Financial analysis of projects

Why discuss financial analysis of projects in project management?

- The project manager is often responsible for evaluating the economic and financial feasibility of a project.
- Project managers need to assess and qualify the needs of projects that require investments.
- Or simply put, they need to interact with other areas of the company (such as management control or accounting departments) and should possess the necessary knowledge.

Financial calculation is the universal language of business (and projects).

Financial analysis of projects – basic concepts

"Financial calculation" is based on three fundamental concepts:
- Capital (what is invested or borrowed)
- Time (the period during which the capital is invested)
- Interest (compensation for the use of capital, i.e., the increase gained from the capital)

The concept of "interest" is different from the "interest rate":
- Interest is an absolute measure, representing the absolute return obtained over a certain period. For example, at the end of a consumer loan, we pay 500€ in interest.
- Interest rate is a relative measure, representing the return on 100 units of capital in one unit of time. For example, a loan may have an annual percentage rate (APR) of 5.67%, meaning 5.67% is applied annually to the outstanding amount.

Financial analysis of projects – basic concepts

Time Value of Money

The value of money varies over time, meaning it is not indifferent whether you have a certain amount of money today or a year from now. This is because it is generally assumed that it is always possible to earn an annual income from having a certain amount of money that you don't intend to spend on the purchase of consumer or investment goods.

This income can be obtained by investing the available cash in a financial instrument, such as a bank deposit. The measure of this income is then the rate of return that the bank offers for such a financial investment.

In this case, the return you forego by choosing to invest the capital in the project instead of a bank deposit is known as the **opportunity cost.**

Financial analysis of projects – basic concepts

Future Value

€1000 today is more valuable than the same €1000 one year from now (or even tomorrow). In fact, if you had that amount today, you could invest it, earning a certain rate of return and ending up with a value greater than €1000. The accumulated value at a future point in time of a given principal amount along with the associated interest represents the Future Value (FV) of that initial sum.

For example:

Applying PV = €1000 at an interest rate of i=10% for a period of n=1 year:
Then, the future value in the first year is calculated as:
- FV1 = (€1,000 + 10% x €1,000) = €1,100
- (the interest naturally amounts to €100)

For 5 years:
- FV5 = FV1 x (1+i) x (1+i) x (1+i) x (1+i) = PV x (1+ i)^5
- FV5 = €1,000 x (1+ 10%)^5 = €1,610.51, which is the future value (FV) in 5 years.

Financial analysis of projects – basic concepts

Future Value

Generally, the formula for calculating Future Value, at n periods, is as follows.

$$VF_n = VA(1+i)^n$$

Financial analysis of projects – basic concepts

Present Value

Let's suppose that entity Y (our hypothetical debtor) has given us the choice to receive €1,610.51 five years from now or X euros today (assuming we have no doubt that they will deliver this amount, meaning there's no credit risk).

Assuming we have no immediate need for the money (e.g., for consumption), we will assume that our only alternative investment option is to deposit the money in the bank at a 10% interest rate (with no risk). In other words, our opportunity cost would be 10%.

What is the value of X that would make it advantageous to receive this amount today, or wait for the 1,610.51€ in five years?

Financial analysis of projects – basic concepts

Present Value

The calculation of present values is nothing more than the reverse of the Future Value formula:

$$VF_n = VA(1+i)^n$$

$$VA = \frac{VF_n}{(1+i)^n} = VF_n(1+i)^{-n} = VF_n\frac{1}{(1+i)^n}$$

In other words, the Present Value of €1,610.51 in 5 years with a 10% opportunity cost is:

VA = 1.610,51€ / (1 + 0,10)^5 = 1000€

Financial analysis of projects – basic concepts

Present Value

In conclusion,

If X >= €1,000, it is preferable to receive the amount now.
If X is less than €1,000, it is preferable to wait and receive €1,610.51 in 5 years.

In general, we can define the Present Value of an amount due in n periods as the value that, if held today, could be invested over n periods to equal the future sum.

Calculating Present Value can be relevant in situations such as:
- A debtor looking to repay the outstanding debt.
- A creditor looking to receive their credits in advance.

Financial analysis of projects – basic concepts

Definitions

• **Capitalization:** This is the increase in the value of capital as time passes. It's the process of accumulating capital or earning interest. This concept is applied when calculating Future Value.

• **Discount (or Discounting):** This is the reduction in the value of capital over a certain period of time. It's applied when calculating Present Value.

And, indeed, Excel can be a great tool for performing these financial calculations:

- =PV (or =VA in Portuguese) for calculating Present Value.
- =FV (or =VF in Portuguese) for calculating Future Value.

Financial analysis of projects– Capitalization regimes

Capitalization regime: the process by which the calculation of interest on the invested capital is determined.

As mentioned previously, interest depends on:
- The amount of the invested capital.
- Time.
- The interest rate.

From the connection between time and capital, two methods for calculating interest emerge:

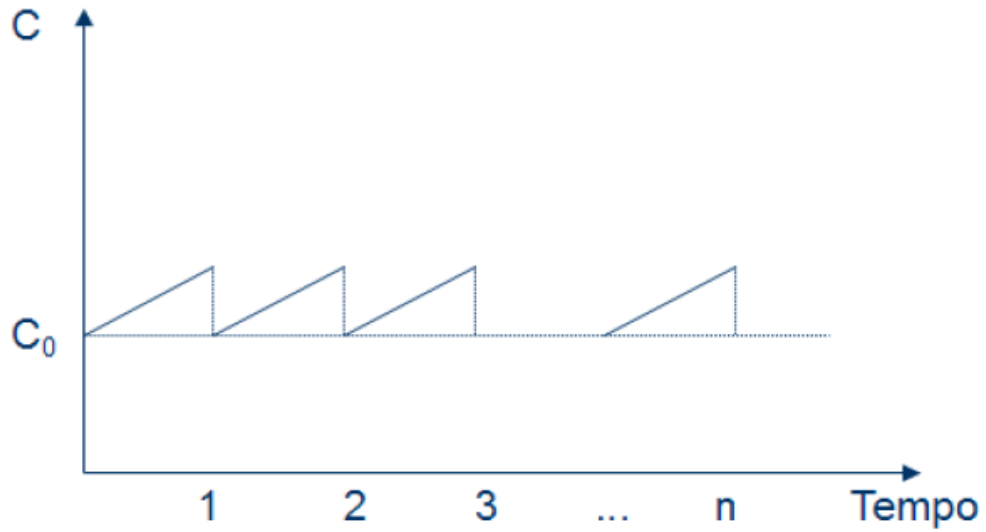
1. Simple Interest.
2. Compound Interest.

Financial analysis of projects– Capitalization regimes

Simple Interest

Characteristics:

- The principal amount remains constant at the beginning of each period.
- The interest accrued in each period is constant.



Financial analysis of projects– Capitalization regimes

Simple Interest

There is a direct proportionality between the interest for any period and the initial capital:

$$\frac{j_0}{C_0} = i$$

Expressão que permite calcular a taxa de juro

$$j_0 = i\, C_0$$

Expressão que permite calcular o juro periódico

Example:
A capital of €150,000 produced interest of €4,500 over one year. Calculate the applied interest rate

$$i = 4.500\ € \ /\ 150.000\ € = 3\%$$

Financial analysis of projects– Capitalization regimes

Simple Interest

In summary:

Interest = Initial Capital x Time x Rate

If:

- Accumulated Capital = Initial Capital + Interest
- Interest = Initial Capital x Time x Rate

Then:

- Accumulated Capital = Initial Capital + (Initial Capital x Time x Rate)
- Accumulated Capital = Initial Capital x (1 + Time x Rate)

Financial analysis of projects– Capitalization regimes

Simple Interest

Example:

A capital of €300,000 was invested for 3 years under a simple interest regime at an annual rate of 3%.

a) To calculate the interest earned each year:

$$300.000 € \times 3\% = 9.000 €$$

b) To calculate the interest earned during the investment period:

$$300.000€ * 3 * 0,03 = 27.000€$$

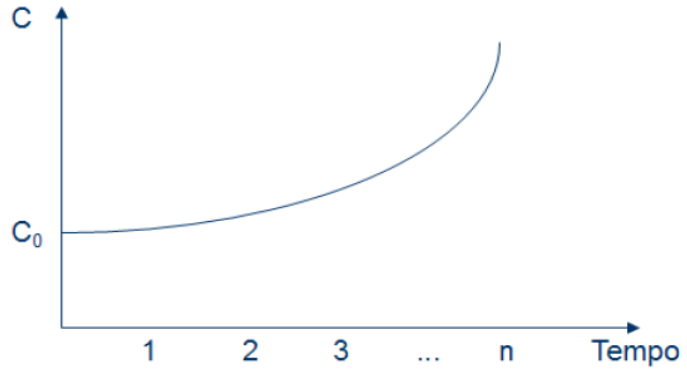
c) To calculate the accumulated capital at the end of the investment period:

$$300.000€ * (1 + 3 * 0,03) = 327.000€$$

Financial analysis of projects– Capitalization regimes

Compound Interest

Characteristics:
- Accrued interest is included in the capitalization process (interest on interest).
- The interest generated is not constant in each period.
- Interest is cumulative **and grows over time.**



$$C_1 = C_0 + j_1 = C_0 (1 + i)$$
$$C_2 = C_1 + j_2 = C_0 (1 + i) + j_2 = C_0 (1 + i) + C_0 (1 + i)\, i = C_0 (1 + i)^2$$
$$C_3 = C_2 + j_3 = C_0 (1 + i)^2 + j_3 = C_0 (1 + i)^2 + C_0 (1 + i)^2\, i = C_0 (1 + i)^3$$
...
$$C_t = C_0 (1 + i)^t$$

Financial analysis of projects– Capitalization regimes

Compound Interest

In summary, in a compound interest regime with a rate of i over n periods:

Interest at n = Initial Capital * [(1 + i)^n – 1]
Accumulated Capital at n = Initial Capital * (1 + i)^n

The capitalization regime implemented in the Excel formula =FV (or =VF) is that of compound interest!

Financial analysis of projects– Capitalization regimes

Compound Interest

Example: Consider an investment for 5 years at a 6% rate with an initial capital of €80,000. Calculate the difference in interest earned using simple and compound interest regimes.

Interest earned with simple interest:

80.000€ * 5 anos * 6% = 24.000€

Interest earned with compound interest:

80.000€ * [(1 + 6%)^5 -1] = 27.058,05€

Difference = 27.058,05 € - 24.000,00 € = **3.058,05 €**

This difference pertains to the so-called "interest on interest."

Financial analysis of projects– Capitalization regimes

Compound Interest vs. Simple Interest

- The interest earned in both capitalization regimes is the same at the end of the first period of the interest rate.
  - Example:
    - Simple Interest: €80,000 * 1 * 6% = €4,800
    - Compound Interest: €80,000 * [(1 + 6%)^1 - 1] = €4,800

- Interest earned is higher in the compound interest regime if the elapsed time period is longer than the reference period of the interest rate (e.g., two years at an annual rate of x).
  - As demonstrated in the previous example.

Financial analysis of projects – interest rates

Nominal Rates and Effective Rates

Nominal Rate: Typically, the Nominal Annual Rate (NAR or TAN) is the actual interest rate, meaning it is a rate set for a one-year period and is not affected by inflation. This rate must be stated in all credit contracts and banking applications.

Effective Rate: The Effective Annual Rate (EAR ot TAE) is the rate that is effectively applied due to successive capitalizations. It uses the NAR as a reference rate.

Financial analysis of projects – interest rates

Example. Consider an investment of €100 for 1 year with a 10% Nominal Annual Rate (NAR):

In a regime of Simple Interest with semi-annual compounding:
- Semester 1 -> Interest = €100 * 0.5 * 10% = €5. With simple interest, the capital remains €100.
- Semester 2 -> Interest = €100 * 0.5 * 10% = €5.

At the end of the year, €5 + €5 = €10 in interest, which corresponds to a rate of 10%.

In a regime of Compound Interest with semi-annual compounding:
- Semester 1 -> Interest = €100 * 0.5 * 10% = €5, and with compound interest, it is added to the capital.
- Semester 2 -> Interest = €105 * 0.5 * 10% = €5.25.

The total interest is €5 + €5.25 = €10.25, which corresponds to an Effective Rate of 10.25%!!

So, despite a stated NAR of 10%, the actual return was different due to the compounding effect.

Financial analysis of projects – interest rates

In other words, for investments with simple interest, the comparison between financial products should be based on the Nominal Annual Rate (NAR). For products with compound interest, the comparison should take into account the Effective Annual Rate (EAR), which includes the effect of interest compounding.

The effective interest rate is higher the more frequent the interest is compounded.

$$TAE = \left(1 + \frac{i}{k}\right)^{k} - 1$$

i = TAN e k= The number of times interest is compounded per year.

Or more easily using the Excel formula =EFFECT() (or =EFETIVA() in PT).

Financial analysis of projects – interest rates

Important Concepts

APR (Annual Percentage Rate or TAEG in PT): represents the total cost of the loan to the customer and is expressed as a percentage of the amount borrowed from the bank. The calculation of the APR includes all loan fees, required insurance, interest, tax expenses, and/or registration fees (if applicable), and other associated charges.

TCC (Total Cost of Credit or MTIC in PT): corresponds to the total amount that the customer will have to pay to the bank over the entire loan period. It is calculated by adding the total loan amount to the credit costs (interest, fees, taxes, and other charges imposed by the bank). Typically, it is also represented as the amount to be paid for every euro borrowed. For example, €1.18 for every €1.

In conclusion, although there are various rates or indicators associated with a financial product, it is advisable to use the APR and/or TCC to gain a true understanding of the cost of financing.

Financial analysis of projects – interest rates

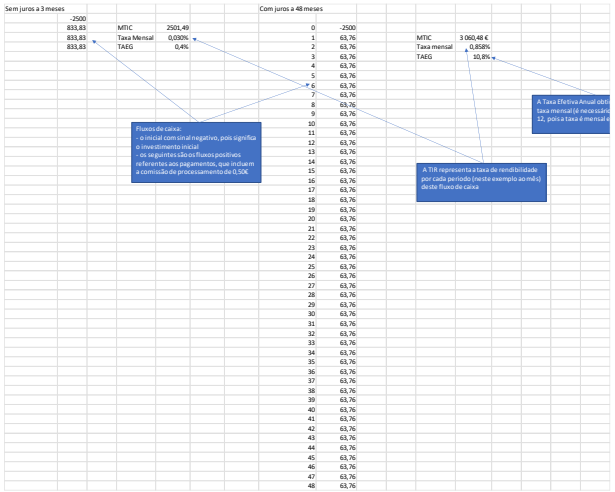
Important Concepts

Internal Rate of Return (IRR): he discount rate at which a cash flow must be to have its Net Present Value (NPV) equal to zero.
In simplified terms, the TIR corresponds to a rate of return on cash flows (typically an initial investment and subsequent cash flows). It is a tool that can be used to compare:

- The economic profitability of various projects and support the selection process.
- The profitability of a project and the opportunity cost of a bank investment (provided they have the same level of risk).
- Financing options, such as the number of rent payments to contract in a leasing agreement, e.g., 36 months or 60 months.

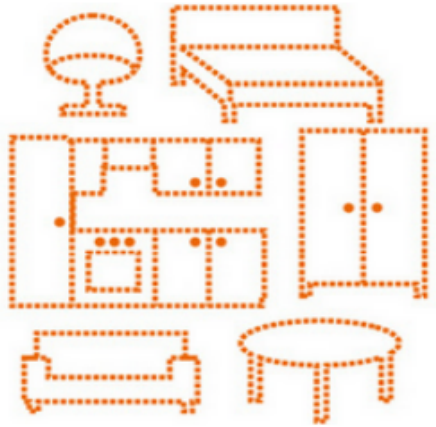
Financial analysis of projects – interest rates

Example: how get to the APR (TAEG) in this IKEA example:



Crédito Clássico (TAEG 0,2% a 12,6%)

CRÉDITO CLÁSSICO



Na IKEA encontra opções de pagamento flexíveis que o ajudam a tornar a casa dos seus sonhos em realidade:

- **Mensalidades reduzidas**
- **Aprovação imediata**
- **Sem custos de adesão**
- **Sem mudar de banco**

Conforme promoções em vigor na loja e de acordo com as condições comunicadas. Pode optar pela modalidade de pagamento que mais lhe convém.

MODALIDADES SEM JUROS

- 3 meses - **a partir de 45€**
- 6 meses - **a partir de 120€**
- 12 meses - **a partir de 400€**

MODALIDADES COM JUROS

- 24 meses - **a partir de 500€**
- 36 meses - **a partir de 500€**
- 48 meses - **a partir de 1.500€**
- Outras modalidades - **até 60 meses**

Modalidade sem juros – TAEG 0,4%
Para um financiamento de 2.500€, reembolsado em 3 x 833,33€ (acresce comissão de 0,50€), TAN 0%, totalizando 2.501,50€.

Modalidade com juros – TAEG 10,8%
Para um financiamento de 2.500€, reembolsado em 48 x 63,26€ (acresce comissão 0,50€), TAN 9,50%, totalizando 3.060,48€.

Informe-se no Cetelem, através do 707 27 27 27, de 2.ª a 6.ª F das 9h às 20h. A IKEA é Mediador de Crédito a título acessório e com exclusividade.

Financial analysis of projects – Financing

Project Financing

The decision to seek financing for components of a project is an organization's decision, typically made by the Finance Department, and takes into account a set of factors:

- Opportunity: Sometimes, products with low or even zero interest rates become available. Major technology players (Cisco, HPE, DELL, etc.) have financial arms to finance customer projects, such as HP Financial Services.
- The company's debt burden.
- Cash availability.
- The opportunity cost between liquidating deposits/investments and financing.
- And other relevant considerations.

Financial analysis of projects – Financing

Project Financing

There are various methods of project financing:

1. Traditional Bank Loans
2. Secured Overdrafts: Short-term solutions to address cash flow shortages, allowing the use of overdrafts.
3. Factoring: Involves the transfer of the rights to collect outstanding invoices in exchange for the immediate value of those invoices.
4. Tax Incentives: For example, programs like SIFIDE and Portugal 2020.
5. Leasing and Rentals

In the technology sector, crowdfunding, venture capital (business angels, venture capital), and investment funds are currently in vogue.

Financial analysis of projects – Financing

Leasing* vs *Renting

In Information Technology, especially for investments in equipment and infrastructure (assets), leasing (financial leasing) and renting (operational leasing) are the most common solutions.

Both models share similarities in that:
- They involve the payment of rent by the customer (lessee) to the financing entity (lessor) for the use of the asset for a specified period (the contract's duration).

Financial analysis of projects – Financing

Leasing* vs *Renting

However, they differ in the following ways:
- By definition, leasing includes the option for the customer to purchase the asset at the end of the contract for an agreed-upon residual value set at the beginning of the contract. Renting does not offer this purchase option; the asset is returned, the contract is renewed, or the customer acquires it at the market value at that time.
- Leasing payments typically cover only the use of the asset. Renting often includes associated services such as insurance, support, and maintenance.
- In leasing, the asset is recorded on the company's balance sheet, which leads to its depreciation. This affects the company's solvency ratios and increases debt service. Renting, on the other hand, is categorized as "FSE – Fornecimentos e Serviços Externos" (Supplies and External Services) and does not burden debt service. However, it's essential to acknowledge the liability on the balance sheet (if the company adopts the IFRS accounting standard).
- For this last reason, renting allows for the conversion of CAPEX (Capital Expenditure) into OPEX (Operational Expenditure), which, in various situations, can enhance tax efficiency (operational expenses can be fully deducted as expenses in the year they occur, unlike capital expenses where only a percentage can be expensed in the year of purchase).

Financial analysis of projects – Financing

Leasing* vs *Renting

In light of the differences between leasing and renting, regarding IT investments:
- Leasing might make sense for equipment with a longer lifecycle, where you want to take advantage of the purchase option at the residual value when the contract duration is shorter than the asset's useful life. For example, for storage and data center technologies, which can easily have lifecycles exceeding 5 years.
- Renting could be more suitable for equipment with a shorter lifespan and rapid obsolescence, such as PCs and laptops, to benefit from the ability to return and acquire new equipment.

Naturally, these are not absolute truths, and each case should be analyzed to determine the most advantageous solution for the organization..

Financial analysis of projects – Financing

Separation of Principal and Interest

In the case of financing repaid in rental systems (leasing and renting), it's essential to note that implicitly within each rental payment, there is both an interest component and a loan repayment component.

This separation is particularly important because the interest component represents a cost (both accounting and tax-related) for the company, while the repayment component results in a reduction of the liability. It affects how rental invoices are recorded in the company's accounting system.

For this reason, in financing cash flow statements, the interest component is typically differentiated from the principal repayment in each rental payment.

It's also evident that the interest's share in the total rental payment is more significant in the early payments than in the later ones. This gives the accurate impression that, at the beginning, you're reducing the debt only slightly and paying a lot in interest!

Financial analysis of projects – Financing

Separation of Principal and Interest

Example:

Data Inicial: 01/08/2019

Data Final: 31/12/2026

Mapa CashFlows

CashFlow

Negócio	Mobiliário	**Capital**	126.151,60	**Imposto Venda**	51-NOR CONT	**Data Inicial**	27/11/2019
Operação	XXXXXXX	**Valor Residual**	2523,03 - 2,00 %	**Imposto**	51-NOR CONT	**Data Final**	20/11/2022
Moeda	EUR	**Plafond**	0,00	**Regra Indexação**	E12B360_I0_AT	**Data Valor**	27/11/2019
Regime	Antecipado	**Prazo Total**	36	**Periodicidade**	MENSAL	**Data Contabilistica**	27/11/2019

Cliente: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.

Tipo	Número	Data Valor	Capital Dívida	Valor	Capital	Juros	Imposto	+/- Valias	Cap. Amortizado
RENDAS	1	27/11/2019	126.151,60	15516,65	12615,16	0,00	2901,49	0,00	12.615,16
RENDAS	2	20/12/2019	113.536,44	3977,24	3142,86	90,67	743,71	0,00	15.758,02
RENDAS	3	20/01/2020	110.393,58	3977,24	3118,54	114,99	743,71	0,00	18.876,56
RENDAS	4	20/02/2020	107.275,04	3977,24	3121,79	111,74	743,71	0,00	21.998,35
RENDAS	5	20/03/2020	104.153,25	3977,24	3125,04	108,49	743,71	0,00	25.123,39
RENDAS	6	20/04/2020	101.028,21	3977,24	3128,29	105,24	743,71	0,00	28.251,68
RENDAS	7	20/05/2020	97.899,92	3977,24	3131,55	101,98	743,71	0,00	31.383,23
RENDAS	8	20/06/2020	94.768,37	3977,24	3134,81	98,72	743,71	0,00	34.518,04
RENDAS	9	20/07/2020	91.633,56	3977,24	3138,08	95,45	743,71	0,00	37.656,12
RENDAS	10	20/08/2020	88.495,48	3977,24	3141,35	92,18	743,71	0,00	40.797,47
RENDAS	11	20/09/2020	85.354,13	3977,24	3144,62	88,91	743,71	0,00	43.942,09
RENDAS	12	20/10/2020	82.209,51	3977,24	3147,90	85,63	743,71	0,00	47.089,99

Financial analysis of projects – Cashflow

Concept of Cashflow

Cash flow, (or fluxo de caixa in PT), refers to the difference between cash inflows and cash outflows. It's a purely financial concept, representing what is received during a given period subtracted from what is paid during that same period. It reflects the company's ability to generate liquidity.

One objective way to assess the financial viability of a project is by developing a business case supported by a cash flow statement, where the following elements are explicitly outlined:
- Cash inflows: such as sales, savings, etc.
- Cash outflows: including equipment purchases, licensing fees, hiring of human resources, etc.

Analise financeira de projetos – Cashflow

Concept of Cashflow

Example: A customer support service in a pharmaceutical company aims to automate the process of data entry for orders received via email in PDF format using Robotic Process Automation (RPA) technology. The technology involves significant costs, such as annual licensing fees. It is necessary to determine if the savings achieved by freeing up an operator in the service outweighs the investment.

Nº de horas/dia eliminadas de data-entry	8	* ASSUMIR 1 FTE
Nº dias uteis/ano	255	
Custo/hora (€/h)	7,56 €	

Benefícios	Descritivo Benefício	Custo unitário		Benefício estimado (ano)		Benefício a estimado (ano c/adesão a 100%)	N	N+1	N+2
1	**Aumento da eficiência**					**15 422**	**0**	**11 567**	**13 880**
1,1	**Registo das encomendas no SAP (T-CODE: VA01)**	7,56 €	**€/FTE**	15 422	**€**	**15 422**	**0**	**11 567**	**13 880**
					TOTAL Benefícios	**15 422**	**0**	**11 567**	**13 880**

Parceiro Implementação	Descritivo Custo	Custo unitário		Custo estimado (ano)		Custo a estimado (ano c/adesão a 100%)	N	N+1	N+2
RPA									
1	**Capex**					**-6 500**	**-6 500**	**0**	**0**
1.1	Serviços Consultoria	6 500	€	-6 500	Implementação (€)	-6 500	-6 500	0	0
2.	**Opex**					**-7 050**	**-7 050**	**-5 850**	**-7 050**
2,1	Licenciamento anual	5 850	€	-5 850	€	-5 850	-5 850	-5 850	-5 850
2,2	Pack de horas parceiro	1 200	€ (pack de 20h)	-1 200	€ (pack de 20h)	-1 200	-1 200	0	-1 200
					TOTAL Custos	**N.A.**	**-13 550**	**-5 850**	**-7 050**
					TOTAL Cash-Flow	**N.A.**	**-13 550**	**5 717**	**6 830**
					TOTAL Cash-Flow Acum.		**-13 550**	**-7 833**	**-1 003**

TIR	45%

Analise financeira de projetos – Cashflow

Concept of Cashflow

Example: A company in the Import/Export industry intends to automate a series of its internal administrative processes to convert a portion of its workforce into the sales and operations areas. To achieve this, it needs to implement an innovative information system that will provide the necessary efficiency gains to maintain the current service level with fewer people. The acquisition and implementation of this information system require significant investments, so it is necessary to assess whether the benefits to be obtained justify the projected costs. The project manager had to develop a business case and represent it in the form of a cash flow statement.