



UNIVERSIDADE CATOLICA PORTUGUESA

Project management applied to investments in Production Fixed Assets

Case study: Sonae Arauco

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Católica Porto Business

School 2022



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Executive Summary

This dissertation in form of a case study discusses the applicability of project management methodologies to fixed asset investments in the context of a fixed asset-heavy company. The focus of this study is set on finding key project management aspects such as KPIs, metrics, scheduling and goal setting and verify its application on an investment made by Sonae Arauco. This case study is aimed at both undergraduate and graduate students in the field of business taking a view at several areas such as finance and management. In addition to the case study itself, this dissertation provides an extensive literature review which introduces the need for project management in the everyday business. The thesis at hand is roughly composed of three parts: the first one is to raise awareness to project management methodologies and their wide applicability in the business world. Second is to identify key project management tools utilized by Sonae Arauco. Third, to verify the relation between theory and reality and to provide constructive criticism and praise where its due. The culmination of these three parts show how vital project management can be to create the maximum amount of value possible with an investment.

Key words: KPI, Metric, ROI, Project Management, Investment, Fixed asset

Word count: 6828

Sumário Executivo

Esta dissertação, sob a forma de caso de estudo, discute a aplicabilidade de metodologias de gestão de projeto a investimentos em ativos fixos no contexto de uma empresa de índole produtiva. O foco deste caso de estudo é encontrar aspetos chave de gestão de projetos como KPIs, métricas, agendamento e definição de objetivos e verificar a sua aplicação num investimento levado a cabo pela Sonae Arauco. Este caso de estudo é destinado a estudantes universitários e estudantes diplomados que estejam no campo das finanças ou gestão. Para além do caso de estudo, esta dissertação tem uma revisão de literatura extensiva que introduz a necessidade de metodologias de gestão de projetos nas atividades empresariais cotidianas. Esta tese está dividida em três partes: a primeira é para aumentar a conscientização da necessidade de metodologias de gestão de projeto e a sua aplicabilidade no mundo empresarial. A segunda é para identificar ferramentas chave de gestão de projeto utilizadas pela Sonae Arauco. Por último, é verificada a relação entre a teoria e a realidade de modo a produzir críticas construtivas e elogios quando justificável. A culminação destas três partes, mostram o quão vital as metodologias de gestão de projetos podem ser para criar o máximo de valor possível num investimento

Palavras-chave: KPI, Métricas, ROI, Gestão de Projeto, Investimento, Ativo Fixo

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1. Introduction

1.1 Research topic and definition

Production fixed assets in an industrial organization are a vital organ, not only to its profitability but also to its continuity. These kinds of companies put aside a big slice of their yearly budget for investments in assets that aim to optimize operational efficiency, allow the production of new goods, and implement ways to improve operational profitability by reducing variable costs like raw material consumption.

The execution of an investment project in fixed assets is a large scale, complex activity with a well stipulated beginning and end. For that reason, the need for planning and follow-up with project management methodologies emerges. Consequently, the role of project manager and the methodologies used play a key role for the survival and development of a company since they form the bridge that will connect the strategy defined by the top management and its execution.

1.3 Methodology

This thesis aims to evaluate the applicability of project management frameworks in fixed asset investment projects through a literature revision of project management concepts and a consequent connection between it and a fixed asset investment case study. As such, the first step comprised the investigation of themes like the importance of value creation through properly investing and the metrics that should be used in doing so and project management methodologies and tools that would aid said investments in creating value for a company. The second step consisted of gathering all information related to Sonae Arauco that would help this case study such as

company description, their investment procedure (IAAP) and a real-life example of a fixed asset investment, the last two were deconstructed and compared to the theory analyzed in step one, following the base steps of constructing a case study according to Yin (2009).

1.4 Outline

The document is structured as follows. The second and third chapters discuss the theoretical framework in which the thesis will be centered around: value creation through investment, its importance and measurements and project management methodologies. The next chapter introduces the company which investment will be studied. The following two chapters provide an insight into the company's investment procedure and a critical analysis of an investment template that is used by the companies group. The final chapter is the introduction and critical analysis of the investment case.

2. Investments: Forgotten value lever

In 2007, around 11.8\$ trillion was spent on capital investments in the whole world. Despite this fact, literature about capital investment as a value lever is relatively limited. Not only the amount invested is enormous, but its long-term influence on company performance is huge. Since the 90's, asset-heavy companies in the S&P500 have increased their average return on invested capital (ROIC) by 3.8%. Analysis indicates that about half of that growth is related to investment activities (Jiang & Koller, 2006).

Investments are crucial in the optimization of an asset structure of a company or project, but also for the enabling of new product introduction or for the introduction of structural cost reductions.

An investment is not a sure thing, its results depend on a wide range of variables that influence the outcome both positively and negatively. Understanding these variables is therefore critical in assessing the likely outcome of an investment.

Several capital investment optimization projects demonstrate that there is a significant value creation potential in the optimization of capital investments. Results show this potential to be between 15% and 40% of the return on an investment. This comes from three distinct value levers: reductions in the amount of capital invested, acceleration of the production ramp-up and increases in the operating cash flow during the productive life of an investment. (Hansen et al., 2009)

As was stated previously, in 2007 \$11.8 trillion (23% of the world's GDP) was spent on investments. When analyzing the changes in GDP for the 30 biggest countries GDP wise, Hansen et al. (2009) found a 69% correlation between changes in the GDP growth and the gross fixed capital formation (GFCF consists of a country's resident producers' investments, deducting disposals, in fixed assets during a given period).

However, a word of caution is in order, there is a multitude of interdependencies between growth and investment, it's hard to see at first what is the cause or the effect although it's safe to assume that investment is the heart that pumps the economic veins (Sun et al., 2021).

2.1 Investments are a core driver behind recent ROIC increases

Since the beginning of the 90s, there was a continuous paradigm shift in how companies are run: profit maximization is no longer the main objective. Value

creation as taken over as the core metric of company success. How does a company create value? By investing capital at rate of return above their cost of capital. Most common metrics utilized to quantify value creation nowadays is the return on invested capital (ROIC), net present value (NPV) and economic value added (EVA).

This shift in paradigm to a management more focused in the value creation had a significant impact in the ROIC of the S&P500 companies in the beginning of the century, it's median rose from 11% to 26%. This growth occurred despite the fact that sales didn't grow in the same proportion.

Capital investments have been a major driver of this increased value creation. Jiang and Koller (2007) estimated that 48% of the of the mentioned ROIC growth is investment related. This efficiency increase is fueled in part by the increasing awareness of value metrics.

2.2. Company success relies on capital investments

Generally speaking, a company can grow in two ways: inorganically, by expanding its revenues through acquisitions, or organically, by selling more goods or services. Both of which require investment upfront. It is therefore expectable some degree of correlation between the growth in revenues and the capital expenditure of a company, although this correlation might not be perfect, because there are several factors that affect the company's revenues growth such as business cycles or customer preferences.

This correlation isn't palpable in the first years of an investment. Typically, the full impact of an investment takes between 6 to 10 years to unfold. The main

reason for this is the delay between the beginning of the investment and the ramp-up in the production.

3. Project management

3.1 Understanding project management

In the next decades, executives will be facing more and more complex management problems. These challenges will be the result of high demand factors for salaries and raw materials, and pressure from stockholders. These environmental conditions have existed before but not in today's magnitude (Kerzner & Saladis, 2009).

In the past, executives embarked on cost-reduction programs to ease the impact of these environmental conditions. The usual results of these programs have been forced retirements, layoffs, and manpower reductions. As job positions become vacant, executives tried to pressure managers into accomplishing the same results with less resources, either by increasing the performance requirements of the worker, or by improving efficiency. Since people costs are more inflationary than the costs of fixed assets, executives are investing more capital into equipment projects in an attempt to increase or improve productivity without increasing labor.

As a matter of fact, historical evidence provided by Crawford (2005), through a study that involved over 200 project personnel from three countries (Australia, United Kingdom and United States of America), suggests that project management is not perceived by business managers as competent to manage the total process, because it does not possess, articulate, and demonstrate an understanding of and competence in all the elements

necessary. After a few years, managers observed that productivity increase only through brute capital investments were very limited in terms of adding value to a company.

Today's executives are somewhat in agreement that the solution to most corporate management problems involves looking internally for better use and control of the existing resources instead of acquiring new ones. One of the techniques under consideration for this procedure is project management.

The project management approach is relatively modern. It is described as a way of achieving better control and use of existing resources through the reorganization of management and adapting special management techniques (Slack et al., 2016).

The rapid growth rate of both the markets and technology have bolstered the straining on existing organizational forms. The traditional structure is highly bureaucratic and therefore it can't respond quickly enough to the everchanging environment that is faced today. Thus, this structure must be switched by project management.

To understand project management, project must be defined. As such, a project can be considered as a set of tasks that:

- Have a pre-determined, specific objective;
- Have a defined start and end dates;
- Consume resources;
- Are multifunctional.

The second bullet point can be time gated within itself. Between the start and end dates, different phases of the project must be delineated in order to successfully manage the project (figure 1):

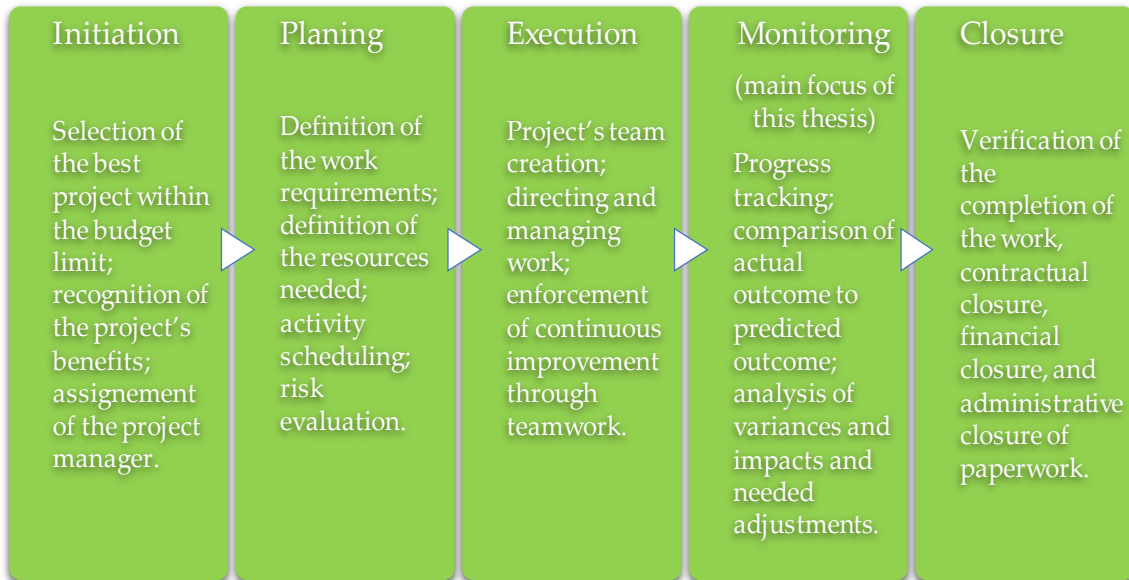


Figure 1
Phases of a project

Through the good practice and application of these concepts, a successful project is in range. A successful project is the product of good project management and is achieved if the project's objectives are completed:

- within time;
- within cost expectancy;
- at the desired performance level;
- within customer acceptance.

Project management brings benefits such as:

- Identification of functional responsibilities in order to account for, divide and organize all activities;
- Minimizing the need for continuous reporting;
- Identification of a trade-off analysis methodology;
- Early identification of problems and respective corrective actions;

- Enabling future planning.

Despite all its advantages, effective project management can only be achieved if certain obstacles are overcome:

- Project complexity;
- Organizational restructuring;
- Risk;
- Technologic changes.

In terms of workflow, project management helps companies manage their communication and workload horizontally and vertically. This approach does not entirely dismiss the need for the top to bottom, bureaucratic flow of work, but makes it simpler by enforcing horizontal communication. The vertical workflow remains in the responsibility of the companies' departments top managers and the horizontal workflow is the project managers responsibility. The latter's primary effort is to coordinate and communicate activities between the department's organizations. Here's a simplified company overview of vertical and horizontal structure (figure 2):

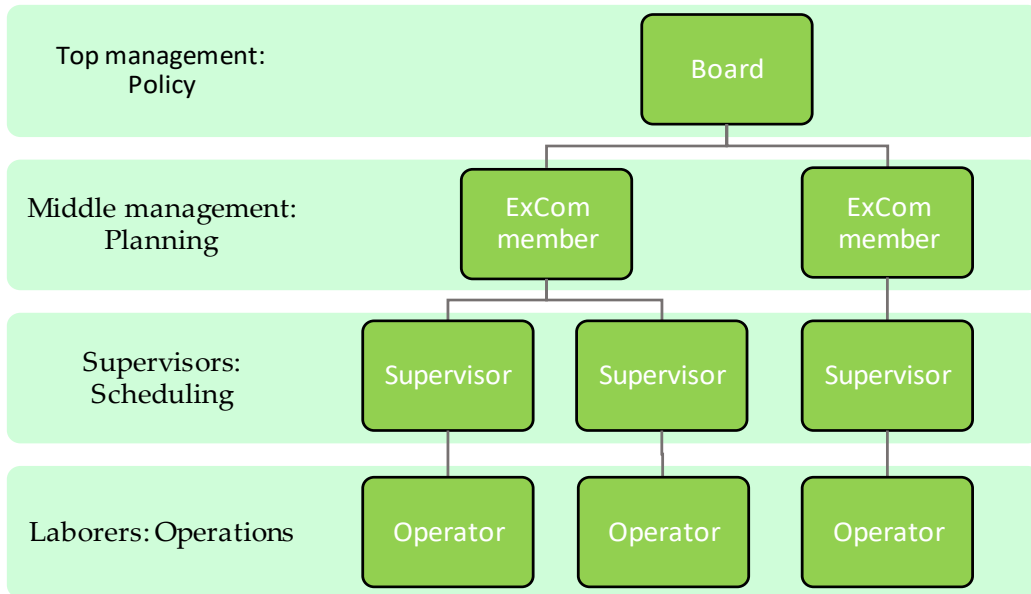


Figure 2
Management structure

Project management is the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives. Furthermore, project management utilizes the systems approach to management by having functional personnel (the vertical hierarchy) assigned to a specific project (the horizontal hierarchy) (Anderson & Merna, 2005).

3.2 The stage-gate process

When companies feel the need to develop project management, the starting point is usually a stage-gate process.

Just as the words imply, the process is comprised of stages and gates. Stages are groups of activities that, depending on the risks that a project team can undergo, can be performed at the same time or in sequence. These stages are

managed by cross-functional teams. The gates are points at the end of each stage in which decisions are made. One of the main goals of project management is to shorten the time between gates by managing the stages. This is a critical success factor to consider if the stage-gate process is to be used for the development and launch of a new product. Good management methodology for the process would be to implement checklists and guidelines to ensure that critical aspects of the project are not skipped or omitted.

Checklists are a critical component of gate review; these comprise 4 main points:

- Where is the project today? (Cost and time);
- Where will it end up? (Cost and time);
- Present and future risks;
- Extra needs for assistance from management;

It should be recognized that the stage-gate process is neither an end result, nor a self-sufficient methodology. Instead, it is just one of several processes that provide structure to the overall project management methodology.

According to Hansen et al. (2009), represented by figure 3, an investment project is divided in three phases: the decision and design phase (from Time = -1 to 0) in which the company designs the strategy of the investment, the execution of the investment (which is Time=0) and sales ramp-up phase (from Time= 0 to 1), and the life cycle management (from Time=1 and beyond). Once a project reaches the second phase, its potential for optimization drops considerably since all the foundation for the project's maintenance has already been laid out. Thus, the crucial phase for this optimization process is the decision and design phase. Decisions made in this phase determine the

boundary conditions for the business assets (and its ROIC) for many years to come.

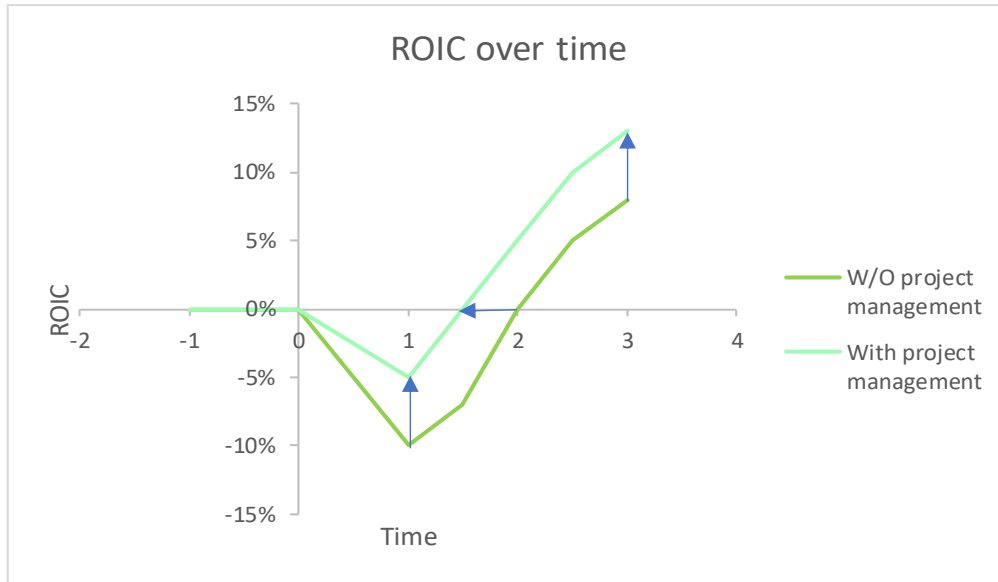


Figure 3

ROIC under project management

Thus, there is a straightforward relation between the theory of Kerzner and Saladis (2009) and Hansen et al. (2009) in which both set up a framework which is comprised of well-defined points in time that represent the beginning and the ending of the different phases of their projects. More specifically, the latter's theory could be interpreted as narrowing down of the firsts. Therefore, there is a clear application of a project management structure to an investment.

Any business needs to be able to develop itself in line with the changing business environment, technical advancements, customer needs, its peers, and competitors. This involves investigating options and making choices, leading to the need to manage the changes desired, which in turn necessitates creating

projects as the vehicles for introducing change that often involve significant capital investment (Anderson & Merna, 2005). Therefore, the two are intertwined and rely on each other to propel the company forward.

4. Sonae Arauco

Sonae Arauco is one of the largest wood-based solutions companies in the world. The company resulted from a wood-based alliance between two strong brands and competitors: Sonae Indústria and Arauco. Both companies share an international growth ambition and a long-term business vision.

Sonae Indústria is a multinational company, founded in 1959. Rooted in the north of Portugal, initially with an HPL plant located in Maia, it has sprouted to the world, developing products for the furniture, building and interior decoration industries.

Having wood as its main raw material, Sonae Indústria is focused in using the natural resources in a sustainable way and in keeping its environmental impact to a minimum.

Beside the 50% stake in Sonae Arauco, Sonae Indústria owns one of the largest particleboard industrial plants in North America (Tafisa Canada), as well as a plant for high-pressure laminates in Portugal.

Arauco was founded in 1970 with the mission of producing and managing renewable forestry resources. Today, it is considered an international benchmark in terms of forestry management, industrial plants' efficiency, production standards, innovation, environmental responsibility and social commitment.

Originated in Chile, Arauco's reach is now spread to more than 75 countries. Over almost 50 years, it has increased and enhanced its forestry plantations through permanent research and the application of best global practices in relation to sustainability and conservation of trees, soils and biodiversity of its forested areas for future generations.

4.1 Sonae Arauco's vision, mission, and values

A written vision, mission and values statement is an important device that may promote better communication within the company, especially the transfer and converging of relevant information (Dermol & Širca, 2018). This is not only relevant to internal communication but also to external communication because these allow for an effective advertising and promotion of the company when done correctly (figure 4):



Figure 4

Sonae Arauco's vision, mission, and values

4.2 Sonae Arauco's main products and brands

Wood-based panels are the basis of everything Sonae Arauco does and the most, flexible, sustainable, and functional alternative to solid wood. They are a more efficient way to use resources and have a greater dimensional flexibility (figure 5):

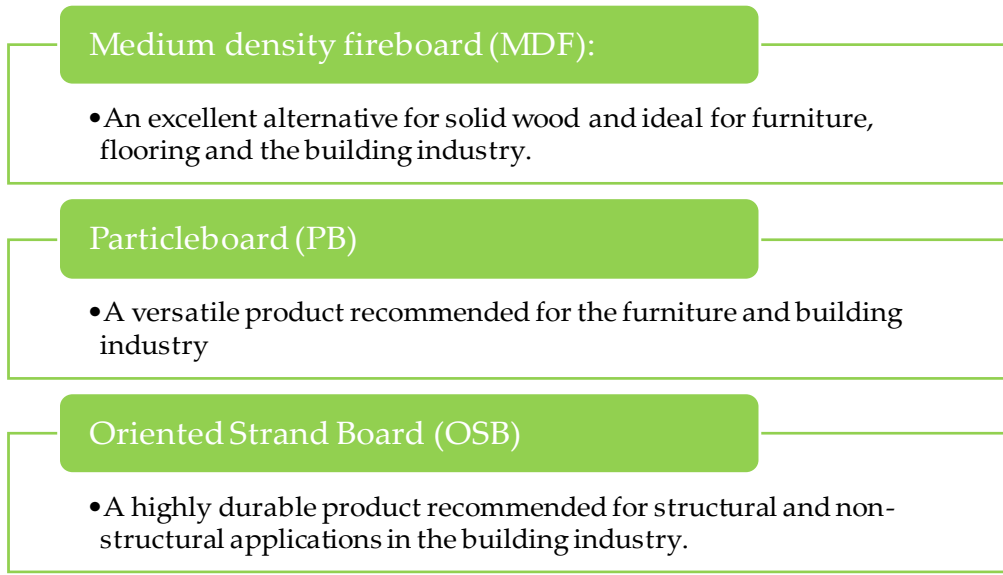


Figure 5
Sonae Arauco's main products

Sonae Arauco's portfolio thus contemplates a vast range of products that cover the diverse necessities of the furniture, interior design, and construction markets, from the more standard to the most demanding from a technical viewpoint, which are mostly sold under the following brands (figure 6):



Figure 6

Sonae Arauco's main brands

4.3 Sonae Arauco Financial performance

CONSOLIDATED INCOME STATEMENT					
Million euros	2019	2020	2021	2020 / 2019	2021 / 2020
Consolidated turnover	767,4	675,3	949,1	(11%)	41%
Other operational income	28,0	22,5	30,6	(20%)	36%
EBITDA	71,1	55,6	143,5	(8%)	158%
Recurrent EBITDA	74,7	62,3	149,1	139%	139%
Recurrent EBITDA Margin %	9,7%	9,2%	15,7%	0,8 pp	6,5 pp
Depreciation and amortization	49,1	49,5	51,2	1%	3%
Provisions and impairment Losses	3,5	(2,9)	19,2	-	-
Operational profit	18,7	8,7	72,8	-2%	732%
Net financial charges	(16,3)	(7,8)	(7,5)	6%	(3%)
o.w. Net interest charges	(5,8)	(7,7)	(6,6)	33%	(15%)
Share in results and impairments in Joint Ventures	0,0	(2,0)	(0,5)	-	(74%)
Profit before taxes (EBT)	2,6	(1,0)	64,7	-	-
Taxes	1,3	(1,3)	1,4	-	-
o.w. Current tax	3,5	6,4	10,0	57%	57%
o.w. Deferred tax	(2,2)	(7,7)	(8,6)	12%	12%
Consolidated net profit / (loss) for the period	1,3	0,3	63,3	-78%	>1000%

Table 1

Sonae Arauco's Income statement

Sonae Arauco's (table 1) consolidated turnover was around 685 million Euros in 2020, representing a decrease of 11% when compared to 2019, mostly as a result of worsened market conditions in Europe and South Africa, substantially impacted by the Covid-19 pandemic (especially in 2nd quarter of 2020), the impacts of the unplanned downtimes in South Africa, due to electricity cuts at country level, and lower electricity sales, as a result of the sale of Horn power plant business.

In 2021, the consolidated turnover was around 949 million Euros, representing an increase of 41% when compared to 2020, mostly as a result of a strong market demand in Europe, especially in OSB, and in South Africa. Total sales volume increased 20% when compared to 2020, reaching a record level of approximately 3.2 million m³, particularly thanks to the positive contribution from the German operations, driven by a very positive construction market but also by the higher contribution of the new PB line installed (which will be focused on later in this thesis).

The consolidated Recurrent EBITDA for Sonae Arauco reached 71.8 million Euros at the end of 2020, 4% below the 2019 figure. Nevertheless, the company was able to mitigate the impacts of Covid-19 by improving margins, making structural improvements to some of its processes and optimizing fixed costs. Accordingly, the Recurrent EBITDA margin for 2020 reached 10.5%, up by 0.8 p.p. when compared to 2019.

In 2021 the consolidated Recurrent EBITDA for Sonae Arauco reached 149.1 million Euros, more than doubling the 2020 figure, driven by a strong market demand and despite the increase in raw material prices and fixed costs. Accordingly, the Recurrent EBITDA margin for 2021 reached 15.7%, up by 6.5 p.p. when compared to 2020.

4.3.1 Sonae Arauco Capex expenditure

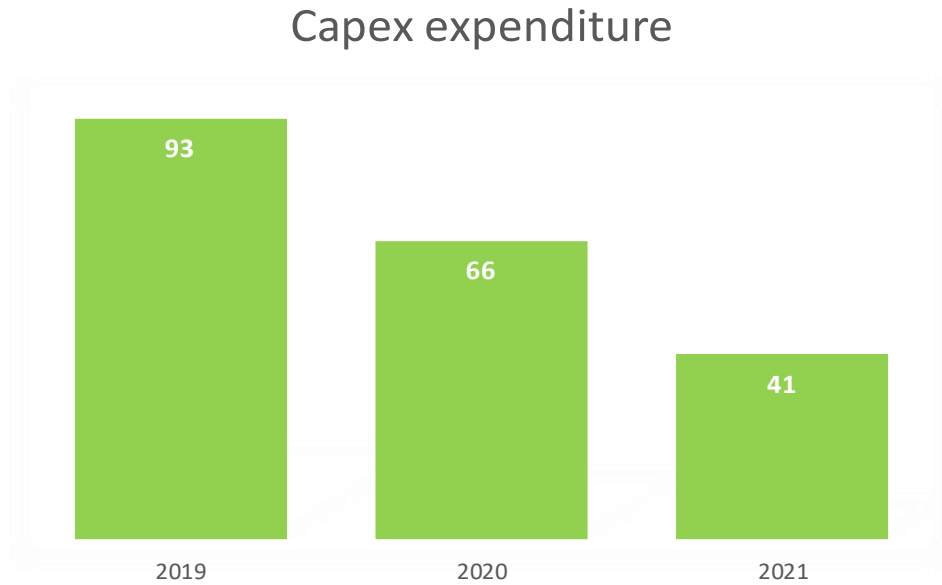


Figure 7
Sonae Arauco's Capex expenditure in millions of euros

Additions to Gross Tangible Assets (figure 7) reached 41 million Euros in the year, with the capital expenditure on assets used under leases accounting for circa 3 million Euros. The reduction, when compared to previous years, is mostly justified by the fact that in 2019 the level of investment included the installation of a new melamine presses in White River, South Africa, as well of a new PB line in Beeskow, Germany, and that 2020 capex also included some relevant new projects, such as the investments in new dryer abatement systems at our MDF plants and several operational debottlenecks at the Mangualde (Portugal) plant.

Most of the amount invested during 2021 was related to on-going efficiency and productivity projects, maintenance, and environment initiatives. In

addition, the installation of a MFC line was initiated in Nettgau (Germany) during the year, aimed at increasing the share and quality of melamine-based products, as per Sonae Arauco's strategic goals.

5. Sonae Arauco's Investment Procedures

5.1 Tangible Fixed Assets Definition

According to (Ias 16, n.d.), Plant and Equipment are tangible items that are held for use in the production, supply of goods or services, rental to others or for administrative purposes, and are expected to be used during more than one period (one year).

The cost of an item of property, plant and equipment shall be recognized as an asset on the balance sheet if, and only if:

- it is probable that future economic benefits associated with the item will flow to the entity;
- the cost of the item can be measured reliably.

Initial cost (cost incurred when the asset is constructed or acquired):

- its purchase price, including import duties and non-refundable purchase taxes, after deducting trade discounts and rebates;
- any costs directly attributable to bringing the asset to the location and condition necessary for it to be capable of operating in the manner intended by management;
- the initial estimate of the costs of dismantling and removing the item and restoring the site on which it is located.

Subsequent cost (costs incurred when the asset is already operating as intended)

- day-to-day servicing of assets (costs of labor, consumables, and small parts);
- routine maintenance;
- periodic maintenance;
- major inspections;
- replacement of parts with or without connection to periodic maintenance or major inspections.

Each element of cost, whether initial or subsequent, must be assessed as to whether it fulfils the recognition criteria. If, for example, extends the asset's expected useful lifetime (more than half of the initial useful lifetime), increases the asset's production capacity, reduces the asset's operating costs, or reduces the risk/incidence of accidents, is a tangible asset because adds up the potential of the asset to generate economic benefits. If it is a replacement of an existing component of the asset, and does not add up to the potential of the asset to generate economic benefits, is a cost in P&L.

5.2 Investment Analysis and Approval Procedures

Sonae Arauco, like every Sonae company, utilizes the IAAP (Investment Analysis and Approval Procedures) as its investment preparation, evaluation, approval, and evaluation policy.

This procedure has multiple purposes:

- Alignment of the capex spending with strategic direction;
- Lead investments to improve business profitability;
- Empowerment of operational leaders on appropriate level to take decisions within a defined framework;
- Engagement of ExCom / Board Permanent Committee / Board of Directors at appropriate level of detail;
- To support the decision process on the investment proposal, aiming at the sustained growth of Sonae Arauco supported by a solid financial basis;
- To establish methodologies and define common terms for analysis and evaluation of the investment process;
- To ensure compatibility with group and management objectives at each level of the different business units and to allow an adequate link between strategy and financial constrains;
- To allow for a detailed analysis of the investment alternatives, using qualitative and quantitative information.

5.2.1 IAAP phases and participants

The investment process has 4 phases. Which goes along perfectly with Kerzner's theory that states that a project has well defined timeframes:

- Preparation - The planning phase, including technical research (strategic, operational, and financial), to prepare the investment proposal;
- Implementation - All actions necessary to implement the project (e.g., changes in facilities, licenses, staff recruitment, agreements with suppliers and customers, purchase of equipment, fundraising...);

- Start-up - the beginning of the project and the management of the resources used to achieve the profitability predicted by the initial studies;
- Post-Mortem - an analysis of deviations from the initial project and a review of the project's feasibility including its results.

During the preparation phase, the participants can be classified as:

- Promoter - Starts the analysis process of the investment project;
- Proponent - Proposes the investment project for approval by the respective management level. It may be a group company, a business unit or a special team for a specific project (for instance: a new business). The project idea may emerge and be promoted within the respective business units or at the corporate level;
- Advisor - Technically supports the preparation of the investment proposal. It may be the proponent staff, the group staff, or external consultants;
- Supporting group - There are projects that need a multidisciplinary team support, due to the complexity of the proposal, low business knowledge, strategic importance of the project and need to ensure a good investment opportunity.

Supporting groups are the following teams (depending on project dimension):

- Project team - Set up by the proponent. Must include multidisciplinary participants, working together in the proposal preparation;
- Attendance group - Multifunctional advisory forum, supporting the investment proposal, including participants with strong knowledge of

an efficient project development and/or with future responsibility in its evaluation;

- Steering committee - Composed by those who will decide the project approval, including the proponent, the promoter, and some Board members.

5.2.2 Investment approval levels and workflow

Through the delegation of power by the management, various levels of decision-making power and the corresponding investment limits have been defined.

These levels are indispensable, since the investments must be measured and compared with other alternatives to be sure that the resources allocated to the projects create the maximum possible economic value for Sonae Arauco.

The IAAP establishes a bottom-up process of investment approval, with distinctive analysis and approval levels (table 2):

Level	Name	Limits	Decision
3rd	Corporate	Above 3 M€ and not approved in the current Annual Budget	Board of Directors
		Between 1-3 M€ and not approved in current Annual Budget	Board Permanent Committee
		Above 75 K€	ExCom
		Up to 75 K€	Corporate Apporval Committee
2nd	Region / Business Group	Up to 20 K€	Industrial Operations Director
1st	Business unit	Up to 10 K€	Business / Department / Plant manager

Table 2

Investment approval levels

5.2.3 Investment analysis

Today, part of the project manager's role is to understand what critical metrics need to be identified and managed for the project to be viewed as a success by all the stakeholders. Project managers have come to the realization that defining project-specific metrics and key performance indicators are joint ventures among the project manager, client, and stakeholders (Kerzner, 2017).

It is through the following analysis that Sonae Arauco's project managers do the research to determine the correct KPIs and metrics to use:

Strategic analysis must ensure that there is a compatible and consistent link between the investment project and the long-term objectives defined by the Board of Directors. It may include:

- SWOT analysis: strengths, weaknesses, opportunities, and threats;

- Analysis of the critical points of success and the points that stand out from the competition;
- Source of sustainable competitive advantage;
- Analysis of synergy effects (positive, negative, and crossovers with other areas and companies in the group);
- Market and competition analysis (the combination of different studies considered important for the investment proposal, integrating strategic and operational analysis, and including others such as:
 - Customer analysis and segmentation;
 - Competition Analysis;
 - Problems with antitrust authorities;
 - Analysis of barriers to entry;
 - Analysis of alternative products;
 - Market trend analysis.

Operational analysis is the collection of information related to the operational aspects of the project, it may include:

- Investment Plan;
- Organization and Systems;
- Production process and planning;
- Production costs;
- HR Analysis;
- Restructuring costs;

Financial analysis is the study of the investment proposal focusing mainly on its financial and fiscal effects, in other words, a study of various alternatives or scenarios and special solutions for financing the project. It may include:

- Assessment of financial viability;
- Study of financing solutions;
- Study of fiscal and tax law;
- Study of the contractual obligations of the financing, including guarantees and contractual clauses of a quantitative (financial ratios) and qualitative nature (restrictions on the sale of assets, etc.).

Risk Analysis

Risk indicates the possibility of some external factor (e.g., macroeconomic environment) affecting some key assumptions and consequently causing deviations from the initial plan. The project preparation must include all the analyses included above in order to assess and frame the level of risk related to the investment decision.

Due to the high level of uncertainty, the most important key variables must be identified, those that will most influence the value of the decision indicators (NPV, IRR or EVA).

Sensitivity analysis - evaluates the importance of the decision variables (e.g., NPV), when considering the value of the other critical variables. Among others, market size, market share, sales price, raw material cost, investment start-up, wages, and WACC should be considered.

Scenario analysis - a scenario is a set of predicted values used to establish critical variables. This analysis allows the study of several critical variables at the same time. As a rule, scenarios are characterized as one optimistic and one pessimistic situation.

Analysis of management indicators

Analysis of the consistency between internal (operational, technological, financial...) and external (competition) assumptions, as well as the definition of critical variables. Forecasting future cash flows for a project is one of the most critical and determining points of an investment proposal. A detailed description should be made of the assumptions used in the definition of the variables used in the investment proposals, including:

- Price Evolution;
- Transportation Cost;
- Market share;
- Product Offering;
- Cost of raw materials;
- Consumption Evolution;
- Salaries.

5.2.4 Investment control

It is important to remember that metrics are measurements and, therefore, provide project managers with opportunities for continuous improvements to the project management processes. It is therefore important to observe closely the unfolding of the project through said metrics and establish a control procedure (Kerzner, 2017).

Sonae Arauco follows this principle and applies through the following:

Control:

Fundamental to any investment, it must be done according to several standards:

- Control reports: documents submitted by the proponent to the approver with a timetable (defined by the investment proposal and according to the size and characteristics of the project) and project development stages (implementation or start-up);
- Report on periodic productivity meetings: preparation and discussion on project follow-up;
- Internal audits: periodic review of the project's progress, requested by the project approver;

Follow-up:

For projects over 1M€, an executive report has to be made detailing the main deviations of the project.

Post-mortem analysis

Should be done to improve planning and execution of future projects.

6. IDAR critical analysis

The IDAR, or Investment/Disinvestment Approval Request, is a form that must be filled in all Sonae companies to undergo an investment or disinvestment as it is a core part of the IAAP.

This form is composed of two sheets: the IDAR itself and a follow-up questionnaire, which helps the investment requisitioner to fill the IDAR form.

The first one is composed of all the pre-determined information that Sonae Arauco requires to consider an investment. Many of these blanks to fill are in accordance with some of the criteria that Kerzner & Saladis (2009) indicates to be the pre-requisites of a well-functioning project plan:

- Project goal;
- Project description;
- Expenditure breakdown;
- Risk analysis;
- Project's time length and respective time-gates;
- Project's team;
- Investment return;
- Investment alternatives.

Right from the start, Sonae Arauco seems to have good understanding of project management mechanisms and their broad application, and the questionnaire in the second sheet reinforces that idea very well. It is composed of a list of 9 topics that might impact the proposed investment:

- Quality;
- IT;
- Supply Chain;
- Health and Safety;
- Environment;
- Risk Management;
- Industry 4.0 (it refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data.);
- Reliability;

- Process engineering.

By gathering the information in the questionnaire, the proposer can give a more accurate overview of cost breakdown and risk analysis. Through this standardized procedure, the simplification of communication between the several levels of approval of the investment is somewhat achieved. This step is crucial to a project's approval as well as its well functioning (Sadeghiyan et al., 2022).

The questionnaire should reveal some more adaptability by introducing a tenth topic, which could be a general one in which the proposed could indicate some information he deemed to be important. A vital and missing component in the IDAR is benchmarking: if applicable to other investments of the company or even other companies' projects, the requester should benchmark his investment against others in order to highlight the importance of the investment.

Besides this alteration, it could be implemented in the IDAR layout a blank space in which the proposer would fill in some metrics and KPIs around those same metrics that could be used to track the performance of the investment, give it some objectives to reach and some clear tracking figures to utilize (Kerzner, 2017).

According to Hansen et al. (2009), the ROIC would be the perfect metric to calculate the investment's success as it would be the most clear and up to date measure of a project's value creation in a firm. Despite it being good, only using one metric provides an incomplete overview of the project (Kerzner, 2017). Another suggestion could be sales volume if it's an investment to increase

productivity or market integration if it's an investment to insert the company in new products or new products in markets that the company is already on.

7. Investment x

Investment x was proposed in 2015. It was needed since the old PB press line at the plant was ending its life cycle and it was becoming non-competitive in its natural market.

There was a concrete threat that one of Sonae Arauco's main clients wasn't going to renew its contract in 2018 due to the high manufacturing costs that the old and inefficient line was subjecting the company to. To aggravate the situation, regional demand in the plant's location was on the rise and the plant couldn't keep up.

Therefore, a modern and fully competitive PB line would solve that plant's problems, realizing the full potential of the natural market.

The EEG subsidy, which is a renewable energy subsidy that was granted to this plant, will end in 2021, which means that the energy price will increase in that year by a considerable amount. Thus, creating a need for the plant to tackle this issue by investing in an internal supply of electricity and selling the surplus at market price.

7.1 Investment properties

7.1.1 Risks and Opportunities

Risks:

- Delayed market demand pick up: since production will be affected by company restructuring, meeting natural demand will be harder;
- While restructuring is happening, competitors might also invest in this area.

Opportunities:

- Sales growth due to productivity increase;
- Matching demand growth;
- Electricity selling.

7.1.2 Economic analysis

- Total investment: 51M €;
- NPV: 60M €;
- IRR: 21,8%;
- Payback: 7 years;
- WACC 9,59%.

7.1.3 Project schedule

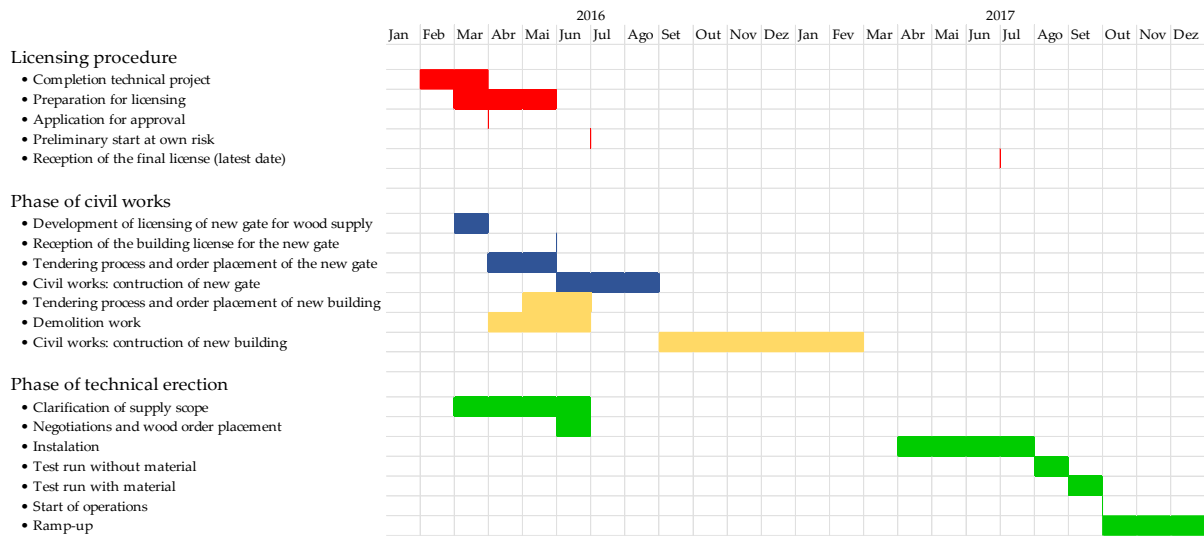


Figure 8

Investment schedule

7.1.4 Project control

Since the beginning of the project there has been a clear focus on certain metrics to ensure the project success. The focus of this investment, as stated above, is to ensure that Sonae Arauco remains competitive in the market by being able to supply its current customers with PB at competitive prices as well as being able to keep up with market demand. As such, in the project presentation, it was established as a metric the cost level of the plant which would impact the final price of the sold goods as well as its production capacity which would be translated to target sales.

To complement the previous analysis there was a benchmarking of the plant against its main competitors on both levels, with and without the investment proposed.

7.2 Project Follow up

Between the start of the project and the end of 2017 there were multiple meetings to review the status of the project.

In the last one (or at least the most recent documentation provided for my analysis), the main focus of the meeting was to review the cost structure and its deviations. These alterations of the investment plan were reflected on the economic metrics provided above, mainly the NPV, IRR and Payback, as well as the productive metrics: sales capacity and manufacturing costs.

7.3 Critical Analysis

7.3.1 Positives

The Sonae Arauco approach to investment in fixed assets brings a lot of the project management methodologies previously discussed to the table.

Firstly, the project's objective is pre-determined and specific: to renew an old PB press line.

It has a time-gated structure, in which is possible to identify many different stages of the project and therefore, giving it an easier way to organize and follow up (figure 8).

It also fulfils the 4 main criteria defined by Kerzner & Saladis (2009) which are: the overcoming of project complexity, since it's clear in the presentation that there is a deep understanding of all the nuances of the project, mainly due to the fact that there are several experienced people in Sonae Arauco; organizational structure which was evidenced in chapter 4; risk analysis which

is deeply covered in the project presentation, specifically at a geographical, competition and market levels; and finally technological change which was analyzed in-depth and is one of the main drivers of the investment.

The usage of NPV and other metrics as a performance indicator is widely appreciated by the academic community as well as the business one because they are fundamental for project control since it allows the managers to observe the unfolding of the project through said metrics and establish a procedure accordingly. Finally, and according to Kerzner's (2017) suggestion in his book, the company is utilizing market integration and sales capacity as metrics for this specific investment which is a productivity increase one which aims to match the market demand in its current market and new ones (geographically close to the ones in which Sonae Arauco already works in).

7.3.2 Negatives

Despite the clear and wide use of metrics by Sonae Arauco, Hansen et al. (2009) defends that the usage of the ROIC nowadays is fundamental since it allows for the computation of the return an investment has by subtracting the cost of capital to rate of return of the capital employed, giving the user a percentage which he can use to benchmark the investment to other opportunities and also to measure more reliability the value creation that was discussed in the beginning of this thesis and economic efficiency of capital employment.

Since NPV is an absolute measure of profitability, comparing it to other investment opportunities might be a mistake since two investments with equal NPV might require highly different amounts of initial investment, making so

that the one with lowest capital requirements is the best option. This would be automatically reflected in the ROI since the cost of capital of the first option would be smaller than the second and the return is the same, the return per unit of capital employed would be significantly higher.

Hansen et al. (2009) shows that it is not sufficient to look at the NPV of a new technology as it is done by Sonae Arauco in this case. Nor it is sufficient to compare the NPV of a new technology to the old one. Instead, to attain the optimal NPV and investment timing for a new technology, the total path NPV should be calculated: the NPV generated by assuming that the old technology would be employed up to the transition point. The maximum amount for this NPV is reached where the technology transition creates the most value. As such, after calculation the initial NPV for a certain point in time, even if the amount is positive, it might not be the highest amount it can achieve, therefore, even with a positive NPV, the investment shouldn't necessarily be approved.

The investment presentation is missing a crucial aspect of Kerzner's (2017) project management theory, which is the establishment of KPIs with respect to the metrics used. Despite the importance of metrics, these can only be used to provide static information with no ability to highlight future action and without any ability to measure progress towards key business goals.

A well-established KPI system would avoid these issues by creating cross-department objectives that the company as a whole could aim to achieve regarding that specific investment. Specifically, the market integration or the sales capacity metrics should have been used by the investment's proponent to design realistic yet ambitious goals to drive the course of action of everyone involved instead of them being just another metric. At management level, these KPIs would help the decision process of what steps to take next as well as

providing a progress meter towards desirable outcomes or targets (Budayan et al., 2020).

8. Discussion and Conclusion

The goal of this document was to discuss the applicability of project management frameworks to fixed asset capital intensive investment projects to which it could be said that a high degree of success was found since there were clear parallelisms between the theoretical methodologies and the practical applications that Sonae Arauco uses while managing their own projects. For further investigation of this subject I would recommend the utilization of an R&D project instead of a capital intensive fixed asset one, since an R&D one has much more uncertainty and therefore would require a higher degree of project management in order to be successful.

“Today is not the same as yesterday, and tomorrow will be different as well” (Anonymous). The magnitude and rate at which the difference and changes occur might be small, but there comes a threshold point where the number of changes, their size, or their rate of occurrence overwhelms the normal routine and suddenly, the whole paradigm is shifted. This might apply to the business world but also to our lives. This degree of uncertainty that makes everyone get out of their comfort zone, materializes into a need for coping with reality and deal with it as effectively as possible, and that is when one might find himself, willingly or unwillingly, creating and managing projects.

Often project management is employed intuitively, “think before you talk” or “look both ways before crossing the road” are common sense approaches that get the job done. The same can be said about straightforward investment

projects: traditional project management will get the job done. But is the full potential of the project truly achieved?

In this thesis, through literature review of project management methodologies and consequent application to an investment project case study provided by Sonae Arauco, it was formulated that project management frameworks are ideal to manage fixed asset investments as was seen in the several tools that Sonae Arauco utilizes to manage its investments. Although these tools were tailored to fit the Sonae Arauco business, it was found that it shared many similarities with the project management frameworks discussed in the thesis.

Finally, some changes and additions should be made in order to improve the quality of value creation through project management such as adopting a KPI methodology.

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