_SOITEC_SOITEC Bernin 4- poste HTA/BT	FR24	I81	232852217	I81_SOITEC_SOITEC Bernin 4- poste HTA/BT	10	PSSL2	SOITEC SA	ZPF2	POC	11/07/22
FR24	I81	F1-233202472	I81_FERROPEM_FERROPEM ANGLEFORT	FR24	I81	233202472	I81_FERROPEM_FERROPEM ANGLEFORT	10	PSSL2	FERROPEM	ZPF2	POC	15/07/22
FR24	I81	F1-231063995	I81-LOT HTA - CEA INES	FR24	I81	232901202	I81_EDMI_CEA INES	10	DBSL2	INES - INSTITUT NATIONAL	ZPF2	WIP	26/07/22
FR24	I81	F1-232063479	I81_INEO RAA MT BLANC_HTA NTN-SNR	FR24	I81	232063479	I81_INEO RAA MT BLANC_HTA NTN-SNR	10	PSSL2	INEO ENERSYS SNC	ZPF2	POC	02/08/22
FR24	I81	F1-232807242	I81_SOITEC_SOITEC Bernin 4- poste HTA/BT	FR24	I81	233088525	I81_SOITEC_ADD02 raccord TGBT SOITEC B4	10	PSSL2	SOITEC SA	ZPF2	POC	02/08/22
FR24	I81	F1-232063742	I81_EDMI_AO RAME HTA -ENERGIE SOLAIRE-CE	FR24	I81	232063742	I81_EDMI_AO RAME HTA-ENERGIE SOLAIRE-CEA	10	PSSL2	INES - INSTITUT NATIONAL	ZPF2	POC	04/08/22
FR24	I81	F1-232063742	I81_EDMI_AO RAME HTA -ENERGIE SOLAIRE-CE	FR24	I81	232063742	I81_EDMI_AO RAME HTA-ENERGIE SOLAIRE-CEA	20	PPLVB	INES - INSTITUT NATIONAL	ZPF2	POC	04/08/22
FR24	I81	F1-228019120	I81_GREENALP_PDL MONTSAPEY	FR24	I81	228019120	PDL MONTSAPEY	10	PSSL2	GREENALP	ZPF2	POC IG	08/08/22

Helios

Source: The Author (2022).

3.3.2 Planning sheets

Planning worksheets were used throughout the application portion of the work to ensure that all project requirements were met. As examples, action plans, Gantt Charts and business follow-up were carried out through the sheets.

3.3.3 E-mail

Organizational email was used as the main communication tool between project stakeholders. Considering that many projects are managed simultaneously, it is necessary to classify and archive all the communication history - which occurs in a very intense flow on a daily basis.

Figure 4 shows an example of how the inbox is organized: on the left are some of the folders named by project, and on the right are some emails that have not yet been opened or sorted.

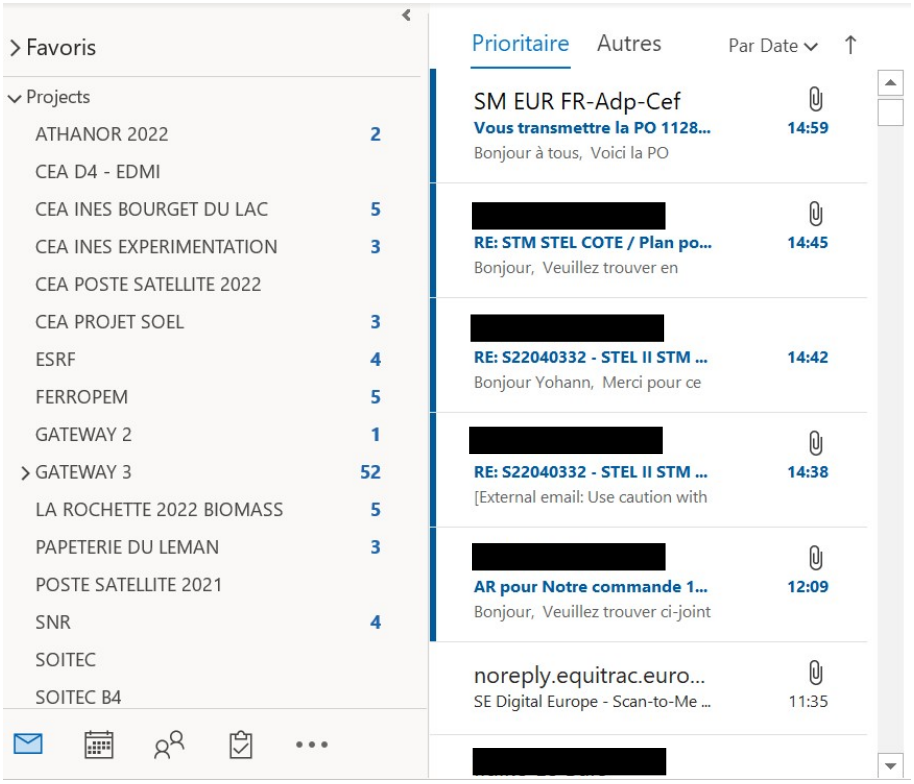


Figure 4 – Email inbox.

3.3.4 Project documentation

Project documentation in general was also used as a tool for project management. Documents serve to file and formalize all project information, and also serve as a reference and analysis resource for all processes that must be carried out throughout the project life cycle.

For the storage of project documents, secure content sharing platforms are used, such as Box and Microsoft OneDrive. These platforms allow project team members to add and query all project life cycle documents. As a company policy, documents cannot be stored in individual folders or on the hard drive - they must be shared with the team and be in the cloud.

3.4 WORK ENVIRONMENT

Schneider Electric is a French multinational, global leader in energy and automation solutions for efficiency and sustainability. The company addresses homes, buildings, data centers, infrastructure and industries by combining energy technologies, real-time automation, software and services. Schneider's purpose is to empower all to make the most of the world's energy and resources, bridging progress and sustainability. The company operates in over 100 countries and has more than 135,000 employees worldwide.

Schneider Electric's Electrical Distribution Application Center (CADE - Centre d'Application Distribution Électrique) has 260 energy management specialists based in 7 regional departments covering all of France. Business engineering, construction sites and project management, as well as Quality, Safety, Health and Environment control, are the main areas covered by its experts.

The Auvergne Rhône-Alpes (AURA) regional department has CADE representatives in Clermont-Ferrand, Lyon and Grenoble. In Grenoble, the team is composed by the project manager Gilles Collavet and the technical leader Roland Delpierre, working together on projects located mainly in Isère. The technical leader specifies the technical solution in accordance with the customer's needs, validating technical choices to guarantee the final solution. The project manager ensures the execution of projects in accordance with the company's implementation process and guarantees the profitability of the project.

The team agreed that the student would work approximately 80% of the time on the main project management mission, with Gilles Collavet, and 20% of the time on the document review of Schneider's project methodology, collaborating with the Solution Risk Manager Marie-Pierre Kupperschmitt. Knowing the documents and the integrity of the process is important for those who will apply it, which means the time dedicated to document management would also help with the internship's main mission.

The CADE team in Grenoble is based in the Intencity smart building, shown in Figure 5, where the internship took place. Spread over 26,000 m^2 and equipped with the best Schneider technologies, the building offers outstanding energy management performance and innovative workspaces, standing out as a reference model on an international scale.

Intencity's design aims to reduce greenhouse gas emissions, using windows that tint according to brightness to naturally regulate the temperature, reducing lighting and climate control in unoccupied spaces, and flexibility of renewable energies.

Figure 5 – Intencity site of Schneider Electric, in Grenoble.

Source: Schneider Electric (2022).

Project Management services in Schneider Electric include:

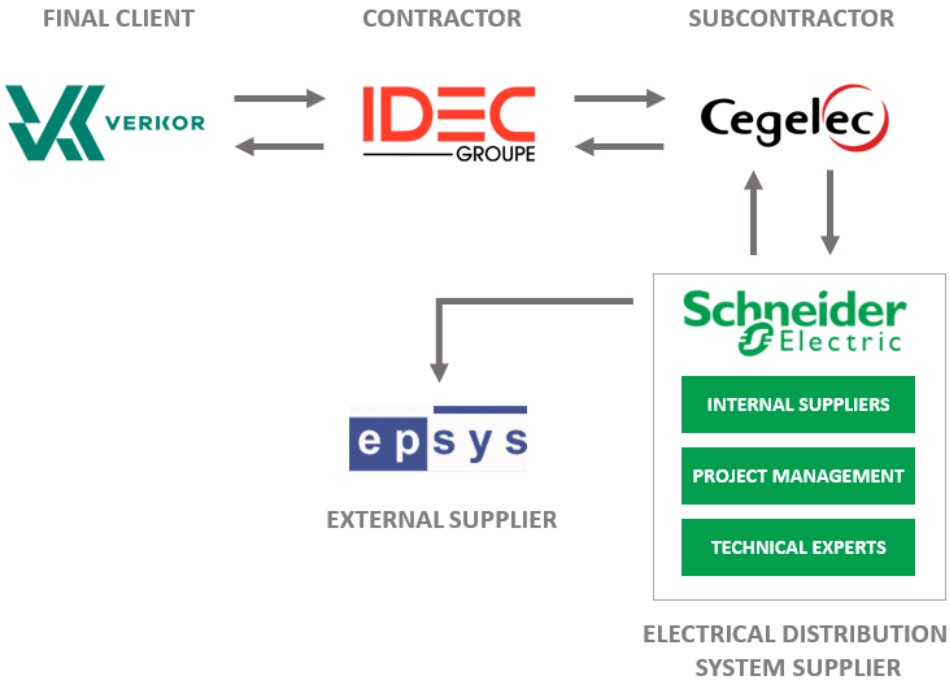
- A qualified Project Manager, who assures generally accepted project management tools, techniques and practices, are used to help complete the effort on time and budget;
- The development and management of an installation plan, which provides an integrated managed solution, encompassing design, acquire implementation phases, and project close-out;
- Scheduled qualified and approved service personnel, to assure the workforce is on site, at the appropriate time and with the right skills, to install a solution to manufacturer's specifications;
- Customer-specific site documentation, providing a portfolio of project-related documentation, such as inspections, safety records and other on-site work documentation.

4 CASE STUDY: VERKOR 2022

4.1 PROJECT OVERVIEW

Verkor 2022 is a project sold and managed by Schneider Electric, for the supply of an electrical distribution system composed of medium voltage switchboards, transformers, electrical busbar system and power delivery substation. The project was commissioned by Cegelec, a French industrial group that works with technical engineering and technological services. Cegelec is contracted by IDEC, a design and construction company for logistics and business buildings which, in turn, is contracted by the battery cell producer Verkor. The main stakeholders chain is presented in Figure 6.

Figure 6 – Verkor 2022 stakeholders chain.



Source: The Author (2022).

4.2 VERKOR, A BATTERY CELL PRODUCER

Verkor is an industrial company based in Grenoble, set to amplify battery cell production in Europe. With a team of international experts in the battery sector, the company was founded in 2020 with the sole ambition of accelerating the production of low carbon batteries, striving for manufacturing excellence and optimizing proven technology.

Backed by prominent shareholders such as Schneider Electric, Capgemini, Renault Group and Arkema, one of the strategic pillars on which Verkor builds its expertise is the optimization of manufacturing processes through industrial excellence 4.0. The company aims to increase low carbon batteries production to meet the growing demand for electric vehicles, launching smart solutions and sustainable manufacturing processes as part of the first French Gigafactory - expected for 2024. The Verkor Gigafactory is poised to become the most modern and efficient Gigafactory in the world, thanks to its data architecture and unprecedented levels of industrial digitization.

The electrical distribution project sold by Schneider Electric, internally called Verkor 2022, concerns the Verkor Innovation Center (VIC), a 12,000 m² building designed to be a proving ground for manufacturing digital innovations. The VIC, shown in Figure 7, will lead to a new generation of Intellectual Property, creating over 250 direct jobs in Grenoble. An R&D laboratory will allow products to be innovated and an intelligent pilot line with a capacity of 50 to 150 MWh per year will produce cells for small batches.

Figure 7 – Verkor Innovation Center - VIC.

Source: Verkor (2022).

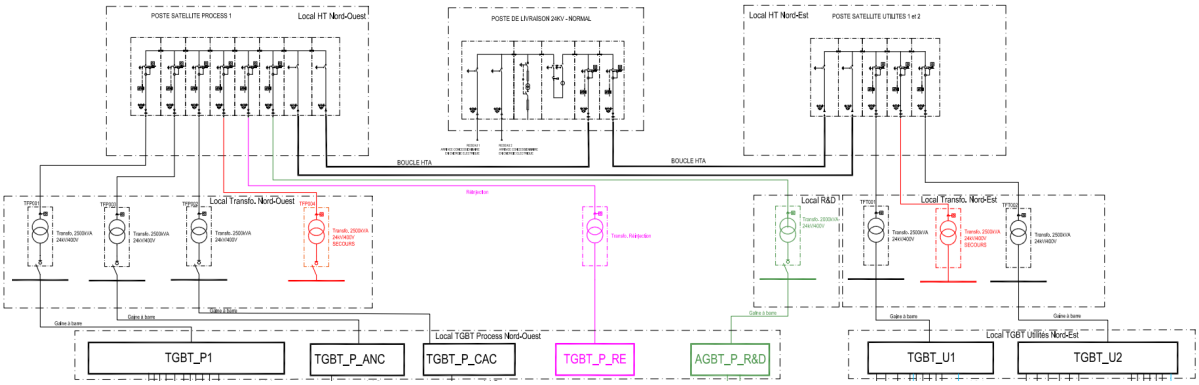
4.3 THE SCOPE: TECHNICAL APPROACH

Verkor 2022 scope is mainly divided into three parts: Utilities and Process substations, and a delivery station supplied by the public service network, making a loop distribution with the two previous substations. Process substation is dedicated to distributing energy to a production site, while Utilities substation will distribute energy to the VIC building itself. Both Utilities and Process substations include circuit breaker cubicles and transformers. The delivery substation includes medium voltage switchboards, a remote terminal unit (RTU) and a precast envelope made of reinforced concrete.

Figure 8 presents the single-line diagram of the system. Medium voltage switchboards distribute electrical power to transformers which, in turn, lower the voltage from 20 kV to 410 V and deliver electrical power to the low voltage switchboard through electrical busbar trunking. The three substations are located at the top of the single-line diagram, followed down by the transformers.

Looking at the diagram, the only transformers provided in this project are the ones in black. The green transformer corresponds to an additive to the project, which later will also be supplied by Schneider, but which was ordered by another contractor and is not part of the main scope. Regarding the low voltage switchboards and red and purple transformers, they are not part of Verkor 2022 scope of supply.

Figure 8 – Verkor 2022 single-line diagram.



Source: Schneider Electric (2022).

Next, the main components of the project scope will be briefly introduced, including equipment and services. As explained earlier, this project is being used as an illustrative example, and much of the content presented in this chapter is largely in common with other projects as well.

4.3.1 Medium voltage switchboard

SM AirSeT is an SF6-free Modular Medium Voltage Switchboard up to 24 kV, used for secondary distribution networks and installations for utilities, commercial and industrial buildings sectors. This innovative switchgear delivers benefits with regard to sustainability, efficiency with innovation and operational safety.

SM AirSeT represents a significant step forward for electrical distribution and environmental protection. Is presents a green and sustainable design thanks to an innovative combination of vacuum and clean air that eliminates any alternative or greenhouse gases. Technology based on clean air and SVI (Shunt Vacuum Interruption) eliminates issues related to global warming potential, regulatory considerations and the need for end-of-life gas recovery.

Figure 9 – SM AirSeT, Schneider Electric.

Source: Schneider Electric (2022).

The project scope includes three SM AirSet switchboards, one for each substation.

4.3.2 Transformers

The Cast Resin Distribution Transformer, called Trihal, is a dry-type transformer known as an environmental friendly solution with improved safety and condition monitoring for medium voltage and electrical distribution networks. Its main benefits are the high performance certified to the latest international standards, suitability for installation in harsh environments, compliance to various industry-specific constraints and ease to install with minimum maintenance.

Figure 10 – Trihal Transformer, Schneider Electric.

Source: Schneider Electric (2022).

The scope includes five transformers Trihal 2500 KVA 20 kV/410 V with digital thermal feedback. Two of them are connected to the Utilities substation, and the other three are connected to the Process substation, as can be seen again in the single-line diagram of Figure 8.

4.3.3 Busbar trunking

Canalis KT (SCHNEIDER ELECTRIC, n.d.) is a high power busbar trunking for transport and distribution from 800 A to 6300 A, consisting of aluminum or copper conductors. Its main benefits are a modular and upgradeable system, quick and easy assembly, halogen free, high protection index IP 55 for all types of buildings and safety.

Figure 11 – Busbar trunking between transformer and low voltage switchboard.

Source: Schneider Electric (2022).

Verkor 2022 scope includes two batches of 4000A busbar trunking: one dedicated to the distribution of electrical power for the transformers of the Process substation, and another for the Utilities substation.

4.3.4 Medium voltage delivery station

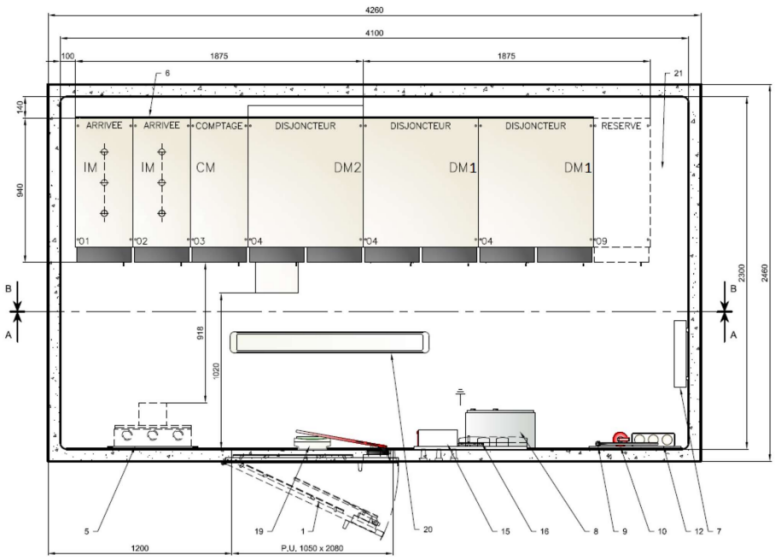
A medium voltage delivery station is an electrical installation connected to a public distribution network under a nominal voltage of 1 to 35 kV comprising a single or several transformers. If the installation includes MV substations, the distribution of the user's MV network can be done in single branch, double branch or loop depending on security and continuity of service needs. As seen before in the single-lined diagram, this project uses a loop to the Process and Utilities substation which, in their turn, feed the transformers.

The location that makes up the delivery substation can be a small building, a room available in a building or a simple equipment protection box. In this project, the distribution system equipment will be installed in a precast concrete substation, as the one in Figure 12, which is ordered from the external supplier Epsys. Figure 9 presents the delivery station project, indicating the components configuration on the precast concrete building.

Figure 12 – Precast concrete building.

Source: Schneider Electric (2022).

Figure 13 – MV delivery station.



Source: Schneider Electric (2022).

4.3.4.1 MV equipment

SM6 is an air-insulated modular switchboard up to 24 kV that guarantees high reliability for underground secondary distribution, flexibility and simplicity of installation and operation. It contains fixed or withdrawable circuit breaker, using SF6 or vacuum breaking technology, switch-disconnector and contactor.

As seen in Figure 9, the delivery substation is equipped with six modular switchboards: IM - IM - CM - DM2 - DM1 - DM1. The first two, called IM, are responsible for the arrival of the electrical energy supply at the station. CM is a a voltage measuring switchboard. DM2 is a double isolation circuit breaker switchboard, while DM1 is a single isolation circuit breaker switchboard.

Figure 14 – SM6, Schneider Electric.

Source: Schneider Electric (2022).

4.3.4.2 Remote Terminal Unit

Easergy T300 is a Remote Terminal Unit (RTU), configurable to precise specifications and responsible for the remote control and monitoring for energy distribution automation. This RTU delivers advanced monitoring, protection, control, and automation functions in both overhead and underground electrical distribution networks.

Easergy T300 helps utilities optimize energy availability and operational efficiency while securing operation and communication. Regarding critical infrastructures, it helps maintain infrastructure while expanding installations and operations, providing energy reliability with Automatic Transfer switch operations, fast fault location and predictive maintenance.

Figure 15 – Easergy T300, Schneider Electric.

Source: Schneider Electric (2022).

The project scope includes the supply, installation and connection of the Easergy T300 in the precast concrete substation. This T300 is used to control the two arrival IM SM AirSeT switchboards.

4.3.5 Selectivity

Selectivity study, or discrimination, is a method that consists of coordinating electric circuit protections so that, when a fault occurs in the circuit, only the protection placed in the head of that circuit is activated, avoiding the shutdown of the rest of the installation. The study advantages are mainly to improve the continuity of service and to guarantee the safety of the installation.

Verkor 2022 scope includes a selectivity study for the delivery substation, carried out by a technical expert, who writes and delivers a report presenting:

- The data used (element characteristics, network short-circuit power, etc.);
- All assumptions used for the calculation of short-circuit currents (operating modes used, voltage level, etc.);
- A single-line modeling diagram (network structure, switching devices, protection markers);
- Short-circuit current calculations;
- Discrimination diagrams showing the tripping curves of each protection and associated comments;
- A summary table of settings;
- Selectivity curves.

4.3.6 Factory Acceptance Test

A factory acceptance test, or FAT, is carried out at the factory where the machine was manufactured, allowing the customer to verify the machine's good functioning, according to previously defined specifications. One of the main benefits of FATs is avoiding the delivery of a defective machine to the end user. After the acceptance test, a report must be prepared summarizing the checks that have been completed by the technical experts.

The scope of this project includes a factory acceptance test of the SMAir SeT switchboards and later of the equipped delivery station.

4.3.7 Site services

After the equipment is delivered to the final customer, the site services team performs final tasks such as functioning tests and insulation check, parameterization of protection relays, testing of locking devices, commissioning support and signing of minutes.

At this stage, it is important to verify and control the security measures required by the company, considering that the environment and services can be life threatening.

4.3.8 Additive: Verkor EDMI

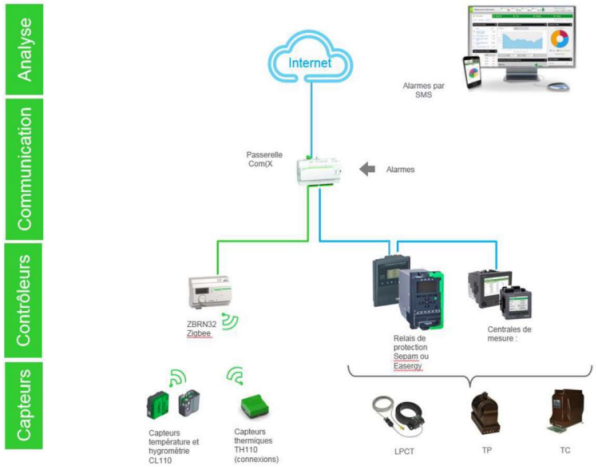
To recap, the main order involves the delivery substation, the Utilities and Process substations, 5 transformers and the electrical busbars, which are all in black on the single-line diagram. The Verkor EDMI additive corresponds to the green colored transformer, and it was ordered by EDMI, a company that carries out study, installation and maintenance of projects in areas related to industrial and tertiary electricity in France.

An additive is a new supply order, not necessarily made by the same contractor, that can be internally registered in a project that already exists in the company. This increases the margin of the existing project and prevents very small projects from being registered separately.

4.4 CONNECTED SOLUTION

The MV switchboards will be equipped with a remotely accessible monitoring system allowing the client to monitor his equipment during operation, in order to reduce the failure rate, increase energy availability and improve operator and equipment safety. The system, which is a cybersecure digital service called EcoStruxure Asset Advisor, will use a web application to provide information in real-time and immediately indicate an identified alarm to the operator. The system is composed by temperature and humidity sensors, communication gateways, power supply and circuit breaker. The connected architecture for Verkor 2022 is presented in Annex A.

Figure 16 – Asset Advisor Architecture.



Source: Schneider Electric (2022).

5 CUSTOMER PROJECT PROCESS

This chapter brings information and results of the working time used to study, adapt and contribute to the project management methodology used by the company Schneider Electric.

Project management services in Schneider Electric are carried out following a specific methodology, in agreement with the Project Management Institute (PMI). The CPP, short for Customer Project Process, is taken as the end-to-end process framework for Customer Projects in the company. Both selling and execution phases of a project are covered, from early opportunity identification until transfer to services after project completion.

Schneider's methodology brings consistency and professionalism in different businesses, by supporting objectives such as profitability and customer satisfaction with emphasis on risks, opportunities, contract management and continuous improvement. The process, as shown in Figure 6, is structured in 2 phases, 11 stages, 7 decision gates and 4 milestones, in alignment with typical customer buying process.

Figure 17 – Customer Project Process

Source: Schneider Electric (2022).

CPP governance is based on checkpoints, the "Gates", and on Milestones. Gates are control points that ensure objectives are met and that the project is ready to move on to the next stage, a decision that needs to be validated and approved by key stakeholders. Milestones are significant progress points, primarily related to progress with clients. While not as formal as "gates" decisions, milestones have potential impact on project risk, profitability, and customer satisfaction.

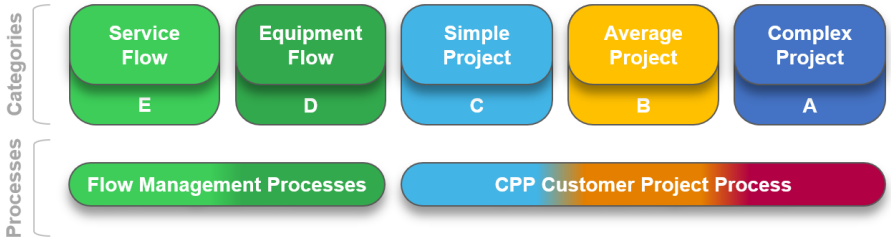
Responsibilities of key and support roles involved in Customer Projects are defined in a RACI matrix, a tool used to determine the roles and responsibilities of each actor of a project in an operational process. In this method, R corresponds to Responsible, A to Accountable, C to Consulted and I to Informed. According to the PMBOK, a RACI matrix is a useful tool to ensure clear assignment of roles and responsibilities, ensuring that only one person is responsible for each task to avoid confusion over who is ultimately in charge of or has authority over the work.

The RACI matrix distributes among the actors the tasks, tools and deliverables that must be made at each stage of the CPP, also considering the category of the project.

The project categorization is designed to support decision-making in selling phase, aligning resources, skills, processes and governance to the needs of each project. Then, depending on the project category, CPP requires different documents, processes, tools and resources.

Five categories cover all systems and services: A, B, C, D and E, where A is the most complex category, for projects with high technical and contractual risks, and E is the simplest category, typically concerning referenced services made from standard components. CPP covers only A, B and C projects, while a process named Flow Management covers the equipment and service flows in categories D and E.

Figure 18 – Project categories and processes.



Source: Schneider Electric (2022).

5.1 PROJECT MANAGEMENT STAGES

Next, the Selling Phase will be briefly introduced and the Execution Phase, on which project management is mostly concentrated, will be further detailed.

5.1.1 Selling Phase

The Selling Governance defines the different actions, rules, roles and responsibilities accompanied by the tools and models to be completed to secure sales. The main actors are the opportunity pursuit leader, solution architect, tender manager and tender architect.

Figure 19 – Selling phase structure.

Source: Schneider Electric (2022).

Analyze & Qualify stage is the initial evaluation of opportunity based on attractiveness and feasibility to win and deliver a valuable solution. It ends at the first decision gate,

S0, which corresponds to a Go / No Go decision, a formal decision whether to proceed with investing resources in opportunity prescription and development.

Influence & Develop is the solution prescription and the influence of development of customer request for quote. It ends at the second gate, S1, the Bid / No Bid decision. This decision gate is the formal decision whether to proceed with investing resources in a bid response to customer request for quote.

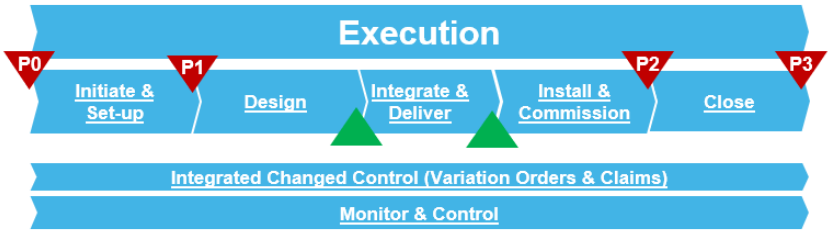
Prepare & Bid is the preparation of bid including full technical, contractual, commercial, costing, pricing and risk and opportunity analysis. It ends at the third gate, S2, the Bid Review & Approval, which is a formal decision whether to submit binding bid to customer.

Negotiate to Win is the completion and submission of bid package to customer and follow-up negotiations to reach a contract, resulting into either award or rejection from customer. It finally gets to the forth gate, P0, which is a formal decision whether to accept customer contract and initiate project. If the project is initiated, the execution phase begins.

5.1.2 Execution Phase

Execution Governance is about the principles, practices, roles and responsibilities to be implemented to secure the cash collection, customer satisfaction and margin improvement of CPP solution projects across Schneider's Energy Management Business. At this phase the main actors are the project manager, the technical leader, project controllers, solution supply chain and Environment, Health & Safety managers.

Figure 20 – Execution phase structure.



Source: Schneider Electric (2022).

- Initiate & Set-up

  This stage includes the hand-over to execution team, preparation and validation of project charter and project management plan, internal and external kick-offs and formalization of coming into force.

The checkpoint that marks the end of this stage is is the P1, Project Set-up. It consists of confirming that project is properly handed-over, initiated and set-up by execution team and that coming into force conditions are met before actual start.

- Design

  This stage is the preparation of basic and detailed engineering designs and major procedures, as well as the validation with customer and launch of procurement of long lead items.

  At this stage is the first milestone, M1. Named Design, this milestone is the confirmation that design is completed and validated, with low risk on design left beyond this milestone.

- Integrate & Deliver

  Completion of procurement, manufacturing, factory integration and testing, and delivery to customer site are the main activities at this stage.

  Milestone M2, Factory Acceptance, is the confirmation that factory acceptance is completed and validated, with low risk on scope left beyond this milestone.

  Milestone M3, Delivery Complete, is the confirmation that delivery is completed as per contract obligations.

- Install & Comission

  This stage concerns the installation, testing and commissioning on site, getting to a complete hand-over to customer.

  Milestone M4, Installation Complete, consists of confirming that installation is completed as per contract obligations.

  Gate P2, Customer Acceptance, is the confirmation that all contract obligations are met, including also a formal acceptance certificate from customer.

- Close

  The last stage is the hand-over to services team, management of warranty and completion of remaining internal and external obligations.

  The last gate, P3, or Project Closure, is the confirmation that all contract obligations are met and that internal project closure is completed.

Throughout the execution phase, there are still two other stages, which need to be continuous in the governance process of project execution. Integrated Change Control is the identification, documentation, review and approval or rejection of changes to contractual baseline during execution, including variation orders and claims. Monitor & Control is the tracking, review and control of project progress versus baselines and targets, identifying and acting on areas where changes or improvements are required.

Considering both selling and execution phases, the key project success factors are:

- Formal P0 validation before accepting the order;
- Proper hand-over from tendering to execution and kick-off meeting with the customer in order to fix the basics and manage expectations;
- Risk and Opportunity analysis commenced at tendering stage then maintained through the execution;
- Lessons Learned and Return on Experience from previous projects;
- Strong collaboration between sales, execution and service during the execution and in front of the customer;
- Experienced and certified staff in project planning, risk and opportunity management, and contract management;
- Early escalation and resolution of issues that can impact project margin and customer satisfaction.

5.2 DOCUMENT MANAGEMENT

Project management documents are among the most important responsibilities of the project manager. They must be kept up to date, as well as have their changes considered, evaluated and submitted to an organizational committee, which can approve or reject them. Reviewing all documents during the project life cycle can be an exhausting and tiring activity. However, this is one of the main tasks of the project manager, who must constantly keep the documentation updated and adherent to the project (TORRES, 2013).

In terms of CPP and quality processes, the student's practical contributions were mainly in document management, in addition to participation and assistance in meetings with the teams involved. These tasks allowed a familiarization with the company's project methodology and important documents, as well as the help to the Risk Solution Manager, who was on a mission to update all electrical distribution center procedures for the forthcoming external quality audit.

Schneider is a global company and has many documents, presentations and materials that are written in English by international teams. To facilitate the understanding of francophone and ensure that the language would not be an obstacle for them to use the company documents, the results of this work also involved English-French documentary translations.

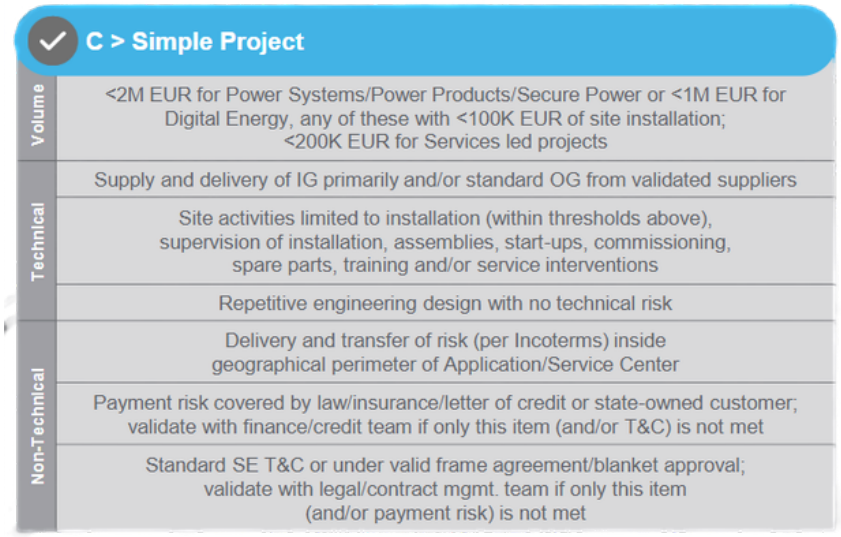
6 PRACTICAL RESULTS

Verkor 2022 has been running since February and will be completed around September 2022, which exceeds the period of time devoted to this work. Therefore, the work does not present practical results of the case study's delivery, installation, commissioning and closing. The results will be divided between the main deliverables of the study case and the main contributions to the work team during the internship, which also include the management of other projects and activities.

6.1 CASE STUDY DELIVERABLES

Despite being valued at over 700.000 euros, Verkor 2022 is considered a simple project, being classified by CPP as a Category C project - which means that the project deliverables and formal requirements are more simplified than for projects A and B. The conditions for the project to be in Category C are presented in Figure 21. It is important to consult the Category C RACI matrix to identify the project manager's responsibilities regarding the documents and procedures.

Figure 21 – Category C project conditions.



Source: Schneider Electric (2022).

6.1.1 Handover meeting and Project Charter

The transfer of a project from its seller to its manager is essential for the project to be executed. Soon after receiving the customer's order in accordance with the technical and commercial proposal, a handover meeting must be held between the sales and project management teams, to ensure the transmission of information and its understanding.

Depending on the complexity of the project, project managers are more or less involved in the client proposal phase. Regardless of whether they participated in the bidding phase or simply knew that the project was being negotiated, when the project is actually sold the handover meeting is mandatory and must be documented and formalized.

The handover meeting for Verkor 2022 happened on February 7th and was formalized by a Category C Project Charter (ANNEX B), required by the CPP. The project charter consists of a summary of project key information, a list of input documents, contractual milestones, plus actions and decisions taken during the handover meeting. By completing the Project Charter, most of the events that can hinder the successful completion of the project are detected, as well as the eventual doubts of the execution team are clarified.

The handover meeting participants were the project seller, the project manager and the technical lead. The commercial proposal accepted by the customer, as well as the customer's order, were reviewed so that the most important points could be discussed. The project manager is responsible for understanding all the commercial content and the technical leader is responsible for understanding the technical content of the project (equipment, characteristics of the system and installation location, requirements or technical limitations).

The Project Management Plan is a formal document that defines how a project will be carried out. It outlines the scope, goals, budget, timeline, and deliverables of a project, and it's essential for keeping a project on track. In category C, according to the RACI matrix, the project management plan is included in the project charter.

6.1.2 Project registration

After the handover meeting, the project must be registered within the company's system. From this registration, the project receives an identification number that will be used internally for all procedures, until its closure.

A specific file called Registration Form, was completed and sent to the Sales Administrators, along with the customer's request, through FactoToP, Schneider Electric's invoice management tool, quickly introduced in Chapter 3. The Registration Form includes important data such as project costs and margin levels, the identification of the seller and project manager, the coordinates of the installer and the final customer, the main contract documents references, the billing plan and the order acknowledgment to the customer.

The responsible sales administrator registers the project data in SAP, an ERP (Enterprise Resource Planning), which helps to run the entire business, including processes in finance, human resources, manufacturing, supply chain, services, procurement, and more. At the same time that the project is registered, an order acknowledgment must be completed and sent to the customer, signaling that Schneider has received the order and that it is formally registered with the company (ANNEX C).

6.1.3 Project schedule

The project schedule will rarely be intact from the beginning to the end of the project. It shall be updated if there are any delays in the planned tasks, presenting the new dates for both the delayed step and the steps that come later but that depend on the previous one. In addition, the updated schedule should always be communicated to the customer - whether the delayed task was the customer's or the supplier's responsibility.

The project schedule for Verkor 2022 (ANNEX D) was established during the launch phase according to the main deliverables proposed in the technical and commercial offers. The planning was modified a few times during the project execution, mainly due to delays in the validation of drawings, but also for some unforeseen on the part of the customer. Despite the execution team having to put all possible efforts to guarantee delivery on the contractual date, often the change of delivery dates also comes from the customer. In this specific project, the client had problems with the storage space and with the progress of the rest of the construction.

As we got closer to the equipment delivery date, and when tracking the production progress with the factory, a long delay in the delivery of the SM AirSeT cells was identified, caused by a shortage of raw materials. To try to solve the problem, it was necessary to maintain constant contact with the regional director, who participates in prioritization meetings with the factory and who, depending on the dimension and characteristics of the project, applies administrative strategies to try to receive the materials within the contractual time.

In complex projects and especially in projects in construction sites, the installation date will also depend on the schedule of other contracted companies and other parts of construction. Constant communication and the willingness of both parties to enter into agreements that are beneficial to both are important.

When any delay occurs at the beginning of the project, as in the validation phase of the technical drawings by the client, all the rest of the planning can be impacted. The project manager can succeed by using strategies to not delay the final delivery. However, the opposite can also happen, and not necessarily the delivery delay will be directly proportional to the initial delay - it can be longer due to the complex planning of the factory, which has to manage many orders at the same time, or due to availability of raw material and other resources.

6.1.4 Actions plan

The action plan is part of the organization and planning in project execution, but is also linked to communication with stakeholders. Especially when the project manager is responsible for many projects simultaneously, individual action plans for each project are essential for the fulfillment of all the necessary activities in the execution stage.

The external actions plan (ANNEX E) of Verkor 2022 organizes the tasks that are the responsibility of the customer Cegelec and those of Schneider. The plan includes the status of the task, which can be "to do", "in progress" or "completed", as well as the deadline and the date the task was completed. The internal action plan works in the same way, but it is not shared with the client and includes tasks delegated only to CADE Grenoble team members.

6.1.5 Monthly follow-up with the client

Communication by e-mail is essential for sending information and documents, and for formalizing actions and decisions. However, in large-scale projects, it is also important to maintain a regularity of meetings with the client, whether face-to-face or virtual. In the Verkor 2022 project, monthly meetings are held between Cegelec an Schneider Electric. The meetings are important mainly to follow and control the action plan but, at the same time, eventual clarifications and alignments are made. At the end of the meeting, the action plan is sent by email to the participants as a way of formalizing discussed points.

The biggest benefit of implementing project management techniques is achieving customer satisfaction. For the contractor, this could lead to additional business with the same customer in the future or business with customers referred by those who were previously satisfied (GIDO; CLEMENTS; BAKER, 2018). Ensuring direct monthly contact with the customer brings the execution team closer to them and helps to ensure customer satisfaction, both for the simple fact of "being present" and for the communication that helps to avoid mismatch of information.

6.2 OTHER CONTRIBUTIONS AND ACTIVITIES

The deliverables presented above were carried out within the internship not only for the Verkor 2022 project, but also for several other projects that started after February or that were already in progress. These deliveries took a large part of the working time, from learning how to fill out documents by collecting the correct information, to using the company's internal softwares.

In addition to the previously presented procedures ans tasks, other activities and results were obtained:

6.2.1 Integration Plan

At the beginning of the internship, following the company's best practice, an integration program was established. The objectives of the integration plan are to provide documentation that can facilitate the arrival in the company, to enable a full understanding of the position and key company procedures, and to familiarize the intern with the company's EHS (Environment, Health and Safety) policy.

The integration program included meeting with CADE's regional director, the responsible for site service activities, the tendering engineer, the sales administrator and the financial controller. All these meetings were important to learn basic notions about each role, and to establish contacts within the company.

6.2.2 STMicroelectronics - Crolles

STMicroelectronics is a Franco-Italian multinational that designs, manufactures and markets electronic chips. It is one of the world's leading players in the economic sector of semiconductor production, which represents a big income to Schneider Electric. The STM Crolles site, in France, is undergoing a major expansion, valued at €5.7 billion, partially supported by the French state.

For the CADE team in Grenoble, the expansion of STM in Crolles has represented, in recent years, some massive busbar supply projects. The most recent project, called Gateway 3, involved the planning, supply and installation of approximately 1 kilometer of electrical busbars.

My main tasks in this project were:

- Ordering equipment, filling out the purchase order form and formalizing the order to the sales administrator;
- Controlling order confirmations, verifying that the materials, prices and deadlines were well registered by the supplier;
- Monitoring deliveries, while keeping a constant contact with the factory;
- Receiving and checking delivery invoices;
- Receiving the equipment during delivery to the end customer.

Participating in the reception of the equipment delivered to this project, as shown in Figure 22 was a very interesting experience within the internship. We helped to unload 7 trucks that came from Hungary and the challenges ranged from communication with truck drivers, who normally spoke only Hungarian, to taking the necessary safety measures.

Due to the large amount of equipment ordered, it was very important to control the pallets on each truck, to avoid problems when the installer went to assemble the system. A missing part could cause a significant delay in assembly and consequently in the deadline required by the customer, putting at risk the satisfaction of a very important customer for the company.

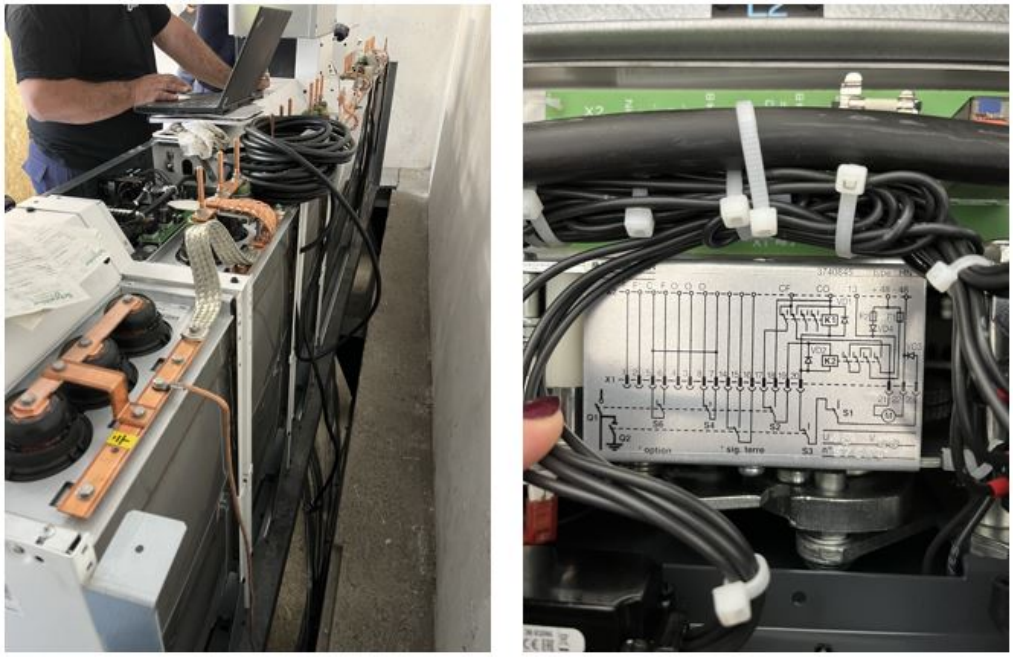
6.2.3 Régie Électrique de Villarlurin

The Régie Électrique de Villarlurin project consisted of a delivery substation supply and commissioning support. I joined my tutor on a visit to the service site, on the day when final assembly, testing and, later, commissioning were being completed - Figure 23.

Figure 22 – Unloading monitoring of busbar delivery.

Source: The Author (2022).

Figure 23 – Installed switchboards in Villarlurin.



Source: The Author (2022).

The main purpose of the visit was to carry out a safety audit of on-site service providers, to ensure they were following the company's security instructions. During this visit, a report must be completed by the project manager, indicating if the employee is following a list of safety requirements.

6.2.4 A work day

A project manager, especially when managing many projects simultaneously, has an extremely busy and diverse schedule. Time is divided between internal and external meetings, face-to-face visits to factories or customers, individual and team planning, control of action plans, continuous communication through different means, technical and specific understanding of each project, among others. To better illustrate what the work routine was like during the internship, an example of a work day is presented in Frame 1.

Frame 1 – Example of work day schedule.

8:30	Check the email inbox and sort the emails in the corresponding project folders. Reply to emails as much as possible, or add to the to-do list for the day if the answer depends on confirmations or information verification.
9:00	Business follow-up meeting with the Grenoble CADE team. The action plan for all projects is passed on to update what was done in the last week and what should be done over the next few days.
11:00	Launch meeting of a new project with the client, to introduce the team members who will be involved in the execution of the project, and align important information for taking the next steps.
12:00	Lunch break and coffee with other teams to maintain good relations.
13:30	Repeat checking, sorting and replying to the email inbox.
14:30	Check for equipment deliveries that are close to their deadline, and send emails to the suppliers to verify that everything is going as expected, or if there will be delays in deliveries.
15:00	Monthly meeting with the entire CADE team for the director to make general announcements, present the month's business results and set goals for the coming weeks.
16:00	Prepare purchase orders for starting projects and send them to sales administrators so that orders can be registered in the system and sent to suppliers.
17:00	Reply to the last emails of the day and update the list of actions with what has been accomplished and what still needs to be accomplished as of the next working day.

Source: The Author.

7 CONCLUSIONS

Poorly managed projects or the absence of project management can result in missed deadlines, budget overruns, poor quality, rework, uncontrolled project expansion, loss of reputation for the organization, dissatisfied stakeholders, and inability to achieve objectives for which the project was undertaken.

Project management turns out to be a complex and vast assignment. The tasks performed, in most cases, consist of maintaining an organized control structure, carrying out demands from leaders and acting directly on problems that cover multiple sectors. In addition to the great responsibility, the project manager must carry an essence of continuous improvement in the projects, in the system and in the control structure.

If in the past the main focus of companies to achieve success was the product or service developed, today most companies focus on customer satisfaction. Understanding, defining, evaluating and managing customer requirements in order to satisfy their expectations are important points to ensure customer satisfaction and, consequently, bring the results that the company seeks. In addition to all the attention throughout the sale and execution, it is important to carry out a satisfaction survey at the end of the project, to measure the results based on the answers provided by the clients.

This work presented a study on project management, focusing on engineering and industrial projects, specifically in the field of electrical distribution. A project whose client is a French company set to amplify battery cell production in Europe was used as a case study. The project management techniques and procedures were applied in a practical way in the case study, and the main results were presented.

In addition to the case study results, other contributions to the work environment were presented and discussed. The application of the research was carried out in the context of a real work experience, in which the author had the opportunity to live in the shoes of a project manager for a few months.

The practical contributions were important, especially in day-to-day tasks throughout the execution stage of the projects' life cycle. The workload was intense, in a period when the receipt of orders was four times greater than in previous years, which brought the experience of managing several projects simultaneously and having a fast paced view of the business world.

Thanks to the double degree and the author's work experiences both in Brazil and in France, a difference was noticed in the structuring of project management work. Brazilians can overestimate the European First World and underestimate their own country, but in the author's project management experience, the Brazilian work team showed greater qualities of organization, standardization, structuring and compliance with rules and procedures.

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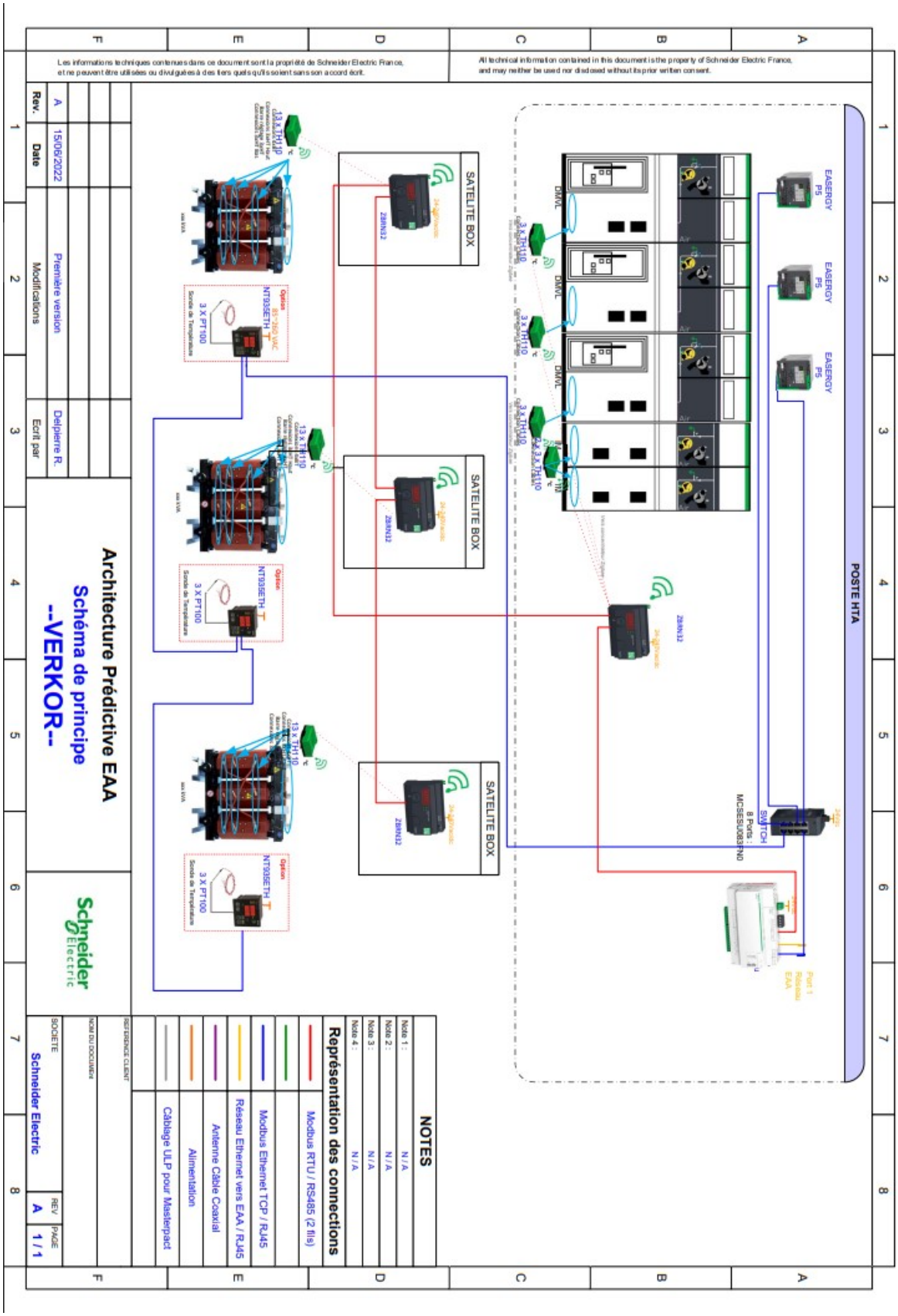
ANNEX A – Verkor 2022 Connected Architecture



ANNEX B – Verkor 2022 Partial Project Charter

Date : 25/01/2022

Charte de Projet Catégorie C

Document rempli par le Pilote d'Offre pour le transfert en Réalisation

Nom du Projet : VERKOR 2022
Lieu du Projet : GRENOBLE
N° de l'Opportunité (N° Proposition Commerciale PC via Optima) : OP-210318-10664753
N° QLK (BFO) :2021_sesa12561_PC0050539_2_0
Montant : 647 800€
Client passeur d'ordre & code SAP : CEGELEC
Nom du contact Client en phase d'offre :
Client Final & code SAP : SAP : 1500131375 ; FC : 601906
Pilote d'Offre : [redacted]
Project Manager : [redacted]
Etendue de la fourniture et des Prestations : Fourniture cellules HTA / transfo / GAB / poste PDL / étude de sélectivité

Liste des Documents d'Entrée			
Nom	**Version/N° et Date**	**Date et validation**	**Transféré ou non transféré**
Offre Technique et Commerciale	2021_sesa12561_PC0050539_3_1	20/01/2022	
Contrat ou Commande	A VENIR		
CCAP Client			
CCTP Client + échanges qui dérogent au CCTP (si nécessaire)	VIC APCER2I TCE		
Marché Public : a/ DC2 (si applicable) b/ DC4 (si applicable) c/ Contrat de sous-traitance d/ GME	NA		
Fiche d'Enregistrement validée et signée	(QE2356)		
Accord du DR Front Office pour validation du P0			
Analyse de Risques (ROR) pour projet C (si applicable)			
Offre(s) de(s) Fournisseurs IG et OG valable(s) et référencés Avetta pour S/T	Offre EPSYS / AMT / FT		
QSSE (Qualité Santé Sécurité	Points 16.1 Maîtrise de la qualité et 16.2 Maîtrise de la santé et de la sécurité dans le document Offre		

Jalons contractuels du projet	Date
Etudes transfo et SMAIRSET	T0+6s
Etudes GAB + étude sélectivité + poste béton	T0+15s
FAT	31/08/2022 AMT 01/09/2022 EPSYS
Livraison	S36
Mise en service	?

Conclusion(s) de la Réunion de Transfert			
Item	**Oui**	**Non**	**Commentaires**
Décision d'émission de l'AR	x		
Eléments non transférés (à lister) :			ER2I Bureau d'étude. CP Cegelec Camille Fournier CER Cegelec Jeremy Bouvier
Actions prioritaires à réaliser :			Prévoir serrure en double (gestion entre le PDL à EPSYS et les cellules livrées directement sur site). 1 FAT EPSYS et 1 FAT à Macon pour poste Utilities et process AMT : modifier les VPIS pour les IM piloté par T300. Supprimer ligne coffret ITI de 1492,02€ Process : commander 3 cellules sup à 11320€ Utilities : Rajout 1 SM6 sup. Postes préfa : visite site pour grutage. Les termes de paiement sont validés avec Cegelec. Transfo : 1 ZBRN par transfo => câblage par Cegelec mais leur transférer un schéma de principe Appairage capteurs des transfos pilotés par CADE => se recouper avec Gwen affaire Air liquide. Fiche PR40

ANNEX C – Verkor 2022 Order Acknowledgement to the client

Schneider Electric			Client :	CEGELEC		
			Projet :	POSTES HTA PROJET VERKOR		
Gate P1	Page	1/2	Référence Projet:	F1-231957422	Du	28/02/2022

ACCUSE DE RECEPTION DE CONTRAT

Emetteur :
SCHNEIDER ELECTRIC
[redacted]

Destinataire:
CEGELEC
[redacted]

Madame

Votre commande du 28.01.2022 référencée 960680216 est arrivée dans nos services et nous vous en remercions vivement.

Elle a été enregistrée sous le numéro de dossier : F1-231957422

Merci de bien vouloir rappeler cette information dans toutes vos correspondances avec notre société dans le cadre de cette affaire.

Nous restons à votre entière disposition pour tout renseignement complémentaire et vous prions de croire, Madame, à l'assurance de nos respectueuses salutations.

Signature [redacted]

Page 1 / 2 Centre d'Exécution France

Schneider Electric		Client :	**CEGELEC**	
		Projet :	**POSTES HTA PROJET VERKOR**	
Gate P1	Page 2/2	Référence Projet:	F1-231957422	F1-231957422

Client : **CEGELEC** **Affaire** **POSTES HTA PROJET VERKOR**	**Pilote de l'offre :** [redacted] **Pilote de réalisation:** [redacted]
Réf. Cde client : **960680216**	**N° Prop. Commerciale et Version :** **2021_sesa12561_PC0050539_3_1**
Date d'accusé de réception de la commande : **28/02/2022**	**Interlocuteur :** [redacted]
Référence d'enregistrement au sein de nos services : F1-231957422	**Conditions de livraison :** **DAP : lieu de destination finale convenu**
Conditions de paiement : 45 jours fin de mois	**Délais de livraison:** **Cellules HTA et poste de transformation => semaine 36** **Transformateurs et GAB => semaine 30**
Documents contractuels applicables : **Notre proposition commerciale 2021_sesa12561_PC0050539_3_1**	**Adresse de Livraison :** A nous transmettre ultérieurement.
Montant HT de la commande : (€) 579 044,20	**Interlocuteur**

Termes de paiement

Pourcentage	Fait générateur	Date de déclenchement	Taxe
			O
			O
			O
			O
10,00 %	A la remise des plans	25.04.2022	O
80,00 %	A la livraison	09/09/2022	O
10,00 %	A la mise en service	02.11.2022	O
			O
			O
			O

Faits générateurs de l'entrée en vigueur du contrat :

A la reception de votre commande conforme à notre notre proposition commerciale 2021_sesa12561_PC0050539_3_1

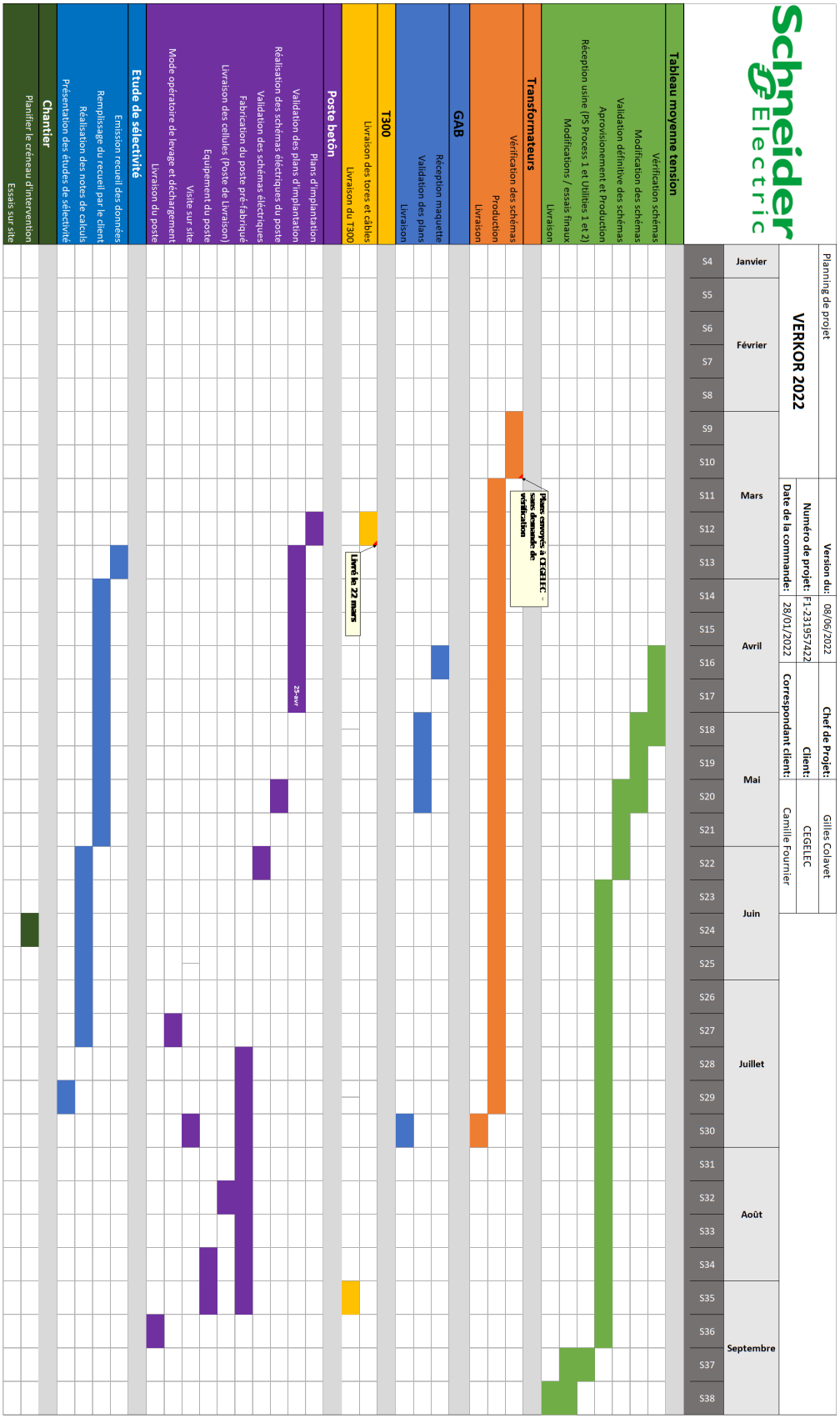
Remarques/Observations:

Même si cela est connu au moment de la conclusion de la présente commande/contrat, tout ou partie des produits et/ou des services à fournir, conformément à l'offre/commande/contrat, peuvent provenir ou être produits, livrés ou exécutés dans des zones touchées par la pandémie de COVID-19 et/ou par la pénurie/interruption de transport ou d'approvisionnement en matière première/énergie/composants qui sévissent actuellement (ci-après « Circonstances »). En conséquence, le calendrier de livraison et/ou d'exécution est fourni à titre indicatif uniquement : en cas de retard du fait de ces Circonstances, le Vendeur ne pourra pas voir sa responsabilité engagée à quelque titre que ce soit (notamment pénalités/résiliation pour faute) et si l'exécution de la commande/contrat devient disproportionnée/trop onéreuse, les parties négocieront de bonne foi les nouvelles conditions de prix.

Clauses particulières :

Nous vous rappelons que cette commande est soumise à l'application des termes et conditions de notre offre, référencée F1-231957422, émise en date du 28/02/2022

ANNEX D – Verkor 2022 Schedule



ANNEX E – Verkor 2022 Actions Plan

PLAN D'ACTIONS	Projet : VERKOR 2022 F1-231957422 Client : CEGELEC			
Action	Status	Responsable	Deadline	Soldé le
GAB en attente de la maquette		Cegelec	21/04/2022	22/04/2022
Attente des plans de TGBT		Cegelec	21/04/2022	22/04/2022
Definir la tension des auxiliaires des cellules C13.100 et C13.200		Cegelec	20/04/2022	25/04/2022
Envoyer les plans de poste bêton au client		SEF	23/03/2022	31/03/2022
Valider les plans de poste bêton		Cegelec	20/04/2022	25/04/2022
Envoyer le schéma de la DM2 et demander la confirmation de la puissance souscrite pour l'enroulement mesure		GCO	23/03/2022	31/03/2022
Valider le schéma de la DM2		Cegelec	20/04/2022	25/04/2022
Envoyer le recueil des données - étude de selectivité		SEF		31/03/2022
Retour du recueil des données - étude de selectivité. --> Il manque la longueur des liaisons entre postes de la boucle		Cegelec	25/05/2022	31/05/2022
Valider les GAB		Cegelec	25/05/2022	03/06/2022
Nous donner l'adresse pour la livraison des têtes d'alimentation sur les TGBT (date de livraison souhaitée?)		Cegelec	20/06/2022	31/05/2022
Valider le schéma SMairSet		Cegelec	18/05/2022	31/05/2022
Transmettre l'adresse de livraison du site VERKOR		Cegelec	14/06/2022	
Confirmation du type de canon DENY pour le poste bêton		Cegelec	05/05/2022	
Transmettre le PGC et le PPSPS Cegelec		Cegelec	14/06/2022	
Transmettre le nom et adresse du manuntentionaire pour livraison cellules HTA (pied de camion) et transfo (non déchargé)		Cegelec	14/06/2022	
Attente confirmation de l'adresse pour la livraison des GAB (non déchargé)		Cegelec	14/06/2022	31/05/2022
Planning du chantier pour réserver nos techniciens		Cegelec	14/06/2022	
Transmettre les informations sur le concentrateur de capteur de temperature des transfos		SEF	10/06/2022	
Selectivité logique à realiser entre le PDL et les postes satellites (liaison inter-tableaux)		Cegelec	31/08/2022	