INVESTMENT PLANNING

CAPITAL BUDGETING

AS A SOCIAL PROCESS

SCHÖNBOHM

TEACHING NOTE

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5 Investment Planning and Capital Budgeting as a Social Process

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5.1 Introduction and Learning Objectives

Investments are substantial for starting, maintaining and growing a business or non-profit organization. Without investments, a profitable growth strategy is almost impossible. Unfortunately, the list of investment projects that failed to deliver on their promises is long. The Berlin Airport (BER), which was scheduled to be operational in 2012, had even in mid-2019 no opening date prognosis and had consumed more than four times the originally budgeted funds. But also the private business has to complain about huge misallocations of investment projects. ThyssenKrupp's decision to build steel-mills in Brazil and the US has led to billions of Euros of losses. But the opposite is also true: Apple Inc. invested into the development and the launch of the

IPod and managed thus a spectacular turn-around from the brink of bankruptcy to become the most valuable company in 2014. This chapter deals with the nature, planning, decisions and cognitive biases in long-term investments. The fundamental assumption is hereby that we are dealing with a social process instead of a rational decision making which could be transferred to an artificial intelligence fed with the right investment algorithm.

5.2 The nature of investments

Investments in long term assets of the company, which are also referred to as capital assets, are crucial for companies. BASF SE added in 2013 7.5 billion € to its non-current assets (including acquisitions), which represented 10.2% of total sales in 2013. These investments lay the foundation for the business model, especially in capital intensive industries like the chemical industry. These assets can be tangible assets like trucks, buildings, robots, ships, computers or a gold mine, or intangible like patents, knowledge build up in R&D or trainings or improved business processes. BASF SE displayed 1.8 billion € of research expenses in its annual report 2013. The results of investments could be new and innovative products, a new Business Intelligence system, increased service quality, a new production plant, efficiency enhancements in the production or a replacement machine.

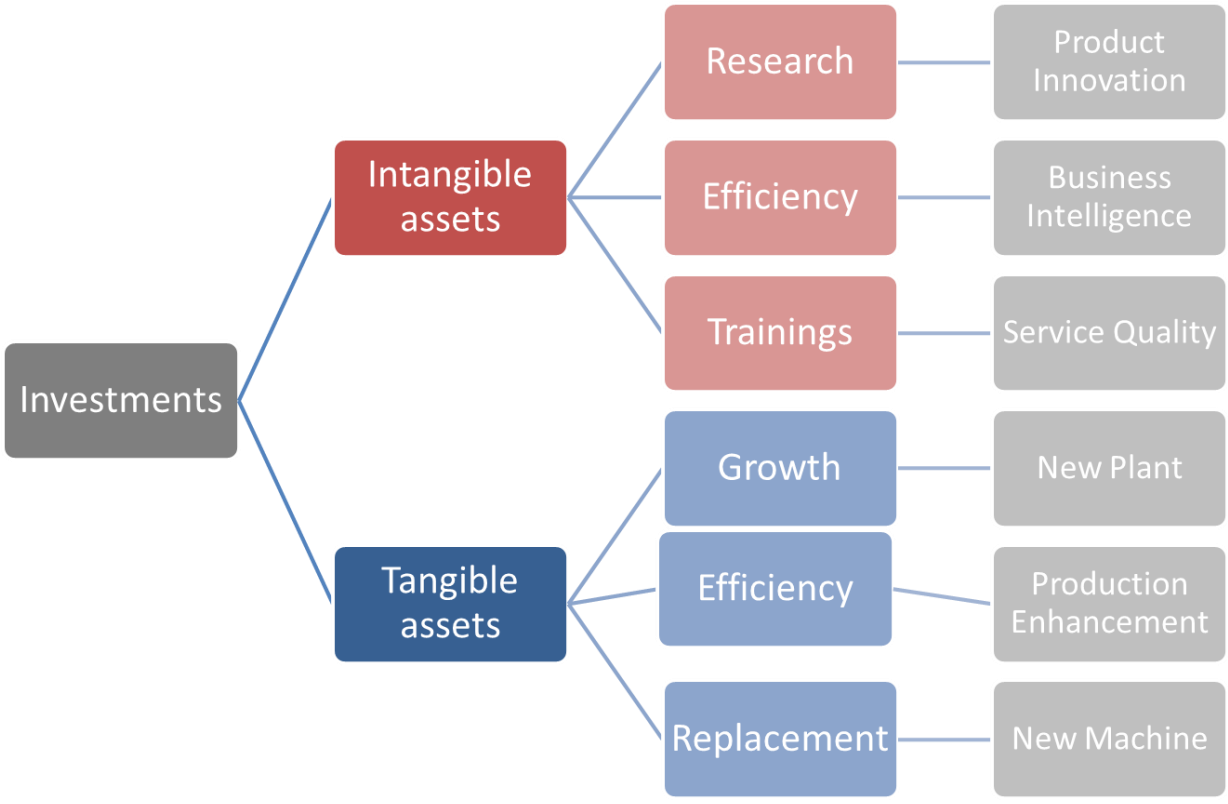

Figure 5-1: The nature of investments

Although the original idea of capital budgeting was tied to an increase in long term assets in the balance sheet, it is more relevant to think of investments in terms of long-term value to the company. Investments in trainings and organizational enhancements might be costly, but prudent accounting principles might have difficulties to generate assets in the balance sheets to compensate for the incurred period costs.

Special cases of investments are long-term financial investments in shares of other companies (Mergers and acquisitions) or other investments in non-operational investments. This chapter focuses on operationally relevant investments for organic growth options.

5.3 Investments into the future come at a risk

Although the importance of investments is evident, the acquisition of long term assets implicates significant risks, namely political market related, operational and liquidity risks.

Figure 5-2: Investment risk categories

Politics. Long-term investments face the risk of changing regulations and social or political pressure. The definition of what is sustainable and politically wanted business is changing. New laws get passed and new regulations might erode the

basis for the investment by prohibiting the value generation process, banning potential products for ecological reasons or adding substantial production cost for ecological and social measures, like adding filters or introducing high minimum wages. Even though there might be legal compensation of a certain extent, the political sphere can destroy the raison d'être of the investment.

The greatest risk is about the volatility of the respective **markets**. It is very difficult to predict market demand and the behavior of potential competitors, especially for the next ten to twenty years. Market and related expectations tend to be very to overly optimistic, due to the overconfidence bias of market participants. Overoptimistic market demand for a product might result into an excessively large production plant and a constantly underutilized and loss-making investment. On the contrary, a factory which has too little capacity for market demand might attract competitors and lead to fierce price competition. Flexible options that can adapt to a volatile market demand usually come at a higher price. Likewise, an R&D project might be technologically successful, but due to a technology and market shift over the 7 year time of the project it might not find the expected market.

Operational risks are high in a long term project like setting up a plant in a new country. Apart from unforeseen regulatory hurdles and difficult construction work it might be difficult to get the right machinery and human resources to stick to the original plan as far as time and quality are concerned. The risks include theft and sabotage, power outages or weather abnormalities. Technological uncertainties might further complicate the implementation.

Liquidity. Investment projects need substantial amounts of cash to be financed and in many cases it takes for market reasons or operational challenges more time and cash than initially planned. Over the course of the years the funds might run dry. Volatility in the core business might reduce the cash available from operations and then overall liquidity poses risks. The investment will be spread over more years and thus become more expensive.

5.4 Capital Budgeting as a Process

Although Capital Budgeting or investment appraisals are often implicitly presented in textbooks as rather rational and technocratic processes which boil down to almost

objective calculations of net present values, the social reality in corporations looks differently. In the following a process scheme with six steps is presented to describe an ideal type of investment process adding typical cognitive bias pitfalls for each process step.

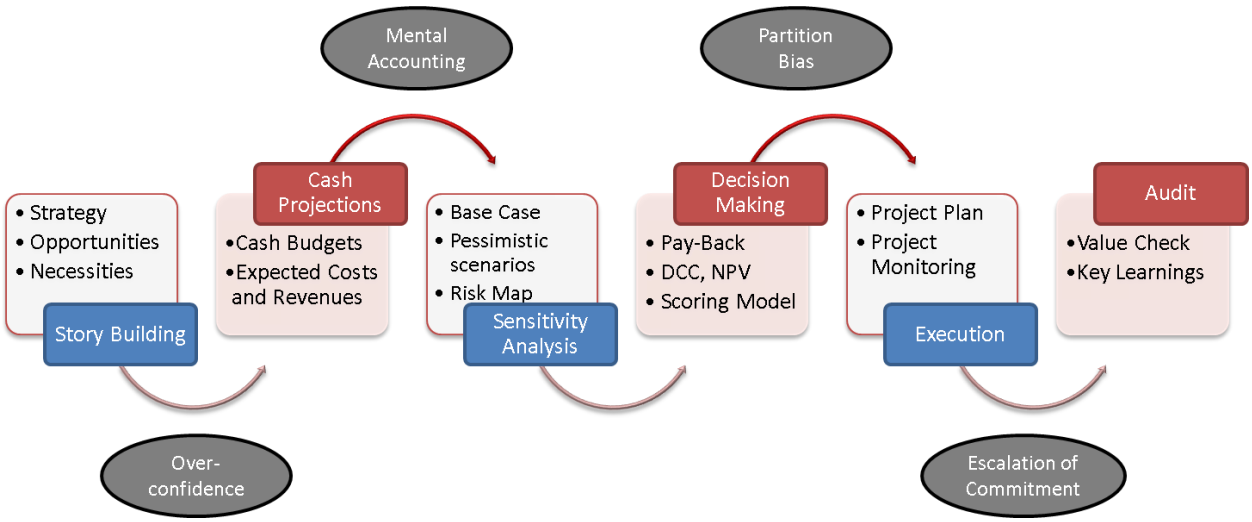

Figure 5-3: Capital Budgeting Process

The six steps are called story building, cash projections, sensitivity analysis, decision making, execution and audit.

5.4.1 Story Building

Why should the company invest cash into a certain topic, instead of giving it back to its shareholders? Every investment needs a reason and a story to support it. This is true for necessary investment due to changed environmental regulations or long term financial investments. Even replacement investments should be able to explain their case or the rationale of the potential investment decision.

Ideas for investment opportunities and needs can be generated from each part of the organization. The workers on the shop floor can create valuable ideas for the enhancement of production, the R&D departments generate ideas for development projects, marketing and sales might develop new business ideas requiring substantial funding, foreign subsidiaries generate ideas on how to expand the local business scope and the strategic planning department together with the executive team and external advisors develop new opportunities for profitable growth. Depending on the corporate and national culture these investment ideas are either initiated in a top-

down or a bottom-up manner or both. In countries with a high power distance it is widely expected to have management in charge for generating strategic ideas.

The stories developed might be very different in style and substance: From "We need a new machine, or we will lose business." over "The competitor has started a joint venture in Vietnam. We have to do the same to participate at the growth market." to "Based on our trend analysis, we should buy a company with expertise in material recycling to create a new niche market within our existing business." The closer the source is to the executive team the more the proposals tend to be in line with the strategic planning and the more operational the source is, the more it tends to be bound to the existing business model.

The following questions might help you to assess whether the story is promising or not.

- How does the particular investment fit into the overall strategy of the company? What kind of synergy with the rest of the business is possible?
- What is the concrete business opportunity? Are there alternatives?
- Why will the investment increase the value of the company?
- What is the outlook for the relevant markets?
- What will the competition do?
- Why is it necessary to invest or why would not investing pose a threat to the company?
- What are important social or ecological topics relevant to the investment?

The main cognitive bias that managers have at this stage of an investment is **overconfidence**. Usually opportunities are overvalued whereas potential risks are heavily discounted. Although this might be useful for starting a project, it should be met with caution. The answers to the questions should be substantiated with external data and outside opinions or assessments. An additional factor to be reckoned is the personal motivation of the proponent of the proposal? The quest for personal prestige, power and other private motives might also distort the picture.

5.4.2 Cash Projections

If the initial proposal is considered to be interesting by the screening board, the proposal enters the next stage, the one of **cash projections**.

At this stage, the investment proposal goes through a financial modelling procedure. A detailed plan with expected revenues, costs, taxes and capital expenditures of the planning period has to be developed for the investment project. Out of this the net cash flow can be derived for each year of the planning period. Although this might lead into a simplified net flow chart like below, it has to lay bare the key assumptions: On the cash inflow side these include but is not restricted to statements about the expected market conditions, market shares, price levels and product life cycles. The cash outflow takes into account the investments, the production and personnel costs for expected activity levels. Let us assume the proposal "Project Z" to invest into a sales office with a small workshop in India which will be sold to the joint venture partner at the end of year 5. At this stage and without doing the formal assessment **mental accounting** as a cognitive bias tends to kick in: It boils down to the statement that a € does not equal a €. This could be because, there is a general market perception that one has to invest in China or even better that a potential investment in China might give fresh impetus to a lackluster market performance there. The implicit hope is that a failed investment of the past might be equalized and this is subjectively precious although the business case might look more promising in India or Vietnam.

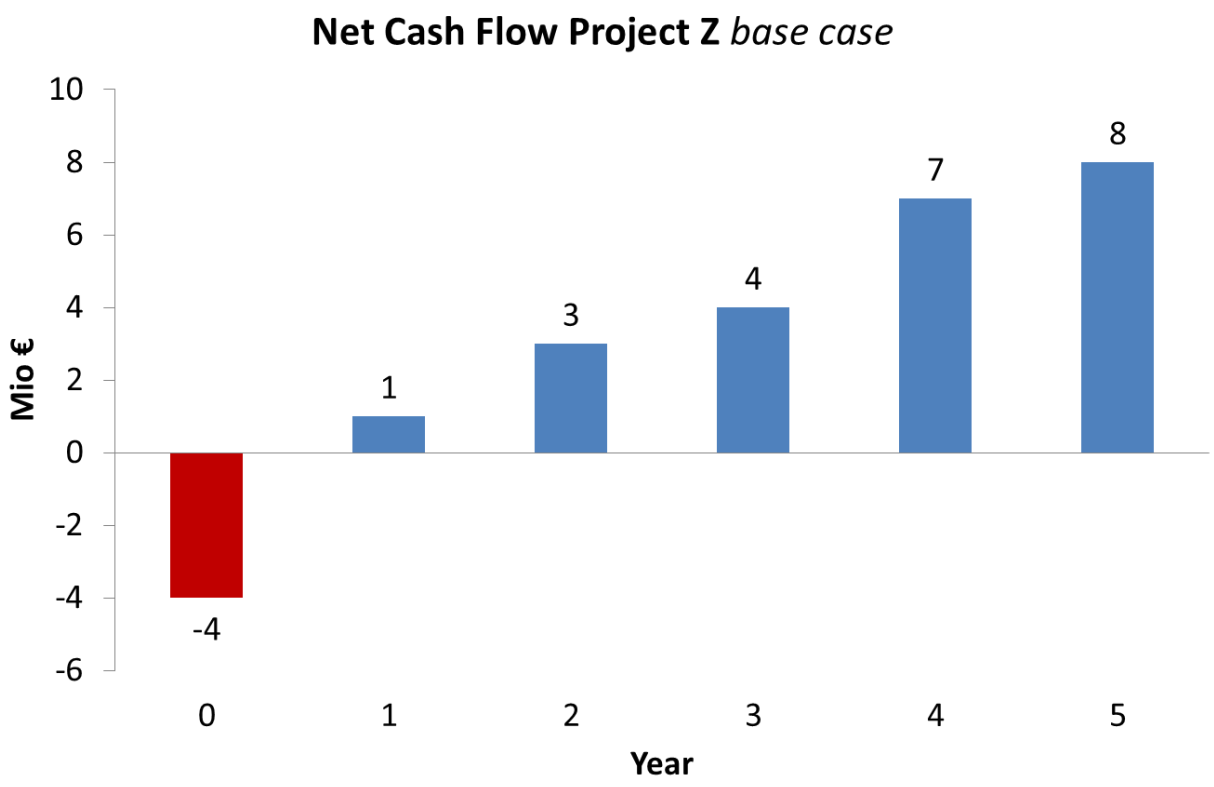

Figure 5-4: Project Z base case net cash flow projection

The base case is based on the assumptions that management deems most likely to occur. The following questions might help you to assess whether the cash projections are consistent or not.

- What are your assumptions about market growth and market share?
- How will the price level develop over time?
- How do you plan to build up the relevant personnel?
- Have you taken into account potential tax payments?
- Have you thought about inefficiencies and training requirements in the beginning?
- What are your assumptions about wage inflation?
- What happens at the end of the planning period?
- What kind of government risks are to be expected?

5.4.3 Sensitivity Analysis

Within the planning process one comes almost naturally to the point that certain key assumptions about the net cash flow might be subject to uncertainties and that it would be interesting to plan with different scenarios. Important variables might be the exchange rate, the market growth or competitive action. The expected scenario is usually titled with "base scenario". Keeping the key variables in the favorable area of the possible means to create an "optimistic case" and adjusting the key variables to uncomfortable (but still possible) levels builds the "pessimistic case".

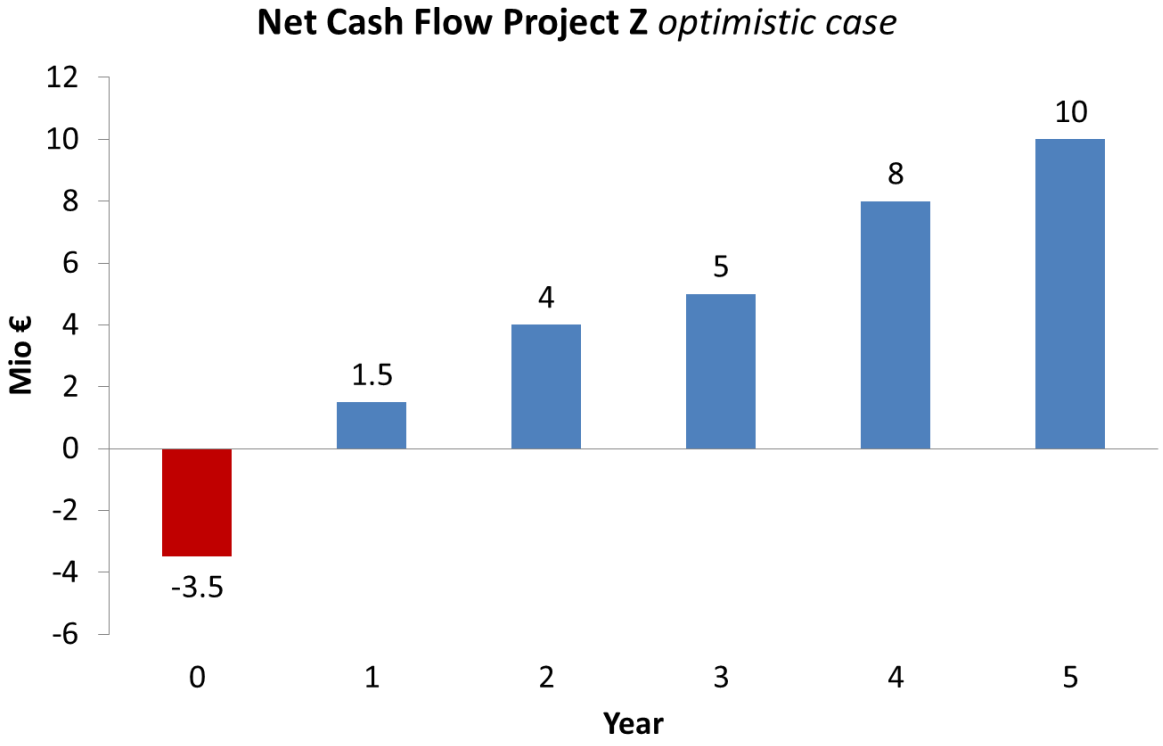

Figure 5-5: Project Z optimistic net cash flow projection

The optimistic case is also build to bring some sensitivity to the financial modelling. Just adding 20% sales and leaving the rest constant does not suffice. The consistency of the model on the cash budgeting level for each year might be more revealing than the upside potential.

Taking a skeptical view on the project and sticking to more unfavorable assumptions will create a pessimistic scenario. This includes making pessimistic assumptions about key variables. In many cases, the "pessimistic case" still includes a lot of optimism. Critical questions might include the following:

- Why is it pessimistic to assume that the market growth in the next 10 years will exceed the market growth of the last decade?
- Have you thought about integrating deteriorating prices if the competition reacts aggressively towards our investment?
- What is pessimistic about increasing our market share by 5%?
- Have you priced in the potential of one year of recession?
- Why are the costs identical in the base and pessimistic case?
- What is your worst case scenario and how far is it away from your pessimistic scenario?

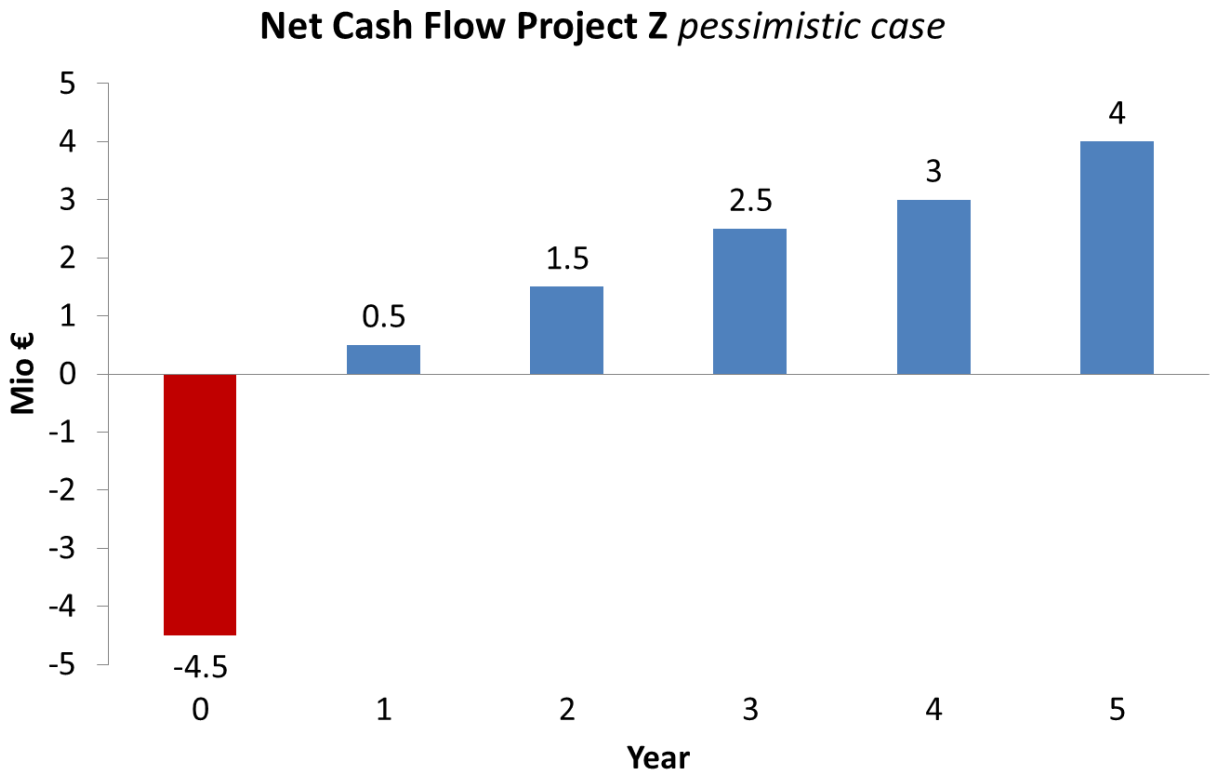

Figure 5-6: Project Z pessimistic net cash flow projection

The pessimistic case should be best accompanied by a risk map. The risk map reveals the risk awareness and reasoning of the proponent of the investment proposal and serves as a consistency check of the whole project. If the risk map misses substantial risks, this becomes evident. The discussion about the perceived probability, impact and influence will sharpen the overall picture of the investment. The risks should also be reflected in the different scenarios and cash flow cases.

Using the example of "Project Z", the five major risks identified are a lack of adequate technical personnel, a potential price war by the local competitors to fight the new market entrant, potential coordination challenges with the joint-venture partner, an unsuitable project manager and last but not least a temporary market decline. It might also be wise to look for reputational risks and social and environmental repercussions of a given investment project.

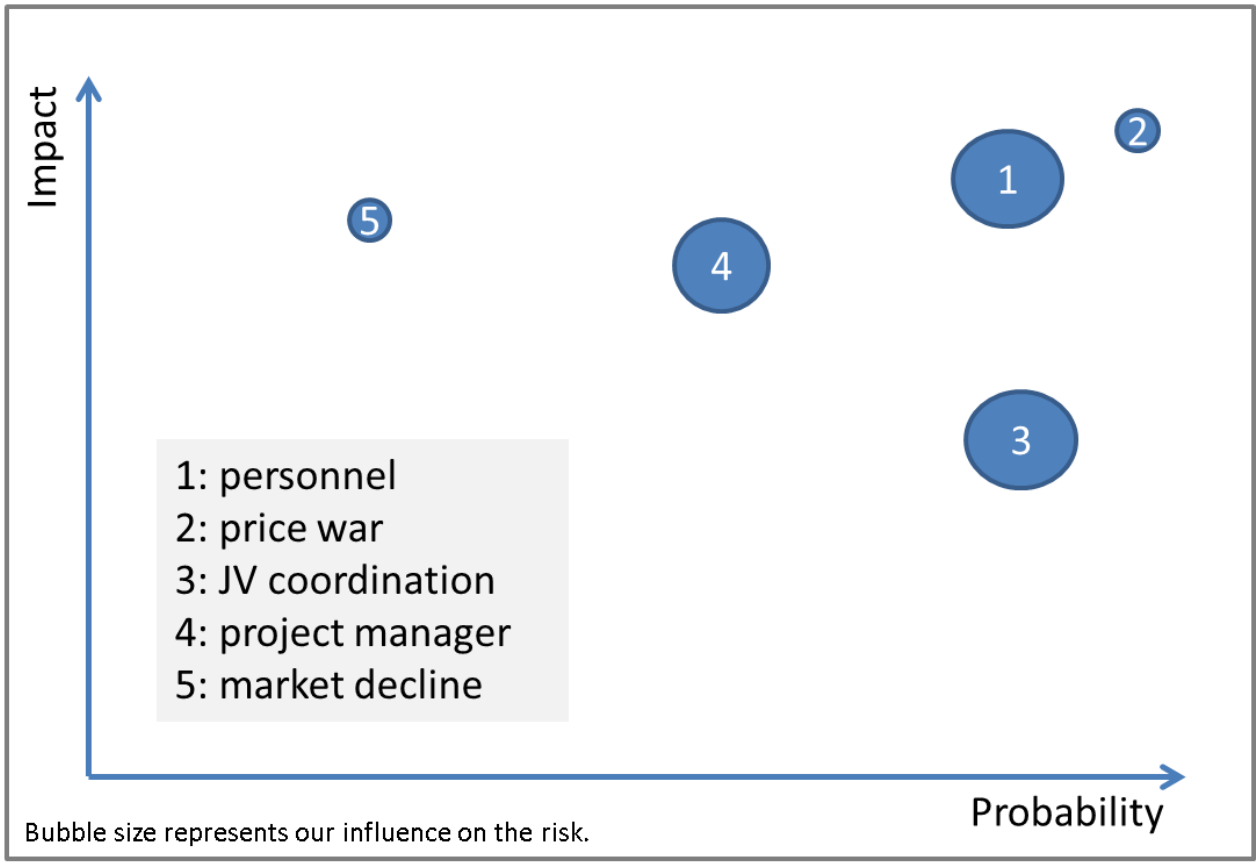

Figure 5-7: Risk map Project Z

5.4.4 Decision Making

After analyzing carefully, one has to come to a decision on which project to pursue. Usually there is a choice of various investment projects and only a limited amount of cash available. Therefore, it is necessary to bring the investment projects into a certain order. This can be done in numerous ways. It would, however, be one-dimensional to just go for the project with the highest net present value or the shortest pay-back time, although these are important criteria. To deal with a multidimensional decision problem, a scoring model might help in preparing a reflected decision.

The process of deciding and releasing of capital budgeting is of strategic importance to the company and involves many hierarchical layers within the corporation. The responsibility lies with the executive board to establish a process that is properly governed and eventually audited and challenged by the supervisory board. Although this process tends to be annual, it might be wise to create some maneuvering space for investments opportunities throughout the year. Regardless of the process, the investment proposals have to be ventilated, assessed and evaluated and only a few projects will be realized. One might think of a funnel that channels and filters the proposals and only lets those in that are in line with corporate requirements. This funnel of screenings and assessments could be compared to the immune system of an organization.

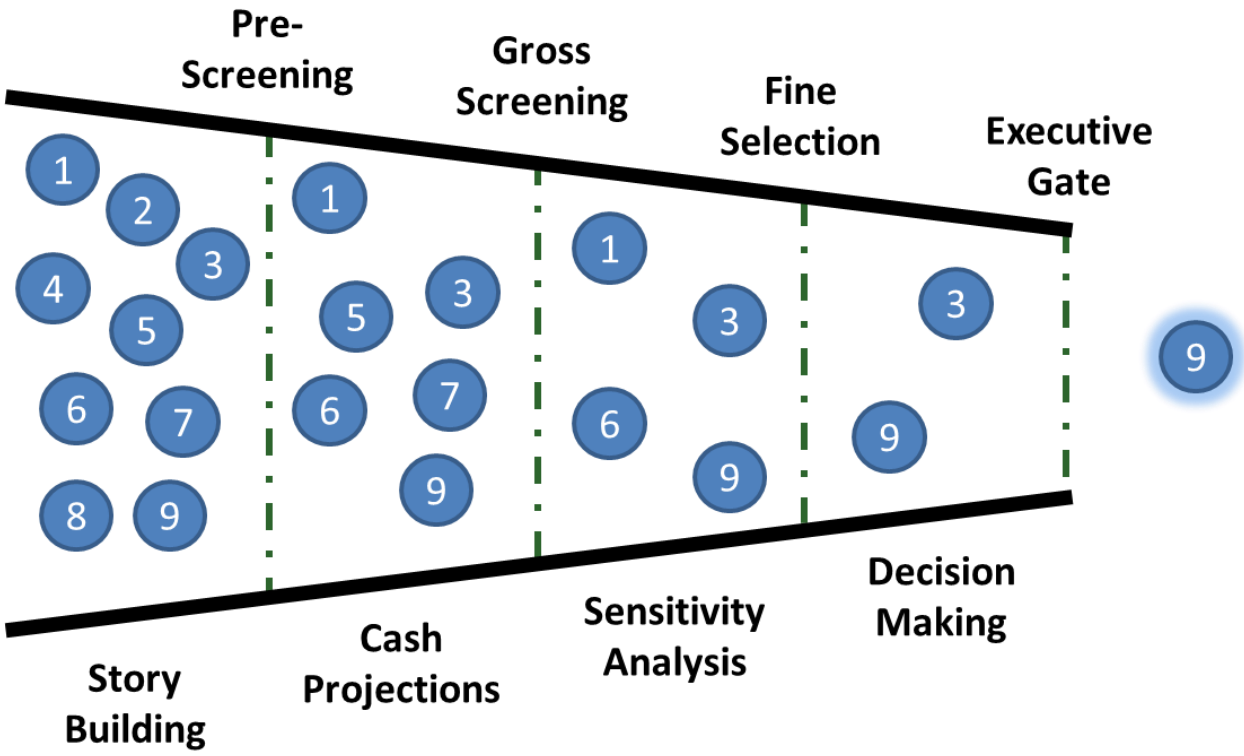

Figure 5-8: Investment Decision Funnel

Pre-Screening

All relevant hierarchical levels pre-screen these ideas on a qualitative level before they elaborate the story further with preliminary cash projections and pay-back assumptions and let it move to the next decision gate, which might be a quarterly management meeting.

Gross Screening

This gross screening process selects the most promising projects and asks for further assessment work. First assessments of cash flows and profit opportunities are needed here. Preliminary risk assessments are developed and offer an overview over potential threats and risk scenarios. In some companies hurdle rates on profitability or payback help reducing the number of projects to be processed into the fine selection phase.

Fine Selection

The fine selection process requires detailed preparation work for each investment proposal. The objective is to get a well-researched and reflected picture of each project. It might be helpful after the gross screening to bring in additional people into the process of building a better and more detailed picture of the opportunities and risks of the projects. Managerial accountants or strategic planning staff could help applying the evaluation methodologies in line with management expectations. They will also provide a fresh and critical sounding-board function and might anticipate questions of the final decision makers. The result is a short list of the most interesting and well prepared investment proposals. They will be presented to the executive team for final selection and approval.

Executive Gate

The portfolio of elaborated investment proposals is presented to the final decision body. Since capital restrictions usually do not allow for all projects to be pursued. Therefore, decision criteria have to be found to decide on a few projects to be realized.

One important systematic psychological or political flaw is the so-called partition bias. Projects are approved not by the value of the projects itself but by the perceived need to represent different business segments or business units.

5.4.5 Execution

The execution of investments can be complicated and take many years. The investment proposal, however, is the benchmark for the execution. A comprehensive

risk map could also be the starting point for the project management. Project management is an art for itself that cannot be explained in detail here.

It might be worth mentioning that many bad projects suffer from the so-called escalation of commitment. To make an example, the project X was planned to cost 5 million € and based on this projection was scheduled to create a 15% return on investment. Unfortunately, at the end of year 1 it becomes obvious that the project will cost at least 3 million € more and the cash flow outlook for the future has also deteriorated. If the deciders had had to base their decision on the current estimations of the project, they would have rejected it. It would be most rational to stop the project immediately and accept the sunk costs. However, the executive team continuous to release additional funding for the project. This escalation of commitment is partly explained by the psychological need to reverse the bad decision of the past. This practice is also referred to as "throwing good money after bad".

5.4.6 Audit

Decisions under uncertainty do not always generate the intended outcomes. They are entrepreneurial decisions and this includes the propensity to underperform expectations. Therefore, one should be gracefully judged on past entrepreneurial decisions. This does not mean avoiding a performance audit of investments. It is a good practice to audit the finished project against the plan and expectations of the investment proposal. Double-loop learning requires this feedback. Please find listed a few guiding questions for the audit:

- Were the quantitative goals concerning dimensions like time, sales, costs, cash flow achieved? If not, what were the reasons?
- Was the risk management based on the initial risk map coherent and active and could it prevent further damage?
- Are there lessons learned for the investment process concerning investment criteria, tools or people involved?
- If the project did not fulfill expectations, what kind of early warning signals were registered and why did they not trigger successful corrective action?
- If the project met unexpected internal and external resistance, how could this have been avoided and how could the communication process be enhanced?

- How was a bad project stopped successfully? Which were the main obstacles to be surmounted?

Looking at the investment process as a social practice instead of a rational process will help to carefully design the process and gracefully audit the results for enhancements of the process.

5.5 Tools of Capital Budgeting

The practice and theory of capital budgeting has developed many tools to deal with the decision making on investment projects. The following table lists the most important ones from a practitioner's point of view.

Tool	Description	Benefits	Drawbacks
Payback method	Time until recovery of investment: amount invested divided by expected annual cash flow	Ease to calculate and understand; based on cash flows; acknowledges risk	Ignores the time value of money, profitability, cash inflows after investment recovery
Accounting rate of return (ARR)	(annual net cash inflow - annual depreciation on asset) / (amount invested in asset + residual value)/2	Ease of calculation and investment decision); based on profitability	Uses accounting income measures; ignores the time value of money
Net present value (NPV)	Sum of discounted cash flows minus the initial investment.	Based on profitability, time value of money and cash flow measures	Uncertainty in predictions of cash flows and discount rate; no rigorous consideration of risk and return volatilities
Internal rate of return (IRR)	The discount rate that makes the net present value of the project equal to zero	Based on profitability, time value of money and cash flows	Uncertainty in predictions of cash flows and discount rate; no rigorous consideration of risk and return volatilities
Risk Map	Visualization of a project risk assessment based on probability, impact and influence	Raises risk awareness and creates a basis for' what if?" discussions	Misuse could create a false sense of safety
Sensitivity Analysis	Calculation of possible misestimated cash flows after identification of key variables effecting them	Greater caution due to identification of key variables; help in detection of inappropriate forecasts	Ambiguous estimations and results; underlying variables often interconnected
Real options / decision trees	Options to modify projects, such as expand or abandon a project; calculated by adding up net present values with assigned probabilities	Flexibility; reduces the escalation of commitment to failing projects when used in the selection phase	Ambiguous estimations
Investment Scoring	Compares various projects by quantifying various quantitative and qualitative investment criteria	Creates a multi-dimensional discussion and decision of investment projects	The selection and weighing of investment factors remains (inter-) subjective

Table 1: Overview of instruments and methods of capital budgeting

Most of the tools are explained in undergraduate textbook about management accounting or corporate finance with the effect of reducing the social process of identifying the right investments against an uncertain future into a one-dimensional

technocratic heuristic. Nevertheless, a few basics are worthwhile be repeated or elaborated to refresh the memory.

5.5.1 Payback

The question behind the payback method is: When will I have recovered my invested capital? Or put differently, when will the project as a whole become cash-positive? The assumption is the shorter the better, because this implies reduced inherent business risks. Applied to the different scenarios of Project Z, this means for the base case a payback time of three years (-4 Mio€ in year 0 will be offset after two more years with 1 and 3 Mio. €.). The optimistic case has an estimated payback time of 2.5 years (-3.5 Mio € will need the payback of 1.5 in year one and half the 4 Mio. € of year 2 to become cash positive.) The payback as a rule of thumb which does not require a calculator is rather popular in practice. Against the backdrop of rather uncertain estimated future cash flows, a simple heuristic or decision tool can provide adequate answers.

5.5.2 Net Present Value

Most companies use net present value calculations to justify their investment decisions. The loan providing banks require this kind of reasoning and they have a point in adding the time value of money to the rationale. Discounting future cash flows by a discount rate ideally equivalent to the risk free interest rate and a specific risk premium, reflects the time value of money. Money today is more valuable than in 5 years (especially if I have to finance the investment and pay interests on the loan) and the cash flows in 5 years are subject to many more risks.

Since it is almost impossible to decide on the adequate risk premium, many companies in low- inflation countries use a set hurdle rate of 10% for their investments, which they adjust only for obviously risky projects. In countries like India, Brazil or Vietnam with years of considerable inflation, the rates could be as high as 20-25%. The required minimum internal rate of return is then calculated with nominal 25% per year.

The present value of a future net cash flow equals the future net cash flow discounted and the sum of all positive and negative present values equals the net present value (NPV).

The two fundamental formulae are:

$$\text{Present Value} = \frac{\text{Net cash flow in period n}}{(1 + \text{discount rate})^{n}}$$

$$\text{Net Present Value} = \sum_{n=0}^{N} \frac{\text{Net cash flow in period n}}{(1 + \text{discount rate})^{n}}$$

The NPV of the Project Z base case scenario is then calculated as follows, assuming a discount rate of 10%:

Project Z base case NPV (in Mio. €)

year	net cash flow	calculation	present value	
0	-4	*(1.10)^0 =	- 4.000 €	
1	1	*(1.10)^-1 =	0.909 €	
2	3	*(1.10)^-2 =	2.479 €	
3	4	*(1.10)^-3 =	3.005 €	
4	7	*(1.10)^-4 =	4.781 €	
5	8	*(1.10)^-5 =	4.967 €	
		SUM	**12.142 €**	**NPV**

Figure 5-9: Project Z base case NPV calculation

The same can be done for the optimistic and pessimistic case as seen below. Any positive NPV indicates a financially viable project.

Project Z optimistic case NPV (in Mio. €)

year	net cash flow	calculation	present value	
0	-3.5	*(1.10)^-0 =	- 3.500 €	
1	1.5	*(1.10)^-1 =	1.364 €	
2	4	*(1.10)^-2 =	3.306 €	
3	5	*(1.10)^-3 =	3.757 €	
4	8	*(1.10)^-4 =	5.464 €	
5	10	*(1.10)^-5 =	6.209 €	
		SUM	**16.599 €**	**NPV**

Figure 5-10: Project Z optimistic case NPV calculation

Project Z pessimistic case NPV (in Mio. €)

year	net cash flow	calculation	present value	
0	-4.5	*(1.10)^-0 =	- 4.500 €	
1	0.5	*(1.10)^-1 =	0.455 €	
2	1.5	*(1.10)^-2 =	1.240 €	
3	2.5	*(1.10)^-3 =	1.878 €	
4	3	*(1.10)^-4 =	2.049 €	
5	4	*(1.10)^-5 =	2.484 €	
		SUM	**3.605 €**	**NPV**

Figure 5-11:Project Z pessimistic case NPV calculation

Professional assessments of investment proposals include a net present value analysis. The process facilitates a detailed treatment of the case. The NPV tool as such might not create the immediate answer to the question whether to invest or not. The values are also to be interpreted with caution since they are the condensed result of the assumptions of the input variables, most importantly the cash flows. The positive NPV even of the pessimistic scenario summarizes the effects of the assumptions of the different scenarios. The net present value in itself assumes that available funds could be invested at the same rate as the discount factor. Small differences in NPV should not be over-interpreted. Asking critical questions which

could reflect even more on the suitability of the project might further enhance the decision quality:

- What are events which would threaten a positive NPV in the pessimistic scenario?
- What options do we have to abandon the project gracefully?
- Which are criteria for investment success for the project in year 3 and 5?
- What are the environmental effects of our investment?
- What are the motivational repercussions for our workforce (e.g. when production is off-shored?)
- How much does this project limit our future options?
- What would happen if we do not pursue this project?

Having developed and appraised various investment proposals is not a goal in itself. It pays tribute to the fact that capital and long-term funding is limited.

5.5.3 Investment Appraisal Scoring Model

The beauty of the net present value is that it produces a clear ranking of projects. How can various investment criteria partly quantitative and partly qualitative be reconciled in one decision? An investment appraisal scoring model could help: Three steps are necessary to rank different investment projects based on multiple investment criteria: 1st Definition of investment criteria, 2nd the weighing of the different criteria and 3rd the scoring of the projects for each criterion.

Definition of investment criteria

The definition of investment criteria is more complex than one might intuitively think. This is probably the main reason, why most companies stick to NPV rankings. The criteria should be mutually exclusive and not correlated. NPV would for example be correlated with profitability or internal rate of return. The choice is intersubjective, which means the decision body had agreed upon the criteria, even if they are neither objective nor perfectly exclusive. In the following example 5 criteria are explained: (1) strategic fit & synergies, (2) net present value, (3) risk profile, (4) managerial options, and (5) management confidence.

Investment Appraisal Scoring Model	investment criteria	strategic fit & synergies	net present value	risk profile	managerial options	management confidence	total weighted score	
	weighting	20%	50%	10%	10%	10%	100%	
							0-10	ranking
project X		4	9	8	2	10	**7.3**	1
project Y		9	6	7	8	7	**7**	2
project Z		2	10	3	5	2	**6.4**	3

Figure 5-12: Investment scoring model

Strategic fit & synergies assesses whether the projects fits into the strategic plan of the company and offers synergy potentials with existing business models. A "0" would mean that it does not fit into the explicit strategic plan and is not related to the existing business, but would divert management attention from the core business. A "10" would mean that the project is well in line to achieve the long-term strategic goals of the company and offers valuable potential synergies with other businesses which have not been part of the NPV calculation. The **net present value** has been explained above. The best project could serve as a benchmark ("10") and the NPVs of the other projects are a certain percentage of the benchmark. If this is 41%, the project would be rated with "4". The **risk profile** might have already been partially integrated into the NPV, but there are additional risks that usually are not integrated: Would a failure of

the project put into question our business model? Are there reputational risks involved? Do we have influence over the most important risk factors? The more the decision body feels comfortable with the risks, the higher the score, the more the risk profile raises fundamental questions, the lower the score. **Managerial options** as a criterion details the possibilities to change the project along the way (increase capacity later in line with growing demand) or to abandon it and sell it at a fixed price or use parts of the projects (e.g. machine tool) somewhere else. If the NPV was already calculated by taking into account real options, this criterion should be exchanged, since it would not include additional information. As for the assessment, the "0" would mean that the money and efforts would be lost completely (sunk costs) and a "10" would offer options almost as attractive as the base case. **Management confidence** is a highly subjective criterion. It could include the trust that the decision body puts into the project management or the trust that the project will succeed because of proven technologies or market knowledge. This criterion gives also explicitly room for the gut feeling of the deciders. The discussion about the point and the evaluation of various projects might be an opportunity to discuss non-rational aspects of the proposal.

The weighing of investment criteria

Playing around with the weighting factors of the different criteria reveals the preferences of the decision body. If 95% is NPV than it might as well be 100% NPV and no scoring model is needed. The five criteria from above are weighted with 20% for strategic fit & synergies, 50% NPV and 10% for the remaining criteria. In this case there is a real possibility that projects will be selected which do not provide the highest NPV. A choice should reflect the real preferences of the deciders. It may well be that the deciders decide during the process to change the weighting of the criteria to better reflect their preferences.

Now, the individual projects have to be evaluated and a quantitative assessment from "0" to "10" has to be agreed upon. The investment score is the sum of the weighted scores per criterion. For example for project the management confidence score is 10 multiplied with 10% equals 1. The total score for the projects is calculated as follows:

$$\text{InS (project X)} = (4 \times 20\%) + (9 \times 50\%) + (8 \times 10\%) + (2 \times 10\%) + (10 \times 10\%) = 7.3$$

$$\text{InS (project Y)} = (9 \times 20\%) + (6 \times 50\%) + (7 \times 10\%) + (8 \times 10\%) + (7 \times 10\%) = 7.0$$

$$\text{InS (project Z)} = (2 \times 20\%) + (10 \times 50\%) + (3 \times 10\%) + (5 \times 10\%) + (2 \times 10\%) = 6.4$$

We can easily see that project X has the highest score and project Z despite the top NPV has scored lowest. An interpretation might look like this. Project Z has the highest NPV but is not linked to the core business model or the strategic fit of the company and comes along with discomfort in the risk profile and management confidence. It might have been proposed by the foreign subsidiary. Project Y has an almost perfect fit with the strategy and an acceptable risk profile but scores lower in NPV. This proposal could typically stem from the strategic planning department. Project X combines the beauty of providing a high NPV plus a lot of management confidence. Although the strategic fit and potential synergies are relatively low, the project tops the ranking. It could be a production enhancement investment for an existing production plant and probably stems from business operations, which might have successfully implemented the same technology somewhere else.

Questions and Cases

1.1 Capital Budgeting Quiz

1. Capital budgeting can be described as having three phases: a) identification of potential investments, b) selection of investments, and c) postaudit of investments. What is the management accountant's role in each phase?
2. Why is discounted cash flow a superior method for capital budgeting?
3. "The higher the minimum desired rate of return, the higher the price that a company will be willing to pay for the cost-saving equipment." Do you agree? Explain.
4. "The DCF model assumes certainty and perfect capital markets. Thus, it is impractical to use it in most real-world situations." Do you agree? Explain.
5. "Double-counting of costs occurs if depreciation is separately considered in DCF analysis." Do you agree? Explain.
6. Does the IRR model make significantly different decisions than does the NVP model? Why or why not?
7. What does the real options model recognize that the NPV and IRR models do not?
8. "We can't use sensitivity analysis because our cash –flow predictions are too inaccurate." Comment.
9. Why should the differential approach to alternatives always lead to the same decision as the total project approach?
10. "The NPV model should not be used for investment decisions about advanced technology, such as computer-integrated manufacturing systems." Do you agree? Explain.

11. Distinguish between average and marginal tax rates.
12. Distinguish between tax avoidance and tax evasion.
13. "Companies that try to avoid taxes are unethical." Do you agree? Explain.
14. Explain why accelerated depreciation methods are superior to straight-line methods for income tax purposes.
15. Why should companies take tax deductions sooner rather than later?
16. "If DCF approaches are superior to the payback and the accounting rate-of-return methods, why should we bother to learn the others? All it does is confuse things." Answer this contention.
17. What is the basic flaw in the payback model?
18. Explain how conflict can arise between capital-budgeting decision models and performance evaluation methods.

1.2 Multiple Choice on Investment Planning

1. Investments aim to prepare the company for a certain future:
   a) Yes
   b) No

2. The companies ability to reflect investments in financial statements is influenced by?
   a) Local GAAP
   b) Management Decisions

3. Investing into a machine is a rationale investment if:
   a) Everyone in the market is doing it and its NPV is positive
   b) Its DCF is positive
   c) It may be used by different business units of the company and increases their margins

4. Imagine you just joined an expensive Golf club and paid the membership fee for the year cash in advance (non-refundable). After 2 weeks of playing you hurt your ankle really bad, but still force yourself to go golfing. What kind of bias does this example refer to?
   a) Over-Confidence
   b) Mental Accounting
   c) Partition Bias

5. During the Pre-Screening phase of the Investment Decision Funnel, what aspects are considered first?
   a) Qualitative
   b) Quantitative

6. Does it make sense to invest in projects with a negative NPV?
   a) Definitely not
   b) Yes, if there are no better alternatives
   c) Yes, if the project delivers any other value to the company

7. At the end of a Capital Budgeting Process you should have an audit in order to:
   a) Document lessons learned
   b) Improve your processes for future decisions
   c) Assess the quality of planning assumptions
   d) All of the above

8. The underlying assumption to the NPV is:
   a) Todays money is worth less than tomorrows money
   b) Todays money is worth more than tomorrows money

9. Investment planning is heavily influenced by:
   a) Company policies
   b) Market return rates
   c) External Environments Riskiness
   d) All of the above might be true
   e) None of the above

10. A management accountant should have the following position in a capital budgeting process:
    a) Project owner
    b) Sparring partner of the project owner & Management
    c) Number cruncher (Calculations only)
    d) Should not be involved at all

11. If there are no measurable cash inflows the DCF method cannot be applied?
    a) Correct
    b) Incorrect

12. If a company sets a hurdle rate of 10% RoI for accepting an investment, what could be the results of this?
    a) The company experiences benefits forgone
    b) The RoI will always >10%
    c) The RoI will move <10%>
    d) a&b
    e) a&c
    f) b&c
13. The SCORING Model can be used for investment decisions:
    a) Correct
    b) Incorrect
14. The SCORING Model should always include the NPV:
    a. Correct
    b. Incorrect

Please use the following information on a Project for the next calculations:

Useful Life	5 Years
Net Initial Investment	400.000 €
Depreciable Amount	375.000 €
Savings in Operating Costs	500.000 €
Required Rate of Return	10%

15. Which Accounting Rate of Return is correct?
    a. 6,25%
    b. 5,63%
    c. 7,93%
16. Which Internal Rate of Return is correct?
    a. 8,42%
    b. 6,48%
    c. 7,93%
17. Should the Project be undertaking from purely from a NPV standpoint?
    a. Yes
    b. No
18. After how many years will the project have covered its costs (Payback Period Method)?
    a. 3
    b. 4
    c. 5

Answer sheet:

Question	Correct Answer
1	B
2	B
3	C (Not because everyone is investing in something, it must be worthwhile
4	B
5	A
6	C

7	D
8	B
9	D
10	B
11	B
12	E
13	A
14	B
15	A
16	C
17	B
18	B

1.3 Codexa

Codexa is considering buying a new bar-coding machine for its plant in Seattle. The cost of the machine would be $ 48,000 without any residual value after the estimated useful life of five years. The bar-coding machine will generate according to expectation $ 13,000 of annual net cash inflow for each of the five years. The required rate of return is 16%.

a) Compute the bar-coding machine's payback period.

b) Compute the bar-coding machine's accounting rate of return.

c) Compute the bar-coding machine's net present value.

d) Would you recommend buying the bar-coding machine? Explain your reasons.

e) What else could be reasons for a good decision?

1.4 Anirban Plastic Glasses - Advanced Capital Budgeting

A plastic manufacturer has under consideration the proposal to produce high quality plastic glasses in India. The necessary equipment would cost him € 1,000,000 and would last 5 years. The tax relevant rate of depreciation is 25% on written down value. The expected salvage value is € 100,000. The glasses can be sold at € 40 each. Regardless of the level of production, the manufacturer will incur annual cash costs of € 250,000. The overhead costs allocated to this new line would be € 50,000 each year. The variable costs are estimated at € 20 per glass. The manufacturer estimates he will sell about 75,000 glasses per year. The tax rate is 35%. Should the proposed equipment be purchased? Assume 20 % cost of capital and additional working capital requirements of € 500,000.

1.5 Adding Probabilities to Decisions

As CEO of SeaSpray Marine, Ron Greenwood knows it is important to control costs and to respond quickly to changes in the highly competitive boat-building industry. When IDG Consulting proposes that SeaSpray invest in an ERP system, he forms a team to evaluate the proposal: the plant engineer, the plant foreman, the systems specialist, the human resources director, the marketing director, and the management accountant. A month later, management accountant Mike Cobalt reports that the team and IDG estimate that if SeaSpray implements the ERP system, it will incur the following costs:

a) $ 350,000 in software costs,

b) $ 80,000 to customize the ERP software and load SeaSpray's data into the new ERP system

c) $ 125,000 for employee training.

The team estimates that the ERP system should provide several benefits:

a) More efficient order processing should lead to costs savings with a present value of $185,000.

b) Streamlining the manufactoring process so that it maps into the ERP system will create savings with a present value of $275,000

c) Integrating purchasing, production, marketing and distribution into a single system will allow SeaSpray to reduce inventories, saving $220,000

d) Higher customer satisfaction should increase sales, which in turn should increase the present value of profits by $ 150,000.

The team knows that because of complexity, some ERP installations are not successful. If SeaSpray's fails, there will be no cost savings and no additional sales. The team predicts that there is an 80% chance that the ERP installation will succedd and a 20% chance that it will fail.

1) If the ERP installation succeeds, what is the dollar amount of the benefits? (3 Minutes)

2) Should SeaSpray install the ERP system? Why or why not? Show your calculations. (7 Minutes)

1.6 Scoring Modelling

Your friend asks you to help her with the decision to do a master program or start a trainee job at an international company. Please help her by building a scoring model with five decision perspectives and give her your own rational choice.

1.7 Case Study: Blueprints Investment Decision Process

The Property Management Group Blueprint currently experiences problems with some of its development projects that it accepted in the last years. The company buys abandoned houses in the Berlin area, and renovates them for different purposes. Further, it offers services with regard to facility- and tenant management for its own premises as well as other customers like companies or airports.

However, some of the latest projects have been finishing late or well over budget due to different unexpected reasons. Therefore, the Board of Management has initiated a project in order to eliminate problems relating to faulty project-selection methods. To support this process, Blueprint has contracted a group of consultants with the task to prepare two Investment Appraisal Methods that they may use when assessing projects.

As a result, the consultancy advises to implement the following two methods for evaluating project proposals. The first one is the Net Present Value Method for assessing the financial performance, and the other one a SCORING Model to be able to incorporate more aspects into the decision making process. In order to test these methods, Blueprint agrees to make use of them for evaluating two options they are currently reviewing for the development of an old factory in the centre of Berlin. Two different development teams of the company have proposed these options and now Blueprints' Board of Management has to evaluate them.

The first idea (Option A) is to convert the factory into offices, and rent them out to a Berlin based venture capitalist that would be willing to sign a contract for 500,000 EUR for the next 10 years. However, in order to bring the factory into an acceptable condition, Blueprint has to invest 2,4 mEUR and transfer it to the construction company directly at the beginning of the construction phase. This is because, the construction company wants to minimize the risk of default creditors and instead offers to convert the factory at a fixed price if Blueprint pays them in advance. Unfortunately, no other construction company was willing to offer a contract for a similar price. Further, the construction phase would take ¾ years leaving only ¼ of the 1st year available to generate cash-inflows for Blueprint.

Option B is again to convert the factory, but this time into a self-storage place with rooms varying between 2-6m^2 and also the possibility to include storage rooms for wine and cigars. In contrast to Option A, Blueprint itself would conduct management of these storage places. Therefore, even though the construction costs are lower, the Initial Investment of 2,5 mEUR is higher because it already includes considerations on installing an IT-System to support the administrative processes. Further, the installation of the different storage rooms would be possible within 3 months, leaving Blueprint the opportunity to fully utilize the building within the 1st year.

Employees needed for running these operations are not required because excess capacity exists because of a lost contract due to a late opening of a nearby airport. The project team assumes that the Net Cash flows will increase by 50.000 EUR each year, starting with 250.00EUR, due to an increase in requested storage. This is also supported by the need for more storage space because of urbanization and less living space available, as assumed by the project team.

An overview of the data available can be found below. The company internal hurdle rate is set at 10% for projects undertaken in the Berlin area.

Investment Year	A	B
0	-2.400.000 €	-2.500.000 €
1	125.000 €	250.000 €

2	500.000 €	300.000 €
3	500.000 €	350.000 €
4	500.000 €	400.000 €
5	500.000 €	450.000 €
6	500.000 €	500.000 €
7	500.000 €	550.000 €
8	500.000 €	600.000 €
9	500.000 €	650.000 €
10	500.000 €	700.000 €
Required Rate of Return	10,00%	10,00%

Further, the consultancy provided the Blueprint group with a template for the SCORING Model, including a proposal on criteria to be included, as well as the corresponding weighting:

SCORING Model Template

Investment Appraisal SCORING Model	Investment Criteria	Strategic fit & Synergies	Net Present Value	Risk Profile	Managerial Options	Management Confidence	Total Weighted Score	
	weighting	20%	50%	10%	10%	10%	100%	
		Range: 0-10						Ranking
Project A								
Project B								

Requirements:

1. Please calculate and evaluate the two projects using the NPV method. Which project should be accepted by the Management Board?
2. Please use the SCORING Model Template to evaluate the two projects. Which project should the Blueprint Group decide for??
3. Which of the two methods proposed by the consultancy should the Blueprint group make use of in the future? Are there any limitations?

1.8 Critical Thinking in Capital Budgeting

1. Investment in R&D

"It is impossible to use DCF methods for evaluating investments in R&D. There are no cost savings to measure, and we don't know what products might come out of our R&D activities." This is a quote from an R&D manager who was asked to justify investment in a major research project based on its expected NPV. Do you agree with her statement? Explain.

2. Business Valuation and NPV

When a company elects to invest in a project with a positive NPV, what will generally happen to the value of the company? What will happen to this value when the company invests in a negative NPV project?

3. Replacement of Production Facilities

A manufacturing company recently considered replacing one of its forming machines with a newer, faster, more accurate model. What cash flows would this decision be likely to affect? List both cash flows that would be easy to quantify and those which measurement would be difficult.

4. Capital Budgeting, Taxes and Ethics

The U.S. tax law is complex. Sometimes the line between tax avoidance and tax evasion is not clear. Discuss the legal and ethical implications of the following two capital investment decisions:

a) A company invested in an asset that it expects to grow rather than decline in value. Nevertheless, the tax law allows the company do deduct depreciation on the asset. Therefore, the company depreciated the asset for tax purposes using an accelerated MACRS (Modified Accelerated Cost Recovery System) schedule.

b) There are often tax advantages to investments "offshore". For example, in Bermuda there are no taxes on profits, dividends or income, and there is no capital gains tax, no withholding tax and no sale tax. A U.S. company decided to invest in a manufacturing plant in Bermuda and use transfer prices to move as much of the company's profits as possible to the Bermuda plant.

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