POLITECNICO DI TORINO

Master of Science Automotive Engineering

Management of Industrial Processes

Graduation Thesis

Analysis of the Project Management Process in TORINO DESIGN Srl

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Dedicated to all the people that helped me building my personality, with love and anger, with support and obstacles, with trust and skepticism, with passion and apathy.

Thanks you

Introduction

This Thesis was developed during a six month internship at Torino Design headquarters in Villa Gualino (Turin). It want to analyze the main activities performed by the project management department making a comparison with the classical project management theory, trying to find out possible management improvements in terms of efficiency, time and costs.

The first two chapters have a descriptive function: in chapter 1 the fundamental points of classical project management theory are presented, while chapter 2 describes the company reality and specifically each activity developed.
Chapter 3, on the other hand, is entirely dedicated to the analysis of the management methodology adopted by project managers, from which the points of possible improvement emerge, mainly linked to the monitoring and control of the activities throughout their development. These points will be analysed in detail in chapter 4, looking for the causes of possible loss of time and costs.
Finally, chapter 5 presents the description of the results obtained, focusing on the benefits that may derive from the thesis activity for the company, the limits that characterise the study carried out, the possible future steps that the company can take in relation to the content of the thesis.

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1 PROJECT MANAGEMENT FOUNDAMENTALS

This chapter wants to recall the main aspect related to the classical project management theory, to contextualize the thesis' topic.

1.1 Project Management

A discipline's introduction will follow.

1.1.1 Historical Evolution

The first major project that saw the rational use of project management concepts was the *Manhattan project*, which began in 1942 with the intention of carrying out nuclear fission and the bombs that would be dropped on Japan three years later [1].
The benefits born in this field of application led the discipline to expand through various industries and companies belonging to the manufacturing sector.
Subsequently, Project Management expanded on a large scale, becoming an integral part of all companies operating through project development.
Currently Project Management plays a fundamental role in all industries with a high degree of complexity and variability linked to the production process, the context in which it operates or the internal structure.

1.1.2 Brief introduction

The discipline of Project Management is introduced below, starting from a series of fundamental definitions:

Project: Temporary enterprise, developed with the intention of achieving a precise and defined
objective [2]. Characteristics of the project are as follows:

- Temporary nature: a project always has a start date and an end date, even if not formally declared, regardless of whether or not the set objective has been achieved.
- Uniqueness: each project turns out to be unique, since the objectives related to costs, processes and customer satisfaction are always different.
- The division into phases: each project is divided into phases, each of which is composed of activities identified by a tangible result, thanks to which it is possible to establish the progress of the activity itself.

Programme: a set of projects managed collectively to achieve an overall result that cannot be achieved in any other way [2].

Project Manager: is responsible for starting, planning, executing, controlling and closing a project using Project Management techniques and methods [3].

Project Management: management approach focused on achieving a tangible result. It requires the definition of precise objectives, to be achieved under certain economic-temporal constraints and through continuous control and monitoring activities [2].

Project management can also be described as a set of knowledge, skills, abilities and tools applied to the activities that constitute the project to meet or exceed the needs and demands of investors.
Project management, if carried out correctly and comprehensively, focuses on several fundamental aspects, listed and described below [2]:

- Integration between the various elements that make up the project itself, achieved through careful coordination.
- Ensuring that the project includes only the elements necessary for its completion.
- Effective use of the human resources involved.
- Fast and efficient communication to facilitate administrative, planning and information exchange activities as much as possible.
- Careful acquisition of goods and services from outside.
- Project balancing operations whenever a problem arises.
- Correct and continuous risk management activities.
- Balancing competitive demand in terms of cost, time and quality.
  This last aspect has two main complexities. The first, internal, concerns mutual influence: it is in fact impossible to act individually on one of them without changing the others. The second, external, concerns the presence of risks that can alter the balance between aspects.

A good management of these aspects makes it possible to control the critical factors of main importance within innovation and product development projects, such as [2]:

- Time To Market (TTM).
- Uncertainty about customer requirements.
- Uncertainties about the technologies used and project results.
- Inter-functional skills within the organisation, supply chain complexities.
- Delays with respect to the most significant project steps.
- Impact of the project on the company in terms of business.

It is therefore essential that the following principles are adopted from the very beginning of the project, in order to guarantee on the one hand, the care of the fundamental aspects, and on the other hand the control of critical issues:

- Create a transversal project vision within all company departments.
- To make monitoring of the progress of activities accessible to all managerial levels.
- To strategically allocate resources, based on individual skills in order to achieve proactive behaviour on the part of all staff involved.

1.2 Project Management phases

According to the Project Management Institute (PMI), the Project Management methodology is normally divided into five basic phases [4]:

- Identification and definition of the project, feasibility analysis
- Planning (Planning).
- Scheduling.
- Monitoring and Control, execution.
- Closing.

Some of them carried out, at least in part, parallel to each other. This is the case of the monitoring and control phase, which immediately accompanies the planning phase and ends with the closure phase, as can be seen in Figure 1. The monitoring and control phase involves all the activities directly related to the concrete development of the project. It is interesting to note that these activities do not coincide with the origin of the axes: the very first part of the identification phase is in fact made up of a series of preliminary activities, which do not see the real evolution of the project, such as market analysis, financial analysis and SWOT analysis.

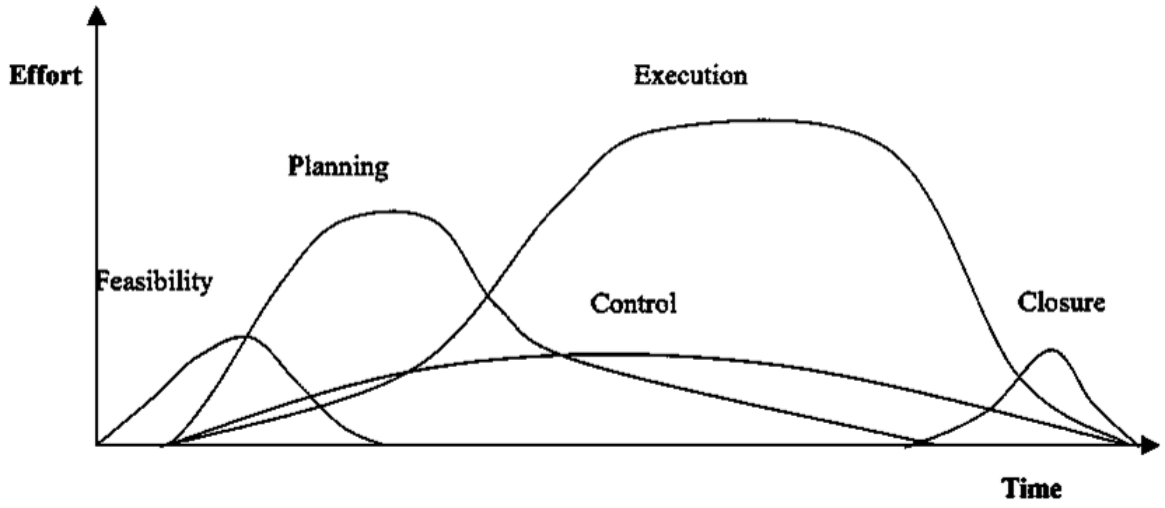


Figure 1: Project phases along time [2]

1.2.1 Project identification and definition, feasibility analysis

In this phase the objectives, i.e. the intermediate results of the project, and the expected results are defined in a preliminary way; a technical and economic feasibility analysis is carried out. The main activities carried out can then be listed as follows [2]:

- Market analysis.
- Definition of the main characteristics of the product to be developed, considering the requirements of the customer and the main aspects of distinction from competitors.
- Preliminary planning, carried out through an initial estimate of time, resources and investments.
- Financial analysis.
- Preliminary analysis of possible risks.

The purely qualitative nature of the contents suggests the use of SWOT analysis within this first phase.
The SWOT analysis provides an important output to determine whether or not to proceed with the project development and, if so, which aspects to focus on from a strategic point of view [5].
The acronym SWOT can in fact be described as follows:

- *Strenghts*: strengths of the company on which to base the initiative and on which the greatest return in economic terms is expected.
- *Weaknesses*: weaknesses of the company due to inefficiency or lack of expertise.
- *Opportunities*: external factors currently existing or with a high probability of occurring that could increase revenues.
- *Threats*: external factors that could negatively affect profits. A clear example is the variability of markets.

As far as the financial analysis is concerned, in this first phase the emphasis is on a first evaluation of the following indices [2]:

- Discounted Cash Flow (DCF)
- Net Present Value (NPV)
- Discounted Pay Back Period (PBP)
- Simple Pay Back Period (PBP)
- Internal Rate of Return (IRR)

If this first phase of the project is successful, the activities continue with the planning.

1.2.2 Planning

Within this phase all the project objectives are clearly identified, this aspect is fundamental not only to clarify the expected results, but to define all the intermediate steps that allow them to be achieved. A precise sequence of activities is then defined, and a second estimate of resources is made.

The first step regarding the planning operation consists in dividing the project objectives into activities with tangible results. Subsequently, for each of these activities an execution process is identified, and the related responsibilities are assigned.

Essential tools to achieve this are the Work Breakdown Structure (WBS) and the Organization Breakdown Structure (OBS).

The WBS consists of an analytical representation of the project, divided into work elements uniquely assigned to a specific organisational function, as shown in Figure 2 [4].

This allows the following aspects to be clearly defined:

- Costs.
- Time.
- Constraints.
- Level of progress.

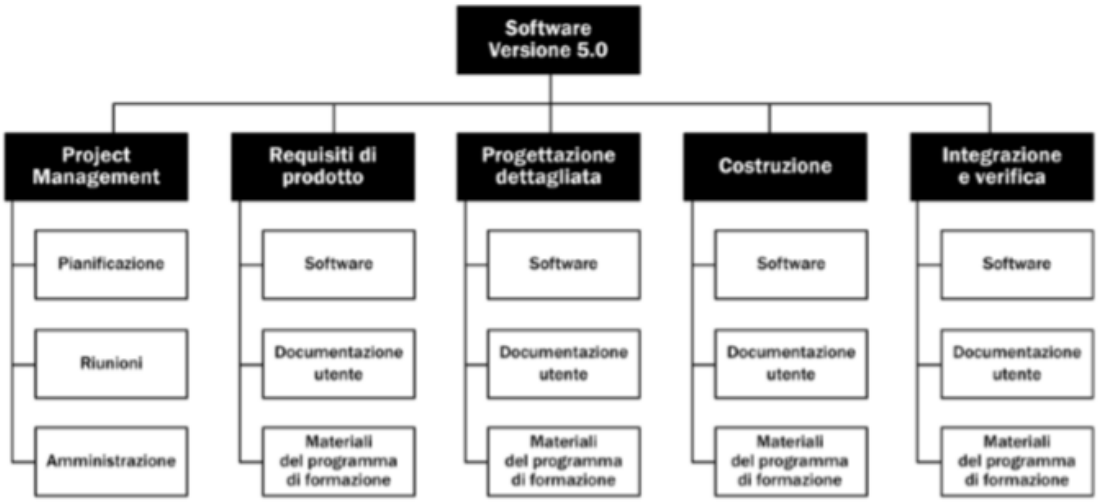


Figure 2: WBS example [4]

the supporting structure of the WBS is normally created following one of the following logics:

1. Functional: complete subsystems are identified from a functional point of view.
2. Physics: subassemblies are identified according to physical elements, as components or subassemblies.
3. Process: the subdivision takes into account the production process, i.e. the sequence of operations that the object undergoes.

4. By Objective: the subdivision is made according to the fundamental stages (milestones) of the project.

The OBS, on the other hand, is expressed in a purely graphic way, and has the objective of clearly defining the distribution of the levels of responsibility and the execution of each operation described within the WBS, as expressed in Figure 3 [4].

Figure 3: OBS example [4]

The combination of WBS and OBS allows to define the Work Package, i.e. the best level of detail in the decomposition of the project. The information obtainable from a WP can be summarised with "Who does What". By combining WBS and OBS it is possible to obtain an important matrix, fundamental output for planning, as can be seen in Figure 4.
Crossing OBS information with WBS ones the green circles are evaluated. Each of them allows to plan and manage work scope, schedule and cost related to activity in scope.

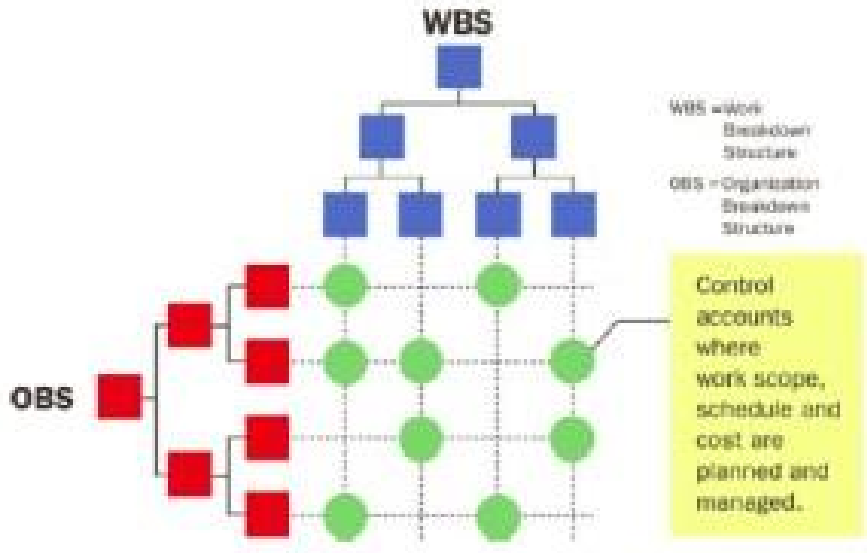


Figure 4: WBS/OBS matrix [6]

Resources Breakdown Structure (RBS)

A resource breakdown structure is a list of the resources that will be required to execute your project. The list is broken down by function and type, and at the very least will cover the people needed to complete a project successfully. However, at its most thorough, it will include anything you spend money on for the project, such as people, project management tools, equipment, materials, even fees and licences.

A resource breakdown structure is more than just a list, however: it's a hierarchical chart that is used to help project managers organize resources and see how they're interrelated. A RBS will inform the budget, as a thorough listing of resources will make it easier to estimate what a project will cost. It's a means to stay within budget rather than spending erratically.

In terms of format, as is possible to see in figure 5, the RBS is like the WBS and requires an estimation of which resources will be needed for each task in the project. Therefore, the task list is essential for collecting the necessary resources.

But a project manager will naturally seek input from a wide variety of sources; these include the schedule, risk register, cost estimates and other organizational processes. This allows a project manager to fully gather all the resources that will be needed to execute the project.

The RBS is usually created as a tree diagram. At the top is the project's final deliverable, under which are the breakdown of resources, each in an individual branch below the overall project heading. These branches are the resource types, such as the site where the project is taking place, the equipment being used and the team that's executing the project [7].

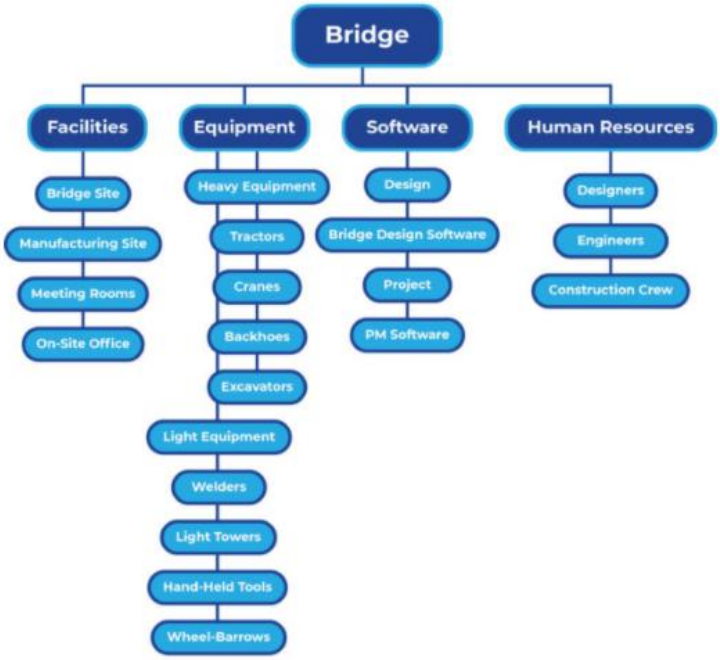


Figure 5: RBS example [7]

A number of important benefits can be derived from the planning activity [2], including:

- Identify the responsibilities associated with each activity.
- Achieve an overall reduction in project duration.
- Allow an integrated view of each activity, facilitating communication.
- Easy verification of project progress.
- Facilitate the control and monitoring phase by identifying the most critical activities. This aspect allows to decide more fully how and with what degree of flexibility to allocate resources.
- Explicit the constraints linked to contractual conditions, in order to better manage relations with suppliers.
- Identify the set of activities that can be standardized and repeated.

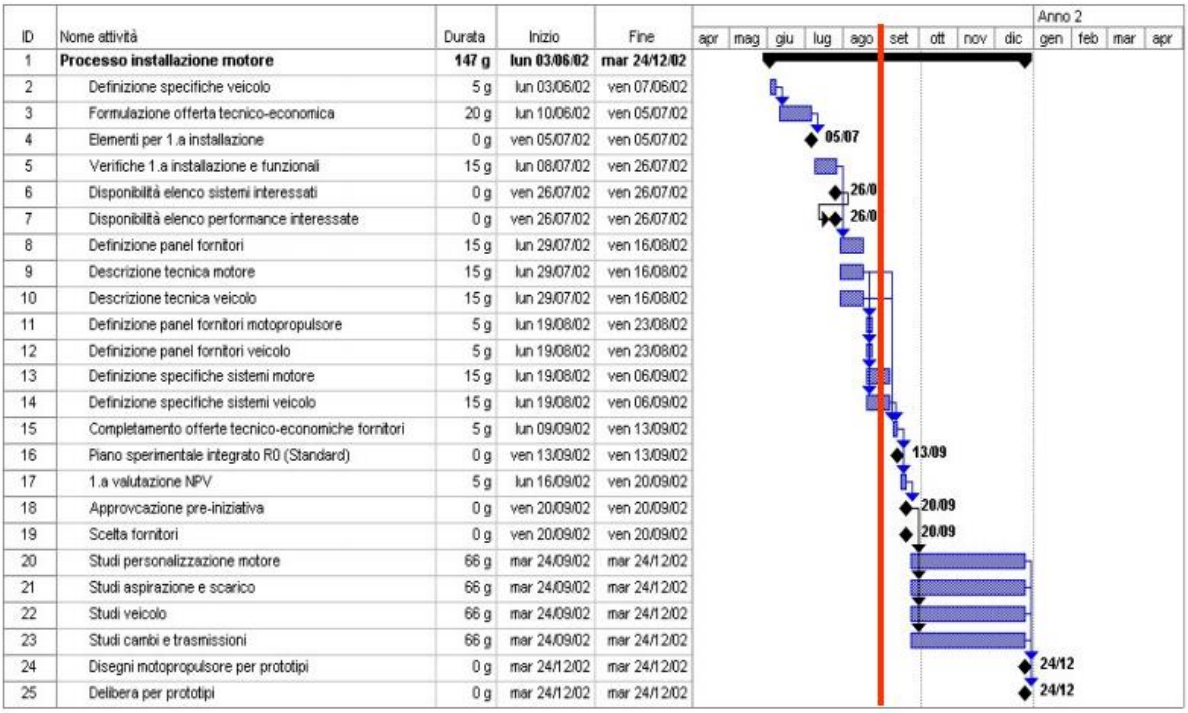
1.2.3 Scheduling

The Scheduling activity foresees the assignment of deadlines and time constraints to each previously identified activity, thus defining the Project Plan (Project-Plan).
The project plan must start with a presentation of the project describing the more general and strategic objectives already established in a previous formal situation. These elements form the basis of the project idea and constitute the motivation for the project. Essentially, they answer the question "why this project?" The key points of a Project Plan are the following:

- Presentation
- Objectives
- Stakeholder
- Roles and responsibilities
- Activities and milestones
- WBS
- Required skills
- Allocation of resources
- Project Scheduling
- Costs
- Control system
- Communications
- Problems and solutions
- Related documents
- Approvals

The phase ends with the drawing up of a project calendar, i.e. with the definition of expected start and end dates for each activity.

It is important to note that the scheduling phase is initially carried out without taking into account the actual availability of resources. Then, after the selection and allocation of resources is completed, the scheduling phase is updated again.
The main tool of this project management phase is the Gantt Chart [2]: graphical representation of the succession of activities over time. This allows an immediate understanding of the project as a whole, but the relationships between the various activities remain undefined and unclear, as can be seen in Figure 6 [2].
This aspect is due to the purely graphic nature of the instrument, which therefore does not allow a clear expression of how the various activities are linked and logically connected.



ID	Nome attività	Durata	Inizio	Fine
1	**Processo installazione motore**	**147 g**	**lun 03/06/02**	**mar 24/12/02**
2	Definizione specifiche veicolo	5 g	lun 03/06/02	ven 07/06/02
3	Formulazione offerta tecnico-economica	20 g	lun 10/06/02	ven 05/07/02
4	Elementi per 1.a installazione	0 g	ven 05/07/02	ven 05/07/02
5	Verifiche 1.a installazione e funzionali	15 g	lun 08/07/02	ven 26/07/02
6	Disponibilità elenco sistemi interessati	0 g	ven 26/07/02	ven 26/07/02
7	Disponibilità elenco performance interessate	0 g	ven 26/07/02	ven 26/07/02
8	Definizione panel fornitori	15 g	lun 29/07/02	ven 16/08/02
9	Descrizione tecnica motore	15 g	lun 29/07/02	ven 16/08/02
10	Descrizione tecnica veicolo	15 g	lun 29/07/02	ven 16/08/02
11	Definizione panel fornitori motopropulsore	5 g	lun 19/08/02	ven 23/08/02
12	Definizione panel fornitori veicolo	5 g	lun 19/08/02	ven 23/08/02
13	Definizione specifiche sistemi motore	15 g	lun 19/08/02	ven 06/09/02
14	Definizione specifiche sistemi veicolo	15 g	lun 19/08/02	ven 06/09/02
15	Completamento offerte tecnico-economiche fornitori	5 g	lun 09/09/02	ven 13/09/02
16	Piano sperimentale integrato R0 (Standard)	0 g	ven 13/09/02	ven 13/09/02
17	1.a valutazione NPV	5 g	lun 16/09/02	ven 20/09/02
18	Approvcazione pre-iniziativa	0 g	ven 20/09/02	ven 20/09/02
19	Scelta fornitori	0 g	ven 20/09/02	ven 20/09/02
20	Studi personalizzazione motore	66 g	mar 24/09/02	mar 24/12/02
21	Studi aspirazione e scarico	66 g	mar 24/09/02	mar 24/12/02
22	Studi veicolo	66 g	mar 24/09/02	mar 24/12/02
23	Studi cambi e trasmissioni	66 g	mar 24/09/02	mar 24/12/02
24	Disegni motopropulsore per prototipi	0 g	mar 24/12/02	mar 24/12/02
25	Delibera per prototipi	0 g	mar 24/12/02	mar 24/12/02

Figure 6: Gantt Diagram [2]

Alternatively, or to support the Gantt diagram, we find the Project Network Diagram, which schematizes the whole project in the form of a network/system by arranging the activities according to its own sequence.
A network diagram is a graphical representation of all the tasks, responsibilities and workflow for a project as is possible to see in Figure 7. It often looks like a chart with a series of boxes and arrows. It is used to map out the schedule and work sequence for the project, as well as track its progress through each stage, up to and including completion. Since it encompasses every single action and outcome associated with the project, a network diagram also illustrates the scope of the project.
A network diagram not only allows a project manager to track each element of a project and quickly share its status with others, but since research shows depicting data in a visual way

can improve comprehension and enhance retention, a network diagram can also boost performance and productivity, while reducing stress among your team members.

Two types of network diagrams:

- *Arrow diagram method* (ADM): arrow diagramming method uses arrows to represent activities associated with the project:
    - The tail of the arrow represents the start of the activity and the head represents the finish.
    - The length of the arrow typically denotes the duration of the activity.
    - Each arrow connects two boxes, known as "nodes." The nodes are used to represent the start or end of an activity in a sequence. The starting node of an activity is sometimes called the "i-node," with the final node of a sequence sometimes called the "j-node."
    - The only relationship between the nodes an activity in an ADM chart can represent is that of "finish to start" or FS.

- *Precedence diagram method* (PDM): In the precedence diagramming method for creating network diagrams, each box, or node, represents an activity—with the arrows representing relationships between the different activities. The arrows can therefore represent all four possible relationships:
    - "finish to start" (FS): This is used when an activity cannot start before another activity finishes.
    - "start to start" (SS): This is used to illustrate when two activities can start simultaneously.
    - "finish to finish" (FF): This is used when to tasks need to finish together
    - "start to finish" (SF): This is an uncommon dependency and only used when one activity cannot finish until another activity starts [8].

It is thus very easy to identify the Critical Path, i.e. the set of activities whose completion cannot be postponed without changing the overall duration of the project. The time oscillation range allowed for Critical Path activities is therefore zero.

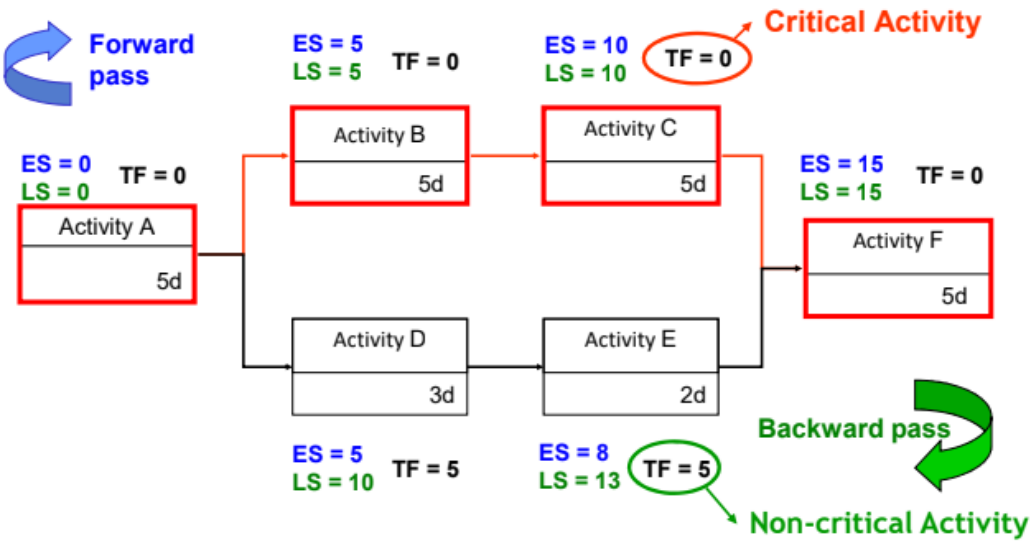


Figure 7: Network Diagram. Critical Path underlined in red [2]

The project duration can also be estimated probabilistically using a tool called Project Evaluation Review Technique (PERT), whereby relative probability is expressed as a function of possible project duration using a β distribution as expressed in Figure 8.

PERT (also called three-value or three-point-estimation) is a statistical method for determining the timing of project activities (but can also be applied to costs). Compared to a simple single-value estimate, the method assumes the determination of optimal, probable, and pessimistic estimate values that are more appropriate for assessing the timing and costs of project activities that are uncertain or complex [9].

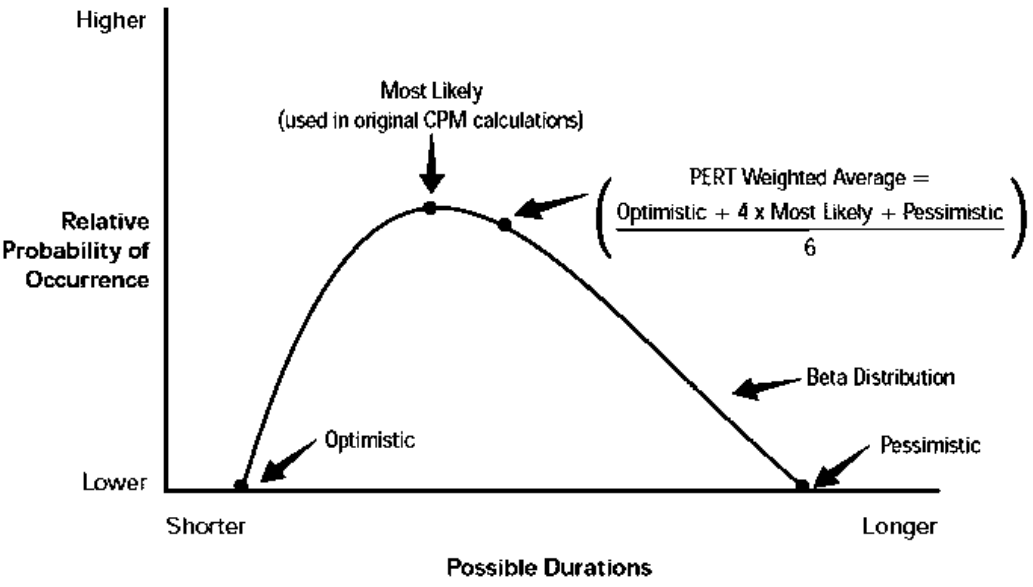


Figure 8: Project Evaluation Review Technique (PERT) [2]

After defining the project dates, it is necessary to compare the available resources with those required, considering the different levels of priority within the various activities. In this context, therefore, two possible approaches to manage the scheduling phase arise:

- The project duration is fixed, and the available resources are varied.
- The available resources are fixed, and a variation is made on the project duration.

Once the necessary resources have been fixed it is possible to proceed with the identification of the budget. The draft produced in the feasibility phase is then analysed and modified, establishing the levels of expenditure and time associated with each Work Package. In this way it is possible to build a histogram, which as final information will provide the budget upon completion (Figure 9).
The black arrow indicates the point normally referred to as Budget At Completion: Expected value for project implementation (initial expected value).
The orange curve obtained by joining the vertices of each histogram is called the S or baseline curve, at its right end coincides with the BAC value.

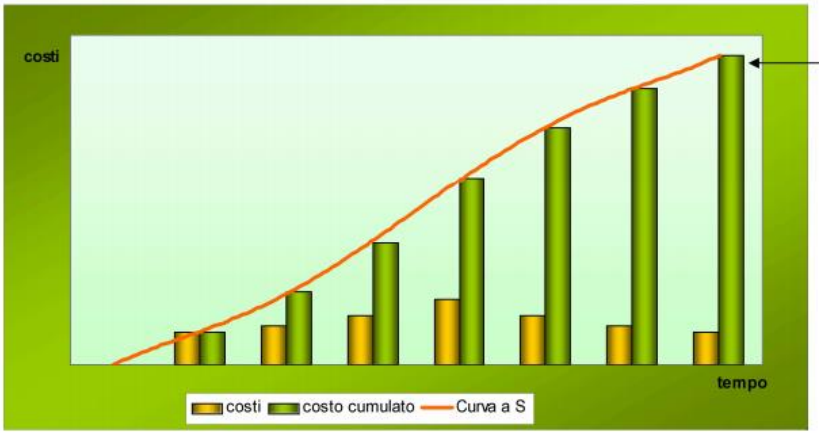


Figure 9: Budget at completion. S curve representation [2]

1.2.4 Monitoring and controlling

The project implementation phase starts with the kick-off meeting, the first of the operational project meetings. It is held when the project plan has been completed and approved and allows the operational phase to start. At the end of a kick off meeting each of the participants should have understood the aims and motivations of the project, the role to be played, the deliverables to be produced, the time schedule, together with the project risks and issues known at the time [10].
It is appropriate to introduce this step by clarifying some definitions [2]:

- Monitoring: Check the progress of the project by focusing on the following activities:
  - Definition of Key Performance Indicators (KPIs).
  - Measurement of KPIs.
  - Comparison between the performances obtained and the expected results.
  - Identification of any gaps.
  - Possible impact of identified gaps on project progress.

- Control: phase following the monitoring that is foreseen:
  - Understanding the causes that generated the gaps.
  - Definition and implementation of recovery activities.
  - Update of the project plan and identification of possible new objectives.

- Reporting: managing documents and communications regarding project performance.

The set of these activities is summarized within what is called the Monitoring Control Plan, whose primary objective is therefore to anticipate the consequences of past events before they occur. The project's control process is therefore cyclical and can thus be schematised as in Figure 10.

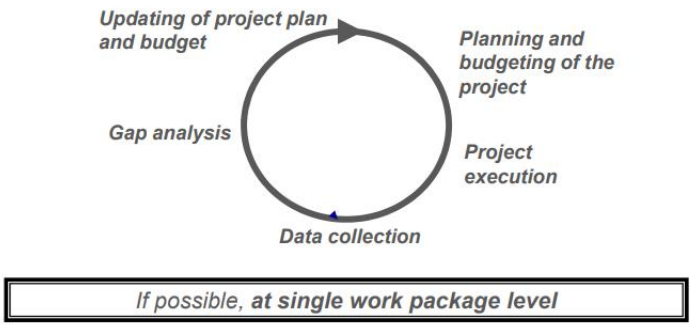


Figure 10: Monitoring control Plan [2]

Performances measurement criteria

The measurement of project performance is a fundamental aspect of the monitoring and control phase and consists in assessing the progress of the project itself. The most common measurement methods are listed below [2]:

- ON/OFF: this criterion provides for a single change in the state of progress, from 0% to 100% at the end of the activities.
- 50 to 50: this criterion provides for a single change in progress, it is set at 50% at the beginning of the activities and goes to 100% only at the end of the activities.
- Complete output units: this criterion measures the state of progress using the following formula:

$$\frac{\text{actual completed units}}{\text{total unit amount expected}}$$

- Intermediate Milestones: the progress of the project is progressively given by the value achieved in coherence with the relative Milestones.
- Proportionality: the state of progress is given by the percentage of resource use, obtained by dividing the amount of resources currently used by the total amount of resources available to develop the project.
- Manager: the state of progress is certified by the activity manager (who oversees the activity to be analyzed in terms of performances). The Project Manager therefore does not use analytical tools to check the progress of the project but only refers to the activity manager concerned at that stage of the project. This type of measurement is normally carried out in smaller, less complex processes.

Cost control

The S curve previously introduced talking about BAC is not a sufficient data from a financial point of view to evaluate in detail the progress of a project, since it only expresses the cumulative value of the budget allocated to each single work package.

The project metrics are therefore introduced, which represent a set of indicators aimed at keeping under control and predicting the trend of the main critical variables of the project (costs, time, quality, resources, variations in scope, etc.).

The introduction of metrics makes it possible to quantify the project performance as objectively as possible by measuring the set of indicators that are part of it. Typically, one of the most important uses of metrics is to measure the progress of the project against the plan. The advantages of using them allow:

- identify cost/schedule problems before they become critical.
- help the team to focus on completing their activities.

In particular, the technique called Earned Value Analysis allows to identify a common denominator for:

- time spent (against estimated time)
- the money spent (compared to the budget cost)
- the value of the work carried out, the so-called Earned Value (compared to the estimated work)

In projects where labour costs have an overwhelming weight (typically in the provision of services), this common denominator can be expressed either in terms of effort (man/days) or in economic terms, depending on convenience.

Three of the main standard project metrics used are listed below:

- Budget Cost of Work Scheduled (BCWS): planned cost (in days or €) to carry out the project activities on the current date. It is normally expressed as the number of hours planned at a certain time T multiplied by the hourly cost.
- Budget Cost of Work Performed (BCWP): Value (in days or €) of the activities performed on the current date. It represents the value produced by the project, i.e. the value of the deliverables released until the moment of measurement following the activities carried out. It expresses the advance or delay compared to what was planned.
- Actual Cost of Work Performed (ACWP): number of hours currently spent at a certain time T multiplied by the hourly cost [11].

Ideally, graphically representing the trend of these three quantities with respect to time, the BCWS curve should be the upper curve for each instant of time T, while the ACWP curve should be the lower one, as represented in Figure 11. A different situation would lead to a higher expenditure than the one foreseen in the budget.

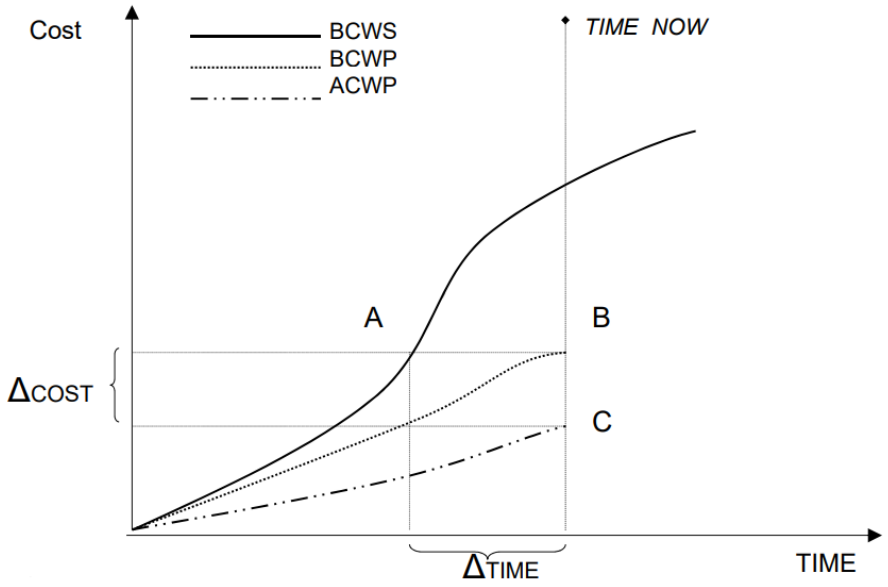


Figure 11: Standard project metrics curves [2]

On the y-axis it is possible to evaluate the difference between BCWP and ACWP, commonly defined as "Cost Variance", while on the abscissae axis it is possible to read the difference between BCWS and BCWP, defined as "Program Variance". These two quantities can also be defined as main project metrics.
These graphs are essential tools to continuously monitor the evolution of what will be the profit margin on the project, comparing it with the one set at the beginning of the activity.
From the graph it is also possible to distinguish certain information from forecast information thanks to the line defined Time Now, which identifies the time present on the graph.

1.2.5 Results collecting and closure phase

Often this phase is largely neglected or completely eliminated from normal project management activities. Often this omission is justified by lack of time.
However, it has to be considered that the collection and processing of data makes it possible to identify strengths and weaknesses within the newly completed project management. This information can be of vital importance not only for the managers currently in charge within the company, but also for future management figures.
A greater focus on this activity would, if carried out in a sufficiently self-critical manner, allow for a faster improvement in project management, reducing the risk of cyclical repetition of decisions or bankruptcy procedures [12].

1.3 Risk Management

Project risk management concerns the conduct of processes related to the planning of risk management, their identification and analysis, the preparation of responses to risks and their monitoring and control during the project.
It is a stand-alone process but should be carried out as much as possible in parallel with project management so that both work as well as possible.
The main complexity within risk management lies in fully understanding the limits within which an impending decision will impact the project.
Globalisation and market complexity, multiple sources of information and the development of ever shorter production processes are some of the factors that most influence risk management.
It is appropriate at this point to give some important preliminary definitions:

- *Risk condition*: condition in which the future is known only in probabilistic terms, based on available information.
- *Risk*: an event characterised by a certain probability of occurrence and which may have some impact on the project in terms of time, cost and quality.
  The concept of "probability of occurrence" should be underlined. If the event occurs with certainty, it is no longer a risk but a constraint.
  Another fundamental aspect linked to the concept of risk concerns the expected result: a risk is managed only if it is possible to have an influence on it, limiting the possible damage to the project.

The objectives underlying project risk management are to increase the probability and impact of positive events and to decrease the probability and impact of harmful events for the project, as expressed in Figure 12.

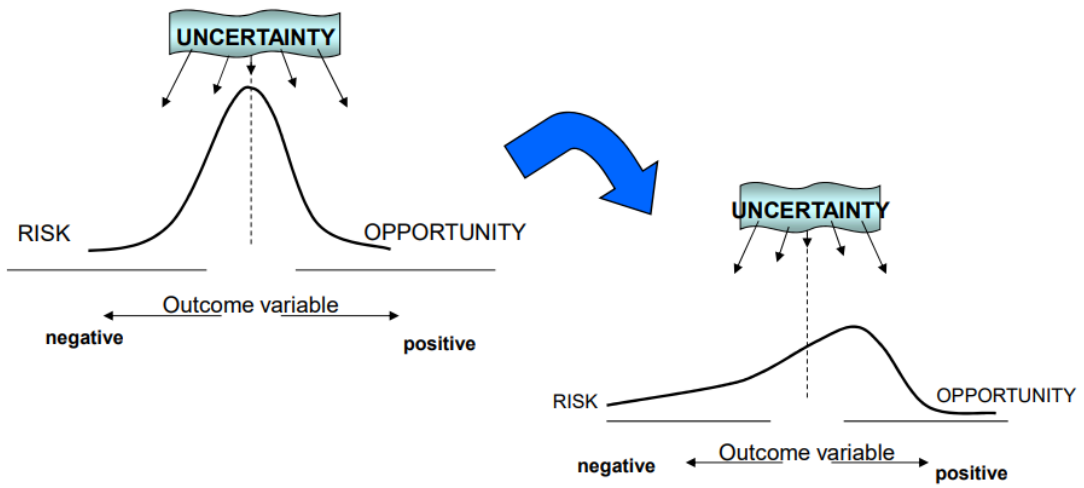


Figure 12: Risks and Uncertainties [2]

Organisations perceive the presence of risks to the extent that they translate into threats to the success of the project or opportunities to increase its chances of success.
Risks recognisable as threats to the project can be accepted if they are adequately counterbalanced by the reward that comes from taking the risk.
Project risk management involves the following processes:

- Risk management planning: Determining how to address, plan and execute a project's risk management activities.
- Risk identification: Determine the risks that may affect the project and document their characteristics.
- Qualitative risk analysis: Prioritise risks for further analysis or operation by evaluating and combining the probability of risks occurring and their impact.
- Quantitative risk analysis: analyse numerically the effect of the identified risks on the overall project objectives.
- Risk response planning: develop possible actions to increase opportunities and reduce threats to the project objectives.
- Risk monitoring and control: detect known risks, monitor residual risks, identify new risks, implement risk response plans and evaluate the effectiveness of these operations throughout the project lifecycle.

This cycle of activities should be carried out in an iterative manner in order to reassign and re-establish priorities within the project.
Each process may require the commitment of one or more persons or groups, according to the requirements and size of the project and is carried out at least once and in one or more project phases.
People and organisational structures show attitudes towards risks that affect both the accuracy of risk perception and the way they respond. It is also necessary to develop a homogeneous approach to risk management in accordance with the requirements of the organisation.
Risk responses reflect what the organisation perceives as the balance between taking and avoiding risk [4].
To be successful, the organisational structure should strive to address risk management in a proactive and uniform manner throughout the project.

1.4 Risk Management phases

1.4.1 Risk management planning

Careful and clear planning can only increase the chances of success of other risk management processes.

Risk management planning is the process by which you decide what kind of risk approach you take and how to conduct risk management activities in a project. The risk management planning process ensures that the level, type and visibility of risk management is proportionate to the risk and the importance given by the organisation to the project in order to provide sufficient resources and time for risk management activities and to agree on a basic criterion for risk assessment.

The risk management planning process should be completed in the early stages of project planning as it is essential for the proper execution of the other processes described in this chapter [4].

Planning and analysis meetings:

Project groups organise planning meetings to develop the risk management plan. Participants in the meetings are the Project Manager, selected members of the project team and stakeholders, whoever within the organisational structure is responsible for planning the risk management and execution of the activities.

These meetings define the key plans for conducting risk management activities. Risk cost elements and scheduled activities are elaborated to be included in the project budget and schedule respectively. Responsibilities in relation to risks are also assigned.

The organisation's generic document templates for risk categories and definitions of terms such as risk levels, probability by type of risk, impact by type of objective and probability and impact matrix are tailored to the specific project [4].

Output of this phase is the Risk Management Plan, which describes the following aspects:

- *Methodology*: defines the approaches, tools and information sources used to perform risk management during the project.
- *Roles and responsibilities*: this section defines the person in charge, support and members of the risk management team for each type of activity included in the risk management plan; it also assigns people to these roles and clarifies responsibilities.
- Budget: Allocates resources and estimates the costs necessary for risk management to be included in the project cost baseline (S-curve).
- *Timing*: defines when and how often to perform the risk management process during the project lifecycle and establishes the risk management activities to be included in the project schedule.

- *Risk categories*: provide a structure that ensures the completeness of the process for the systematic identification of risks at an always homogeneous level of detail and promotes the effectiveness and quality of the risk identification process.

An organisation has the possibility to use a previously prepared categorisation of the most common risks [4].

1.4.2 Risk identification

This phase is also commonly referred to as the "stress phase". It consists of the formal description of the risk, focusing on the reasons behind its occurrence, the impact it will have on the project and possible solutions.
Already from the first phase, the exchange of knowledge between the members of the team is essential: risk management is in fact developed in groups, with the aim of not letting a single vision of the analysed risk prevail and, consequently, a subjective risk management procedure.
Below are some examples of the information gathering techniques used in risk identification:

- *Brainstorming*: The objective of brainstorming is to draw up an exhaustive list of project risks. Generally, the project team carries out this activity in collaboration with a multidisciplinary group of experts not belonging to the team. Project risk ideas are developed under the guidance of a mediator. The risk categories, as well as the risk breakdown structure, can be adopted as a framework. Risks are then identified and categorised according to type and the corresponding definitions are further refined [4].
- *Delphi Technique*: The Delphi technique is a method that allows to obtain the consensus of experts. Project risk experts participate in the procedures of this technique anonymously. The moderator uses a questionnaire to stimulate ideas about risks relevant to the project. The answers are summarised and then submitted to the experts for further comments. Consensus may be obtained by repeating the process very few times. The Delphi technique reduces data bias and prevents some participants from exerting more influence on the outcome than others [4].
- *Interviews*: the identification of risks can be facilitated through interviews with experienced participants involved in the project, stakeholders and other experts in the field. Interviews are one of the main sources of data collection for risk identification [2].
- *Identification of the root cause*: This is an investigation into the root causes of a project's risks. It allows the definition of risk to be refined and risks to be grouped according to causes. If the root cause of the risk is carefully examined, effective risk responses can be developed [4].

- *SWOT Analysis*: this technique makes it possible to carry out the analysis of the project according to every point of view of the SWOT factors, thus widening the range of risks taken into consideration [5].

Risk Identification phase can also be supported by the so-called Risk Breakdown Structure (RBS).

Following the pattern of the WBS definition above, the RBS is defined here as "A source-oriented grouping of project risks that organizes and defines the total risk exposure of the project. Each descending level represents an increasingly detailed definition of sources of risk to the project." The RBS is therefore a hierarchical structure of potential risk sources, as expressed in figure 13 below.

LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Project risk	Product engineering	Requirements	Stability
			Completeness
			Feasibility
			…etc…
		Design	Functionality
			Interfaces
			Testability
			…etc…
		Code & unit test	Feasibility
			Testing
			Coding/implementation
			…etc…
		Integration test	Environment
			Product
			System
			…etc…
		Engineering specialities	Maintainability
			Reliability
			Security
			…etc…
	Development environment	Development process	Formality
			Process control
			Product control
			…etc…
		Development system	Capacity
			Reliability
			System support
			…etc…
		Management process	Planning
			Project organisation
			Management experience
			…etc…
		Management methods	Monitoring
			Configuration management
			Quality assurance
			…etc…
		Work environment	Cooperation
			Communication
			Morale
			…etc…
	Program constraints	Resources	Staff
			Budget
			Facilities
			…etc…
		Contract	Type of contract
			Restrictions
			Dependencies
			…etc…
		Program interfaces	Customer
			Subcontractors
			Corporate management
			…etc…

Figure 13: Risk Breakdown Structure example [13]

The value of the WBS lies in its ability to scope and define the work to be done on the project; similarly, the RBS can be an invaluable aid to understanding the risks faced by the project. Just as the WBS forms the basis for many aspects of the project management process, so the RBS can be used to structure and guide the risk management process [13].
The combined use of WBS and RBS can be used to generate a matrix structure, which allows the project team to manage the risk at a level of detail appropriate to the specific business context. To produce such a combined framework, risk analysis is first performed identifying and classifying risks using the RBS, either directly or to support other methods of identification such as brainstorming or interviews. The lowest levels of the RBS are then linked to the WPs in the WBS, producing a two-dimensional matrix. A link is created only if a particular risk can affect a specific WP. A WBS-RBS matrix is generated which we call the "Risk Breakdown Matrix" [14] as expressed in figure 14 below.

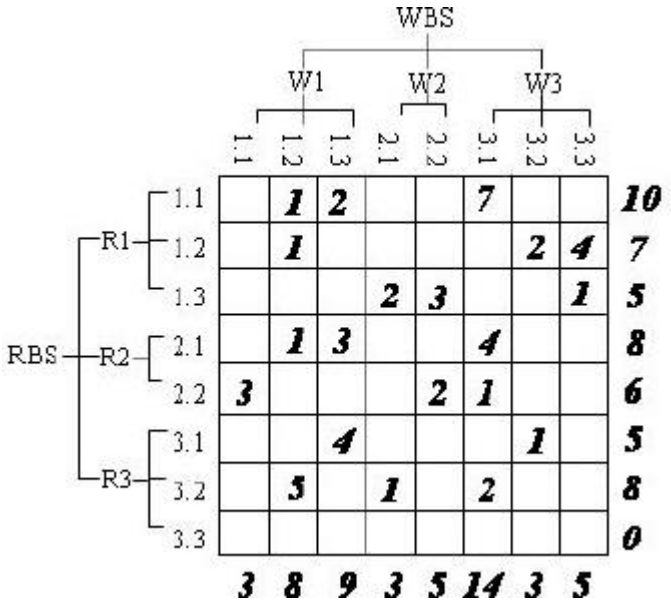


Figure 14: Risk Breakdown Matrix [14]

1.4.3 Risk analysis

The purpose of this second phase is to assess the level of risk, expressed as the product between the probability of occurrence and the magnitude of the loss.
It is in this context that we find the application of the Priority Matrix, a graphic tool that allows to identify the degree of criticality of each risk according to its position within the matrix:

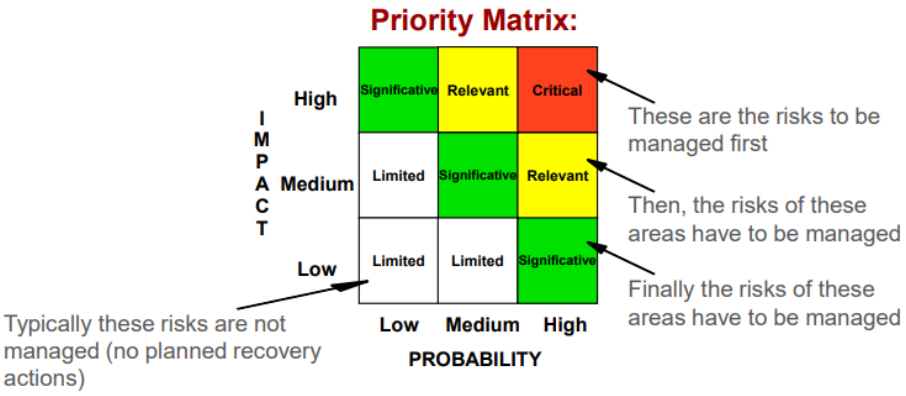


Figure 15: Priority Matrix

The matrix is constructed by collecting the results of two distinct risk assessment methods, a qualitative and a quantitative one described below.

Qualitative assessment:
It involves first an individual assessment and then a common analysis of the team members with respect to the individual assessments. This sequence is carried out in order to fully exploit the potential of each individual team member, without the opinions of other team members influencing their approach to the problem but avoiding that one opinion may prevail over the others.
The most common aspects that are analysed within these activities are the following:

- Probability of risk occurrence.
- Severity: overall losses against costs incurred.
- Control: real possibilities to control or manage the risk.
- Connectivity: degree of correlation between different risks analysed.

Qualitative assessment is quick and simple and is often used in the absence of historical data.

Quantitative Evaluation:
Quantitative risk analysis is carried out on the risks that have been given priority, through qualitative risk analysis, because they are considered potentially and substantially influencing the competitive demands of the project. The quantitative analysis examines the effect of these risk events and assigns them a numerical classification. In case of uncertainty it also offers a quantitative approach for decision making.

It is mainly linked to statistical processes and involves calculations related to the probability of a risk and, above all, its consequences.
The most used approaches belong to the basis of applied statistics:

- Sensitivity analysis.
- Stochastic-probabilistic analysis.
- Graphical model of the decision-making process.
- Monte Carlo simulation.

1..4 Risk reaction planning

It is possible to prioritise each risk in relation to the associated risk level index. It is thus possible to proceed with its treatment, identifying the main corrective actions, assigning specific roles for each of these actions and inserting these actions within the project calendar. Finally, it is possible to insert the entire corrective plan within the Project Plan document.
The treatment priority is then established on the basis of the risk index, while the type of treatment usually falls within one of the following categories [4]:

- *Risk avoidance*: avoiding risk involves changing the project management plan to eliminate the threat caused by an adverse risk, isolating project objectives from the impact of the risk, or reducing the scope of the endangered objective, for example, by extending the schedule.
  Some risks that arise in the early stages of the project can be avoided if requirements are clarified, detailed information gathered, communications improved, or experience gained.
- *Risk reduction*: Reducing risks involves a decrease in the probability and/or impact of a risk event to an acceptable threshold. Taking preventive action to reduce the probability and/or impact of a risk that may occur in the project is often much more effective than trying to repair the damage once the risk has materialised. Examples of reduction actions: adopting fewer complex processes, conducting more audits or choosing a more reliable supplier.
- *Risk retention*: this strategy is adopted because it is not always possible to completely eliminate the risk from the project. The strategy indicates that the project team has decided not to change the project management plan to address a risk or is unable to identify another appropriate response strategy. It is suitable for both threats and opportunities and may be passive or active. Passive acceptance requires no action and the project team must address the threats or opportunities as they occur. The most common active acceptance strategy is to establish a contingency reserve: provisions necessary to deal with unplanned changes but essential to mitigate the occurrence of one or more risks in the risk register.

- *Risk transfer*: transferring risks requires the transfer to a third party of the negative impact of a threat, together with responsibility for the corresponding response. Transferring the risk simply means assigning responsibility for its management to a third party; in other words, it does not eliminate the risk. This strategy is very effective when exposed to a financial risk. Transferring risk almost always involves the payment of an incentive to the party taking responsibility for the risk in question. There are a variety of instruments for the transfer, including, for example, the use of insurance, performance guarantees, other guarantees of various kinds, etc. A contract may be used to transfer responsibility for specific risks to third parties.
  In many cases, the use of a contract for reimbursement of expenses transfers the risk related to costs to the buyer, while a fixed price contract, if the project architecture is stable, transfers the risk to the supplier [4].

1.4.5 Risk monitoring and controlling

Risk monitoring and control is the process of identifying, analysing and planning new risks, recording identified risks, re-analysing existing risks, monitoring trigger conditions for contingency plans, monitoring residual risks, reviewing the execution of risk responses during the evaluation of their effectiveness and analysing the risks included in the watchlist.
The watchlist enables you to easily monitor projects that are starting to slip behind. If you enable this, your daily/weekly digest will contain a list of "at risk" projects that are starting to slip and thus requires some attention.
The risk monitoring and control process applies techniques, such as deviation and trend analysis, which involve the use of performance data obtained from project execution and are compared to initial forecasts.
As with other risk management processes, risk monitoring and control is a process that extends throughout the life of the project and aims to control whether:

- The assumptions of the project are still valid, in terms of starting assumptions and set objectives.
- The assessed risk has changed from its original state (with the help of trend analysis).
- The correct risk management criteria and procedures are respected.
- Cost and time contingency reserves must be modified in accordance with the project risks [4].

1.5 Project and risk management conclusions

It is useful to cite, as the concluding paragraph of this overview of the theoretical foundations underpinning this thesis, those that can be defined as the five key factors for the most effective project management possible. This will allow, once the project management activity within Torino Design has been analysed, to compare its effectiveness in relation to classical project management theory.

- First, planning must always be developed in such a way that it is oriented towards tangible results (deliverables) both at an overall (milestones) and intermediate level. This makes it possible to approach the monitoring and control phase in an agile and simple way.
- The planning phase must always be carried out based on the resources and skills present in the company, trying to enhance the human component as much as possible.
- The Project Plan must be managed in a dynamic and inter-functional manner, implementing a formal Design Review process consistent with the main project milestones. This makes it possible to create a complete and transversal vision of the project's progress and to share it with top management.
- Risk management: it is necessary, right from the feasibility phase, to develop a structured risk analysis and to systematically integrate the recovery actions within the Project Plan. Every single design review must be accompanied by a risk review.
- Capitalisation of project results, regardless of the success of the project [2].

2 TORINO DESIGN

In this chapter, the company will be described both from an historical and a technical point of view. Thanks to this, a better understand of the whole range of activities performed will allow to analyse more critically and proactively the project management strategy explained in the following chapters.

2.1 Historical Notes: Context and Birth

Pininfarina, Bertone and Giugiaro are undoubtedly names that have populated the pages of Italian industrial history, qualifying themselves as world excellences in their field.
Alongside the giants, smaller companies have gradually developed, smaller in terms of turnover, but certainly not for the quality of the product offered. One of them is undoubtedly Torino Design, a company of excellence founded in Moncalieri about 15 years ago, which has qualified as a very valid competitor of the "sacred monsters" of design and then managed to maintain its position, growing slowly and steadily, even in a period of severe economic crisis, notoriously disastrous for the automotive sector.

Figure 16: Roberto Piatti, TORINO DESIGN CEO

Part of the reasons for the success of this company are its founder, as well as its majority partner: engineer Roberto Piatti, represented in figure aside. Born in 1961, he became an entrepreneur after a brilliant career among the ranks of style giants [15].

This is how the founder describes the philosophy behind the birth of Torino Design:

"With Torino Design I tried to give possible, appropriate form to the intention (design). A small number of professionals represent the critical mass that makes the studio credible at an international level, guaranteeing complete assistance, relying on an external supply chain that makes it possible to modulate contributions, to make variable what others consider fixed costs. We then conduct the work ourselves, when we hire an engineering or statistical analysis firm, or our chief modeller goes to a supplier to direct external modellers on the occasion.
It is a sort of on-demand consultancy, sensitive to demand, to the need for a constant increase in quality, for a more appropriate project ethic, where the maximum is the ductility, the flexibility of the approach" [16].

The idea turns out to be attractive and many, starting with Giuliano Biasio, already in charge of Stile Bertone Exterior Design when Roberto Piatti was Managing Director, decide to follow it. Competitiveness, Quality and Operability are key words thanks to which Torino Design consolidates itself on the market right from the start. The latter gives the company significant added value: the streamlined structure combined with the great professionalism of its staff, allow it to offer the same quality as the big names in a shorter time and at lower prices [15].

Figure 17: TORINO DESIGN headquarters entrance

Today Torino Design, relocated to the hillside of Turin, more specifically at Villa Gualino, as is possible to see in figure 17 above, is a consolidated reality in a global context and is undoubtedly a gamble won. Its philosophy and the organisational principles on which it is based reflect what M.Porter expressed in "The competitive advantage":

"The key to a company's success lies in achieving a competitive advantage over its competitors. In the long term, competitive ability depends on the ability to create, at a lower cost and faster than competitors, the distinctive skills that can give rise to new products or innovate existing ones. The real sources of advantage therefore lie in the ability of designers and management to consolidate and harmonise the various production and technological capabilities throughout the company, as well as to plan the organisation of work and the creation of added value. Distinctive skills are also communication, involvement and a serious commitment to work across organisational boundaries" [17].

2.2 The reality of Torino Design

Right from the start, Torino Design is characterised by a very precise approach: creative styling and engineering, which starts from the blank sheet, sets the new car and, if necessary, goes on to produce working prototypes.
Torino Design's clients include not only all the manufacturers defined as "top players" in the new Chinese market, but also renowned Western companies such as BMW, Ferrari, McLaren, FCA and Iveco.
Piatti has developed its business mainly on the foreign market: 90-95% of the turnover in the first years of the company's life is achieved outside Italy. Foreign clients, in addition to having led the startup side, remain preponderant today; especially those coming from China, with whom Piatti had contacts since the time of the I.DE. A. Institute.
Today the Dragon absorbs about 40% of production, another 40% is destined to Europe, 10% to the United States and the last 10% to the Far East.
The strategic choices made by Torino Design are worthy of note, as they are attentive to new market trends. This is demonstrated by the company's industrial commitment, which in recent years has dedicated 80% of its energy to the development of electric or hybrid cars, the new frontier of private mobility [17].
One of the most important collaborations in this field is undoubtedly the one with the new Polish manufacturer EMP, not only from a content point of view, but also because of the very nature of the project.
The new Polish car brand, named Izera, has been created based on strategic partnerships with all the main players involved in operating an electric car, to follow the entire production chain and avoid supply problems. Electromobility Poland is in fact controlled by the state energy companies PGE, Tauron, Enea and Energa.
This is how Piatti describes the agreement reached with EMP:

"We were asked to produce a complete range of cars. For us it was a way of bringing Italian design into a project that is currently proving to be efficient and forward-looking.
The electric car today gives the possibility to abandon the constraints that other cars have. More attractive lines, more space inside the cabin. We want to revolutionise the concept. You can really think of completely renewing the style, now too much tied to the past. This is what we would like to do in the future.
I believe that in order to develop sustainable mobility we need synergy between government, those who build the infrastructure and those who distribute the energy. This is the only way to achieve the goal. And in this, Poland is one step above Italy. And it is demonstrating this with this project" [18].

On 28 July 2020 the presentation of the two prototypes developed by Torino Design was held in the city of Warsaw: a hatchback and an SUV, represented in figure 18 below.
On this occasion EMP announced that the Izera cars will be equipped with two possible types of battery, 40 and 60 kWh. At a fast charging station, the cars should be able to recharge to 80% in about 30 minutes, guaranteeing a range of about 400 km.
The German company EDAG is also involved in the project with regard to component integration, and the platform that will be used to build the vehicles is still unknown [19].
The Izera project is extremely important and topical, especially considering the philosophy behind its development; it will therefore be used as a practical example in the description of all the activities carried out by Torino Design.

Figure 18: IZERA Hatchback and SUV

2.3 Activities

Torino Design does not operate as a subcontractor, but as a "tier one supplier", i.e. a direct supplier to the parent company, which commissions the style development for a prototype.
The company focuses on the first development phase of the car: styling, feasibility engineering, 3D CAS surfacing and full scale model construction until the styling models are frozen, then 3D Class A mathematical models are developed and in some cases also product engineering can be performed.
It is important to note that the above activities are not carried out in series, but in parallel through iterative and consecutive cycles.
After the first steps that characterize the style phase, explained in detail in section 2.3.1 below, the style activities, 3D CAS surfacing and feasibility engineering continue together modifying each other. Then, after model milling milestone, further cycles of refinement follow one another, always involving all the activities.
In the following the activities performed by TORINO DESIGN will be explained separately, only to better understand the individual process.
The process is particularly innovative, and the company has an immersive 3D virtual reality model, based on 3D surfacing, capable of projecting a virtual car, even in the absence of the physical prototype. An equipment that allows essential modifications to be made before milling the model.

2.3.1 Styling

Stile is the first and most delicate of the activities carried out by Torino Design, thanks to which the idea of product present in the customer's mind takes concrete form for the first time.
Following the drafting of the contract, a briefing is established in which the client provides the company with two main types of input:

- Technical input: they describe the powertrain and the ergonomics package of the future vehicle, i.e. indications on the interior ergonomics and the spaces to be preserved suitable for living.
- Marketing input: information related to the strategy behind the launch of the future product, e.g. competitors and markets of interest. Two further categories of marketing input should be considered:
    - Explicit input: specific to a formed client, with a long-established identity and DNA. In this case client asks for styling consultant services that must comply with the existing identity that does not want to give up.
    - Indefinite input: from developing customers who require the supplier's support to interpret their brand identity or, alternatively, to fully create a new design language.

Several times this is useful to define a so-called family feeling: it consists in conceiving and developing visual and shaped elements that are closely linked to each other, though appropriately scaled in size and proportion, so that when placed next to each other, the kinship is clear, evident, recalling the stylistic connotations of the brand.

This information is used by designers as input data to research what is already being offered on the market by the customer's competitors, with an emphasis not only on the most commercially successful cars but also on styling.
The company is also constantly informed about trends in products not yet on the market, i.e. concept cars and teasers released by the main manufacturers to prepare the public for the launch of future products by studying their reaction.
Thanks to all the information gathered internally and externally, stylists begin to work on different interpretative philosophies of the product, considering history of the brand, benchmark of competitors, design trends. The car itself can in fact be conceived with a reference to technology, and therefore represented in a cold, aseptic and extremely minimalist manner for example.
This first phase of creativity, normally lasts for a couple of weeks, is concluded with an internal review in the style department, in which the sketches are analysed and further refinements are planned, bringing them closer on a visual level to the chosen philosophies. This operation, called Sketch Orientation, normally involves an output of several elements, which are submitted to the client for initial feedback. An example is represented in figures 19 and 20 below.

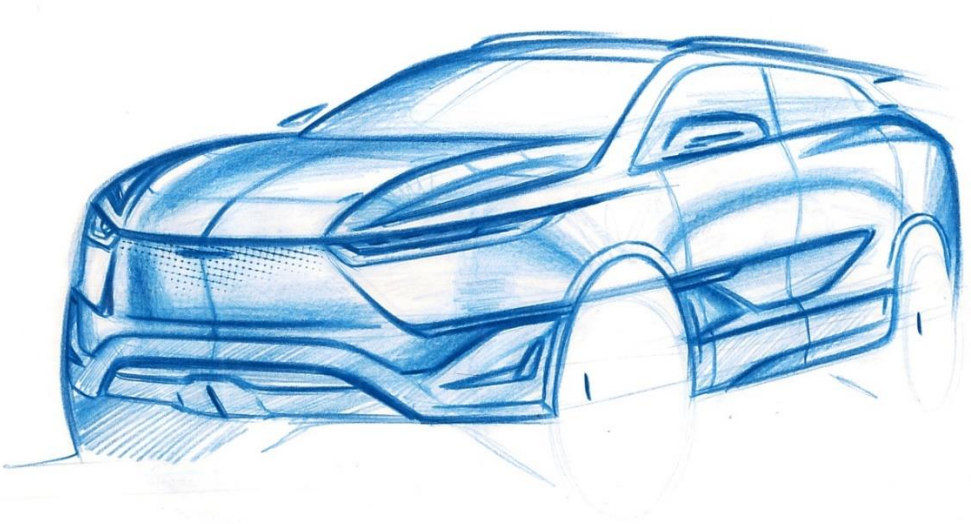


Figure 19: IZERA exterior sketch

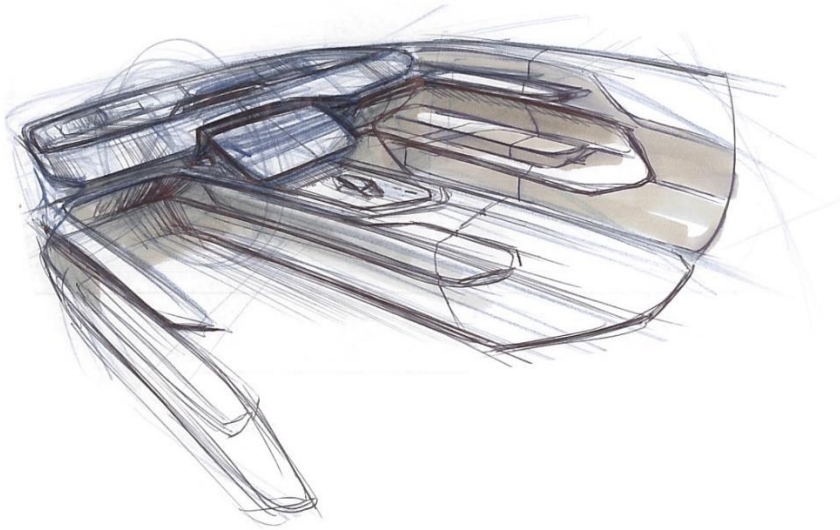


Figure 20: IZERA interior sketch

Afterwards, having obtained the vivid representation of the idea inherent in the client's will, some sketches of style are completed. At this point, sketches start to be coloured. In the following some exterior and interior sketches examples are shown in figure 21 and 22.

Figure 21: IZERA exterior colored sketch

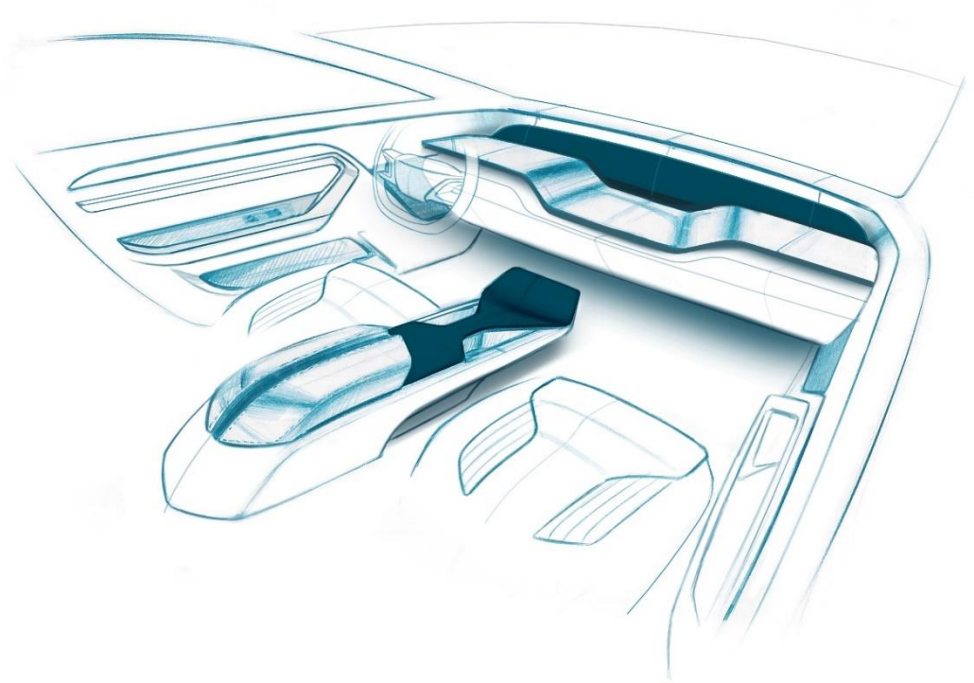


Figure 22: IZERA interior colored sketch

According to the directions given by the client, the proposals are selected and further refined until reaching the final one, normally in two successive steps characterized by the first by three proposals and the second and last by one or maximum two.
At the end of this phase sketches quality level reaches its higher point and the output is usually called renderings. An example is represented in figure 23 below.

Figure 23: IZERA exterior render

The procedure described so far is applied both for the interior and exterior style, for any type of car. Once the final proposal is approved, the product can move on to the next step, i.e. CAS modelling.

Organisation

The hierarchical organisation within the department is purely horizontal, characterised by strong flexibility and fluidity. In fact, senior figures can have weight over colleagues depending on the company's needs. The style director assigns different roles and involvement to the chief designers according to the needs of the moment and to better support the product development. Some examples of the classic tasks performed by chief designers are as follows:

- Supporting CAS's activity in case of style changes due to feasibility constraints.
- Improvement and revision of the style proposals of junior figures. This on an organisational level generates a slowdown in the process but ensures a higher and as standardised level of quality as possible.
- Color&trim proposals on exteriors and interiors.

The assignment of tasks and activities is always carried out trying to make the most of the skills of each individual member of the department, both in terms of creativity and stress management.

2.3.2 CAS (Computer Aided Styling)

The main purpose of the CAS designer's activity is to translate the designer's 2D renderings into 3D surfacing that will be used for milling the model. For 3D modelling and surface construction TORINO DESIGN uses Alias Autodesk software.

Often the starting point is given by the output of the Style phase described above, but it is always important to keep in mind that inputs and modifications come from both style and engineering activities, following the iterative logic described at the beginning of subchapter 2.3. The activities of the CAS department can belong to 3 different types, expressed below:

- The first, of a stylistic nature, takes place immediately after the creation of the style sketches. Here the effort is to immediately give a three-dimensional connotation to the proposed style, highlighting any critical points.
  A tool much used in this phase is the immersive virtual reality, thanks to which it is possible to have a much more concrete idea of the shapes that will characterize the developing vehicle. This tool is also widely used for aspects of Color&Trim.
  TORINO DESIGN boasts one of the most innovative virtual cameras currently on the market: the continuous refinement carried out by the CAS department on the instrumentation present in the camera has meant that today it can be used as a working tool: the user's eye works exactly like the lens on the helmet.

This guarantees a 100% consistency between the real and virtual image, cancelling any deformation and guaranteeing that the model is milled perfectly in line with the CAS model.
TORINO DESIGN virtual room is represented in figure 24 below.

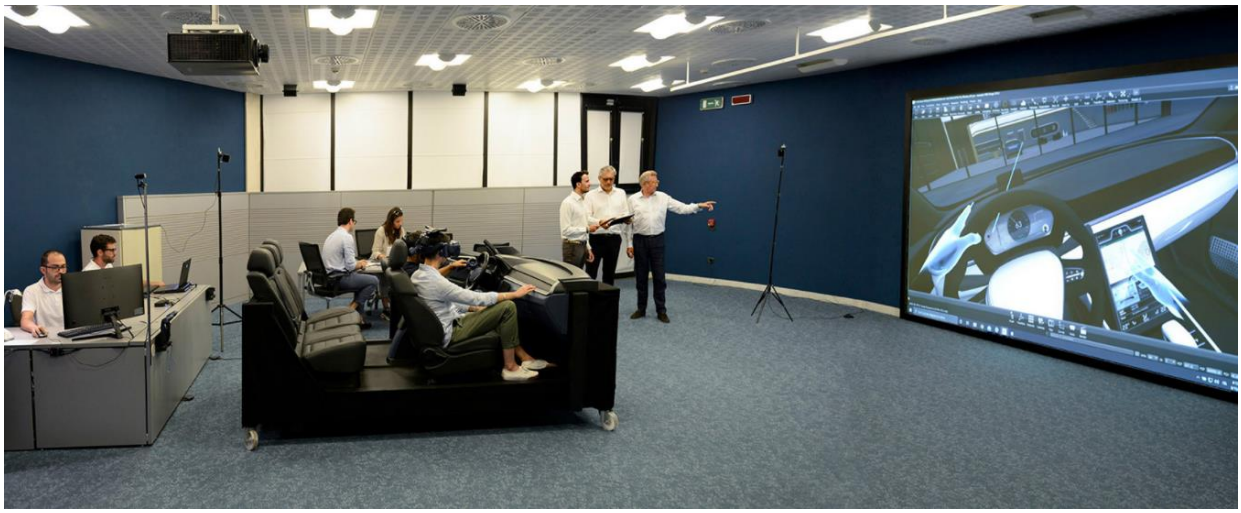


Figure 24: TORINO DESIGN virtual room

- The second, more related to feasibility, occurs immediately after engineering has viewed the output of the first step. Sometimes feasibility engineering suggests several CAS and styling modifications in order to preserve the feasibility of many components. An output example is represented in figure 25.

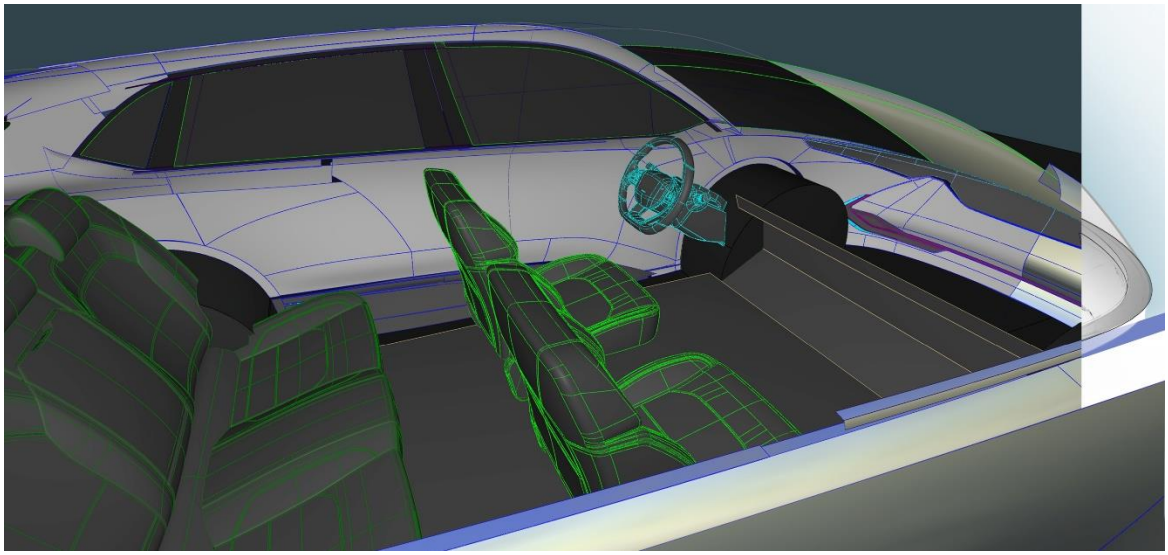


Figure 25: Interior CAS example

- After the last refinements coming from style and engineering, 3D surfacing activities move on to the final phase, which foresees the use of VRed software for the illustration of 3D mathematics. The program allows a realistic visualization of the modeling through the assignment of materials, colours, paints.
  exterior example is represented in figure 26.

Figure 26: VRed example

There are different types of surfaces created by CAS's activity, divided according to the level of complexity required. In the following the main differences are described. It is important to understand that these are just reference parameters, they may be more or less accurate according to the requirements of the individual client.

- The distance between each point of the edges of two neighbouring patches must comply with the following limits:
  - For class A: no more than 0.01 mm.
  - For class B: no more than 0.02 mm.
  - For class C: no more than 0.05 mm.
- Tangents continuity: the angle between the tangents to the surface on the edges of two neighbouring patches must comply with the following limits:
  - For class A: no more than 6’ (0.1◦).
  - For class B: no more than 12’ (0.2◦).
  - For class C: no more than 30’ (0.5◦).

- Curvature continuity: the control parameter is the patch curvature along its contour.
    - Class A surfaces must have coincident curvature at least every 100 mm of contour of two neighbouring patches:
    - Class B and C have no applicable rule.
- Points of maximum curvature or inflection are only allowed along patch contours of Class A surfaces.
- Completion surfaces: they do not belong to the aesthetic surface (even if part of them is visible and influences the aesthetic evaluation of the body) but are added to represent the part as it can be produced.
    - For class C surfaces: completion surfaces are not required; gaps are represented by double lines drafted onto the aesthetic surface.
    - For class B surfaces: only rounded contours are represented on the surface that is always fixed to the body.
    - For class A surfaces: completion surfaces must be designed in all detail.
- Shape tolerance: the shape tolerances are measured by comparison of a surface patch with the counterpart on the aesthetic surface.
    - For class A surfaces: no more than ±0.5 mm on body shell surfaces (or large surfaces) and no more than ±0.2 mm for interior trimming (or small surfaces).
    - For class B surfaces: no more than ±1.0 mm on body shell surfaces (or large surfaces) and no more than ±0.5 mm for interior trimming (or small surfaces).
    - For class C surfaces: shape tolerance is not applied.

An example is provided in figure 27 below.

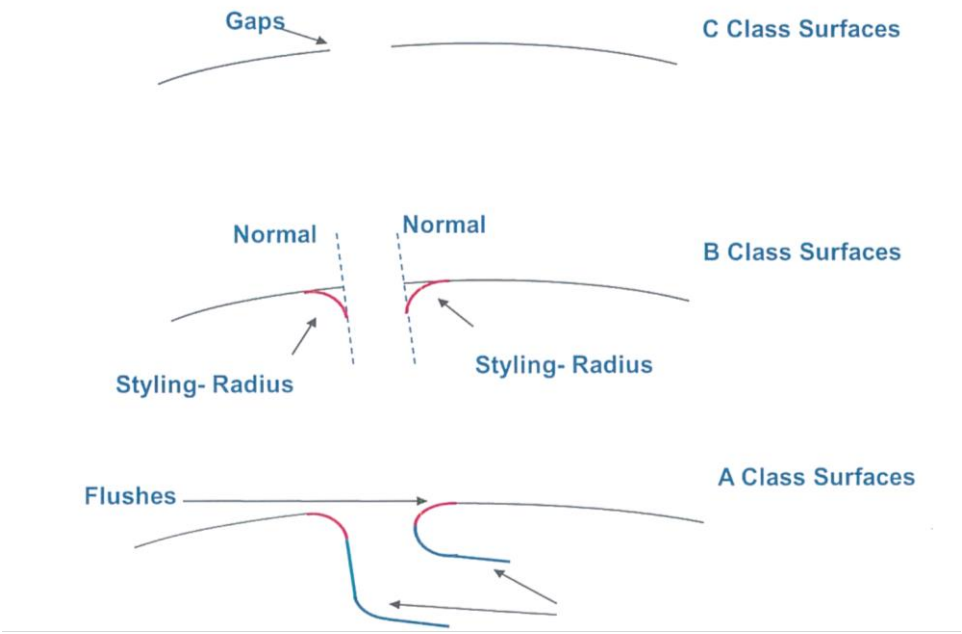


Figure 27: 3D CAS Surfacies

The benefits of a correct CAS modelling phase can be described as follows:

- Efficient patch layout without excessive surfaces, finishes or features.
- Controlled curvature continuity: The CAS tool set can visually display concave and convex curvature. This allows shadow lines and reflections to appear straight and intentional.
- Surface quality and continuity thanks to Zebra strip analysis. This technique simulates a stripped and exaggerated reflective pattern through the surface mesh. You can easily identify problem areas by looking for unwanted distortions in the analysis.
- Realistic visualization: The surface is positioned in a realistic environment and allows you to collect natural reflections.

Organisation

The hierarchical organisation of the CAS department is vertical, more structured than that of the style department: the director assigns reference roles for each type of activity carried out, subdividing first of all between internal and external development and then by components to be developed in the form of 3D mathematics. The work areas within the department are separated under normal conditions but are flexible if necessary.

This pyramidal structure gives the members of the department a level of responsibility commensurate to the degree of experience acquired, distributing the workload in a standardised manner.

2.3.3 Engineering

The fundamental objective of the engineering department is a packaging approach, together with a feasibility analysis of the style proposed to the customer.

The services offered by the engineering department of Torino Design are divided into two macro-categories:

- Feasibility of all the components involved, such as package layout, front doors, tailgate, head lamp, front bumper, instrumental panel, door trim panel, roof trim panel.

  As soon as the first CAS surfaces are available, engineering activities continuously check and control the volumes, in order to provide to Style department feedback on what has been developed so far. As an example, the following are analysed: mechanical dimensions, viewing angles, glass descent, door opening, clean glass areas, height, dimensions and volume of the bonnet to comply with pedestrian impact parameters according to regulations, interior ergonomics according to customer specifications.

  This is followed by more specific analyses linked to critical areas of the car.

  To properly understand the complexity behind a feasibility study, an example is provided below, considering front door as a reference component.

The feasibility is targeted to verify all the Items detailed in the following figure 28:

#	FRONT DOOR
1	Definition of B-R lines following defined typical sections
2	Definition of typical sections sealing and glass sealing internal and external
3	Definition of glass thickness
5	3D definition of glass surface
6	Check glass dropping considering door volume and impact beam
9	Check of door beltline height respecting the H point (H25)
10	Check of side impact for positioning impact beam (CEE, ECE)
11	Typical sections of door structure and reinforcements
12	Definition typical sections of the door sealing
16	Installation of window lift/dropping mechanism (or compatibility with carry-over system)
21	Definition of hinge axis and minimum volume required (carry over hinges)
23	Verify door opening angle
24	Installation hinges
28	Installation of latch and striker
30	Check step height (verify also with open door)
31	Check of total outer width (W 103)
34	Typical sections external opening handle
36	Typical sections for structure of external rearview mirror
39	Check of external projections (CEE, ECE)

Figure 28: Front Door feasibility check list

The Study will be performed through:

- 2D CATIA V5 R18 file drawing including main parts view and 10-15 typical sections. An example is represented in figure 29 below.

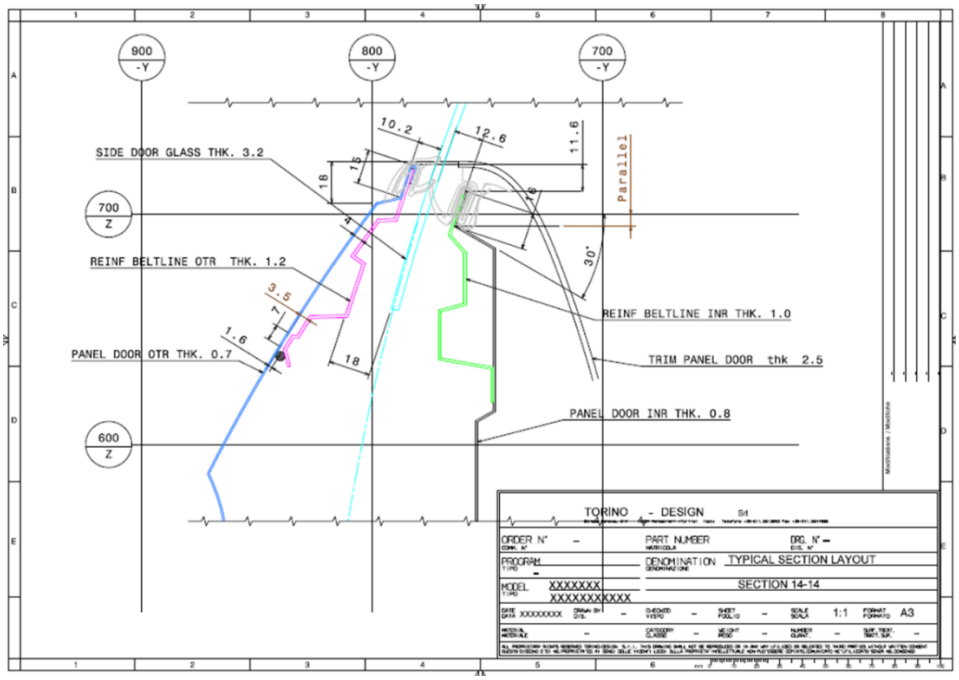


Figure 29: 2D CATIA V5 R18 file drawing

- 3D CATIA V5 R18 file showing 2D typical sections positioned in 3D reference CAS. An example is represented in figure 30 below.

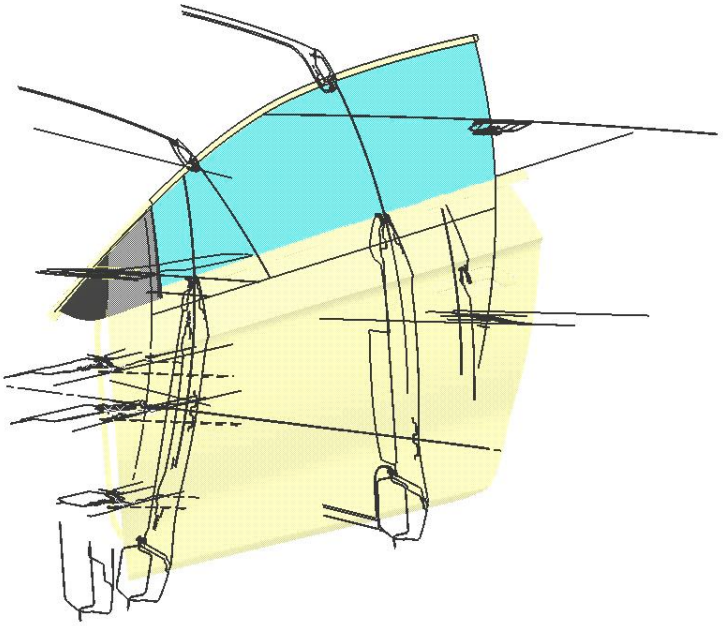


Figure 30: 3D CATIA V5 R18

- Development: Starting from the feasibility we proceed with the development of the individual parts. Considering again the example of the door, you will see the physically constructed frame with all the reinforcements and the anti-intrusion bar, all accompanied by the relative mathematics. A BOM is also drawn up.

From the input data provided by the customer, such as the segment of the future car for example, dimensions are derived that are broadly in line with the main models in the category. In this way the car's length, height and width are set.
Then, taking into account any input or preferences expressed by the customer, the tyres to be fitted are selected. This makes it possible to obtain, thanks to the use of specific tables, the value relative to the radius under load.
The radius under load is a fundamental data, which makes it possible to obtain what is defined as the theoretical ground line of the car's design, on which the three dimensions mentioned above are placed (height, width and length).
This information is used to define the car's trim, including front and rear overhangs and wheelbase.
At this point it is possible to have a sort of platform, closely linked to the type of vehicle structure that will be developed, on which it is possible to propose different styles.
Below is represented in figure 31 what is called the project grid, in which a 2D package can be seen as well.

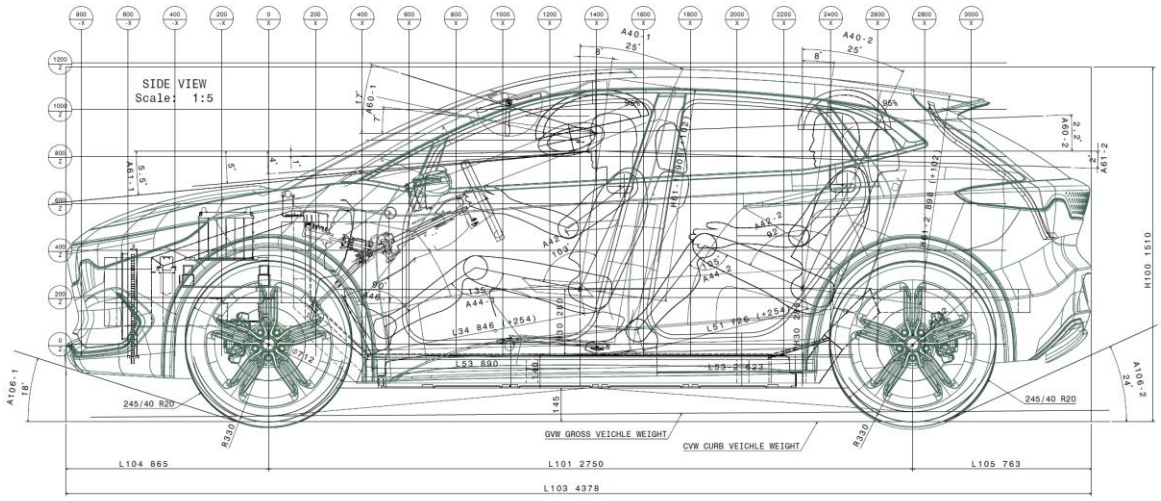


Figure 31: Project Grid

The dummy is then inserted into the car, in compliance with SAE data that allow the use of fully regulated measurements. In most cases the 95-percentile manikin is used.
The engineering department provides support to the customer in choosing the most suitable percentile for the interior design of the car under development, especially in the case of emerging manufacturers who do not yet have sufficient in-house know-how to suggest the most appropriate solutions. The dummy is automatically inserted inside the car.
Obstructions of the A-pillar must now be checked, an obstruction of maximum 6 degrees is allowed. Having a windscreen surface already provided by the CAS department can be very useful at this stage.
However, this is not always respected: for door panels, for example, it may be engineering that provides technical input to the style and CAS departments to develop the component in question. From this point on, CAS's department may already have started work on certain surfaces of the car. A continuous comparison between departments allows these surfaces to be increasingly refined and to comply with feasibility constraints. At this stage, the first critical issues may arise with the styling department, which may find itself correcting lines that are too exaggerated or provocative in the name of a feasibility that would otherwise be too difficult to achieve. A classic example of synergy between departments occurs during the development of feasibility of doors, often designed with attractive lines that compromise the correct functioning of the hinges. A door feasibility study is represented in figure 32 below.

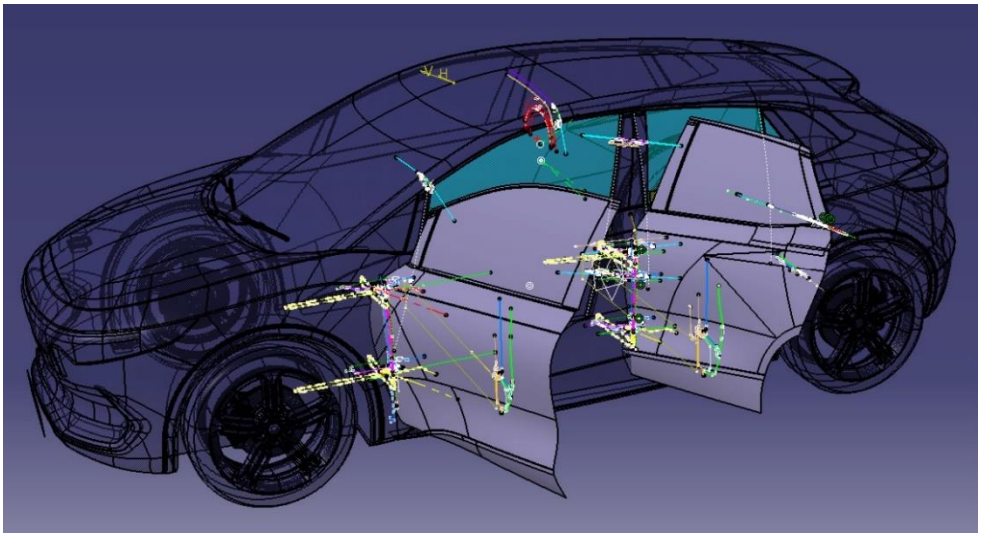


Figure 32: Door feasibility study

Then the dummy's helmets are inserted, and their movements are controlled inside the vehicle. The freedom of movement depends on the vehicle in question, both in height and width. The windscreen construction criteria are then taken into account at this stage, identifying ranges of points that define the degree of feasibility of the component itself.
It is important to remember that the customer can give general guidelines on the interior habitability of the car, often related to the old version of the model. Especially in restyling projects, we start from the critical points highlighted by the client on the old model, using them as starting data. In this phase a reachability analysis of the main controls is also carried out, and the pedal positions are also analysed according to the dummy's seat. The overall dimensions of the door panels and dashboard are also developed.

Another fundamental aspect taken care of by the engineering department concerns the cost of the components suggested to the customer for assembly, together with the impact that the components may have on style. A practical example could be the request for the assembly of miniskirts. During the creation of the class A surface, it is necessary to specify the impact that the use of trolleys or clips for the assembly of the miniskirt would have, both in terms of cost and style.
In these situations, the style, CAS and engineering departments work closely together to propose a solution that respects the proposed style as closely as possible, without compromising feasibility in any way. This makes it possible to give the customer a product in which quality and its needs are respected at the highest possible level.

Especially in projects that require the complete development of the car, Torino Design relies on external suppliers for studies relating to high and low voltage electrical systems, the vehicle's suspension system and the braking system.

Organisation

The hierarchical organisation of the Engineering department is vertical, more structured than that of the style department: the director assigns reference roles for each type of activity carried out, subdividing first of all between internal and external development and then by components to be developed in the form of 3D mathematics. The work areas within the department are separated under normal conditions but are flexible if necessary.

This pyramidal structure gives the members of the department a level of responsibility commensurate to the degree of experience acquired, distributing the workload in a standardised manner.

3 MANAGING A PROJECT IN TORINO DESIGN

In this chapter Torino Design project management strategy will be described. All the activities and all the used tools will be analysed for a further comparison with the classical project management approach. It is key to understand, from the very beginning, that TORINO DESIGN provides consultant services. Therefore, all the project management aspects related to mass production activities are not used by the company, neither considered as useful in managing the activities.

It is also company policy that no dedicated management software is currently used. The only support for the activities of project managers consists of two types of spreadsheets that will be described later.

In the following figure 33, a functional flow chart will summarize the activities managed, that will be deeply described in this chapter.

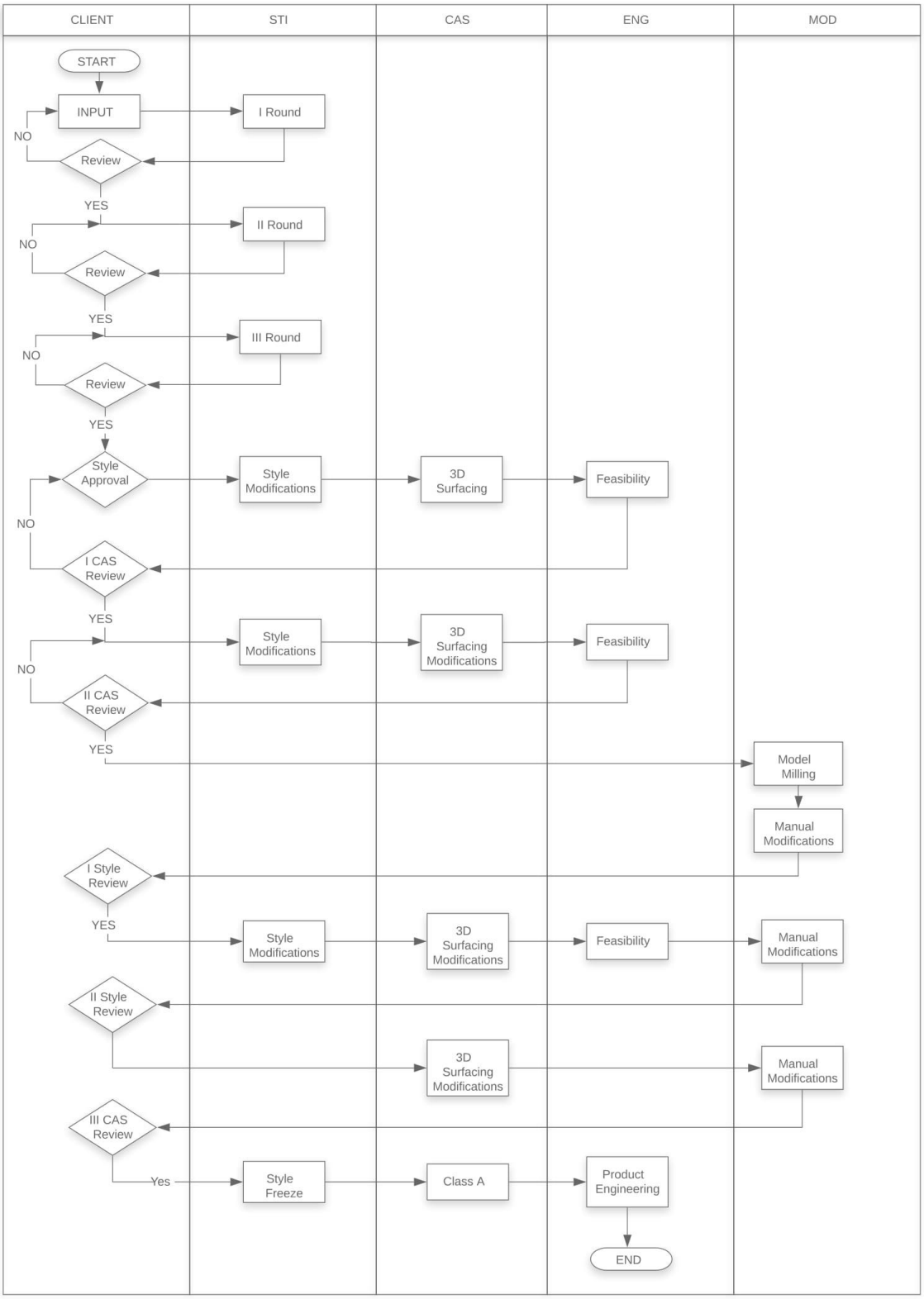


Figure 33: Project Management phases flow chart

3.1 Project identification and definition: feasibility analysis

For the sake of simplicity, the generical clients will be called party A and the supplier (TORINO DESIGN) will be called party B in the following.

After agreements' signature from both party A and party B, definition of the main characteristics of the new model to be developed are provided by party A to party B together with a list of technical input related to the product. This is a key aspect because cooperation between parties may start in different conditions:

- Several times, party A asks party B's consultant services not from the very beginning of the new product development. This should become a technical constrain for party B, because it has to adapt its activities on something that is not so easy to modify.
- Party A asks party B support right from the start of the new product development, this is a better condition for party B, due to the fact that there's more freedom not only in proposing different solution but also in working without the need in adapting to a current situation.

Analyse customer requirements and product features help party B in understanding whether to start a cooperation with suppliers. For example, if the product requires a complete Engineering Development, party B should have the need of additional software or technical external know-how. Therefore, external personnel are involved in the project.
When product features and characteristics are clarified, benchmark analysis is ready to start. This phase is led by Design department, since it usually consists in a design research in the market segment party A want the product to be placed in.
A preliminary planning is usually attached to the agreements, considering an initial estimate of time, resources and investments.
Usually, preliminary risks analysis is not performed in this phase by the company. This is a first relevant difference compared to the classical approach described in chapter 1. Another important difference deals with SWOT analysis.
The SWOT analysis described in chapter 1, especially the section "Threats", takes into consideration aspects related to the variability of the market within which the new product will be launched. This information is not normally considered by a style centre such as TORINO DESIGN, since the services provided by the company do not meet aspects of this kind. However, if we consider the theoretical definition of SWOT analysis out of the context of car manufacturers, it would also be useful for a style centre to evaluate the 4 aspects (strengths - weaknesses - opportunities - threats) related to the new project.

3.2 Planning

Even if a car design centre deals with different kind of projects, Milestones and Objectives are quite standardized, since the logical process the projects go through is the same. Moreover, company size and structure allow a standard scheme to be repeated in an easy and organized manner.
In the following, Milestones (bold) and Objectives (underlined) characterizing the common projects planning are described.

- **Approved style solution release**: at the end of the final round of activities performed by the style department, a style solution (one for the internal and one for the external of the vehicle) is selected and approved by party A.
- First CAS review: a preliminary class C surface (previously described in chapter 2) is developed by CAS department, based on style release, and examined by party A. After the review, class C style and volumes could be modified.
- Second CAS review: a more detailed CAS surface is presented. This version will be used to mill the model if approved.
- First model milling: a 3D model is milled using the CAS surface as reference. As explained in chapter 2, milling activities are performed by external modellers.
- Manual modelling on the model: within a period of 2-3 weeks the manual modelling activity on the milled model is developed, in order to better identify the model, a series of features not yet developed in terms of CAS are simulated, such as light clusters, glazing, handles, etc. preparing the model for the first style review (1 week usually).
- **First style review with the client**: party A reviews the 3D model and ask for possible further modifications. These changes are updated both on style and CAS surface.
- Model refinements: additional modifications are performed manually e di conseguenza le 3D surfaces vengono aggiornate tramite una scansione del modello.
- **Second style review**: party A review the physical and 3D model again and ask for possible further minor modifications. These changes are updated both on style and CAS surface.
- Model refinements: minor final modifications are performed both manual on the milled model and on 3D surfaces.
- Third CAS review: a more detailed CAS surface is finally presented.
- **Style freeze**: no further modifications on style neither on surfaces allows the so-called Style Freeze.
  It is important to point out that during all style reviews, even feasibility checks are refined and may be subject to change as a result of the client's comments.

- **Class A development:** This type of output is normally used to produce moulds useful for the future production of the product under development.
- **Product Engineering development.**

Main criticalities

Several criticalities may rise during party B activities development, as described by Paolo Smeriglio, Head of Project Management in TORINO DESIGN.

The experience gained by Mr. Smeriglio in managing projects has led him to summarize the main critical points encountered in the management of the style model development process as follows. The information was collected during several interviews, of variable duration, made to Mr. Smeriglio during this thesis experience.

The questions asked sought to clarify what the difficulties were inherent in the process and what on average occurred most of the time in the processes.

- First CAS review is a key point, because it has a strong impact on party A: perception of the 2D style may not be confirmed by the 3D surface. Party A may imagine the product volumes in a different way and this aspect should cause further modification both in terms of style and surfaces.
- Technical constraints should vary along the product development, this aspect is not usually controlled by party B, but party B must adapt its own activities on them. This is critical because it may generate inefficiency both in terms of time and costs.
- Another important aspect is related to party A common attitude. Party A usually waits for the further step to suggest a modification. From a theoretical point of view, party A should have clear in mind, right from the start, what it wants to see in the surfaces of the new product.

  This attitude may generate inefficiency in party B activities, and some lost in term of time and money. It is really important to properly analyse all the different modifications useful to obtain party A requests, in order to establish what kind of modifications are included in the agreements and whether to call an extra: a variation on the agreements. This aspect will be discussed in the following, because it deals with cost control.

WBS and OBS

Projects' Work Breakdown Structure is represented in figure 34 below. WBS is the same for all the different kind of projects performed.

Considering the activities usually performed by the company, the followed logic in developing the WBS is Process Logic: the subdivision considers the production process, i.e. the sequence of operations that the object undergoes.

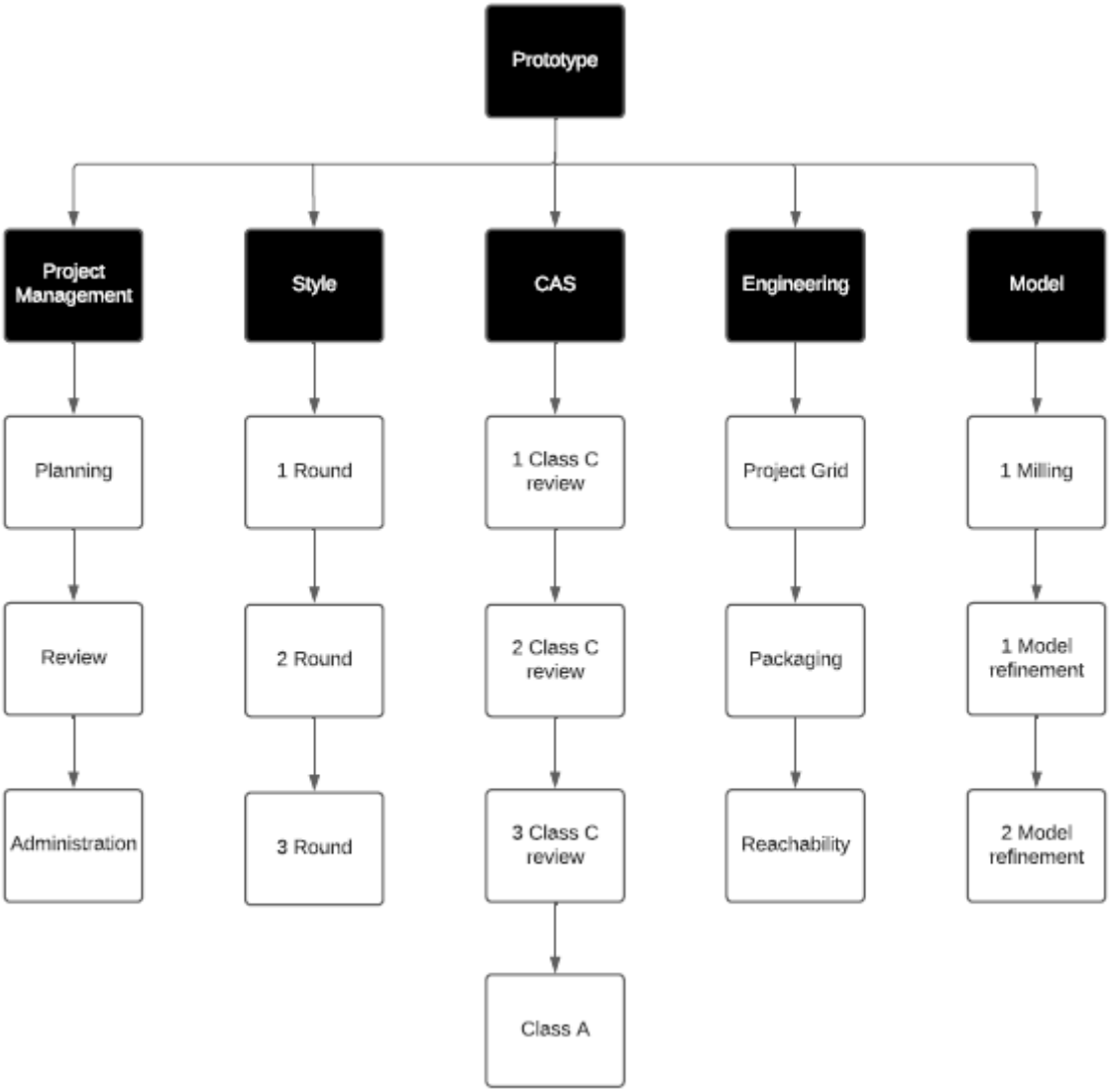


Figure 34: TORINO DESIGN WBS

TORINO DESIGN organization breakdown structure is represented in figure 35 below.

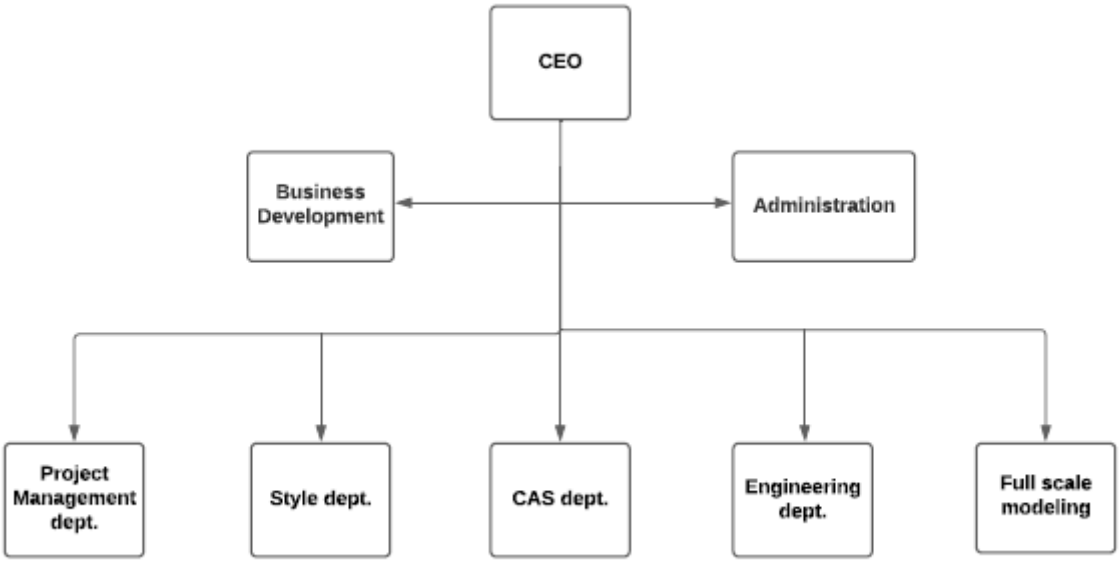


Figure 35: TORINO DESIGN OBS

Crossing OBS and WBS, TORINO DESIGN Project Managers can identify the responsibilities associated with each activity, together with an integrated view of them all, facilitating communication. Work packages are so obtained.

Using an excel file, all the work packages are managed and controlled, there's also the possibility to check the output of Global program plan's personnel table in order to always have clearly in mind what kind of resources are currently involved in the activities. An example of this file will be described in paragraph 3.4.

Considering that department managers are in charge for internal resources management, RBS is not used in party B planning activities. Moreover, because the site where the project is taking place, the equipment being used and the team that is executing the project are fixed, this tool is not considered as useful.

3.3 Scheduling

The Scheduling activity foresees the assignment of deadlines and time constraints to each previously identified activity, thus defining the Project Plan.
The main tool of this project management phase is the Gantt Chart: graphical representation of the succession of activities over time. This allows an immediate understanding of the project.
A TORINO DESIGN Gantt chart example is represented in figure 36 on the following page.
Within the diagram it is possible to appreciate not only the time sequence of the activities, but also the presence of Milestones, Objectives and reviews thanks to the legend provided:

Meeting with the client (approval or release), could be Milestone or an Objective.

Each kind of release to the client, including Work In Progress (WIP)

Important update in the activities

Exterior low intensity activity: something that does not require many dedicated resources, such as refinements or supporting to another activity, i.e. a designer asked to support a 3D surface modification.

Exterior high intensity activity: something that requires many dedicated resources, such as a main step development based on client input

Interior low intensity actitivty: something that does not require many dedicated resources, such as refinements or supporting to another activity, i.e. a designer asked to support a 3D surface modification

Interior high intensity activity: something that does not require many dedicated resources, such as a main step development based on client input

Since the sequence of activities to be carried out within any type of project taken on by the company is highly standardised, as described in section 3.2, the Project Network Diagram is not seen as a useful tool to properly design the Gantt.

It is interesting to observe that, right from the start, resources are considered in scheduling the activities. Dividing the overall hourly load of each activity for the daily hourly load of a single employer, the resources number is evaluated.

Due to company policy all sensitive data relating to the project have been obscured.

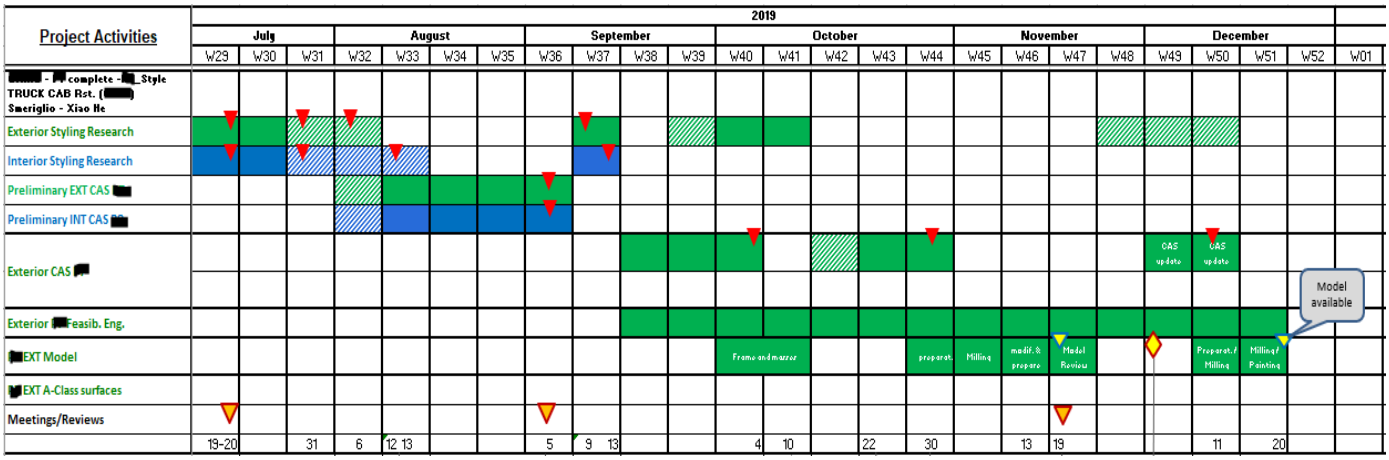


Figure 36: TORINO DESIGN GANTT example

Budgeting

Within the scheduling phase, the Project Budget is drawn up, also called internal commitment budget. This activity is carried out by the project managers referring to an experiential target and directives from the top management regarding the margin to be obtained from the project.

The budgeting operation is carried out on a spreadsheet called the Final Report.

The budget is first developed for each activity, starting with the style and ending with the milling of the model, considering the contribution that each department will have to make to the activity in question.

By multiplying the hourly cost of each resource by the number of hours budgeted for the activity, the indicative budget value is obtained. An example is represented below.

Activity	Dept	Contract Value	BUDGET (€)	BUDGET (€)	Dept	Hourly Rate (Dept)
Exterior styling proposals	STI	€ 60.000	€ 34.000	€ 28.000	TD	€ 70
					Supplier	
				€ 6.000	Travels	

A cumulative calculation of the values obtained is then carried out, thus obtaining the overall budget.
It is interesting to note that the budget is evaluated in euros at this stage. During the subsequent monitoring and control, particularly within the Global Time Plan sheet, the budget is evaluated in working hours.
The budget can be revised during the progress of a project, e.g. with the introduction of any variants, which are considered separately and only then added to the total contracted activities.
An example is represented below, variant is highlighted in yellow.

TOTAL base Contract		€ 1.270.000	€ 660.000	€ 660.000		
TOTAL Variant #2		€ 380.000	€ 233.000	€ 233.000		
Grand TOTAL		€ 1.650.000	€ 893.000	€ 893.000		

3.4 Monitoring & controlling

The monitoring & control phase is performed using 2 types of excel files, called Global Time Plan and again the Final Balance. The following will be analysed separately in terms of structure and functionality.

Global Program Plan

The Global Program Plan is a control tool that makes it possible to monitor the progress of all the projects currently underway, in terms of costs, progress and resources employed.
The sheet also presents, for each project, a simplified Gantt diagram, which contains all the fundamental information related to Milestones and intermediate objectives. Inside each cell coinciding with a work in progress there is a number, which identifies the resources currently employed in carrying out the task. An example is represented in figure 37 below.
As input data for each individual project and for each sub-activity we find the following values:

- Percentage progress of activities
- Internal budget
- Hours up to a specified date
- Budget at completion, highlighted in yellow in figure 38

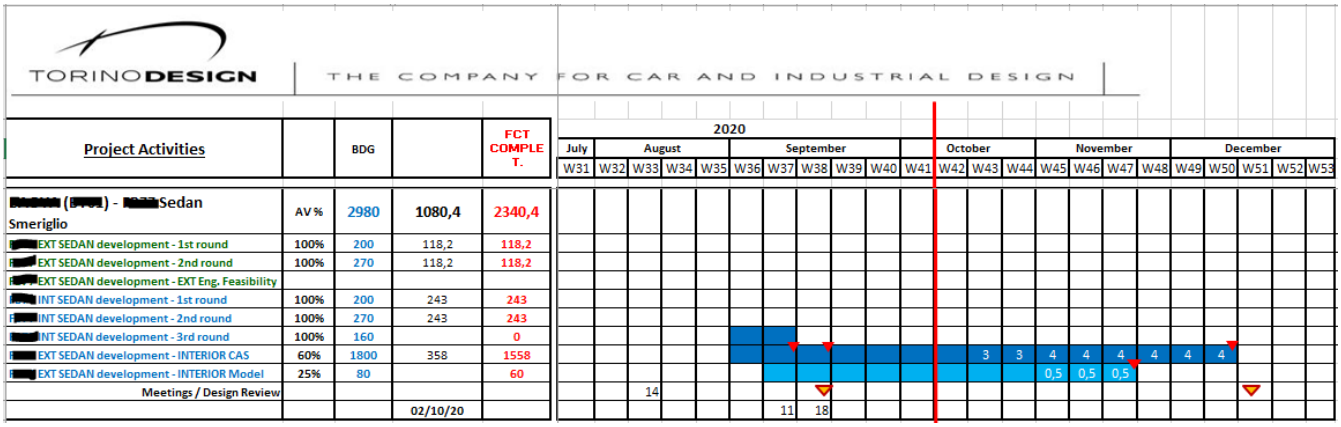


Figure 37: TORINO DESIGN Global Program Plan detail

The sheet structure allows the following operations, expressed in figure 38:

- By subtracting the final value from the internal budget, it is possible to obtain a deviation, defined Delta by Budget. This value is useful to control the state of maintenance of the proposed margin and should never fall below zero.
- Summing up Hours up to a specified date and Budget at completion value, Completion Forecast is obtained. This value should always be lower than the internal budget.

Delta from BDG	end of activity	FCT Complet
-240	0	440
-170	0	440
0	0	0
-41	0	240,5
30	0	240,5
160	0	0
1587	1040	1253

Figure 38: Program plan operations

From the analysis of this simple structure it is possible to plan different corrective actions according to the project progress:

- Negotiation of a variant where the final balance hours increase because of continuous requests for modification by Party A.
  Variant management is a very delicate activity as it is strongly intersected with the contractual conditions. On one hand, party B must push party A to respect the contractual conditions as much as possible. As a rule of thumb, every time there's a variant negotiation, project managers must ask the following question: Does the increase in costs due to the extension of activities justify an increase in the budget?

On the other hand, when necessary, a different business strategy is adopted, which sees more flexibility on the part of party B in following party A's requests with a view to establishing a bond of greater trust and cooperation between the parties.
Another aspect of fundamental importance during variant negotiations is the level of sectoral expertise of party A. emerging clients or start-ups often fail to fully grasp the technical implications of change requests. For party B it is therefore advisable to defend as much as possible the creative solution proposed to the client, with a view to safeguarding the style and feasibility achieved on the product.

- Corrective actions aimed at improving internal efficiency. Normally these activities involve an analysis of the relationships between department managers and the consequent quality of the exchange of information between them, to avoid misunderstanding and operational slowness.
  It is also possible that the causes of inefficiency are to be found within a department. The two main issues related to department activity may concern:

  - Lower than expected level of quality due to possible misunderstandings about the initial input provided by the client.
  - Too long a time frame for the activities to be carried out, which does not allow the deadline to be met.

At the bottom of the Global Time Plan, a suitably structured table provides, for each week, the total number of resources employed for each department.

Final Work Sheet: cost control

Cost control is carried out using a worksheet called the Final Work Sheet, which provides a calculation structure to obtain a cumulative value on costs incurred and the present value of the work.
In particular, as it is possible to see in figure 39, the sheet provides for the evaluation of the following parameters for each month and for each activity:

- Percentage of progress of the activity
- Value of the asset obtained from the product between its percentage of progress and the contract value.
- Hours spent
- Costs incurred, obtained from the product between the hours spent and the hourly cost of the activity. Costs incurred may also be forced values if supplier support is provided.
- Inventory obtained by subtracting from the budget for the activity the value of costs incurred up to now.

October (cumulative 2019)				
% carried out activity	activity value	Expenditure (h)	Expenditure (€)	€ Remain.
80%	€ 52.000	726	€ 36.300	€ 18.700
			€ 0	€ 0
				€ 0
80%	€ 48.000		€ 0	€ 45.000
			€ 0	€ 0
				€ 0

Figure 39: Final Worksheet month example

These values are then added together to give an overall figure for each month of project duration. At the end of the activities it is possible to appreciate the total of each columns expressed in the picture above. The total values for each month of the project duration are collected in a separated tab, from which it is possible to obtain a graphical display of the actual total values. The graph compares the current value of the work (green marked on the previous picture), the cost of labour (red marked on the previous picture) and the dates on which invoices are issued and paid, as expressed in figure 40 below.

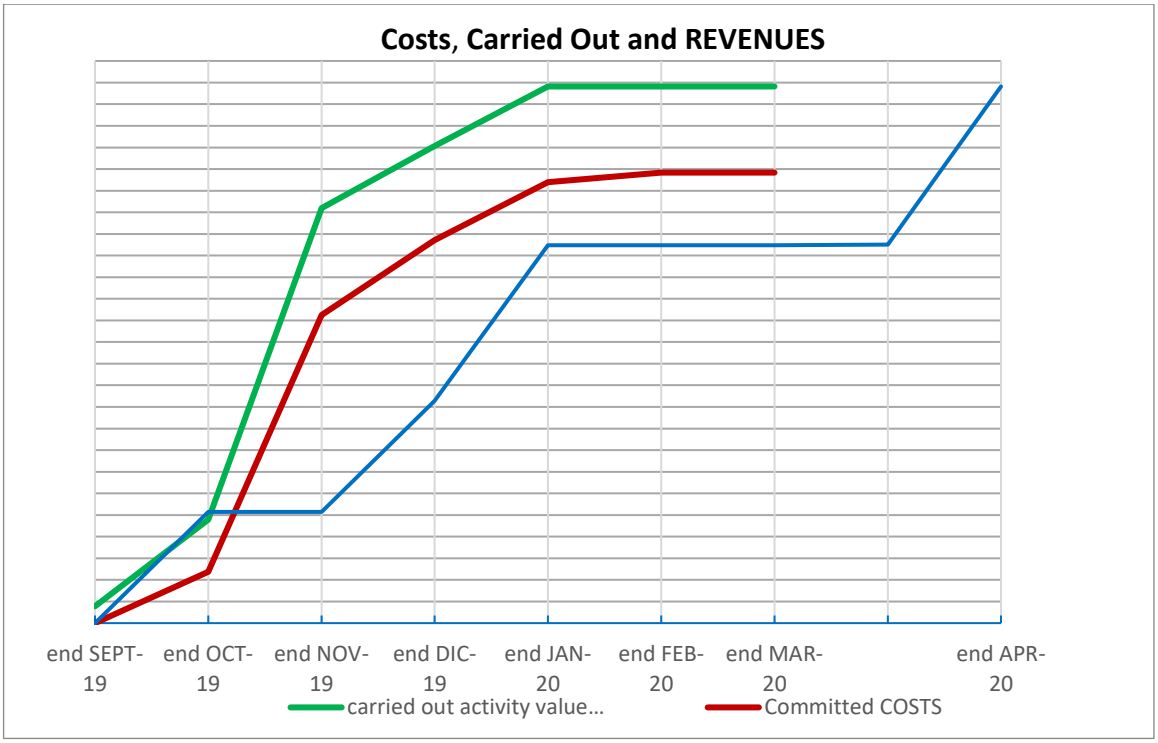


Figure 40: Summary chart example

The last column of the worksheet is allocated to the profit margin: here the total costs incurred in carrying out the activity are subtracted from the contractual value of the activity. Cumulating the profit margin for each activity results in what is called the general project margin.
It is important to underline that the final report sheet does not only present final data, but also forecasts, normally marked in red. On a graphic level it is possible to appreciate the difference between forecast and actual data through the time now line, on the right of which we will always get only forecast values.

3.5 Results collection and closure phase

The phase of collecting the results and closing the project is almost neglected by TORINO DESIGN. Apparently, this kind of disinterest in the last phase of the canonical project management approach could be surprising. However, this practice is widespread throughout industry and beyond.
Dr Chris Croft, one of the UK's most prominent trainers, in twenty years of experience as a project manager trainer, has never found a company that would dedicate enough time and resources to the project closure phase [12].
Analysing different realities, the common points on why time was not spent on closing the project were the following:

- Time and cost of time: often during budgeting operations the time that would be devoted to a final review (unclear to bill the time) is not considered, this leads top management to think that money is being lost and not only precious time for other activities.
- Inability to admit one's mistakes.
- Assuming the uniqueness of the project that has just ended: not spending time collecting the results of a project just because you think it cannot be repeated in the future.
- Convincing yourself that the material produced will never be used by the company in a useful way

3.6 Final Consideration

Considering the four different project management phases described so far, it is possible to assess that project identification, planning and scheduling are quite standardized within the company, whereas services provided by TORINO DESIGN vary in terms of topic, as well as technical features, but they do not vary the process that characterizes their development.
This raises the question of wondering if monitoring and controlling phase should be somehow improved. This will lead studies and analyses performed in chapter 4.
Moreover, several observations were made about the differences between classical project management theory and the procedure adopted by TORINO DESIGN. Since the presentation of these considerations implies a suggestion to add some activities, the reflection will be reported in detail in chapter 5, dedicated to the conclusions.

4. PROJECT MANAGEMENT ANALYSIS

In this chapter, studies and analysis performed along the internship period will be described. The main goal leading this phase is trying to optimize TORINO DESIGN project management activities increasing profit and diminishing the possible risks.
Considering the company structure, the project management procedure and the nature of the projects themselves, it is possible to identify two macro-categories in which to search for the causes of possible loss of time and costs:

- Internal factors, more related to the management of activities such as cost control

- External factors, more related to the customer (i.e. compliance with contractual conditions)

They will be analysed separately below.
Thanks to TORINO DESIGN Project Managers support it was possible to investigate spreadsheets and contracts related to three different projects, in an attempt to analyse both categories of factors.
Due to company policy, clients name and sensible data will not be clarified in the following. To simplify the description, projects will be named Project 1 (EV SUV and Hatchback development), Project 2 (truck development) and Project 3 (sedan development).
For simplicity, clients will be named Party A and TORINO DESIGN will be named Party B in the following, same as in chapter 3.

4.1 Internal analysis and comparison

4.1.1 Spreadsheets' analysis

Final worksheet summary is a very interesting tool. Due to its own structure, it allows to carry out several different information about time relations between Costs, Carried out activities and Revenues.
There is a list of considerations that needs to be clarified at the very beginning, to properly understand these relationships:

- A company should be able to cover the costs as much as possible. This means, from a purely theoretical point of view, that cost line should always be lower than revenues one.
- Cost line should always be lower than carried out activity ones, in order to be able to claim a finished product of higher value than the costs incurred. This significantly reduces the risks associated with possible variations or interruption of the project by the client.

- Is always possible to evaluate party's financial exposure:
  Party B exposure can be expressed as the vertical distance between cost and revenue lines, while party A exposure can be expressed as the vertical distance between revenue line and X axis.
- Cost curve takes into account all the invoices TORINO DESIGN has to pay to modelers and other suppliers water down along time. Cost trend will be less virtuous this way, but surely a lot more conservative.

The analysis starts with a complete study of spreadsheets and contracts for each of the three projects.
Below are shown in figure 41, 42 and 43 the graphic summaries.

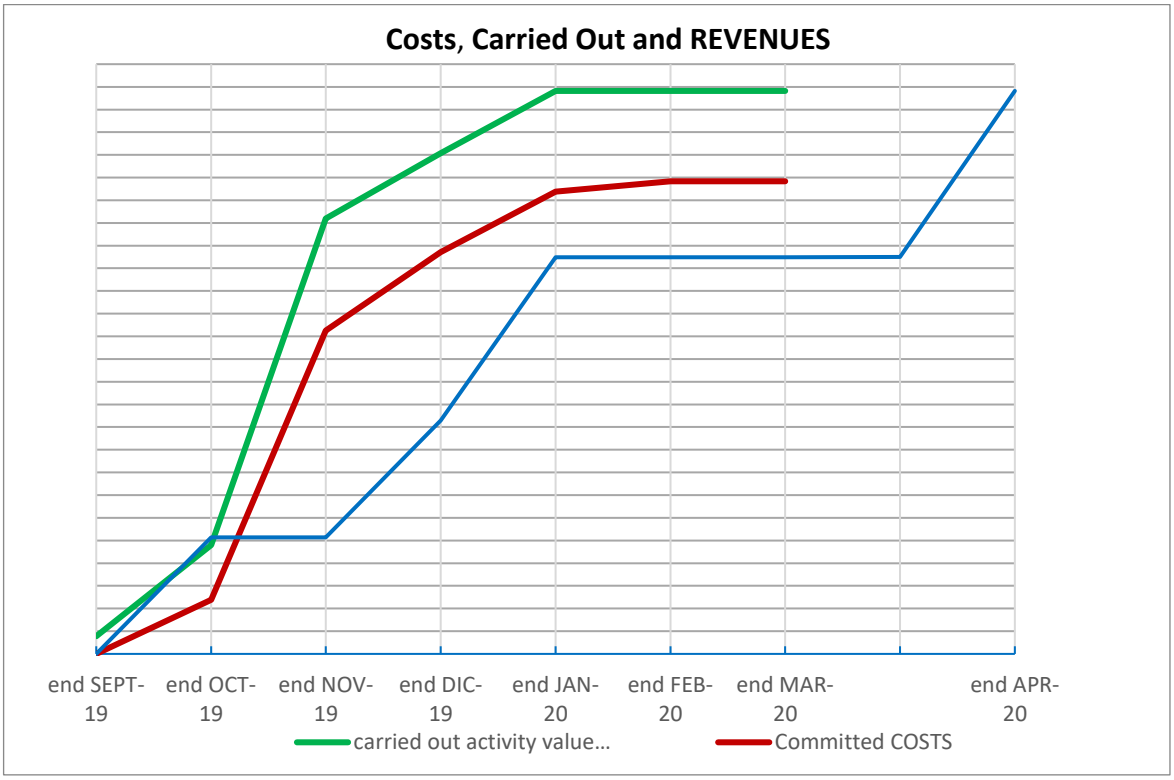


Figure 41: Project 1 summary chart

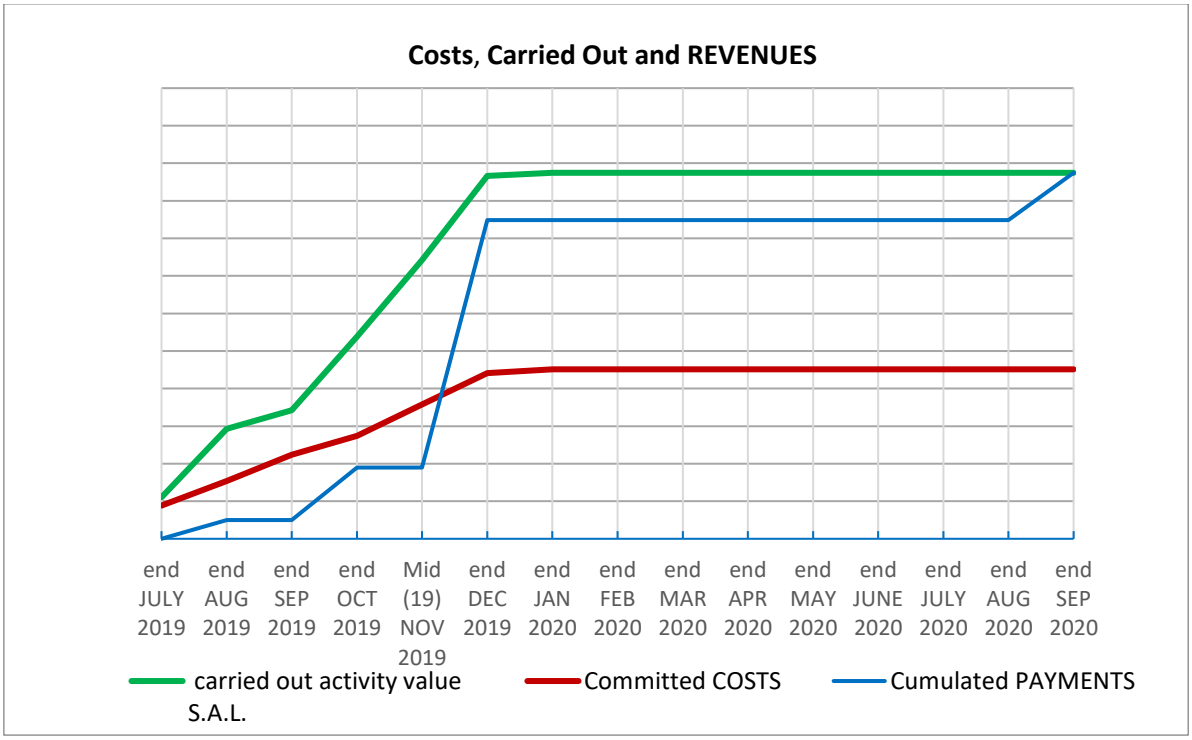


Figure 42: Project 2 summary chart

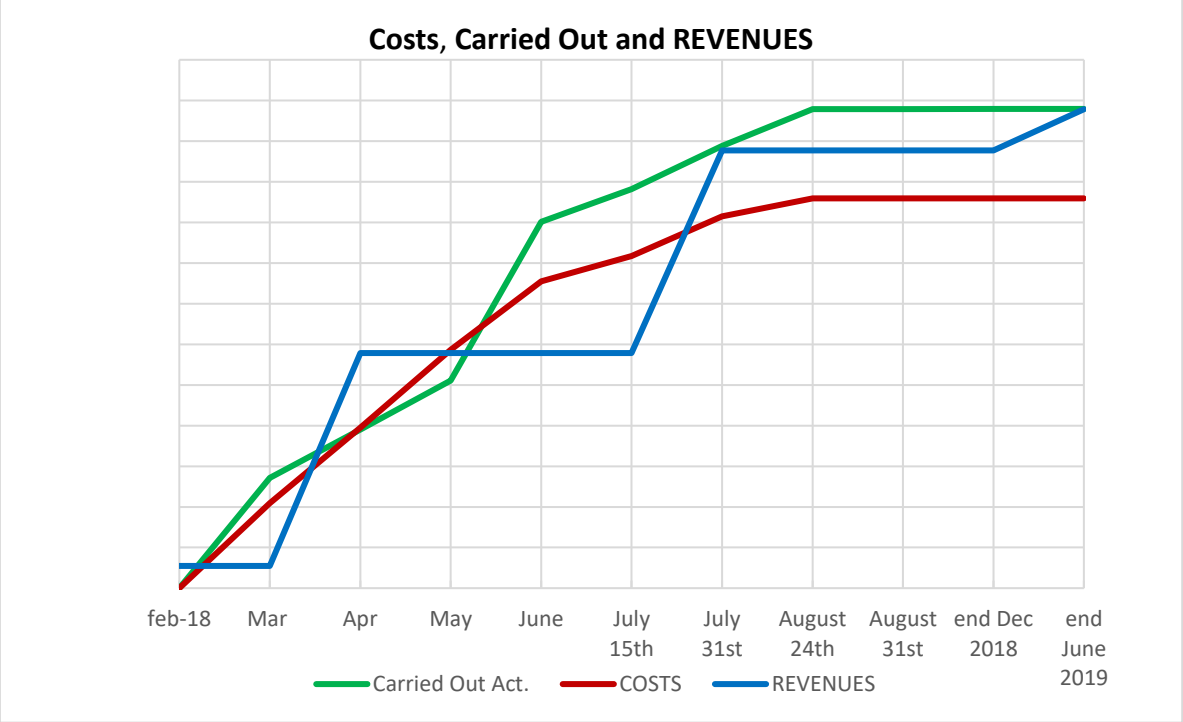


Figure 43: Project 3 summary chart

Let's focus on some considerations:

- In projects 1 and 3 an advance payment was obtained, as foreseen in the contract. In project 2, Party A's delay in the initial payment caused a very risky and even higher economic exposure of Party B than that of Party A. This is a situation that should always be avoided as in the event of a sudden interruption of the Party B project it would result in a significant loss.
- For projects 1 and 3, the maximum exposure interval coincides with the start of the model milling activities. As expressed in the initial considerations, this cost curve takes into account the invoices that will be issued to suppliers, but does not consider the real cash out from Party B. This means that the real exposure of the company is lower than expressed on the graph.

  The exposure of party B is always lower than that of party A, which is positive and gives stability in case of sudden project interruption.
- The initial exposure of project 3, present between March and April, is due to a delay in payment. This delay is unjustified since, according to the contractual terms and conditions, there was no review by Party A, but a simple communication from Party B about the start of CAS's activities as a condition for requesting payment.
- Projects 1 and 2 maintain a lower cost curve for 100% of the duration than the carried-out activity curve, which is perfectly consistent with the ideal curve trend.
- Project 2 was discontinued during January 2020. Considering the project performance up to December 2019, the forecast forecasted an economic result above 35%, the interruption is therefore to be considered potentially negative for Party B. However, considering the economic hedging position of Party B after the payment obtained at the end of December, the unexpected did not have a strongly negative impact.

  It should also be noted that the last payment only arrived at the end of September, 9 months after the stop in business. A graphic of this type describes a phase of litigation between Party A and Party B.
- Project 3 was stopped during August 2018. A long period of litigation followed, which led to the victory of Party B, thus obtaining the last payment in June 2019.

The strong impact that the client's conduct has on the project's performance immediately emerges, and this aspect will be dealt with later.

4.1.2 Spreadsheets' based studies

In an attempt to find the reasons behind the most virtuous trends in the carried-out activities, cost and revenues curves, separate graphs have been created for each activity. This study has allowed a decidedly more targeted and precise analysis, as can be seen from the results obtained.

In the following figures the graphs relating to the same activities for the three different projects will be compared. The values were obtained following the same procedure expressed in section 3.4.

Y axis were deleted not to reveal the real committed cost values and carried out activity values.

Style Activities

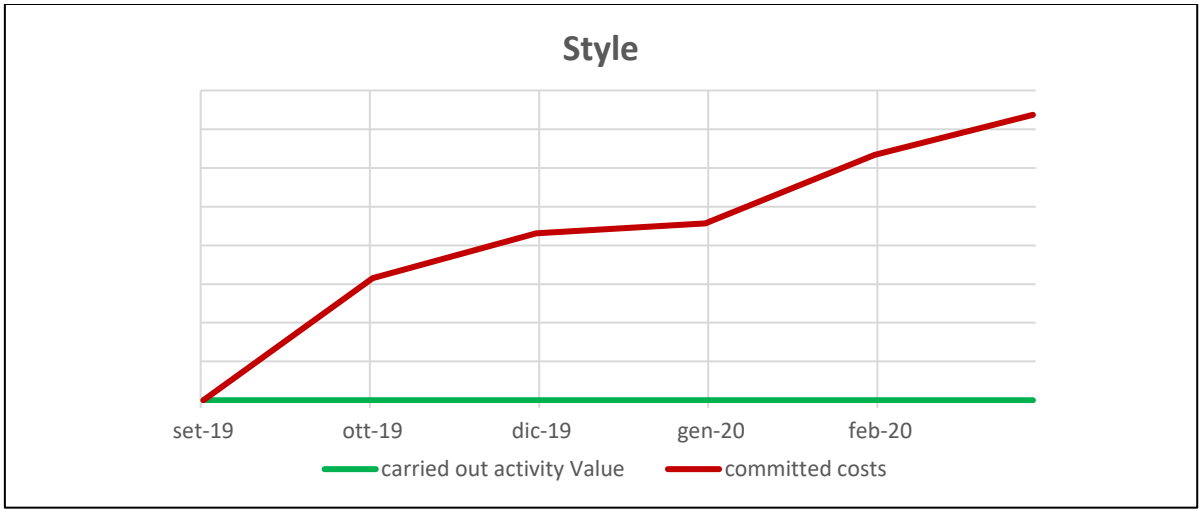


Figure 44: Project 1 style activity

The style activity was not contracted. In fact, the style proposals obtained from a previous project in collaboration with the same client should have been used. Continued requests for changes by Party A led to a significant loss of margin on the contract, which was largely recovered in the later stages as can be seen from the previous summary.

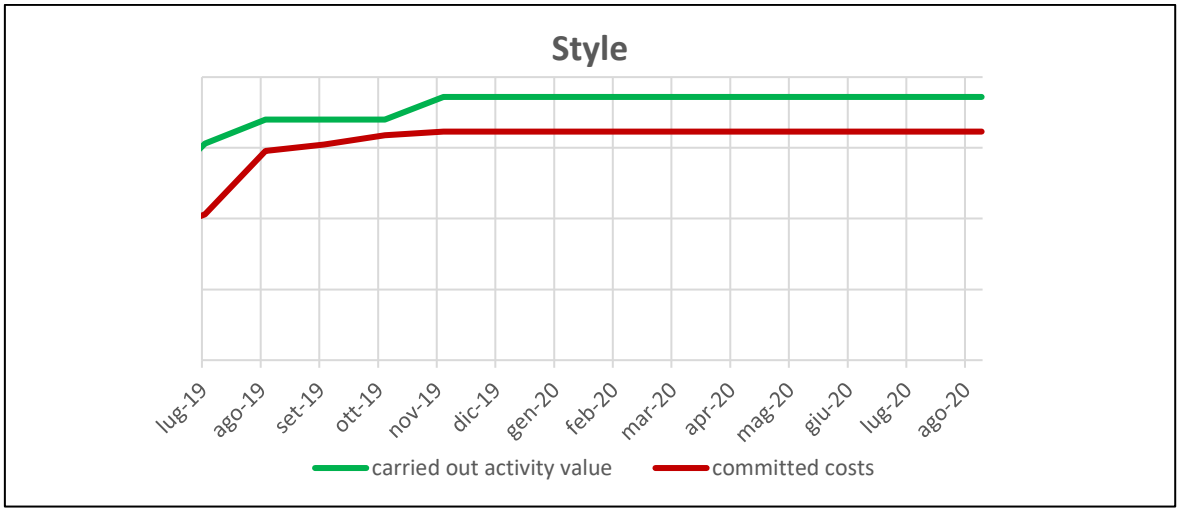


Figure 45: Project 2 style activity

Project 2 style activities run better than project 1 and project 3 ones. Looking at the relative spreadsheets seems that party A inputs were clearer and more defined. Moreover, along the whole project, party A didn't change his mind, allowing party B to perfectly respect the schedule and the proposed internal budget.

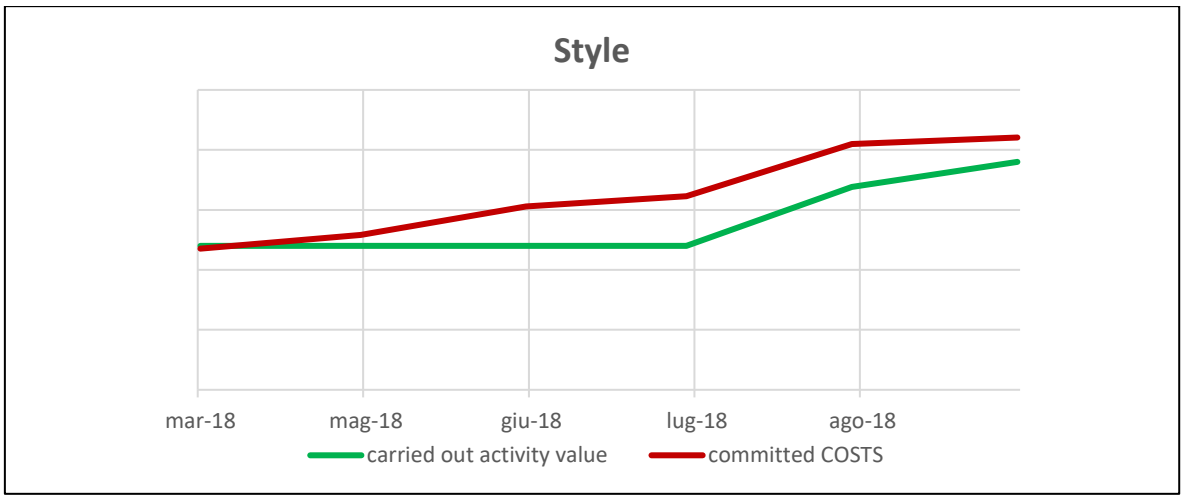


Figure 46: Project 3 style activity

The style activity reached 100% already in April 2018, but continuous changes led to an erosion of the margin until the end of July 2018, when variants were requested. However, it was not sufficient to recover the difference between the value of the asset and the costs incurred.

CAS Activities

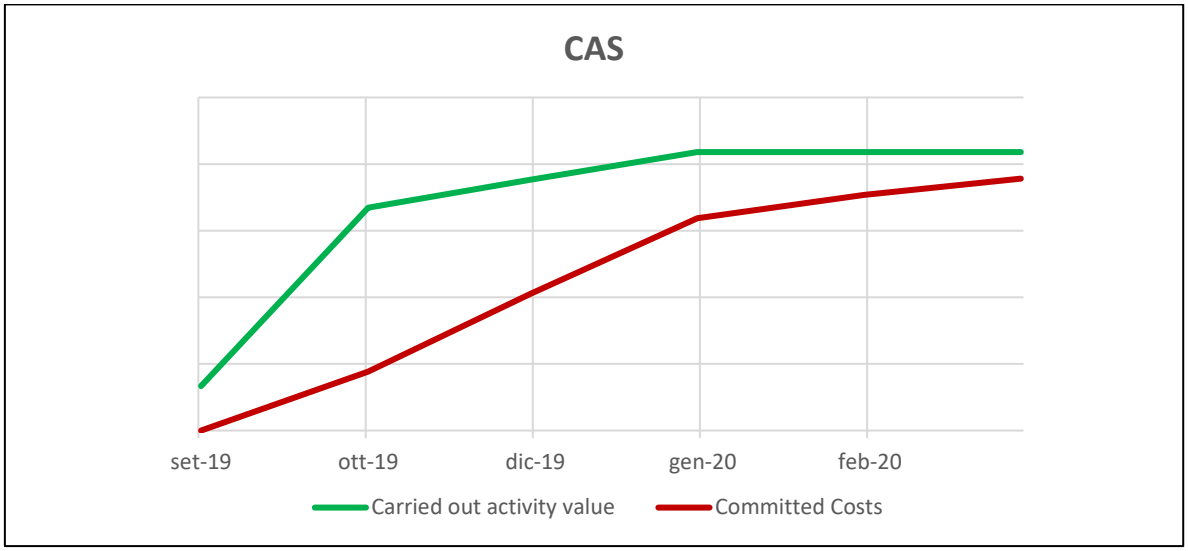


Figure 47: Project 1 CAS activity

CAS's activities related to Project 1 have been carried out in a virtuous manner, making it possible to claim at any time a value of the activity that is always higher than the costs incurred.

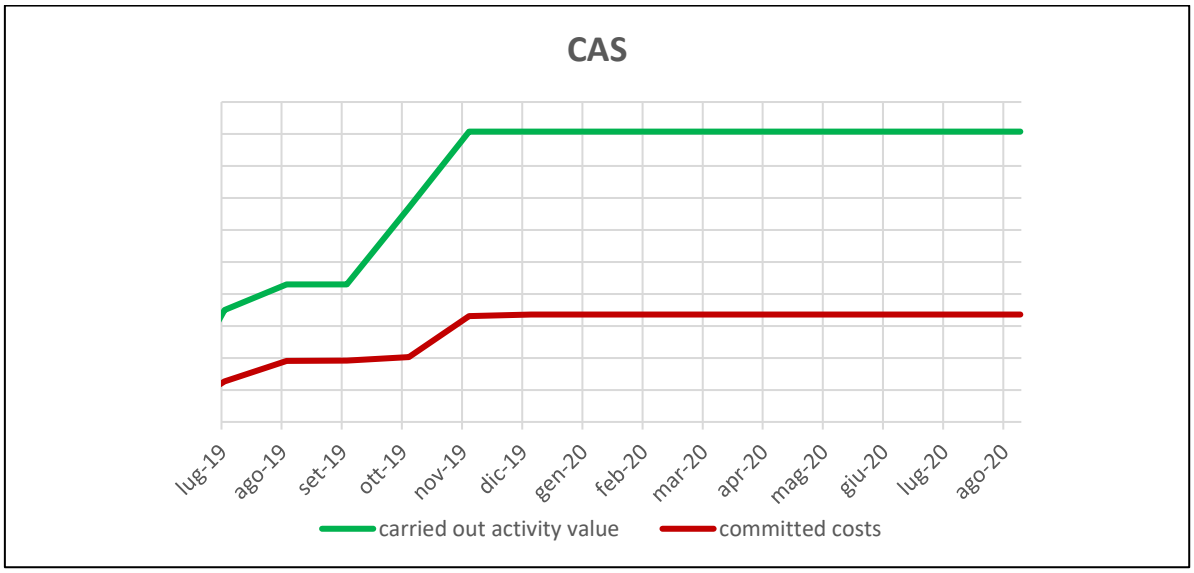


Figure 48: Project 2 CAS activity

CAS activities were good till the project stop in December 2019, obtaining really good performances in term of asset.

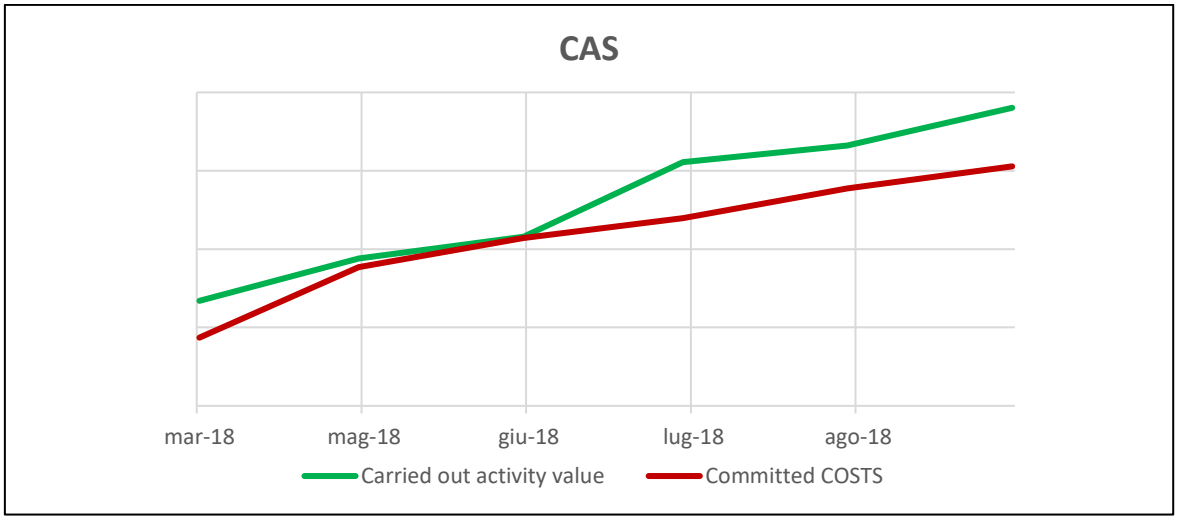


Figure 49: Project 3 CAS activity

Also for project 3, CAS's business is performing very well, with a minimum corresponding to June 2018 in which the two curves almost touch each other, without the costs exceeding the current value of the business.

Engineering Activities

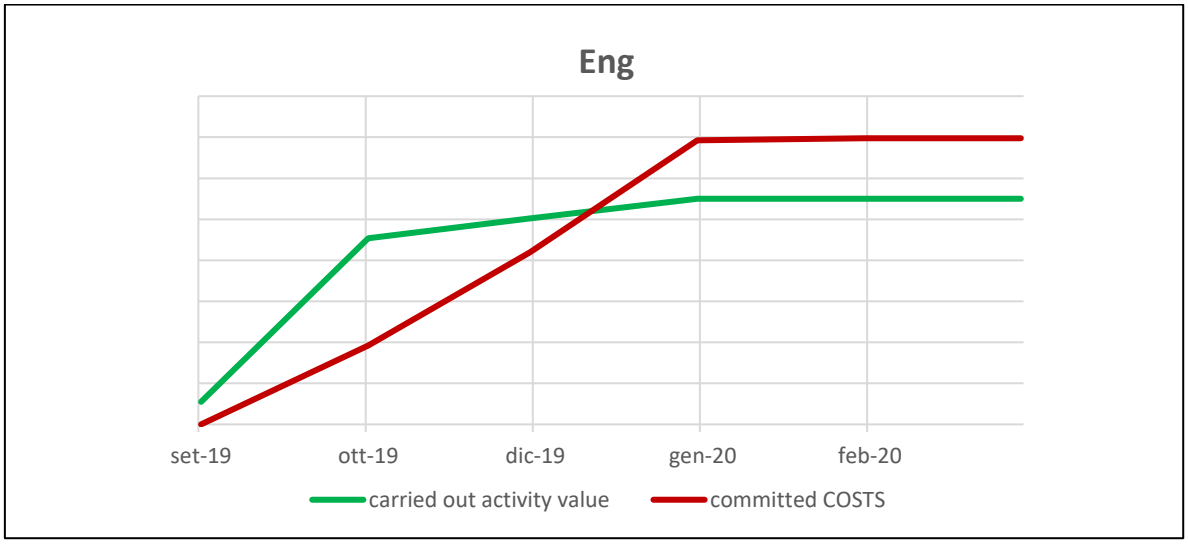


Figure 50: Project 1 engineering activity

Project 1 saw the request for external support on the engineering phase, initially not foreseen. This caused an increase in costs incurred compared to the value of the assets during the second half of the project.

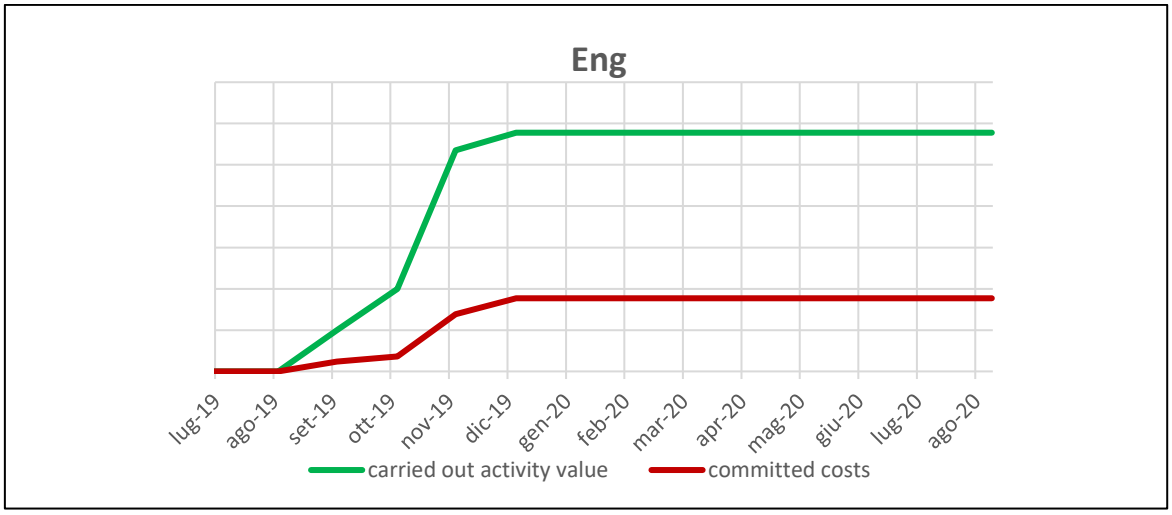


Figure 51: Project 2 engineering activity

Engineering business, as well as CAS, performed very good till the project stop as it is possible to appreciate on the chart.

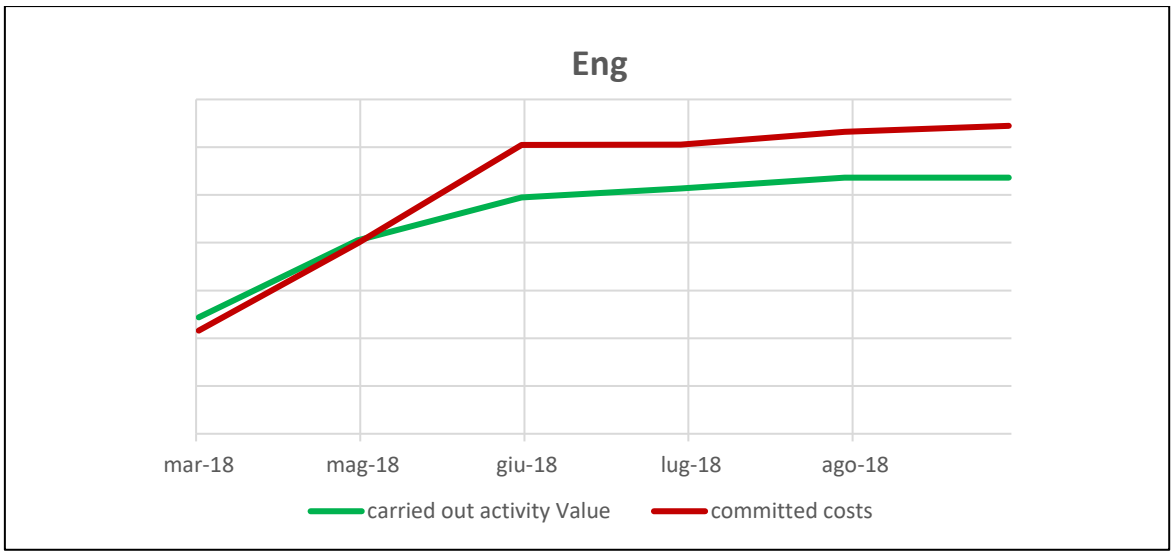


Figure 52: Project 3 engineering activity

During project 3 a variant on feasibility was requested, but it was not sufficient to recover the gap between the cost of the asset and its value.

Model Activities

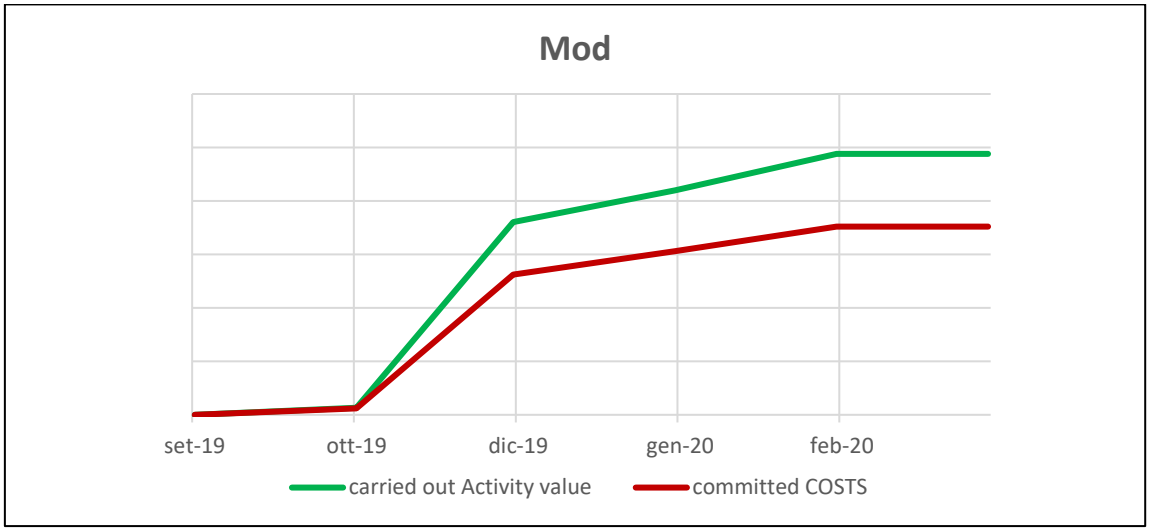


Figure 53: Project 1 model development

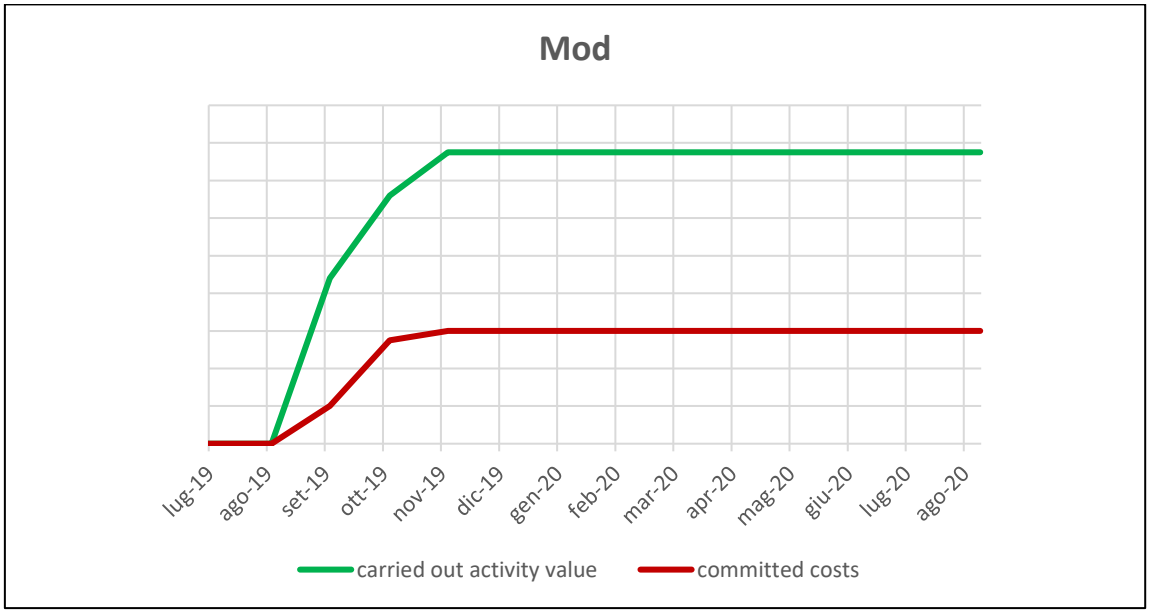


Figure 54: Project 2 model development

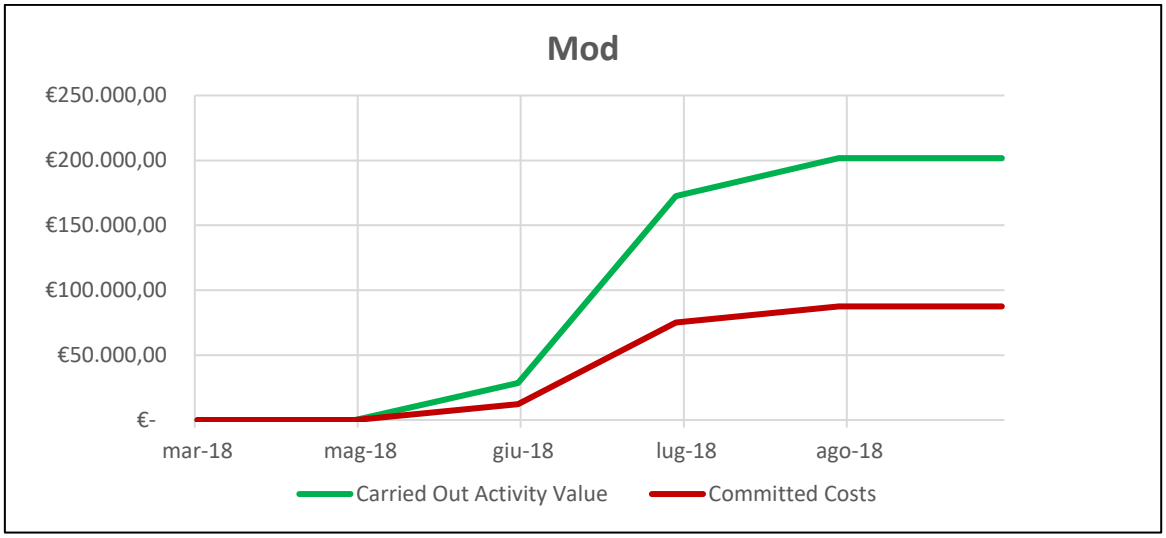


Figure 55: Project 3 model activity development

The development activities of the physical model show a decidedly virtuous trend, claiming at all times a value of the work carried out that is higher than the costs incurred.
It should be noted that the suppliers are not the same for all projects, so it is difficult to objectively compare the trends represented in the three different graphs.

It is immediate to observe how the style activity is the most delicate, followed by engineering. As already mentioned in some observations, the client's conduct can partially explain this trend, but from an internal point of view what could be the weak points to improve?
Looking at the trend as a function of time, there seems to be a growing criticality with the succession of activities. The analysis developed in chapter 3 shows that the concept identification, planning and scheduling phases are in line with classical project management theory and sufficiently standardised within the company. It seems therefore legitimate to think that the phase to be analysed with greater interest is the monitoring and control phase. This part of the project management is carried out daily by the project managers, dealing only individually with the various department heads regarding the progress of the work and any new inputs obtained by the client during the update meetings. This approach allows project managers to have continuous contact with the individual activities, but does not allow department heads to have an overview of the progress of the current project. Since the internal division of tasks and activities within each department is not regulated by the project managers, and considering the close links between the different departments during the various phases of project development, this situation can create inefficiency. In fact, department heads do not have the possibility to better organise work in synergy with the timing and needs of other departments.
This anomaly could cause difficulties of exponential intensity during the succession of activities.

4.1.3 Audit activity

In order to verify the hypothesis just described and propose a solution based on the classical theory of project management, it is necessary to have a picture of the internal dynamics of each department as objective as possible.

After a first phase characterised by personal interviews with the department heads and senior members of each department, useful to go deeper into the internal dynamics, it was decided to carry out a survey, asking the staff a series of questions concerning the management of the activities.

It was decided to proceed in this way in order to structure the questionnaire starting from the problems that emerged during the individual interviews, thus allowing the answers to be standardised. In fact, during the first phase each employee answered subjectively, using each question as a useful opportunity to express a personal point of view on the dynamics in question.

The structure of the questionnaire is as follows:

- Selection of the department
- Answer to the following questions using the proposed scale, allowing a neutral position and for possible degrees of appreciation. [20]

The turnout was over 70%, figure 56 shows the results. As it possible to see, the pie chart in figure xx shows the percentages of the total corresponding to each department.

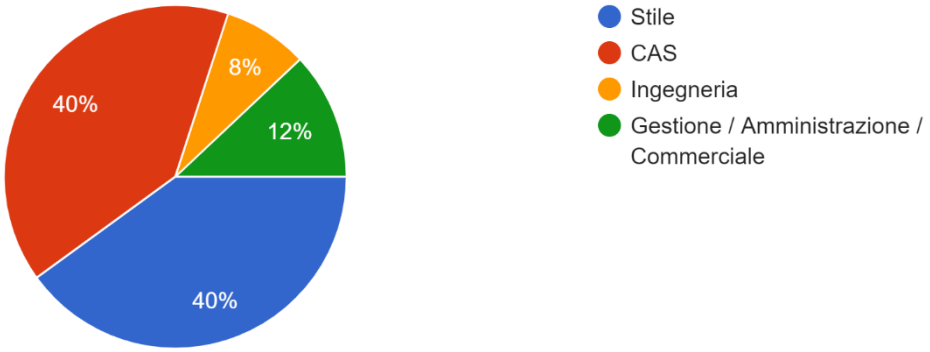


Figure 56: Audit results

In the following, questions and related answers are represented. Each question was written trying to find out possible confirmations or denials in reference to section 4.1.2 final considerations.

1. Do you think that greater and more constant communication between Project Managers and departments can facilitate the performance of activities?

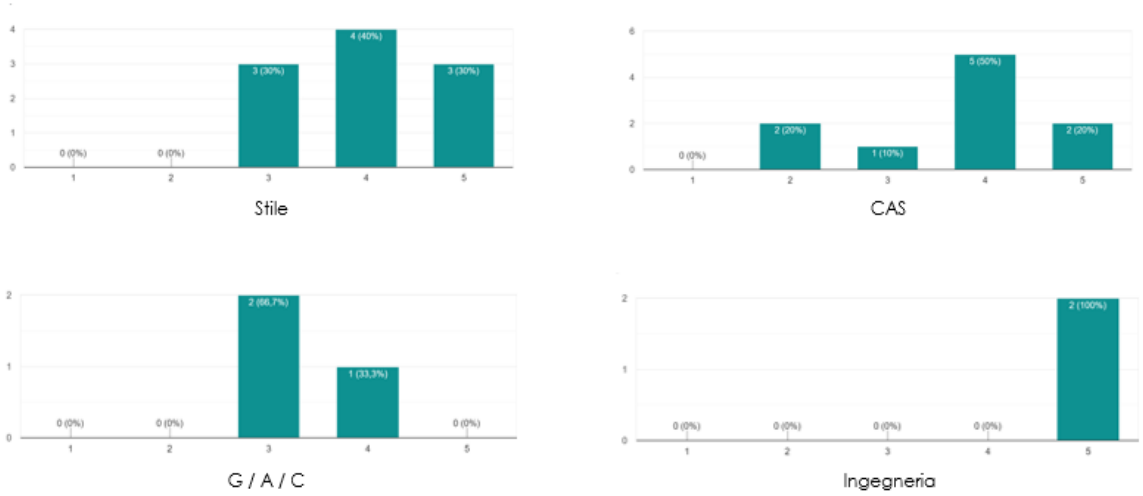


Figure 57: Question 1

the style department seems to have a greater need for contact with project management

2. Do you think that spending more time analyzing client input could help to better understand the work objective?

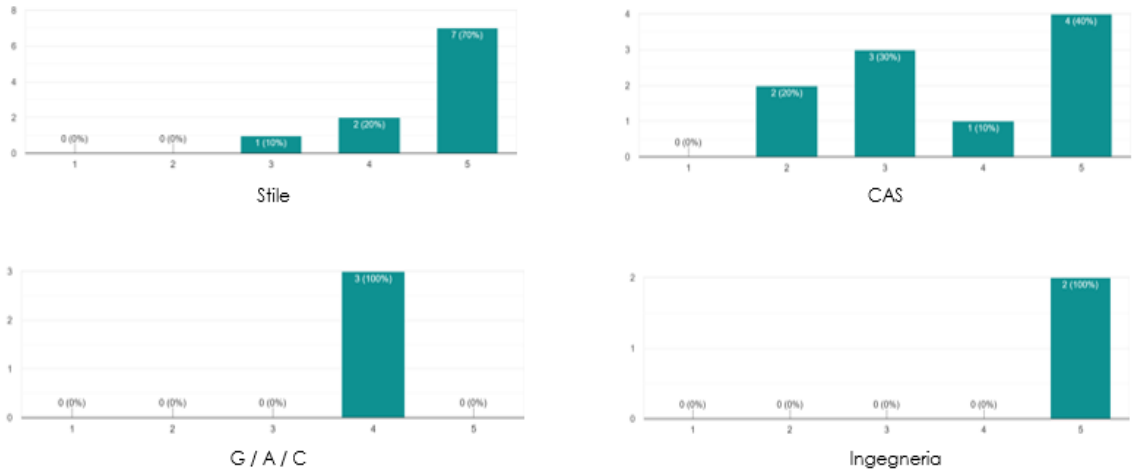


Figure 58: Question 2

It is not surprising how well the style and engineering departments respond, as they are the first to work on the project from a chronological point of view and therefore the most sensitive to the quality of the input provided by the client, especially during the initial phases.

3. Do you think that having a clear and communicated deadline could facilitate the performance of activities?

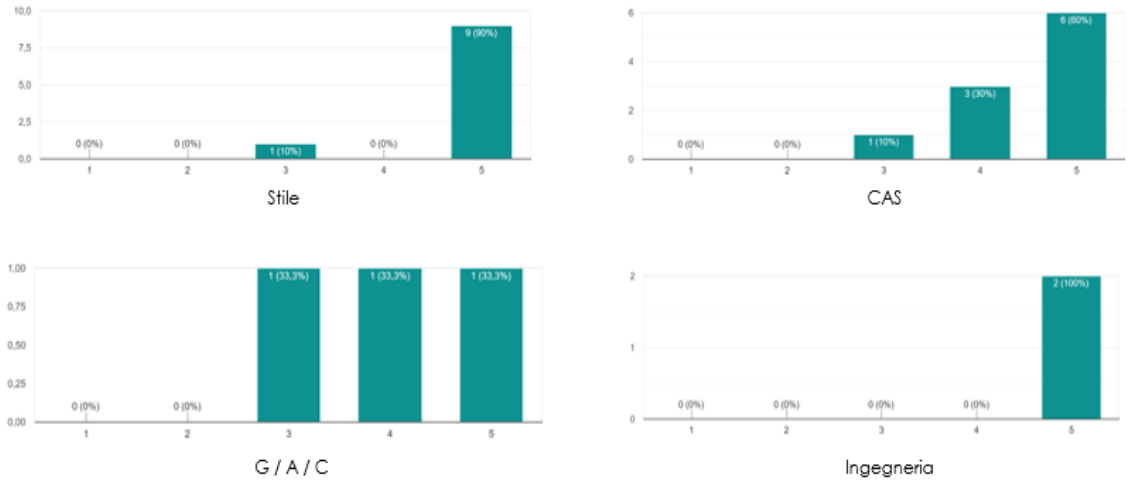


Figure 59: Question 3

A lack of information on activity planning seems to be perceived across all departments.

4. Do you think that a clearer division of tasks and responsibilities within your department could make it easier to carry out activities?

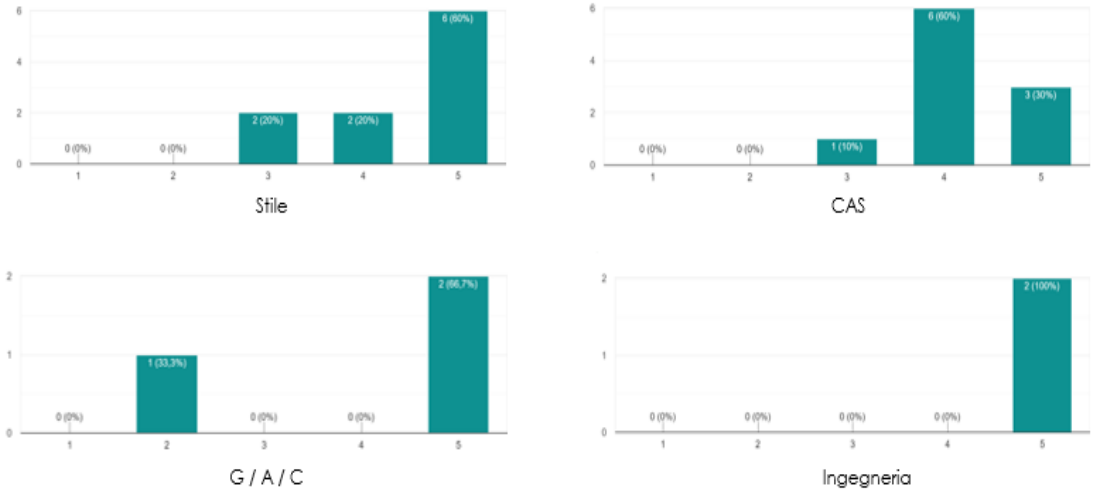


Figure 60: Question 4

The trend of these responses is extremely interesting when put in relation to the previous ones, considering that a clear division of tasks within a department is one of the main ways to optimize time and, consequently, costs.

5. Do you think that more standardized and equal working methods for all members of the department could facilitate activities and material management?

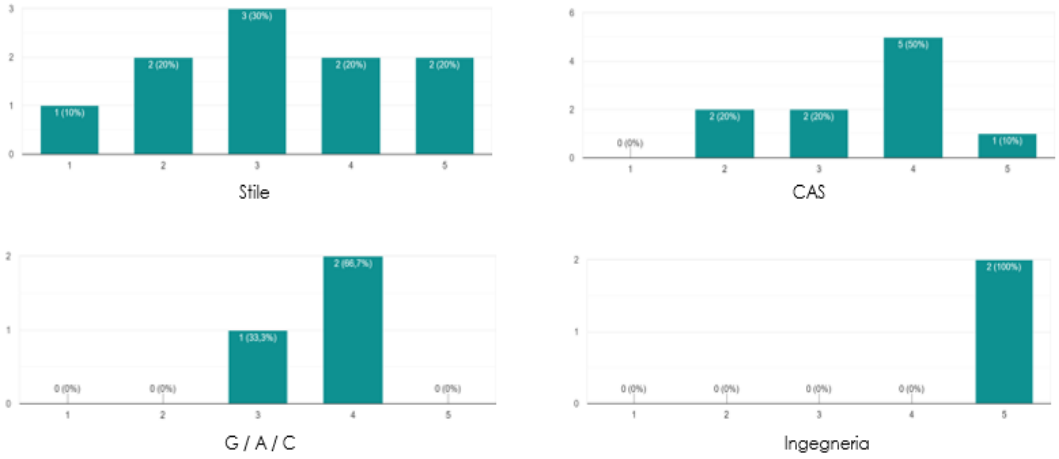


Figure 61: Question 5

The results obtained in this series of responses are of decisive interest. According to classical project management theory a process should be as much as possible made up of activities that can be repeated and standardised [2]. This not only makes execution easier, but also significantly reduces the time and margin of error, thus generating savings in economic terms.

The style department seems not to perceive this strong need, and this certainly leads to an increase in timing and consequently costs within the department, which could be a cause of the less virtuous trends of the carried out activity and cost curves.

6. Do you think that a weekly alignment meeting would help the activities?

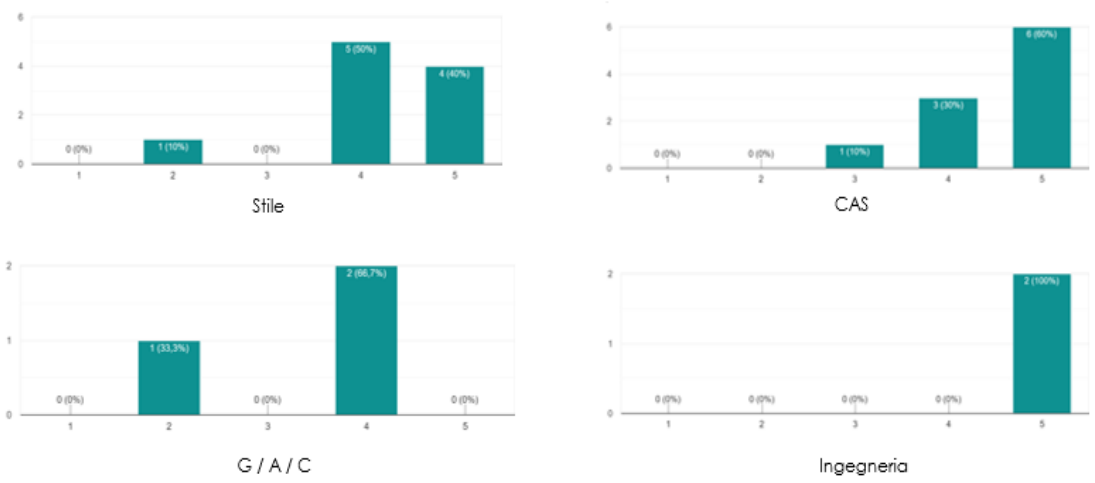


Figure 62: Question 6

The results obtained in this question, as well as those observed with respect to the planning of the activities, suggest a marked lack of time devoted to aligning the status of the activities in a shared manner.

7. Do you think sufficient time is devoted to analyzing the results obtained at the end of each project?

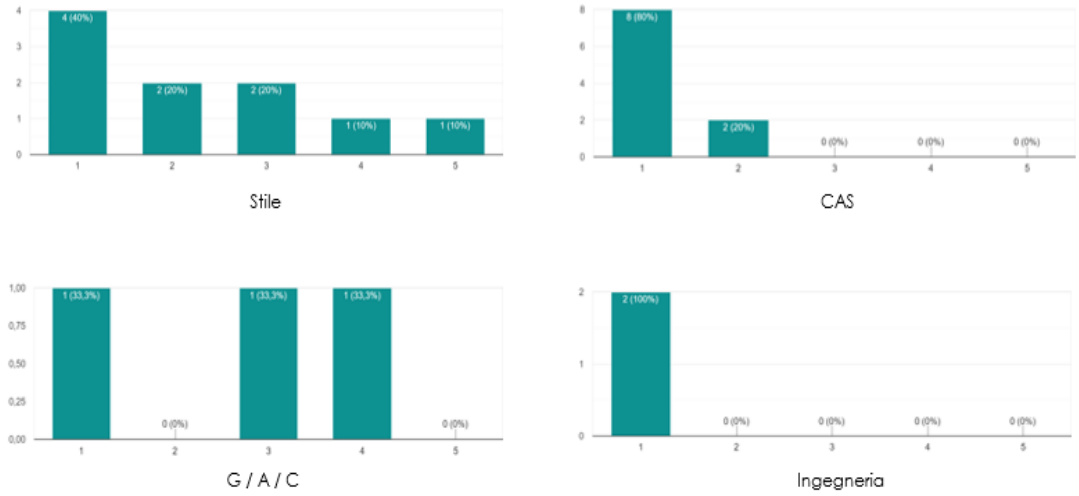


Figure 63: Question 7

The answer to this question reflects the attitude adopted by most companies in the industrial sector, as mentioned at the end of chapter 3.
Collecting the results obtained at the end of a project and drawing up reports makes it possible to create a database useful not only for future generations of project managers but to avoid repeating the same mistakes in future projects.

The results obtained seem to support the hypothesis formulated in paragraph 4.1.2, suggesting gaps not only in the activities strictly related to project management, but also in the internal structure of some departments, in particular style and engineering.
As described in chapter 2. The hierarchical organisation and division of tasks within departments is established by the department head. In these terms it is interesting to recall the internal distinction between style and SAC departments.

- **Style**: The hierarchical organisation within the department is purely horizontal, characterised by strong flexibility and fluidity. In fact, senior figures can have weight over colleagues depending on the company's needs. The style director assigns different roles and involvement to the chief designers according to the needs of the moment and to better support the product development.
- **CAS**: The hierarchical organisation of the CAS department is vertical, more structured than that of the style department: the director assigns reference roles for each type of activity carried out, subdividing first of all between internal and external development and then by components to be developed in the form of 3D mathematics. The work areas within the department are separated under normal conditions but are flexible if necessary.
  This pyramidal structure gives the members of the department a level of responsibility commensurate to the degree of experience acquired, distributing the workload in a standardised manner.

The vertical organisation of CAS's department therefore seems to lead to better results by analysing both trends by activity and employee responses.

4.2 External analysis

As already mentioned in paragraph 4.1, one of the main problems encountered in the management of activities is the analysis of inputs and the management of variants. This aspect largely involves the client's conduct rather than the Managers' ability to manage the initial phases of the project.

According to Giuliano Biasio, an established personality in the world of car design and style director at TORINO DESIGN, the client's inability to give precise inputs is one of the main problems in the contemporary car design scene. There are two fundamental reasons for this situation:

- The first is inherent in the nature of the style project. Very often, in fact, the client does not know what he wants, and on the contrary, he seeks stylistic advice as a source of inspiration to start conceiving the new product.

- No less, the output of the style phase coincides with the first moment in which an idea born in the client's mind takes shape in the real world. This phase is of extreme delicacy, often the concrete expression of the idea present in the client's mind does not express the same emotion, even if it perfectly conforms to the input provided. This is one of the main reasons that characterize the continuous refinements to which the style department is subjected.
- The second is of a professional nature. More and more often it happens to collaborate with clients from emerging countries, with a great availability of resources but without know-how. It is very difficult to work with people who are not familiar with the production phases and the implications that derive from them.

The client's conduct also plays a fundamental role in variant management.
Very often, in fact, the client tries to obtain as many modifications as possible, or even entire rounds of style review, without recognising them as variants.
According to Roberto Piatti, TORINO DESIGN CEO, this lack of professionalism and work ethics is explained in part by the lack of know-how in emerging countries as described above, but also by an increasingly marked devaluation of style activity that has been going on for several years within the sector.
The unfair competition carried out by several competitors in the world of car design has led to a progressive decrease in the quality of work in its various phases, from the search for style to the final rendering. In fact, drawings and mathematical surfaces should be commissioned to trainees instead of qualified personnel, greatly lowering the costs incurred by the style centre but, inevitably, also the quality of the work obtained.
This has caused a progressive devaluation of the style activity in the eyes of the client, who therefore tends not to give it the right weight in economic terms.

In this panorama, a careful analysis of the contractual conditions has therefore begun, with the intention of strengthening any clauses aimed at protecting the company from changes in the client's decision making.

4.2.1 Contract analysis

For each of the three projects, the respective contracts were analysed, evaluating all the clauses describing the inputs and variants.
At present, the clauses in force on the different types of contract proposed for the interior and exterior style proposals are as follows:

Styling Proposals:

- *First Round: TORINO DESIGN will present n.6 styling themes in the form of colored sketches, each theme will include 1 view (¾ front) and a styling proposals description report.*
  XXX Top Management will choose 3 of the 6 styling theme or a mix of the above to be further developed.
  Each of the 3 styling themes selected above will be further developed so to incorporate all the comments received from XXX Top Management.
- *Second Round: TORINO DESIGN will present n.3 updated exterior styling themes in the form of colored renderings, each theme will include 3 views (front, ¾ front, side).*
  XXX Top Management will choose 1 of the 3 styling theme or a mix of the above to be further developed.
  The selected final styling theme developed will be further refined so to incorporate all the comments received from XXX Top Management.
- *Final Round: TORINO DESIGN will finalize the selected styling theme in the form of refined renderings that will include 3 views (front, ¾ front, side).*

These clauses are clear and explicit as regards the numbers of proposals for each round, but leave freedom of interpretation on the mix of proposals.
With a view to limiting the client's ability to take advantage of this aspect, should be useful to update the contractual terms and conditions. In chapter 5 the suggested updates will be described and discussed.

4.2.2 Invoices analysis

Within the summary, the dates of issue of invoices and the dates of receipt of each payment are shown in a separate table. However, only the data relating to payments received are taken into account in the chart. Furthermore, the trend of the curve is approximated to linear, thus distorting the perception of economic coverage in certain phases of the project.

When comparing the costs incurred and the present value of the assets, it is clear that only the value of the payments received is of interest. However, in order to carry out a more detailed analysis of the client's conduct and to try to prevent future risks related to late payments, it may be useful to assess the time relationship between the issue of invoices and receipt of payments. In this regard, special diagrams have been constructed, shown below for each project analysed.

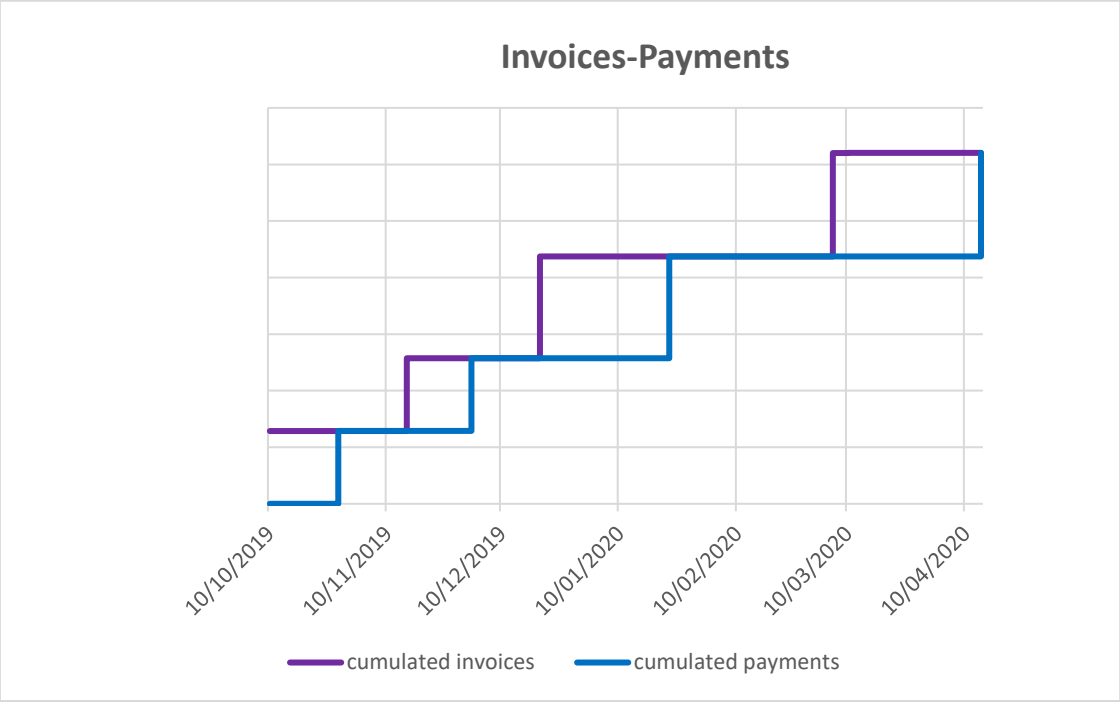


Figure 64: Project 1 invoices & payments

Project 1 was commissioned by a European client. This is an important aspect: the organisation within Western companies, even if partially controlled by the government, allows for greater speed and ease of operation in terms of approval and issuing of payments. This is easily appreciated on the chart: infact, there are no more than 45 days between invoice emission and payment receipt.
The timing of the review of intermediate project objectives is also leaner and faster in Western companies.

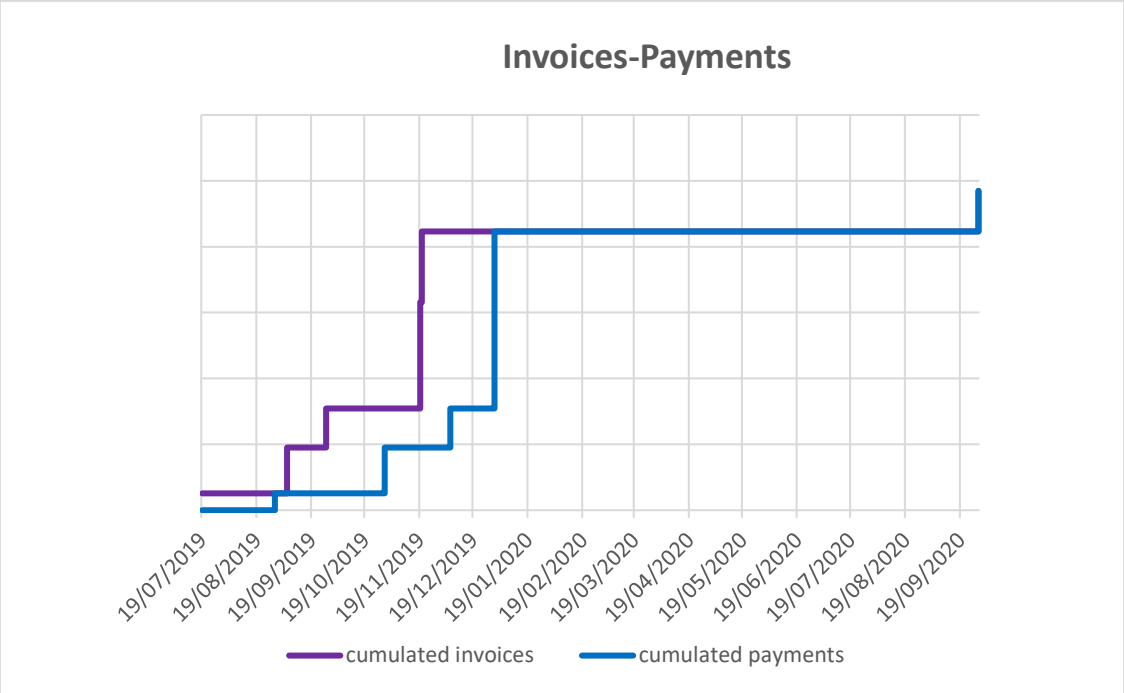


Figure 65: Project 2 invoices & payments

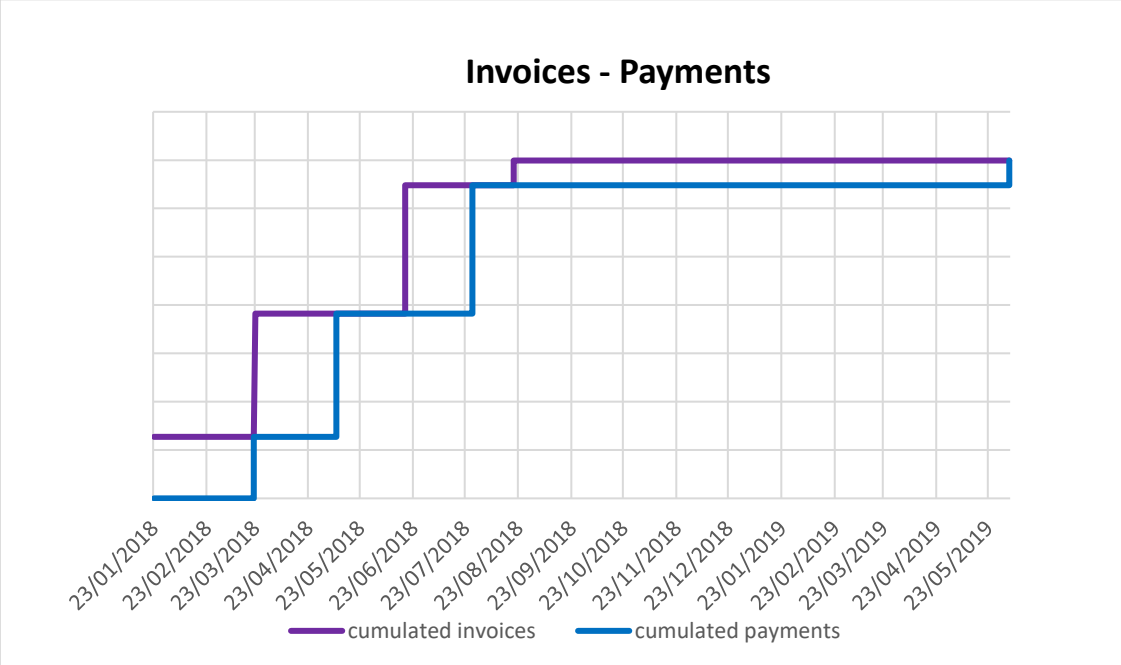


Figure 66: Project 3 invoices & payments

The final part of the two graphs shows a long period of deadlock due to the ongoing litigation between party a and party b caused by the closure of the project before the end.

However, the time lag between one payment and the next throughout the initial phase of both projects is acceptable, especially considering that the projects were commissioned by companies in the Far East, often partially owned by the government.
it is important to underline that the premature conclusions of both projects were caused by changes of direction within the client companies, and not by negligence on the part of TORINO DESIGN.

4.3 Final considerations

The analysis and studies carried out in section 4.1 and 4.2 provide interesting elements on which to base proposals for improvement related to monitoring and controlling activities and contractual aspects. For the sake of completeness, the results that can be extracted from this analysis will be commented on in chapter 5, together with the reflections deriving from the comparison between the project management analysed in chapter 3 and the classical theory described in chapter 1.

5 CONCLUSIONS

This chapter provides a concluding reflection on the differences between TORINO DESIGN project management activities and the classical project management approach, trying to suggest useful additions to the current detailed and professional way of management. Moreover, starting from the results obtained in the project management analysis described in chapter 4, a completely new risk management approach will be proposed.

5.1 Benefits in term of Project Management and Risk Management

5.1.1 Project identification and definition: feasibility analysis

As mentioned in paragraph 3.1, since the services provided by the company do not meet marketing aspects, SWOT analysis is not used. However, if we consider the theoretical definition of SWOT analysis, it would be useful also for a style centre like TORINO DESIGN to evaluate the 4 aspects (strengths - weaknesses - opportunities - threats) every time a new project starts.
An analysis of this kind, carried out during the project identification phase, would make it possible to clearly define what the company's strengths may be in the development of the work required, organising the planning and scheduling phases accordingly. In the same way, making the potential weaknesses of the company explicit would allow a more careful and targeted management of the risks linked to these weaknesses along the whole path of the process.

5.1.2 Planning

Within TORINO DESIGN, as expressed in section 3.2, RBS is not used because the site where the project is taking place, the equipment being used and the team that is executing the project are fixed, and also because project managers are not in charge for resources management within the different departments.
It is interesting to recall the classical RBS definition, as written in chapter 1:

A resource breakdown structure is a list of the resources that will be required to execute your project. The list is broken down by function and type, and at the very least will cover the people needed to complete a project successfully. However, at its most thorough, it will include anything you spend money on for the project, such as people, project management tools, equipment, materials, even fees and licences.

Considering also the outcome of the responses obtained within the survey (chapter 4) regarding the internal division of tasks within each department, the inclusion of an RBS drawn up by project managers together with department heads could be useful.

The use of a defined RBS for each single project would allow to verify in a more precise way that the already excellent planning activity carried out by TORINO DESIGN allows to reach the following benefits:

- Identify the responsibilities associated with each activity.
- Achieve an overall reduction in project duration.
- Allow an integrated view of each activity, facilitating communication.
- Easy verification of project progress.
- Facilitate the control and monitoring phase by identifying the most critical activities. This aspect allows to decide how and with what degree of flexibility to allocate resources.
- Explicit the constraints linked to contractual conditions, in order to better manage relations with suppliers and clients.
- Identify the set of activities that can be standardized and repeated.

5.1.3 Monitoring and Controlling

Starting from the analyses carried out in chapter 4 it is possible to extrapolate a series of objective parameters relating to internal and external factors that could be used to further standardise the monitoring and controlling activity already carried out by the company.

Internal parameters

- The carried out activity and cost charts for each activity allow you to easily define the distance between the two curves at any time. The distance between these curves on the Y axis can be an extremely useful parameter for programming the following corrective actions:
    - intervention on the division of tasks and activities within the department
    - decision of the reference topics to be dealt with during the update meetings

  As the distance between the curves on the Y axis decreases, corrective actions must be planned with increasing priority. As the distance along the ordinates decreases, the correlated risk index increases from green to red.
- In the summary graphs only the cumulative value of the costs incurred is considered. The comparison between BCWS (Bundget Cost of the Work Scheduled) and BCWP (Budget Cost of the Work Performed) is not considered. Some information related to these two parameters is present in the Global Program Plan, but the comparison is less immediate.

A tool that allows the graphical comparison between BCWS, BCWP, ACWP would allow to define the following corrective actions:

- act on the speed of internal execution of tasks
- assessing whether to apply for a variant or not

As the distance between the curves on the Y axis decreases, corrective actions must be planned with increasing priority. As the distance along the ordinates decreases, the correlated risk index increases from green to red.

External parameters

- The graphs of invoices and payment allow you to easily define the distance between the two curves at any time. The distance between these curves on the X axis can be an extremely useful parameter for programming the following corrective actions:
  - comparison with historical data relating to that customer, useful for estimating its payment behaviour
  - solicitation to respect the contractual deadlines

  As the distance between curves on the X-axis increases, corrective actions must be planned with increasing priority. As the distance along the abscissae increases, the correlated risk index increases from green to red.
- Setting a series of pre-established check points in which to check the progress of the model with respect to a specific programming could give as an output a time gap useful to objectively define the risk of error linked to the milling activity.
- Financial exposure can be expressed as the vertical distance between cost and revenue lines on the summary charts. The distance between these curves on the Y axis can be an extremely useful parameter for programming the following corrective actions and analysis:
  - solicitation to respect the timing established in the contract
  - continuously evaluate the economic consequences of premature project closure

  As the distance between the curves on the Y-axis increases, corrective actions must be planned with increasing priority. As the distance along the abscissae increases, the correlated risk index increases from green to red.

All the results collected from these parameters could also be useful during the alignments. Establishing a weekly alignment between PMs and department heads could help monitoring and controlling activities along the whole project duration. It would allow to refine scheduling and prevent any emerging risks more effectively. Moreover, department heads could have a complete overview of the progress of the current project, with the possibility to better organise work within each department in synergy with the timing and needs of other departments.

This certainly would help project managers in respecting the planning.

5.1.4 Results collection and closure phase

Giving more weight to the conclusion phase of the project allows the following aspects to be clearly assessed and analysed:

- What was good
- What was bad
- What could be done even better

This activity leads to the creation of a dedicated database with the history of all the project performed by the company. Such an instrument, allows future managers to learn from previous mistakes, trying not to repeat them.

On this occasion it would also be possible to thank the people who worked on the project.

At first glance it might seem a minor aspect, but enhancing the work of the employees increases self-esteem and confidence in the team, both key aspects to achieve maximum performance by the staff.

5.1.5 Risk Management

The considerations carried out so far revealed the main risks associated with the management and conduct of the client's activities. The objective parameters described in section 5.1.3, are useful to identify the possible emergence of the risks and plan the necessary corrective actions to preserve the timing and margin foreseen for the project in progress.

It is also worth dwelling on the possible risks linked to the milling activity of the model, since it is an activity carried out externally, the problems that may arise around it afflict TORINO DESIGN in terms of time. A delay in milling the model may be due to two main causes:

- Model execution error, not foreseeable or avoidable by project managers.
- Difficulty in acquiring input data provided by TORINO DESIGN regarding materials, components and geometries. This second cause can be partially controlled by the Management trying to standardise the data transmission approach as much as possible.

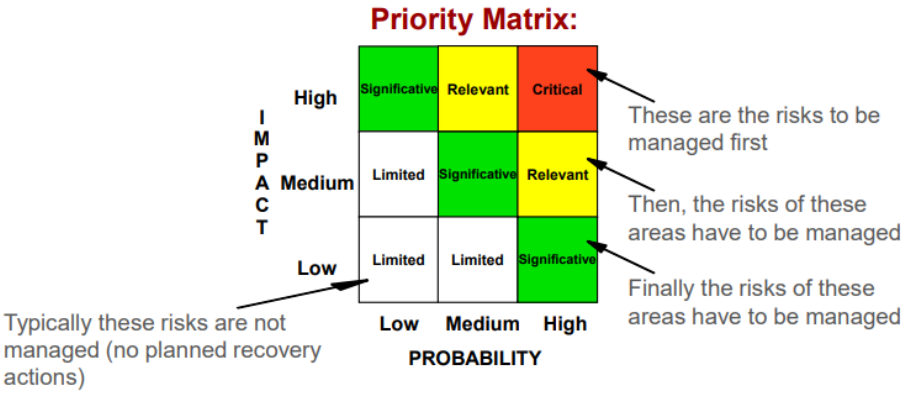
Priority Matrix

The parameters defined so far, accompanied by the relative intensity index, are useful for constructing the Priority Matrix, described in chapter 1. Each parameter previously described, based on the assumed value, will fall into a specific category.

A practical example can be made using the parameter linked to the carried out activity and cost curves.

The values proposed are purely illustrative, they should be established by project managers for every single class, related to every single parameter.

- A distance between the curves between 0 € and 5000 € corresponds to a red risk index.
- A distance between the curves between 5000 € and 10000 € corresponds to a yellow risk index
- A distance between the curves between 10000 € and 15000 € corresponds to a green risk index
- A distance between curves between 15000 € and 20000 € corresponds to a risk index White

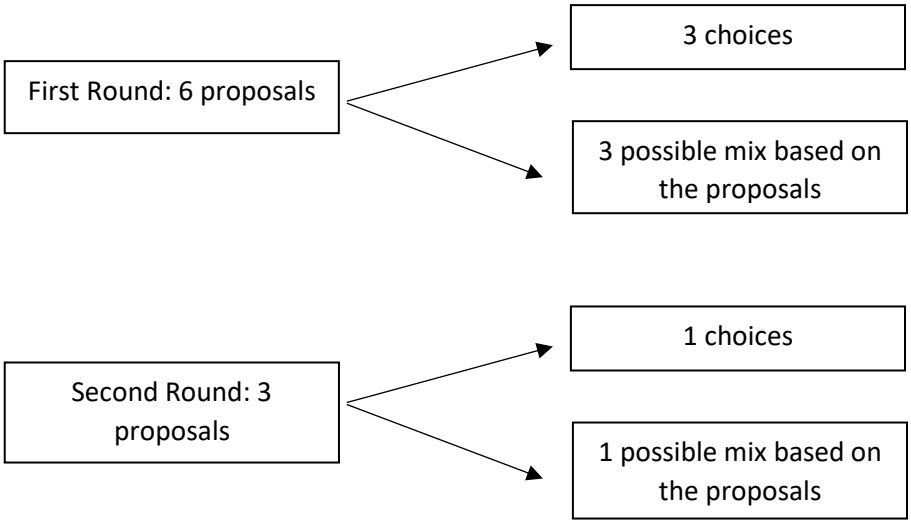


A constant use of the priority matrix would allow a more standardised risk management throughout the duration of the project.
By defining the ranges of values in a conservative way, project managers would have the possibility to plan corrective actions more in advance, reinforcing the prevention approach.
It would therefore be simpler and faster:

- Evaluate the performance of each department in a timely manner.
- Always evaluate the economic advantage or disadvantage that would result from premature project closure.
- Check the milling progress of the model. Predefined checkpoints combined with a list of standardised inputs and specifications agreed with the supplier would also allow standardisation of the activity.
- Collect data useful for profiling the customer. This would allow for maximum customization of the approach strategy with the client, setting ad hoc contractual constraints in order to protect the company's position as much as possible.

5.1.6 Contractual aspects

With a view to limiting the client's ability to take advantage of this aspect, could be useful to update the contractual terms and conditions using the scheme below:



Within the contract related to Project 1, paragraph 2. "Subject of the Agreement" there is the following clause:

In the event that XXX shall request a change to the extent of the wok to be performed by Designer under this agreement, either to a given Phase or to the entire Project, XXX shall notify the Designer in writing of the nature and extent of the change. The Designer shall evaluate, within 3 working days after receipt of such notice, the likely effects of such change as it is specified in such notice and shall advise XXX in writing of the effects (if any) of such change in terms of:

- *Changes to the project schedule, i.e. the time limits (if any)*
- *Changes to the remuneration (if any), considering the maximal rates of remuneration indicated*

Within 5 working days of receipt of such advice from the designer, the parties shall negotiate in good faith the changes referred to in the section above.

this paragraph should be included in every type of contract, because it clarifies and protects the company's position in a way that leaves no room for interpretation to the client.
Within the same contract, paragraph 3. "Performances of the Agreement" there is the following clause:

The language of the implementation of the agreement shall be English. This also applies to all the communication between the Parties. All Deliverables and other results of the performance of the agreement by the designer – unless the Agreement provides otherwise – shall be delivered in English.

This clause makes it possible to formalize communications between the Parties and limits the possibility of misunderstanding.
Very often when translating documents from a third language into English and then from English into Italian, inconsistencies or discrepancies may arise due to different interpretations of a judgment. This not only generates a waste of time within the Management and Business Development department, but also opens up a number of possible inaccuracies related to input data useful to the Style department.
The contract linked to Project 1 has a final important paragraph in Annex 7. "Key team members and communication":

The Parties undertake to meet or schedule a conference call not less than very 2 weeks.

Moreover, it is useful to refer to the clause present within the contract 2, paragraph 8. "Considerations", which in my opinion should be included in every type of contract, as it makes explicit, in a clearer form than others, the Party's duties regarding payments:

It is understood between the Parties that Party A shall be obliged to pay the instalments at the relevant due date, and Party A shall not be entitled to interrupt, suspend or delay the payment of any single instalment for any reason whatsoever.

5.2 Limits

During the thesis experience, some limits strictly connected to the way the company's activities are managed have been identified. It is therefore appropriate to consider and describe them for completeness.

It may happen that some of the operations highlighted as relevant to improve project performance in terms of time and costs are not implemented voluntarily, by decision of top management. These decisions, the backbone of the entrepreneurial strategy, can in fact condition project management tools in an attempt to pursue objectives of greater importance for the company.
A classic example is the approach and acquisition phase to a new client. In this context, with a view to establishing a lasting and fruitful collaboration, the top management may decide to vary the profit margin on certain activities, thus leaving more room for request to the client.

Most of the time this strategy involves style refinements not foreseen in the contract, thus limiting the use of variants in the initial phases of the project.

Another limitation is given by what can be identified as cultural factors.
Statistically project managers note that a project commissioned by European clients is managed according to planning and internal budget in 90% of cases. A project commissioned by Chinese clients achieves the same results in 30% of cases [21].
Very often, the reasons for this diversity are to be found within the socio-political differences in Western and Eastern cultures. Chinese companies have a hierarchical organisation that is very different from western ones, especially in terms of responsibility and decision-making power. An internal division of tasks is always subordinate to top management, which is why all management figures in charge of the current project avoid expressing themselves or taking positions. In addition, companies that are partially owned by the government are further slowed down by longer bureaucratic procedures regarding the issuance of payments and the evaluation of interim reviews.

Another important aspect related to cultural and strategical aspects deals with the contractual proposals explained in section 5.1.6. Often, the company choose not to be too tight in writing the contractual clauses not to lose the potential client. In fact, many competitors propose contracts with even less restrictive clauses than those currently adopted by TORINO DESIGN.

It should also be considered that the thesis experience developed in the first half of the CoVid-19 pandemic, a period dominated by a strong precariousness that afflicts the world economic/political landscape. There was therefore a decrease in the workload, forcing top management to operate with a more conservative rather than ambitious approach.

One last important limit deserves to be analyzed: the progress of a specific project cannot ignore the context, i.e. the workload condition in the company.
The way in which the workloads related to each project are added up within the various departments inevitably impacts on resources and their performance.
In a situation where the company works on many projects at the same time, there may be a need to acquire external resources in order to be able to complete the project in the time set, thus generating extra costs that under normal conditions would not be foreseen.
Also, the absence of work can generate loss in economic terms. In this condition, it may happen that more resources than necessary work on the project to avoid unproductive resources within the company, this means extra hourly rate for each activity.

5.3 Future, possible TORINO DESIGN steps

With reference to what expressed in section 5.1, the company could consider the inclusion of some innovative aspects within the activities carried out in the project management sphere.

Using the proposed risk matrix would allow the Project Management department to prevent more risks and criticalities linked to the entire pattern of activities carried out by the company, thus favouring an approach more focused on prevention and not on correction.
Another significant step could certainly be to devote more weekly time to alignment between departments. Creating an overview of the project within all the key figures at the head of each department could certainly bring benefits in terms of internal work planning, as expressed in section 5.1

Talking about Management tolls, Substituting Global Program Plan sheet and Final Work sheet with a single work excel file that contains all the information useful for managing the projects could be considered.
The resulting file will certainly have a more complex structure, but once created it would be easier to monitor and control the projects.
This file could consist of a first sheet with the same structure as the Global Program plan, which therefore has a summary function and helps to have an overview of all the projects in progress. Then there could be a sheet for each project in progress, concentrating inside it all the information present in the current Final Work sheet.
Each of these sheets cold have the information described in section 3.4 and, in addition, the charts that were built for the analysis developed in section 4.1.2 and 4.2.2. Doing so, in each single sheet could be possible to visualize the whole path of information related to a single project.
Thus, creating a common template with a fixed excel structure would allow, once the sheet has been created, to simply add the input values, automatically filling in all the other cells.

The updating and management of the proposed excel file would inevitably take time, as it already happens for the two excel files used. For this reason, the inclusion of a PMO (Project Management Operator) would greatly lighten the workload of project managers, who could then focus more on activities' monitoring and control strategy and especially on the use of Risk Matrix to prevent the occurrence of risks as much as possible. Moreover, the PMO could also take care of the presentations drawn up for each customer release.

With reference to the limitations described in section 5.2 regarding cultural and strategic factors, the company could consider the full-time inclusion of a Chinese resource within the business development department.

This would allow for a more streamlined and effective communication with all clients from china, who currently cover an important percentage of the company's portfolio.

Finally, by cross-referencing the results obtained from the analysis carried out in section 4.1.2 with those obtained from the survey proposed in the section 4.1.3, the company could consider a slight change in the hierarchical structure of the Style department.
If we consider the results obtained by the CAS department in the same sections, we note how the identification of some reference figures below the head of the department facilitates the performance of the activities, allowing standardization and a shorter execution time, thus obtaining lower costs.
it is therefore fair to assume that the same organisation can also be proposed within the style department.

Acknowledgements

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