RECYCLING ACADEMY.

FINANCE

Mini-guide

How to make a decision to invest in recycling machines?

Turnkey tool and profitability criteria

💡 *Key learning outcomes:*

- *Increase production through investment*
- *Anticipate production costs by planning by category (CAPEX - OPEX)*
- *Use an excel tool to plan your investment*

PLASTIC ODYSSEY

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Table of content

The contents of this guide are proposed in **open source**

Contributions to this mini-guide are welcome → please send an e-mail to jean-baptiste@plasticodyssey.org

Introduction & summary

In industry, investments are considered essential and **strategic**, as they help shape the company's future. In order to control costs and productivity, craftsmen and semi-industrial companies find themselves at a crucial stage, where the investments made will have a decisive impact on the company's trajectory and positioning in their market.

In the business context, investment refers to the deliberate act of allocating resources such as money, human talent or equipment with the aim of creating added value. **Investment management closely associates strategy, decision and instrumentation**.[1] This can include the purchase of goods, the development of new technologies, employee training or any other initiative aimed at improving the company's productivity, competitiveness or growth.

Decisions to increase production capacity are often ranked among the most important strategic decisions. And significantly increasing production often involves investing in machinery. In this document, we'll look at **how to fill in and use an Excel tool** to check the profitability of a project.

1. Why make an investment?

To produce more:

Here are just a few of the ways in which industrial investment can help boost production:

- **Acquisition of new equipment:** The purchase of more modern, high-performance machinery can increase both direct productivity (directly related to production, e.g. extruder, cooling tank, etc.) and indirect productivity (related to production support, e.g. hoist, conveyor, etc.). What's more, it can diversify the business or enable products to be manufactured more quickly and efficiently.
- **Process automation:** Automating repetitive, time-consuming tasks frees up manpower for other, more essential tasks in the value chain. It can also reduce human error and improve accuracy.

To produce better:

- **Staff training:** Investment in staff training can improve employee skills and productivity, enabling them to work more efficiently and maximize the use of new technologies and equipment.

- **Research and development:** Investment in research and development (R&D) can lead to the creation of new manufacturing processes, the discovery of new markets or new products (Plastic Odyssey's Acceleration Programme), which in turn can stimulate production growth.
- **Higher-quality materials:** Investments can also be made in the purchase of higher-quality raw materials, or in the production of higher-quality products. The use of higher-quality materials can contribute to improving the intrinsic quality of finished products (=increasing value).

To lower the costs:

A well-planned investment can significantly reduce costs if it is optimized in relation to the business and its development (see "Going further - Investment strategy").

It's a well-known fact that 80% of total product costs, and 90% to 95% of production costs, are pre-committed by decisions that have already been taken. "It is much easier to 'design economically' before production than to 'realize economically' during the production phase" (MORGAN, 1993).

- **Products are the main profit drivers, and machines are the main profit drivers.**
- Product profitability is essentially determined in the upstream phases of the life cycle (planning, design, choice of materials, etc.) and not in the downstream phases (production and distribution).

For a product to be a success, and before we can even talk about profit, we need to **anticipate** costs - this is the "Target Cost". Cost control then appears as an essential language of communication between the different phases, upstream and downstream, of the product life cycle.[2]

The idea behind "target cost" is to evaluate the cost of producing a product in relation to market prices.[3] Thus, the margin to be achieved on the product is imposed by its cost management, and consequently by the company's overall strategic choices (initial investment, production rate, sales strategy, etc.). Cost should therefore not be considered as a result, but as a target to be reached absolutely.[4]

Target cost = Market price - Expected target margine

2. Expenses per type

CAPEX (Capital Expenditure)

Capital expenditure (CAPEX) refers to major investments in **intangible or physical assets** that contribute to the creation, improvement and expansion of industrial operations. This refers to capital expenditure that is more focused on the company's long-term growth.

1) Costs CAPEX(excl. machines)

These costs generally concern the preliminary aspects and infrastructure required to develop the new business.

Here's an example:

- Economic & technical studies
- Infrastructure (e.g. container)
- Installation & training ...

2) Costs CAPEX machines

CAPEX machine costs" refer to capital expenditure associated with the acquisition of machines that are directly linked to production:

Example for a production line:

- Shredder
- Washing tank
- Centrifuge
- Extruder ...

Remark: This separation is useful for identifying the financial requirements for initiating a project (CAPEX excluding machines) and for carrying it out (CAPEX machines).

OPEX (Operating Expenditure)

Operational expenditure (OPEX) refers to the recurring costs that a company incurs as part of its day-to-day activities to maintain its functioning and support its operations. OPEX can be classified into two sub-categories:

1) Selling, General and Administrative Expenses (SG&A)

This represents a category of operating expenses associated with the day-to-day administrative activities of managing and running the business.

Example:

- **human resources:** employee salaries and social security contributions
- **development costs:** marketing and advertising budget, plus monthly loan payments
- **real estate costs:** rent, insurance.

2) Costs of Goods Sold (COGS)

This represents the total amount of costs incurred by a company in its production.

For example:

- **material resources:** raw materials, components, packaging
- **energy resources:** water, gas, electricity
- **logistics costs:** travel, deliveries.

Remark: OPEX expenses are a key element in calculating margin, which represents the difference between total revenues and production costs.

Tips : It's important to estimate future costs in advance (using an Excel tool) to minimize forecasting errors. Once the investment has been made, it is important to fine-tune the model with actual values to better anticipate future costs.

3. What do you need to make an investment?

To undertake an investment, several essential elements are required. First of all, there must be a genuine **willingness to invest**, motivated by a clear vision of the benefits and opportunities this investment can offer. Of course, **having the necessary funds** at one's disposal is crucial, as money is the driving force behind any financial operation.

The **practical feasibility** of the investment is also a crucial aspect, involving considerations such as land availability, administrative compliance, and so on.

Finally, the implementation of a robust Excel tool for financial forecasting plays a crucial role. This tool makes it possible to estimate and anticipate future financial results, thus contributing to informed decision-making and the success of the investment.

In addition, the **company's financial viability (or margin)** needs to be projected using an excel tool to determine whether or not the investment in a project is worthwhile.

Margin (%) = ((net profit) / Sales)*100
Net profit = Sales - Total costs

Another investment indicator:

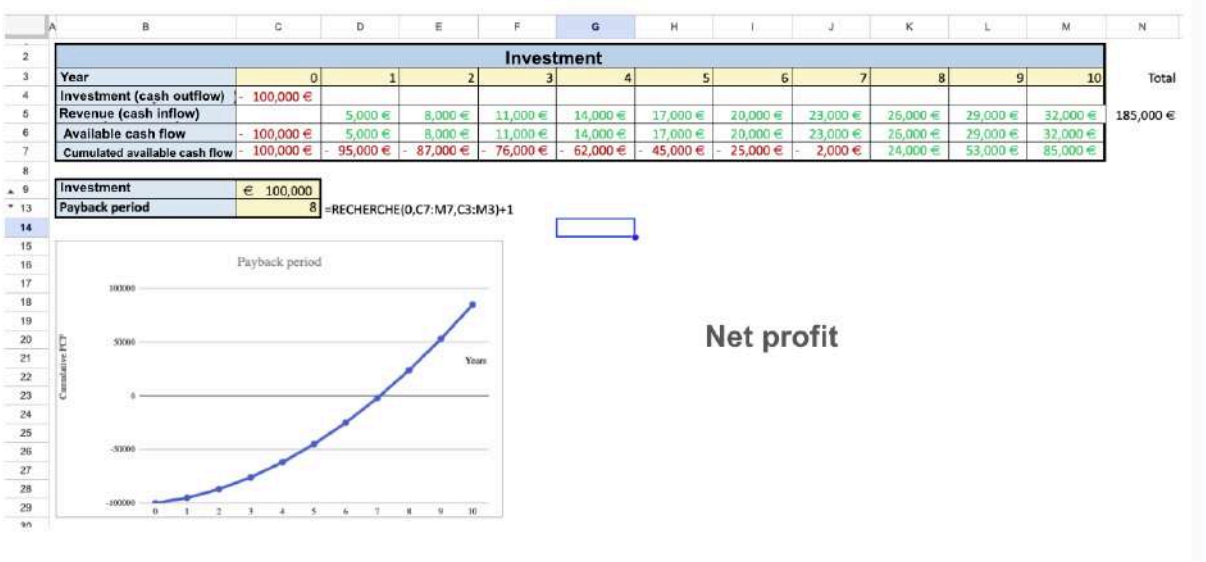
ROI (Return on Investment)
Measures the profitability of an investment. It is generally expressed as a percentage.

ROI (%) = (Net profit / CAPEX) * 100

	A	B	C	D
2		Investissement	100,000 €	
3		Bénéfice net	185,000 €	
4				
5		ROI	185%	=C3/C2

Payback Period:

- Indicates the period of time required to recover the initial investment.
- A shorter payback period is preferred, as tying up cash "costs money" and slows down future investments.



Further examples can be found in the appendix.

Values have been chosen for the example.

4. The Excel Tool

In this section, we'll explain how to use the pre-filled Excel tool. This tool is non-exhaustive, i.e. it does not cover all the elements of a subject and deserves to be made your own. The values given are for illustrative purposes only and do not represent an actual project.

The document is organized by "tab":

- Summary
- 1- OPEX - Feedstock
- 2- CAPEX
- 3- Sales & Turnover

The Summary section brings together data from the various pages, highlighting only the most important results.

Part 1- OPEX - Inputs - Inputs groups together data on raw materials, labor and other operating expenses. This section has a major impact on the income statement. For example, an inexpensive raw material will drastically reduce OPEX costs.

Part 2- CAPEX - Waste processing unit includes CAPEX excluding machine and machine. In addition, there's a formula that calculates the number of machines needed to process the incoming material flow, based on machine capacities (A38:B40).

Part 3- Sales - Sales groups together the activities that will generate money. You need to find the right selling price to increase your bottom line. The market price is a good indicator for positioning.

Instructions

Each page is to be filled in methodically, ideally with values found and verified in the field or through quotations. This is the best way to make predictions.

Self-filling cells are indicated by light green boxes.

The rest is pre-filled.

Many cells communicate with each other via formulas and from one page to another. You must therefore be careful not to delete cells that could be involved in calculating a result.

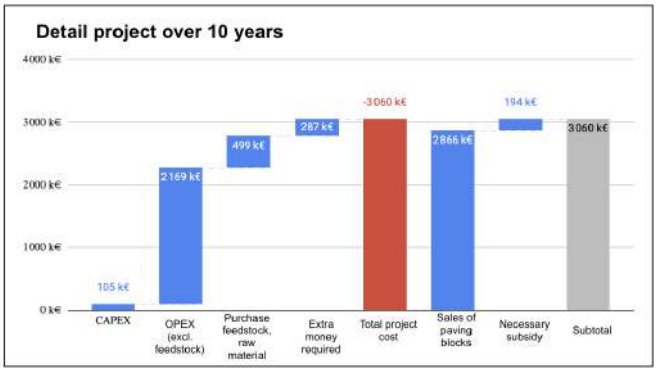
The document respects this color code:

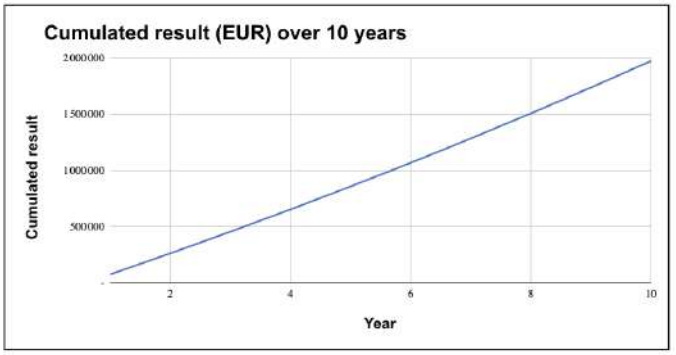
Explanation:
Main part
Secondary part
Cell to fill in by yourself
Cell with a formula
Import result (in bold)

In the "Overview" page, you can see the details of the "main parts". Simply click on this logo to ungroup the lines.

Explanation

In the Summary section, the income statement shows the annual results for each category. It's essential to have it in order to have an overview of the results, and thus to have graphical representations such as these:





This waterfall graph shows the breakdown of the parts that make up a project. It's easy to see whether the project is financially viable or not.

We can see from this example that there is a shortfall in revenue to cover all the costs incurred, and that it is necessary to obtain a subsidy or change the business model (shortfall = €194k).

In this example we can see that from the very first year the business covers its costs and makes a profit (year 1 > €0 revenue).

There are also financial indicators to help analyze whether or not the investment is a good one (seen in chapter 3).

Financial indicators after 10 years	
Net profit	198 k€
Margin	6,90%
ROI	188,4%
Payback period	1

- **Net profit:** the higher it is, the better. It's the money the project will ultimately bring in. It must be positive.
- **Margin:** the higher the better. Note that margin is limited by the market price. It must be positive.
- **ROI:** the higher the better. It shows how much the project has yielded in relation to the initial investment.
- **Payback:** the lower the better. A self-sufficient project allows you to make other investments.

5. To go further

Investment strategy

A company can decide to make its own machines if it is capable of doing so, and if it has carefully studied its capacity to do so. On the other hand, a company may decide to "make its own machines" or outsource its production.

Definition of Make or Buy (MoB): The act of choosing between manufacturing a product in-house or purchasing it from an external supplier.

The 3 most important factors to consider are:

- Availability or saturation of resources (available space, machine availability, number of employees required, etc.).
- Investment costs or limitations (consistency with budgets).
- Market prices (Is there a lot of competition? Are competitors' costs already extremely low? Is it worth it economically speaking?...)

Conditions

After a strategic study of the company's strengths and weaknesses (SWOT: Strengths, Weaknesses, Opportunities, Threats: Cf Bibliography), here are the points that condition the decision. [5]

- Focus on core activities.

- Strengthen competitive levers (profitability).
- Be more competitive than competitors and suppliers (source of differentiation).
- Supplier capacity and market size.
- Reduce supplier risks.
- Control quality, production and agility.

Challenges

Resources allocated to projects and capital expenditure (CAPEX) need to be effectively managed, focusing on what's important for the company's future.

Similarly, it's important to leverage the benefits of internal strategic strengths and suppliers to reduce costs, improve products and drive innovation.

How the MoB strategy works:

Step 1: Calculate a supplier's part price based on direct costs

For step 1, the idea is to approximate competitors' input data as accurately as possible, in order to estimate their production costs and hence their selling prices.

Step 2: Calculate your company's hourly rate

For step 2, the idea is to compare the known data with that of the other company, and fill in the rest of the unknown data with our company's internal data. This gives us the full cost of a part. So it's vital to calculate, know and control costs.

→ These two steps will enable us to define the MoB strategy.

Input data to be determined for full costs

- Material
  - Volume
  - Price
- Machine - Process
  - Cycle time
  - Number of parts produced per cycle
  - Amortization of specific investments
  - Energy
- Workforce
  - Location / country
  - Organization / number of machine operators / line
  - Man hours / operation / type of operation
- Indirect costs
  - Production support
  - Maintenance
  - Methods
- Overheads
  - Building
  - Offices
  - Laboratories

- Coûts transport
    - Type of packaging
    - How many pieces per packaging
    - How many packages / container (container / truck)

Detailed costs

DIRECT COSTS = Material cost + labor cost + machine cost

- Labor cost ($) = hourly rate ($/h) x cycle time (h) x no. of operators / no. of machines
    - Hourly rate = wage paid to employees per hour in the country
- Machine cost ($) = hourly rate ($/h) x cycle time (h) / no. of parts produced per cycle + energy cost
    - Hourly rate = Machine price ($) / (Estimated payback (Years) x days worked (Days) x 24 h)

OVERHEAD COSTS = (labor cost + machine cost) x 50% overheads → approximation

FULL COST = Material cost + Machine cost + Labor cost + Indirect cost + Transport cost + Overheads

Example with cost calculation: Capobianco

Input data:

Extruder output 150 kg/h
Cycle time 1 min
Material type: PE
Part size = 2000 x 200 x 15
Price= 0,48 €/kg

- Labor cost ($) = hourly rate $2.55/h x cycle time 0.017h x nb operator 2 / nb machine 1 = $0.087
    - Hourly rate = Colombia 2.55$/h
    - Cycle time = 1 min / 60 = 0.017 h for 2 m

- Machine cost ($) = hourly rate 0.74$/h x cycle time 0.017h / no. of parts produced per cycle 2 + electricity cost 0,17$ = 0.18$.
    - Hourly rate = Machine price $50,000 / (payback time 10 years * days worked 280 days * 24 h) = $0.74
    - Electricity cost = Power (generator + motor + heaters= ~100 kW) * cycle time 0.017h * price per kWh $0.1 = $0.17

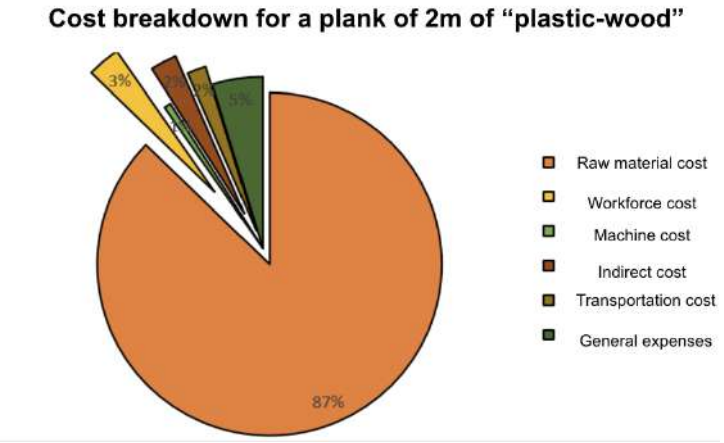
→ DIRECT COSTS = Material cost $2.45 + labor cost $0.087 + machine cost $0.18 = $2.717

- Overhead = (labor cost $0.087 + machine cost $0.18) x 50% overhead = $0.133

→ FULL COST = Material cost $2.45 + Labor cost $0.087 + Machine cost $0.018 + Indirect cost $0.07 + Transport cost $0.05 + Overheads $0.133 = $2.80

Estimated with step 2 and internal company data.

This is an example, and the values you see may be approximate.



Example of margin calculation

Example Capobianco 2m board:

In this example, sales are €1,000,000 after 166,667 2m boards have been sold.

After estimating total unit costs (2.8€) and thus total costs (466,667€), we see that the margin is 114% on this product. Considering that this product is strategic for the company's attractiveness and easy to produce with current resources, and that it has a margin of over 20%...

→ Then it makes sense to produce this product in-house.

	A	B	C	D	E	F	G	H
1		Example calculation: recycled plank - 2m						
2		P&L by category	Formula	% of costs	Amount (EUR)		Data	
3		Turnover			1000000		Selling price	6 €
4		Direct costs					Cost per product	2.8 €
5		- Material costs		87%	407170		Nb products sold	166667
6		- Direct workforce		3%	14459		Total cost	466,667 €
7		- Machine costs		1%	2991			
8		Indirect costs						
9		- Indirect production costs		2%	11633			
10		Transportation costs		2%	8310			
11		General costs		5%	22104			
12		EBIT	=E3-(SOMME(E5:E6)+SOMME(E9:E11))		533333			
13		Capital employed	=SOMME(E5:E7) + SOMME(E9:E11)		466667			
14		Profitability	=E11/E12		114%		>20% : MAKE	
15								

Example of a 1L flower pot made from recycled plastic:
In this example, sales are still €1,000,000 after selling 1,000,000 1L flower pots.

After estimating total unit costs (0.85€) and thus total costs (850,000€), we see that the margin is 17% on this product. Considering that this product is outside the company's range and field of activity, and that it calls for greater investment in machinery (machine costs), this product is unattractive. **This product is therefore of little interest to the company's internal competitiveness.**

→ So this product should not be designed in-house but purchased.

	Example calculation: flower pot - 1L			
18	P&L by category	Formula	% of costs	Amount (EUR)
19	Turnover			1000000
20	Direct costs			
21	- Material costs		62%	527000
22	- Direct workforce		5%	42500
23	- Machine costs		25%	212500
24	Indirect costs			
25	- Indirect production costs		2%	21189
26	Transportation costs		1%	8500
27	General costs		5%	40260
28	EBIT	=E19-(SOMME(E21:E23)+SOMME(E25:E27))		148051
29	Capital employed	=SOMME(E21:E23) + SOMME(E25:E27)		850000
30	Profitability	=E28/E29		17%

Data	
Selling price	1.0 €
Cost per product	0.85 €
Nb products sold	1000000
Total cost	850,000 €

<20% : BUY

6. Subcontracting and outsourcing: two different concepts

1. Subcontracting: This is the act of delegating an activity or an essential task to a partner company, even though the latter may be in competition with the principal company.
partner company, even though the latter may be in competition with the principal company.
For example, if you own a recycling company that makes plastic boards, you could subcontract the manufacture of the boards to another company.

2. Outsourcing: This is a form of service provision, in which another company is called in to carry out a specific task. Outsourcing occurs when you need to have an activity carried out outside your own premises or your usual management perimeter.

Pour les entreprises donneurs d'ordre	
AVANTAGES	**INCONVENIENTS**
• Baisse de l'endettement : si l'externalisation s'accompagne d'un transfert de moyens de production, la vente d'actifs (machines, moules…) permet d'améliorer la trésorerie.	• Risque de sous-performance et donc de dérapage des coûts quand les objectifs fixés par le contrat ne sont pas atteints (problème technique, incompétence, délai).
• Concentration sur le cœur de métier, notamment au niveau des investissements.	• Risque de dépendance envers le prestataire
• Flexibilité :	• Risque de perte de la maîtrise du processus externalisé
- Exécution d'un service au moment voulu, ajustement plus rapide de la production au volume de la demande	• Les salariés du prestataires constituent une catégorie de personnel spécifique n'ayant pas la même culture que l'entreprise, perte de cohésion.
- Droit commercial plus souple que le Droit du travail	• Risque de fuite de certaines pratiques professionnelles
• Amélioration de la qualité grâce à l'expertise spécialisée du preneur d'ordres.	• Existence de coûts cachés : coûts de recherche du prestataire adéquat, de rédaction du contrat, de gestion de la relation.
• Maîtrise ou réduction des coûts :	
- Economies d'investissements (matériel, formation, locaux, économie de masse salariale)	

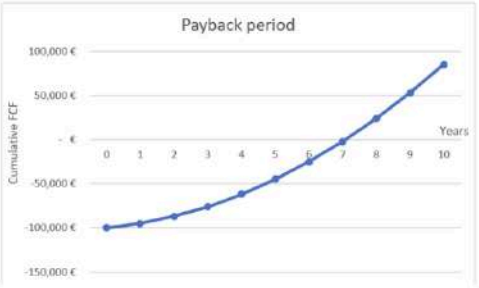
7. Bibliography and resources

Other examples of investments with an equal total annuity:

Example 1: "Growing annuities

Investment												
Year	0	1	2	3	4	5	6	7	8	9	10	Total
Investment (cash outflow)	- 100,000 €											
Revenue (cash inflow)		5,000 €	8,000 €	11,000 €	14,000 €	17,000 €	20,000 €	23,000 €	26,000 €	29,000 €	32,000 €	185,000 €
Available cash flow	- 100,000 €	5,000 €	8,000 €	11,000 €	14,000 €	17,000 €	20,000 €	23,000 €	26,000 €	29,000 €	32,000 €	
Cumulated available cash flow	- 100,000 €	- 95,000 €	- 87,000 €	- 76,000 €	- 62,000 €	- 45,000 €	- 25,000 €	- 2,000 €	24,000 €	53,000 €	85,000 €	

Investment	€ 100,000	
Taux d'actualisation	8%	
VAN	11481	=C6+VAN(C10,D6:M6) >0 so the investment is profitable with the defined profitability rate
IRR	10%	=TRI(C6:M6)
Payback period	8	=RECHERCHE(0,C7:M7,C3:M3)+1



→ Growing income postpones the payback and therefore the next investments. It's not the best investment.

Example 2: constant annuities

Investment												
Year	0	1	2	3	4	5	6	7	8	9	10	Total
Investment (cash outflow)	- 100,000 €											
Revenue (cash inflow)		18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	185,000 €
Available cash flow	- 100,000 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	18,500 €	
Cumulated available cash flow	- 100,000 €	- 81,500 €	- 63,000 €	- 44,500 €	- 26,000 €	- 7,500 €	11,000 €	29,500 €	48,000 €	66,500 €	85,000 €	

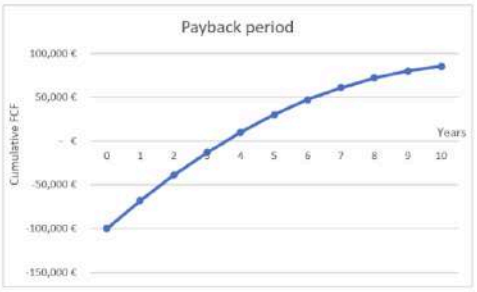
Investment	€ 100,000	
Taux d'actualisation	8%	
VAN	24137	=C6+VAN(C10,D6:M6) >0 so the investment is profitable with the defined profitability rate
IRR	13%	=TRI(C6:M6)
Payback period	6	=RECHERCHE(0,C7:M7,C3:M3)+1

→The IRR is better than the previous example, but still not the best scenario due to its payback period.

Example 3 enters "decreasing"

Investment												
Year	0	1	2	3	4	5	6	7	8	9	10	Total
Investment (cash outflow)	- 100,000 €											
Revenue (cash inflow)		32,000 €	29,000 €	26,000 €	23,000 €	20,000 €	17,000 €	14,000 €	11,000 €	8,000 €	5,000 €	185,000 €
Available cash flow	- 100,000 €	32,000 €	29,000 €	26,000 €	23,000 €	20,000 €	17,000 €	14,000 €	11,000 €	8,000 €	5,000 €	
Cumulated available cash flow	- 100,000 €	- 68,000 €	- 39,000 €	- 13,000 €	10,000 €	30,000 €	47,000 €	61,000 €	72,000 €	80,000 €	85,000 €	

Investment	€ 100,000	
Taux d'actualisation	8%	
VAN	36792	=C6+VAN(C10,D6:M6) >0 so the investment is profitable with the defined profitability rate
IRR	18%	=TRI(C6:M6)
Payback period	4	=RECHERCHE(0,C7:M7,C3:M3)+1

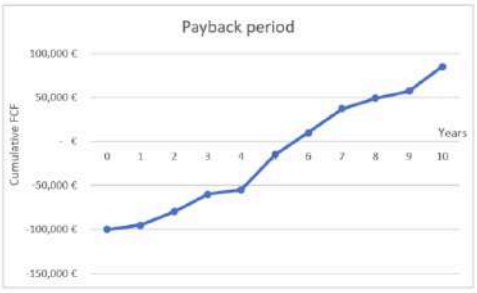


→A decreasing annuity (high annuities to lower annuities) is the best possible scenario. The payback is very low and the IRR is very high. In 4 years, the initial sum will be repaid. This is the best investment example.

Example 4: "Non-constant" annuities:

Investment												
Year	0	1	2	3	4	5	6	7	8	9	10	Total
Investment (cash outflow)	- 100,000 €											
Revenue (cash inflow)		5,000 €	15,000 €	20,000 €	5,000 €	40,000 €	25,000 €	27,000 €	12,000 €	8,000 €	28,000 €	185,000 €
Available cash flow	- 100,000 €	5,000 €	15,000 €	20,000 €	5,000 €	40,000 €	25,000 €	27,000 €	12,000 €	8,000 €	28,000 €	
Cumulated available cash flow	- 100,000 €	- 95,000 €	- 80,000 €	- 60,000 €	- 55,000 €	- 15,000 €	10,000 €	37,000 €	49,000 €	57,000 €	85,000 €	

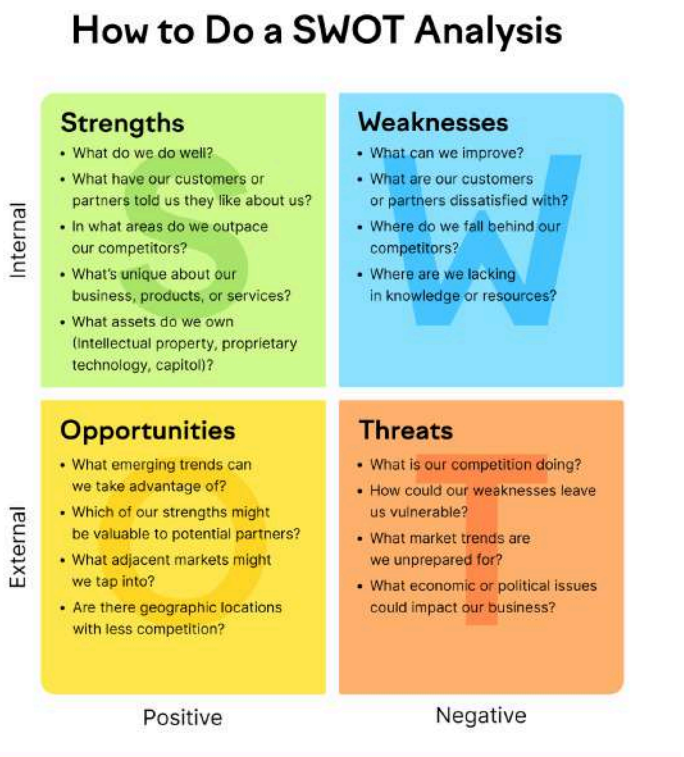
Investment	€ 100,000	
Taux d'actualisation	8%	
VAN	19228	=C6+VAN(C10,D6:M6) >0 so the investment is profitable with the defined profitability rate
IRR	12%	=TRI(C6:M6)
Payback period	6	=RECHERCHE(0,C7:M7,C3:M3)+1



→ Less attractive investment than example 2

Bibliography

1) LE MANAGEMENT STRATEGIQUE DE L'INVESTISSEMENT : CONTENU, PARADIGME ET INSTRUMENTALISATION DE LA STRATEGIE UNE PERSPECTIVE HISTORIQUE, ANNE PEZET
2) Le target costing, Francois Meyssonnier
3) LE GUIDE ULTIME POUR UNE STRATÉGIE TARIFAIRE EFFICACE, Hubspot
4) Target costing, Hubspot
5) SWOT tool



Further reading:

DCG 11, Controle de gestion

It's now up to you to take this knowledge and apply it to the environment around you.