CARISMA_WP5_TN

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CARISMA:
Aircraft Cabin and Cabin Systems Refurbishing,
Optimization of Technical Processes

Planning of a Business Case for a Completion Center

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This Technical Note investigates the business case "completion center" from a financial point of view. Much emphasis was given to the creation of an EXCEL based tool that should serve in management decision making. The tool evaluates expenditures and investment for three types of projects – small, medium and complex for a period of 5 years. It delivers cash flow predictions, minimum investments required and their rate of return. An initial Project Zero covers the initial expenses required to set up the completion center to the capability of starting independent projects. The Technical Note also delivers theoretical background information about risk evaluation, investment estimation or cash flow scheduling. The preliminary results show that an initial solid investment deliver higher profits, while starting with small projects one after the other provides more safety but also less gain.</td></tr>
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19. Kurzfassung
Diese Technische Niederschrift untersucht das Geschäftskonzept "Completion Cente" aus finanzieller Sicht. Der Schwerpunkt der Untersuchung ist die Erstellung eines EXCEL-basierten Managementwerkzeugs, das Managemententscheidungen unterstützen soll. Das Werkzeug berechnet Ausgaben und Einnahmen für drei Projektkategorien – klein, mittel und groß – für eine Dauer von 5 Jahren. Es liefert Geldflussvorhersagen, minimales erforderliches Anlagevolumen und Rendite. Ein „Project Zero“ deckt alle Erstausgaben ab, die notwendig sind, um den Aufbau des Completion Centers zu ermöglichen, so dass ELAN die Leistungsfähigkeit gewinnt, selbstständige Umrüstungs-projekte durchzuführen. Diese Technische Niederschrift liefert auch Hintergrund-informationen über Risikobewertung, Investitionsbewertung oder Geldflussplanung. Die vorläufigen Ergebnisse zeigen, dass eine größere Erstanlage mehr Gewinn bringt, während die Durchführung von kleineren Projekten nacheinander, sicherer und einfacher ist, aber nicht so viel Gewinn bringt.

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Completion Center, Anlage, Werkzeug

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Abstract

This Technical Note investigates the business case "completion center" from a financial point of view. First, a theoretical background is presented, regarding how to estimate chances and risks of a business plan, how to schedule cash flow or how to estimate capital investments. Second, an EXCEL based tool is created, which is foreseen as a management tool for evaluating strategic scenarios towards the vision "completion center". The tool evaluates three types of projects – small, medium, complex – over a period of five years, from 2011 to 2015. Input data for conducting this evaluation are parameters describing the project, on the one hand, such as project type, project duration, personnel required, training intensity, etc. and parameters describing the background of the project, on the other hand, such as monthly costs for staff, costs required for sales or miscellaneous costs, amount of external personnel or experts, etc. Each project evaluation delivers the cash flow, the profit and the profit-turnover ratio. A summary of output data presents the cumulative cash flow, total costs, personnel required, gain after 5 years, minimum investment and Return on Investment for the whole defined scenario. Changes applied to input data reflect automatically on the calculations. An initial Project Zero covers the initial expenses required to set up the completion center to the capability of starting independent projects. With the default input three scenarios are evaluated: 1.) small investments, small number of projects; 2.) medium investments, small number of projects; 3.) large investment, large number of projects. The results show that an initial solid investment delivers higher profits, while starting with small projects one after the other provides more safety but also less gain. However these results may not be accurate enough due to the lack of precision in estimating the project values. Engineering experience is required to create feasible scenarios.

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List of Abbreviations

BCR	Benefit Cost Ratio
CBA	Cost-Benefits Analysis
CAD	Computer Aided Design
CBS	Cost Breakdown Structure
CDF	Cumulative Distribution Function
DO	Design Organization
DOA	Design Organization Approval
EASA	European Aviation Safety Agency
IT	Information Technology
NB	Net Benefit
NPV	Net Present Value
PDF	Probability Density Function
PERT	Program Evaluation and Review Technique
PVB	Present Value of Benefits
PVC	Present Value of Costs
ROI	Return on Investment
ROR	Rate of Return
STC	Supplemental Type Certificate
SWOT	Strengths Weaknesses Opportunities Threats
TN	Technical Note
WBS	Work Breakdown Structure
WP	Work Package

List of Symbols

a	annuity
i	interest rate
k	capital: 0 – initial, n – after n years
n	years
n_{BEP}	Break Even Point
p	$p = i/100$
q	$q = 1 + p$

1 Introduction

1.1 Motivation

This Technical Note (TN) is part of the research project CARISMA which is aimed to deliver results for ELAN GmbH with respect to the vision „Completion Center". The topic treated here refers to WP 5, described in the appendix of the collaboration contract between Hamburg Innovation GmbH and ELAN GmbH as follows (**CARISMA 2009**):

> ***WP 5: Planning of a "Business Case" for the "Completion Center"***
> *WP 5 investigates the project "completion center" as an investment for ELAN. The investigation comprises the examination of the business economics of planned activities and investments with the aim to support decision making by the management board.*
> *- Amount of capital investment, costs, and expenditures (extend to which a DOA is applied for, hard- and software, business partner search, acquiring personnel, personnel training, acquisitions ...)*
> *- Orders, benefits, revenues*
> *- Costs-Benefits-Analysis, investment appraisal*
> *- Chances, risks, sensitivity analysis*

Work Package 5 is the end report of CARISMA and the most important one. The decision of growing into a Completion Center needs to be covered by well documented investigations. Technical Note 5 aims to support the management board of ELAN in decision making by performing business economy investigations and by creating a business case evaluation tool.

Currently, the main concern of ELAN is growing into a certified design organization. This requires not only developing the existing engineering capabilities, but also acquiring the certification and kit administration (or production) capabilities. Restructuring the company involves investments, among other for:

- setting up the Design Assurance System required by EASA through IT Investments,
- setting up a Customer Support division,
- setting up a Sales division,
- training existing personnel,
- acquiring new personnel,
- acquiring consultancy,
- acquiring external personnel or experts.

Additional expenditures are required by EASA for emitting the DOA. Fees to be paid are:

- application fees (one time payment),
- approval fees (one time payment),
- surveillance fees (yearly payment).

Management decisions need to be based on accurate information regarding the business planning economy.

An important research issue is the correlation between possible and planned activities. Currently ELAN is able to conduct very small cabin upgrade projects (see Technical Note 3) in an independent way, by using the certification capabilities of V-Plane. For the future, larger projects are foreseen, ranging from *small* to *medium* and *complex*.

In this context, this Technical Note seeks to support decision analysis and decision making towards the vision „Completion Center".

1.2 Setting the Scene

A cabin conversion project imagined for the Completion Center scenario will have, in ELAN"s view, the following phases:

- Offer
- Engineering
- Certification and Documentation
- Production
- Installation / WP Support, Testing, Inspection

The preparation duration for acquiring the Design Organization Approval is estimated to 5 years, between 2010 and 2015. The idea is to start with small conversion projects, while extending the lacking capabilities and growing into performing medium and complex projects. ELAN lacks capability in several vital domains:

- Engineering
- Certification
- Kit logistics
- Sales

These domains can be covered either by training existing personnel (option preferred by ELAN), by acquiring experts or by subcontracting part of the work.

The initial expenses required for instance for IT investments or for EASA application fees will be seen as an initial *Project Zero* that involves expenses and brings no immediate gain, but helps setting up the vision.

Currently ELAN has Mülhenberg Interiors GmbH as a partner for production and V-Plane GmbH as a partner for certification. ELAN wants to take the difficult task of project coordinator and link the three companies under its management. This involves facing communication difficulties as well as the risk of delays. When analyzing the Completion Center vision, these two partners must be considered with their role in providing their experience. ELAN could buy training from them and use their know-how with limited risks.

1.3 Purpose of Work

The cooperation between ELAN GmbH and HAW Hamburg has the purpose to bring ELAN forward on its way to develop itself and to create the resources to receive greater work packages in the frame of cabin conversions, having in mind the vision „Completion Center".

First, Work Package 5 aims to investigate the business planning for the vision „Completion Center". This involves a research towards available ways of estimating costs and expenditures, revenue and gain or cash-flow and investment. A research is required also with respect to available methods for analyzing risks: Cost-Benefits Analysis, What-If-Analysis, Sensitivity Analysis, SWOT, PERT.

Second, the aim is to deliver an EXCEL tool able to evaluate the business plan. The tool is designed so as to automatically generate cost calculations once the input is changed. The tool should serve management board in decision making.

Third, the results are to be discussed, as well as the assumed project timelines and project definitions, in order to additionally improve the understanding of the business case implications.

1.4 Literature

For developing the EXCEL tool the main input data was delivered by ELAN engineers. The EASA regulations were consulted in order to make the cost estimations for getting the Design

Organization Approval (DOA) and to have a clear vision about the official approval and surveillance procedure. Additional literature sources from the special domain of business economics, as well as contributions in the special domain of aviation management were used in this Technical Note. To mention a few authors: Manfred Burghardt, Triant Floris and Ricky Griffin.

1.5 Structure of Work

The Technical Note is comprised of five chapters, besides the introductory and the conclusion chapter:

Section 2 **Investment Planning with a Business Plan –** approaches topics such as chances and risks, cash flow and investments, revenue and gain. It also presents the foreseen Cost Breakdown Structure for the view Completion Center.

Section 3 **Spreadsheet Programming for a Completion Center** – presents the approach used to build the EXCEL Management Tool delivered by this TN.

Section 4 **Assumed Ramp Up of a Completion Center** – defines and interprets plausible scenarios.

Section 5 **Summary, Conclusions and Recommendations** – presents an overview of the structure and the results of this Technical Note as well as a set of conclusive ideas and management recommendations.

2 Investment Planning with a Business Plan

2.1 Chances and Risks

Risks can affect a design project at any time – the later this occurs the more important the consequences. The most common ways for identifying risks in aviation are (**Flouris 2008**): *checklists* and *brainstorming sessions*. Once risks are identified, a *qualitative* and, as required, a *quantitative* risk evaluation would offer a realistic awareness regarding possible negative events that might affect a project.

Table 2.1 proposes a set of both *qualitative* and *quantitative* methods for evaluating risks within a cabin conversion project. *Qualitative risk analysis* involves an evaluation of possible risks and their effects, usually through a brainstorming session. A *quantitative risk analysis* involves the quantification of the identified risks (possibly through a qualitative analysis) and allows a risk ranking. If a qualitative method increases risk awareness, a quantitative method helps evaluating risk effects by performing a numerical evaluation (**Flouris 2008, Clemens 1993**).

To summarize, the three major steps in risk management are (**Flouris 2008, Clemens 1993**):

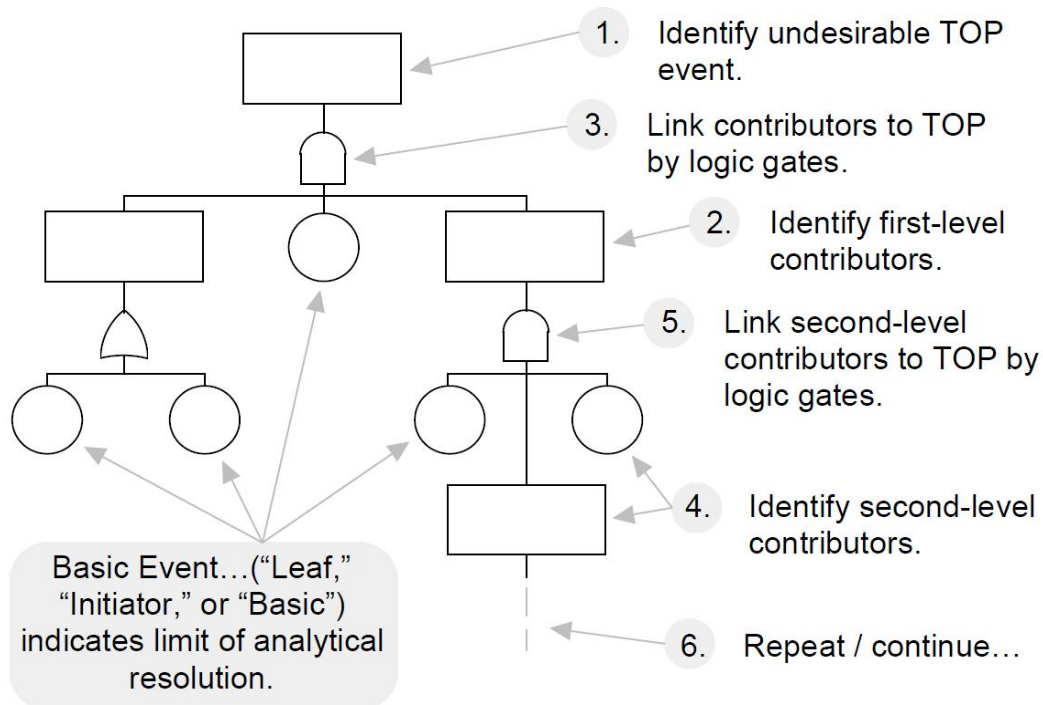
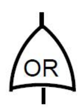
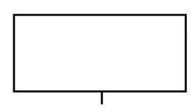
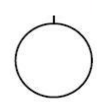
- risks identification
- qualitative assessment of risks
- quantitative assessment of risks

The results of the risk assessment will require certain safety measures. The range of options available for the risk management (**Flouris 2008**) are:

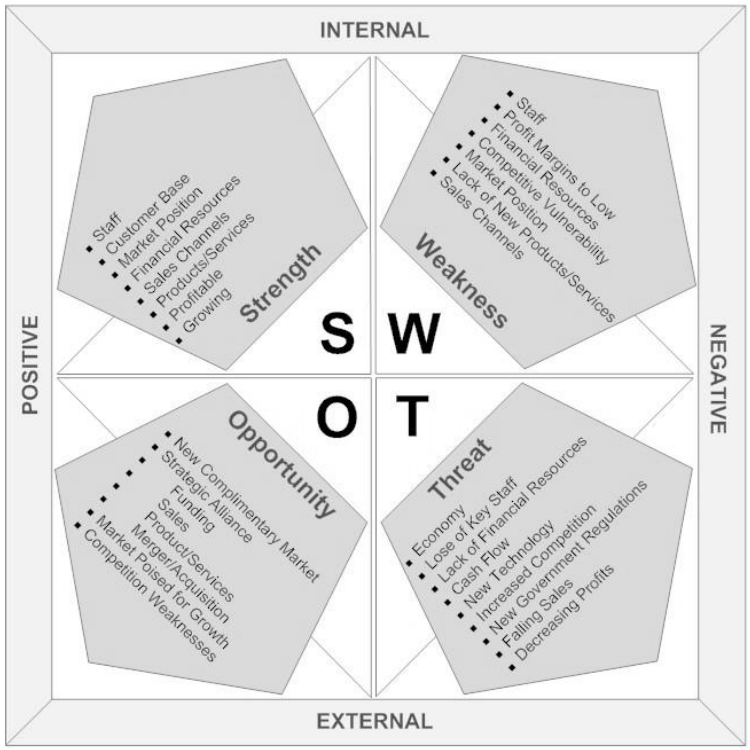
1.) avoid the risk,
2.) take precautions to prevent or mitigate risk impact,
3.) accept the risk,
4.) share the risk,
5.) limit the risk,
6.) transfer the risk.

Option 1.) means abandoning all the causes, which may be unacceptable, as it could lead to the decision not to conduct the project at all.

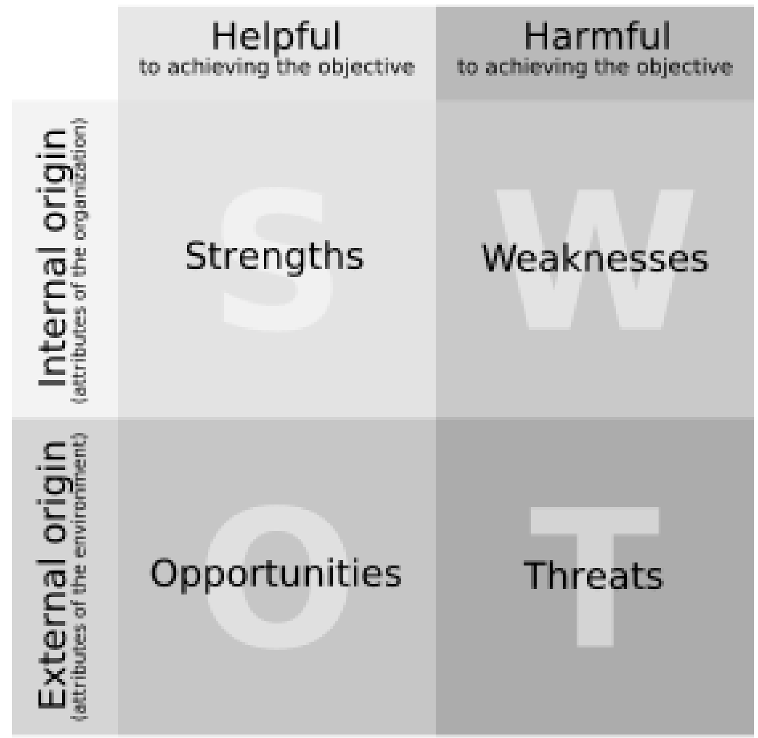
Table 2.1 Qualitative and quantitative risk evaluation methods

	Name	Description
Qualitative	Fault-tree analysis	<u>Utilization</u>: - by safety engineers - by project risk managers <u>Method</u> (**Clemens 1993**):  <u>Description</u>:  “<u>OR</u>” Gate…produces output if any input exists. Any input, individually, must be (1) necessary and (2) sufficient to cause the output event.  “<u>AND</u>” Gate…produces output if all inputs co-exist. All inputs, collectively, must be (1) necessary and (2) sufficient to cause the output event.  <u>TOP</u> <u>Event</u>…foreseeable, undesirable event, toward which all fault tree logic paths flow…or… <u>Intermediate</u> <u>Event</u>…describing a system state produced by antecedent events.  <u>Basic</u> <u>Event</u>…Initiating fault/failure, not developed further. (Called “Leaf,” “Initiator,” or “Basic.”) The Basic Event marks the limit of resolution of the analysis.

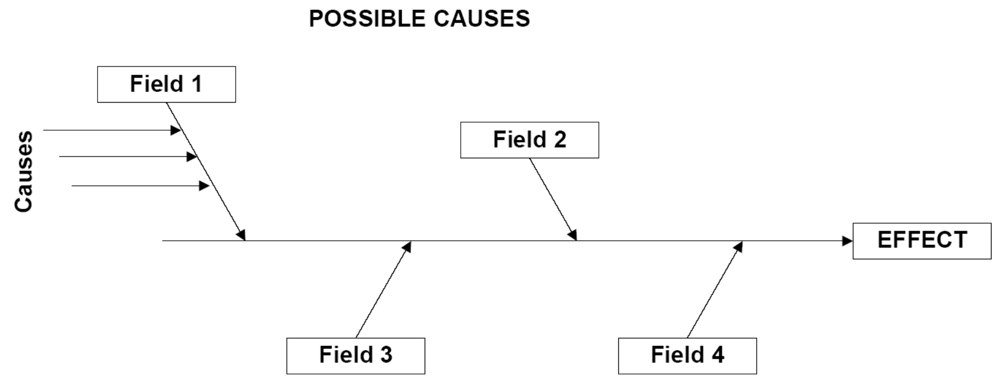
<table>
<tr>
<td>Qualitative</td>
<td>SWOT analysis</td>
<td>
<u>Utilization</u>: - by project (risk) managers
<u>Method</u>: based on certain criteria, generated for example from a brainstorming session, the Strengths, Weaknesses, Opportunities and Threats for a project are identified.
<u>Description</u> (see Appendix B):



Source: http://www.bizstrategies.biz



Source: http://www.businessteacher.org.uk
</td>
</tr>
</table>

<table>
<tr><td rowspan="2">Qualitative</td><td>Ishikawa fishbone</td><td><u>Utilization</u>: - by safety engineers to analyze faults in design and construction
- by project risk managers to analyze risk cause and effect relations
- to analyze poor performance in project organization and communication
<u>Method</u>: the effect is the starting point; possible causes are then sought; it works the other way around too.
<u>Description</u>:

</td></tr>
<tr><td>Failure mode and effect analysis (FMEA)</td><td><u>Utilization</u>: - by reliability and quality engineers
- by project risk managers
<u>Method</u>: starts by considering possible risks and attempts to predict their possible effects.
<u>Description</u>:
<table>
<tr><th colspan="2">Item</th><th>Failure Mode</th><th>Cause of failure</th><th>Effect</th><th>Recommended pre-emptive action</th></tr>
<tr><td>1</td><td>Name</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Name</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
</table>

Qualitative

Risk classification matrix

Utilization: - by reliability and quality engineers
- by project risk managers

Method: each risk is considered for its likelihood of occurrence and for the relative scale of the impact on the project.

Description:

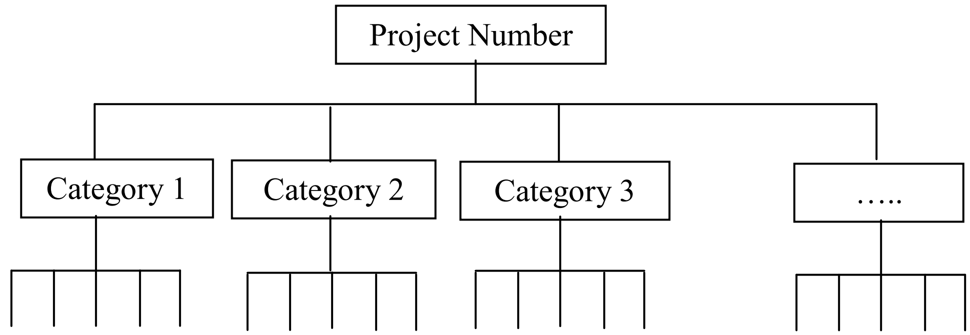
Potential Impact (Low → High) / Chance of occurrence (Low → High)

Potential Impact	Low chance of occurrence	Medium chance of occurrence	High chance of occurrence
High	Severe impact risk with low chance of occurrence	Severe impact risk with medium chance of occurrence	Severe impact risk with high chance of occurrence
	Medium impact risk with low chance of occurrence	Medium impact risk with medium chance of occurrence	Medium impact risk with high chance of occurrence
Low	Low impact risk with low chance of occurrence	Low impact risk with medium chance of occurrence	Low impact risk with high chance of occurrence

Low — Chance of occurrence — High

In practice:

Risk event	Chance of happening	Potential severity	Difficulty of detection	Comment

<table>
<tr>
<td rowspan="1">Qualitative</td>
<td>Risk Breakdown Structure</td>
<td><u>Utilization</u>: - by risk managers and engineers
<u>Method</u>: similar to Work Breakdown Structure (WBS); different categories of risks are identified, as well as their components; it serves as input for the rest of risk analysis methods.
<u>Description</u>: each project has its own categories of risks, which are further broken down in sub-categories.

</td>
</tr>
<tr>
<td rowspan="2">Quantitative</td>
<td>Failure, mode and effect criticality analysis (FMECA)</td>
<td><u>Utilization</u>: by risk analysts or by a brainstorming group of (safety) engineers
<u>Method</u>: the FMEA is extended towards risk quantification, by adding risk evaluation columns; the ranking can be made on a scale from 1 to 5 or different (1 to 3 or 1 to 10) with the highest number indicating the highest degree of significance. Sometimes the header ‘Detection difficulty is replaced by a header called ‘Prediction difficulty’. The total ranking score is given by the product of the partial scores.
<u>Description</u>: a, b, c from 1 to 5
<table>
<tr><td colspan="2">Item</td><td>Failure mode</td><td>Cause of failure</td><td>Effect</td><td>Chance</td><td>Severity</td><td>Detection Difficulty</td><td>Total ranking</td></tr>
<tr><td>1</td><td>Name</td><td></td><td></td><td></td><td>a</td><td>b</td><td>c</td><td>a · b c</td></tr>
<tr><td>2</td><td>Name</td><td></td><td></td><td></td><td>a</td><td>b</td><td>c</td><td>a · b · c</td></tr>
</table></td>
</tr>
<tr>
<td>Quantitative risk assessment codes</td>
<td><u>Description</u>: There are several risk evaluation software available, such as RiskyProject, Cristal Bowl.</td>
</tr>
</table>

Option 2.) requires a well implemented risk-prevention strategy. Solutions may be (**Flouris 2008**):

- regular inspection,
- double check,
- back-up,
- adequate training.

Option 3.) involves taking the risk with the assumption that if it occurs, the re-planning required has acceptable effects.

Option 4.) is valid for joint ventures. The simplest example is Airbus and its suppliers that share risk the risk for each project.

Option 5.) is applicable for projects for which the outcome and especially the costs are not clearly defined. In this case **Flouris 2008** recommends a step-by-step approach; risk would be limited by requiring a „go ahead" at each stage (the name stage-gating is also used). These stages can be determined either by:

- budgetary limits,
- time limits,
- a significant event occurring during the project life.

Option 6.) refers to transferring the risk to third party by paying a certain amount of money, i.e. insurance.

It seems that options 2.), 3.) and 5.) are suitable for ELAN and the vision Completion Center.

2.2 Cost Breakdown Structure

In general, the costs of a project can be divided into three categories (**Burghardt 1988**):

- planning costs,
- control costs,
- process costs.

Planning costs include the costs required in the definition phase. *Control costs* refer to those costs required for controlling the project throughout the project life cycle. *Process costs* are basically development costs.

ELAN currently analyzes the vision Completion Center and the viable ways to implement it in the next 5 years. The above mentioned cost classification is valid. An example of planning costs is CARISMA itself. Control and process costs are still to follow in the next 5 years.

In order to analyze the consequences of this vision, the conversion projects that will be undertaken within the Completion Center need to be estimated. This section defines the Cost Breakdown Structure (CBS) for a cabin conversion project. This CBS will be used for analyzing the business plan (in Section 4).

Two types of costs are included in the breakdown: *direct* and *indirect* costs. *Direct costs* include personnel, training, sales and miscellaneous costs. *Indirect costs* refer to the office space and workspace costs.

Additional costs are represented by the *Project Zero*. Project Zero is seen as an initial investment required to start implementing the vision Completion Center.

The following sub-sections detail the Project Zero costs, as well as the direct and indirect costs.

2.2.1 Project Zero

The expenses included in *Project Zero* include:
1.) Initial training costs,
2.) EASA fees and charges,
3.) Initial IT investments.

1.) Each project phase requires specialized personnel. ELAN lacks experience is most of them. Training is required for:

- Certification
- Engineering
    - Stress
    - CAD
    - Electrical
    - Mechanical
    - Structure
- Production
    - Logistics

    - Kit preparation
- Quality and inspection
- Support
- Others

2.) The Design Organization Approval involves several types of EASA-required expenses:

- Application fee,
- Approval fee,
- Surveillance fee.

The fees depend on the type of activity that the DO wants to perform, as well as the number of staff. The type of activity foreseen for ELAN is *unrestricted changes and repairs under STC*.

Regarding the number of people involved in DOA, required by EASA is a staff team of minimum 5 members, covering the key positions of the design organization. Depending on the size of the projects, the number of personnel will increase. More precise (**EASA 2010a**):

> *The number of staff should be calculated as follows:*
> *For all sites involved in design and certification activities under the approval:*
> *All staff involved in:*
>
> - *Managing the design organization;*
> - *Drawing, calculating, testing, simulating;*
> - *Producing and verifying compliance documentation;*
> - *Performing airworthiness office tasks; System monitoring.*
>
> *In addition, for Design subcontractors, the following staff should be counted:*
>
> - *All staff involved in producing compliance documents;*
> - *All staff involved in verifying compliance documents;*
> - *All staff involved in airworthiness office tasks;*
> - *All staff involved in system monitoring.*
>
> *Only administrative staff required to comply with the applicable Regulation and associated AMC/Guidance should be included in the calculation of the number of staff.*
>
> *With regard to the contracted staff the organization shall identify them in the box "contractors" in the EASA Form and they will be added to the total number of staff for the fee purpose.*

The application and approval fees are to be paid one time. The surveillance fee is payable annually at the anniversary of the issuance of DOA. At this point, EASA will issue (in most of the cases) modification requirements to be incorporated in the documentation of the Design Organization. More precise (**EASA 2010a**):

> *Any fees must be paid prior to any issuance, maintenance or amendment of the certificate. This means that the application fee must be paid prior to the commencement of any work. The first annual surveillance fee has to be paid immediately after receiving the certificate and upon receipt of the invoice.*

The technical documents need to be archived and managed through suitable computer tools. Technical Note 4 presented the required characteristics and recommended a set of tools able to sustain the vision Completion Center. Implementing the tools involves software and licenses as well as personnel training expenditures.

At the present junction of obtaining a DOA where the company faces the possibility of restructuring, the existing IT infrastructure is, however, more than adequate.

2.2.2 Staff Costs

The most important category of costs is the staff costs. Three types of staff were considered necessary:

1.) Internal staff
2.) External staff
3.) Experts

Every phase (offer, engineering, certification, production, and installation) requires specialized staff out of all the above categories. Depending on the complexity and duration of the project, the number of people required will vary.

In the project definition the cost of every staff can be inputted. Default values are 25 €/hour for internal staff, 35 €/hour for external staff and 50 €/hour for experts.

The distribution of the staff members required for every type of project (small, medium, complex) is performed according to the estimations of ELAN, which were used as input (**Mönckemeier 2010**). This input information is expressed by means of two types of so called „k" factors: *First*, there are „k" factors indicating the percentage of internal, external and experts staff out of the total staff used for every phase. For example: k_oi indicates how many internal employees are required during the offer phase. When summarizing vertically, the percentage is 100 % (e.g. default values are 0.6 + 0.3 + 0.1 = 1.0). *Second*, there are „k" factors indicating the percentage of staff used for every type of project (small, medium or complex). When summarizing horizontally, the percentage is 100 % (e.g. default values for a small project are 0.05 + 0.2 + 0.35 + 0.25 + 0.15 = 1.0). These factors can be modified in the *Definition* sheet, if considered necessary. Table 2.2 lists these factors.

Table 2.2 Percentage of staff out of the total staff used for every phase

Staff	K_offer		K_engineering		K_certification		K_production		K_installation	
Internal	k_oi	0.6	k_ei	0.6	k_ci	0.6	k_pi	0.6	k_ii	0.6
External	k_oe	0.3	k_ee	0.3	k_ce	0.3	k_pe	0.3	k_ie	0.3
Experts	k_ox	0.1	k_ex	0.1	k_cx	0.1	k_px	0.1	k_ix	0.1
Small	k_os	0.05	k_es	0.2	k_cs	0.35	k_ps	0.25	k_is	0.15
Medium	k_om	0.05	k_em	0.25	k_cm	0.30	k_pm	0.40	k_im	0.10
Complex	k_oc	0.05	k_ec	0.30	k_cc	0.10	k_pc	0.50	K_ic	0.05

2.2.3 Training Costs

The training costs are higher at the beginning and decrease in time. To the costs for the training itself the salary of every staff being trained is added. Default values used in the EXCEL tool are:

- Offer 25 €/hour
- Engineering 30 €/hour
- Certification 40 €/hour
- Production 30 €/hour
- Installation 35 €/hour

Part of the training costs are included in the Project Zero (see the list under 1.), Section 2.2.1). The proportion of the employees that receive training is defined in the Definition Sheet. Three categories of training were defined: *intense*, *medium* and *light*. Table 2.3 lists the percentages.

Table 2.3 Categories of training and percentages of training

	Offer	Engineering	Certification & Documentation	Production	Installation / WP-Support & Testing & Inspections
Intense	5 %	10 %	25 %	25 %	5 %
Medium	25 %	30 %	50 %	50 %	10 %
Light	50 %	60 %	90 %	90 %	35 %

2.2.4 Sales Costs

A task that has never been so far developed at ELAN is Sales. If the company gets the DOA, it needs to set on some target customers, for which sales activities would be required. Costs for Sales are multiple: from business trips up to marketing activities.

The estimated amount spent for Sales is distributed along the project lead time after a *triangular distribution* (see Section 3.6).

2.2.5 Miscellaneous Costs

This category of costs includes all the costs that are not included in the rest of the breakdown. It may happen that a specific project requires additional investments. This type of costs is also distributed after a triangular distribution.

2.2.6 Office Space Costs

The office space together with the workspace represent indirect costs. The office space costs include the rent and the operating costs and are calculated in Euros per 10 square meters per month per employee. This amount can be inputted in the Definition sheet. The default value is 50 €/month/employee.

2.2.7 Workspace Costs

The workspace costs include the desk, chair, the computer and the standard licenses costs that are required for a standard project. To be reminded that additional IT licenses that may be required in the case of a special project are included in Miscellaneous costs category.

2.3 Orders, Revenue and Profit

The *revenue* or *turnover* represents the income of a company. *Income minus expenditure represents profit*. In this Technical Note turnover is estimated depending on the complexity of the respective project – small, medium or complex. Values for the can be inputted in the *Global Project Timeframe* Sheet of the EXCEL Tool. Since the turnover is estimated based on experience, the accuracy of gain estimation should be questioned.

Estimating orders. For the vision Completion Center ELAN needs to grow first of all in the engineering capability. Currently the cooperation with V-Plane can provide the (of same importance) certification capability. This is a process that can be more or less estimated but the lack of experience in leading independent projects, in dealing with lack of data, in dealing with subcontractors and logistic problems may influence the estimations quite seriously. The safe side is to gain experience from a contract that has no severe consequences for the company.

The number of estimated / plausible orders can be varied in the Global Project Timeframe sheet of the EXCEL tool, and by this mean more realistic estimations can be made.

2.4 Cash Flow, Investment and Return on Investment

Key terms of this paragraph are *investment, return on investment, revenue, expenses* and *cash flow*. The return on investment calculation requires the calculation of profit and therefore expenses. The money used in the daily operations summarizes the cash flow, which at the end of a balance period is either positive, negative or zero. It is easier to estimate expenses than to calculate profit. Section 2.2 provided the cost breakdown structure for the business case of the Completion Center.

Return on Investment (ROI) or *Rate of Return (ROR)* is the *effective interest rate* of the investment (**Scholz 1999**). Others define ROI as the sum of interest plus repayment of principal per annum (**Fink 1999**). The rate of investment is in any case the number that is the most important for the investors – the company itself or another entity coming from outside the company.

After n years, an initial capital k_0 becomes:

$$\begin{aligned} p &= i/100 \\ q &= 1+p \\ k_n &= k_0 q^n \end{aligned} \quad , \qquad (2.1)$$

where i is the interest rate.

The ROI after n years will be then:

$$p = \sqrt[n]{\frac{k_n}{k_0}} - 1 \quad , \qquad (2.2)$$

The invested capital is usually repaid in *annuities, a* (fixed rates). If the annuities are paid at each year-end, then the capital that remains in the company after *n* years will be:

$$k_n = k_0 q^n - a\frac{q^n - 1}{q - 1} \quad . \tag{2.3}$$

From equation (2.3) both the initial capital investment required and the size of the annuity can be extracted as shown in (2.4).

$$\begin{aligned} k_0 &= \frac{1}{q^n}\left(k_n + a\frac{q^n - 1}{q - 1}\right) \\ a &= \frac{\left(k_0 q^n - k_n\right)\left(q - 1\right)}{q^n - 1} \end{aligned} \quad . \tag{2.4}$$

The time required to achieve the final capital can be obtained.

$$n = \frac{\log\left(\dfrac{a - k_n(q-1)}{a - k_0(q-1)}\right)}{\log q} \quad . \tag{2.5}$$

Break-Even-Point (BEP) represents the moment in time when the invested capital is repaid, i.e. $k_n=0$. The BEP is reached after n_{BEP} years:

$$n_{BEP} = \frac{\log\left(\dfrac{a}{a - k_0(q-1)}\right)}{\log q} \quad . \tag{2.6}$$

The equations above are valid no matter if the capital is coming from an investor or from within the company. In the case of ELAN the required investment – for instance for Project Zero, which does not produce profit in the end – is to be covered by the company itself. The aim is to cover the expenses through a very efficient financial management. The tool that is to be delivered by this Work Package will serve this purpose.

If the capital is internal, then the notion *internal rate of return* comes into discussion. This rate is to be defined by the company itself, and usually it should be higher than what an investor would ask for. This is done in order to worth risking in the own company rather than in something that brings more security.

The *Cash Flow* is the movement of cash in and out of a company /project. The cash flow is an indicator of the companies‟ health. For instance, one can determine if the company has problems with liquidities, or to determine the rate of return (**Fink 1999**). There are several types of cash flows (**Wikipedia 2010a**):

- *Operational cash flow* – Cash (received or expended), resulting from the company's internal activities; it should be *positive* for the company to remain solvent.[1]
- *Investment cash flow* – Cash received from investments, acquisitions (i.e. capital expenditure) or from the sale of long-life assets.
- *Financing cash flow* – Cash received from dividends, share repurchases or debt repayments or from the issue of debt and equity.

The total cash flow – operational, investment or financing – will represent the change in cash balance – positive or negative – over the calculated period.

A typical cash flow is illustrated in Figure 2.1 (**SG 2010**). The cash flow curve represents an indicator for the manager / investor, telling him *how much money and when* they are required to be invested in order to have a neutral or positive balance.

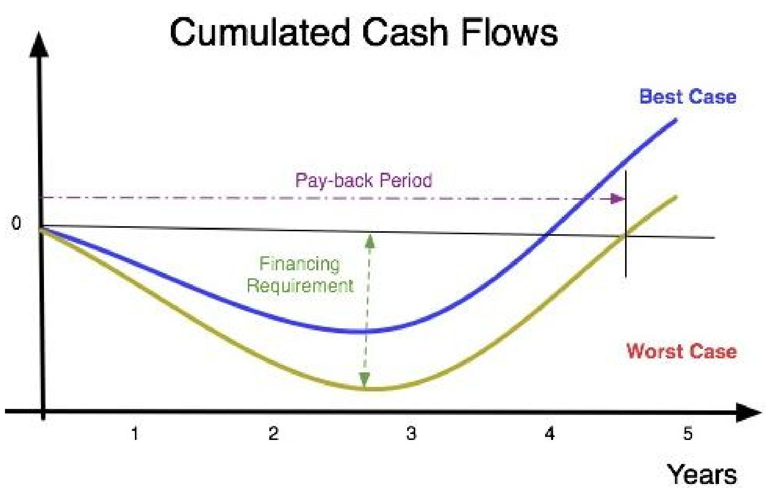


Fig. 2.1 Typical cumulated Cash Flow curve (**SG 2010**)

In Figure 2.1, the blue curve represents the best case scenario, when all the expectations are fulfilled. The yellow curve is the base case scenario, which is the case that it is likely to happen. Anything below these two curves are the worst case scenarios, where the major risks occur and the negative expectations are fulfilled. It is realistic to have negative cash flow in the first 2-3 years. The lowest point on the curve is the *maximum amount of debt* that a company can bare, before it starts rising towards positive cash flows. This represents the amount that could be invested in the business case, or in other words, the *financing requirement* (green in Figure 2.1).

[1] ELAN intends to use operational cash flow to sustain the vision Completion Center

In a cash flow analysis it is important to consider several possible scenarios in the same time in order to generate realistic capital considerations.

Flouris 2008 identifies two problems often encountered when starting a new project:

1.) confusing cash outflow schedules with net cash flow schedules,
2.) regarding the predicted project profit as satisfactory if it forecasts a good end result, but giving no thought to the cash flows during the project.

A good management of the cash flow involves, in the view of **Flouris 2008**:

- getting all payments into the project on very soon after their due dates,
- controlling the credit and not allowing customers to deviate from the payment plan,
- preparing realistic cash flow schedules (see the example in Table 2.4), for internal usage or for customers

Scheduling Cash Flows. The condition of a realistic cash flow schedule – what the EXCEL Tool also tries to attempt – is a detailed cost estimate and a practicable project plan (**Flouris 2008**). Important at this stage is also the *cost distribution*, i.e. setting each item of expected expenditure in the quarter or month when the payment will actually take place. If the amount of cash and the date when the respective amount changes hands are rightly estimated, than the cash flow schedule is realistic (see Figure 2.2).

Table 2.4 Format for a net cash flow schedule spreadsheet (**Flouris 2008**)

PROJECTS UNLIMITED LTD					Tulsa MRO facility for AA								Project number P21900 Issue date March 2010					
Cost item	Quarterly periods all figures $1,000s*																	Total budget
	2011				2012				2013				2014				2015	
INFLOWS	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	
Agreed loans	50				150													200
Client's payments	10		50	100	200	500	1500	1000	1000	1750	1000	1000	1000	3000	1000	1000	1000	15110
Total inflows	60		50	100	350	500	1500	1000	1000	1750	1000	1000	1000	3000	1000	1000	1000	15310
OUTFLOWS																		
Engineering	14	25	59	80	85	63	43	23	12	11	9	6	7	10	14	14		475
Purchasing		5	45	5	550	310	745	295	750	665	215	457	2242	76	2	470		6832
Construction				17	35	97	245	393	436	654	382	241	186	45	30			2761
Contingency					10	20	25	25	30	30	35	35	45	45	50	50		400
Escalation					35	29	74	59	110	136	70	88	322	30	32	85		1070
Total outflows	14	30	104	102	715	519	1132	795	1338	1496	711	827	2802	206	128	619		11538
NET FLOWS																		
Periodic	46	(30)	(54)	(2)	(365)	(19)	368	205	(338)	254	289	173	(1802)	2794	872	381	1000	
Cumulative	46	16	(38)	(40)	(405)	(424)	(56)	149	(189)	65	354	527	(1275)	1519	2391	2772	3772	3772

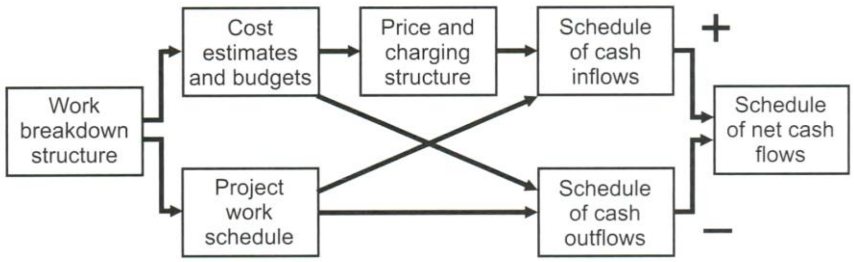


Fig. 2.2 Elements of a project net cash flow schedule – example (**Flouris 2008**)

Estimating investments highly depends on the accuracy of expenditures estimation. For the case of ELAN two expenditure groups can be identified in connection with the required investment:
1.) expenses required to deliver the project results to the customer
2.) expenses required to ensure the capability to achieve 1.)

The cost breakdown structure illustrated in Section 2.2 (including Project Zero) represents the estimation of the resources required to achieve both 1.) and 2.). Based on this estimation and on internal management decision making, ELAN is the only entity able to decide upon required investments (this TN will help in decision making with this respect).

2.5 Costs-Benefits-Analysis, What-If and Sensitivity Analysis

A *Cost-Benefits Analysis* (CBA) involves weighing the total expected costs against the total expected benefits of one or more actions or projects in order to choose the best or most profitable option. In order to deliver accurate results it is necessary to have (based on **Flouris 2008**):

- a detailed WBS,
- an accurate collection and reporting of cost data,
- a method for monitoring and quantifying the amount of work done and the work in progress,[2]
- a method for estimating the profit.

The EXCEL tool provided by this Technical Note aims to provide assistance in exactly this type of assessments.

Benefits and costs (expressed in money terms) must be adjusted for the time value of money (i.e. the value of money with a given amount of interest earned over a given amount of time[3]). This is

[2] This can be achieved through the use of a proper ERP tool
[3] For example, 100 € of today's money invested for 1 year and earning 5 % interest will be worth 105 € after 1 year. Therefore, 100 € paid now or 105 € paid exactly one year from now both have the same value to the

required in order to have a common basis in terms of „present value" when expressing all the flows of benefits and costs over time, especially because these flows tend to occur at different points in time (**Wikipedia 2010b**).

Common used terms used by CBA are (**Flouris 2008**):

- NPV (Net Present Value)
- PVB (Present Value of Benefits)
- PVC (Present Value of Costs)
- BCR (Benefit Cost Ratio = PVB / PVC)
- Net Benefit (= PVB - PVC)
- NPV/k (where k is the level of funds available)

Represented as the difference between the benefits and the costs, the Net Benefit is the most important parameter that quantifies the results of the CBA. This term should be as large as possible.

The accuracy of the results is of high importance. Inaccurate cost-benefit analyses may become a substantial risk in project planning and may lead to inefficient decisions. The accuracy of the results depends on how well costs and benefits are estimated. **Burghardt 1988** enumerates some of the normally used approaches that could determine the degree of inaccuracy:

- heavy reliance on past projects,
- heavy reliance on the project's members to identify (from their collective past experiences) the significant cost drivers,
- reliance on very crude heuristics to estimate the money cost of the intangible elements.

ELAN has a vast experience in cabin conversions, however they lack experience in estimating how much new, complete conversion projects would cost, especially in the context of their attempt to become a completion center. The tool provided by this TN should help deliver accurate estimates, serving as input for the CBA.

Besides benefits in terms of money (i.e. ROI), other benefits can be quantified in terms of market share or reputation. Currently, having a DOA has become a strategic requirement that stimulates more and more companies to gain this capability. In this competitive market, ELAN has to acquire this benefit, and couple it with its already accumulated experience in the field of cabin conversions.

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recipient who assumes 5 % interest. Using time value of money terminology, 100 € invested for 1 year at 5 % interest has a future value of 105 € (**Wikipedia 2010b**).

What-if Analysis is an alternative term for the *Sensitivity Analysis*. This type of analysis helps evaluating the robustness of a study, by changing parameters and by analyzing the effects of their change (**Griffin 1990**).

The What-if analysis can be performed based on a parametric breakdown. Here such an analysis will try to answer which are the global parameters and their effect on the business case. The EXCEL tool will be used to perform these evaluations (see Section 4). Examples of parameters are:

- quarters
- men quarters
- training intensity
- number of experts

3 Spreadsheet Programming for a Completion Center

3.1 Top Down or Bottom Up Approach

Top Down is an approach that starts with an overview of the general system, and decomposes it step by step into smaller subcomponents. For instance, in the case of the Cost Breakdown Structure that was presented in Section 2.2, the general parameter is *cost*, which is broken down into *direct* and *indirect* costs. The direct costs are broken into *personnel*, *training*, *sales* and *miscellaneous* cost categories. Each staff category is decomposed into *internal*, *external* or *experts*.

On the contrary, the *Bottom Up* design approach starts from a particular case and aims to link all smaller pieces in order to form a system. However a lot of intuition and experience is necessary to anticipate the functionality of the whole system.

Besides design, there are several areas where top-down or bottom up approaches can be applied: management, software development, ecology or psychology (**Fink 1999**).

For the programmed EXCEL tool the approach top down was chosen. The tool was build in such a way, that by modifying global parameters, the rest of the cells (representing the smaller pieces of the system) change automatically and provides the user with final results.

3.2 Time Line and Unit of Time

A monthly evaluation of the costs would generate a highly in-transparent interface as well as difficulties in manipulating the data. This is why the fineness ratio of the time lime will be given by quarters. The project lead time can be defined by the user, who will have the flexibility to input the number of quarters allocated for each project, as well as to decide upon the duration (in quarters) of each of the phase.

3.3 Distribution of Men-Quarters for Staff Involvement

Three categories of staff members were decided to be required: *internal* staff – already employed by ELAN, having accumulated experience inside the company for the main client Airbus; *external* staff – specialized on certain areas where ELAN lacks experience; *experts* – required especially in the field of certification.

The parameter that is distributed is the *men · quarters*. The total men quarters assumed for the respective project is defined in the *Global Project Timeframe Sheet* (see Figure A.6, Appendix A). This total number is distributed per each quarter depending on the phase and type of staff, according to Table 2.2 (Section 2.2.2).

An additional input required is the number of quarters. This is defined (as Project Lead Time) in the *Global Project Timeframe Sheet*. In the *Definition Sheet* (see Figure A.3, Appendix A) the quarters are being „activated" for a certain phase by inserting 1. Based on the default collection of 1s, the costs are distributed for the respective number of quarters of the respective project. A line summarized the total costs of staff for each quarter.

3.4 Distribution of Costs for Training

The only category of staff that requires training is the internal staff category. The user must choose between three categories of training intensity: light, medium and intense (as indicated in Section 2.2.3. This is done, again, in the *Global Project Timeframe Sheet.*

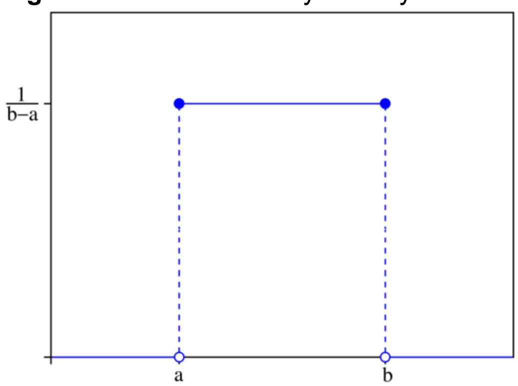
According to the assumed training intensity (see Table 2.3), the costs are distributed per each phase, and summarized.

3.5 Distribution of Costs for Sales and Miscellaneous Categories

The sales and miscellaneous categories may be distributed by using a distribution function. There are three types of distributions that were considered. Selected was a triangular distribution.

Uniform Distribution. The probability is defined as the chance for an event to occur; this is expressed through a number between 0 and 1. In a uniform distribution the probability for an event to occur is constant (the chances are equal). A probability density function (PDF) describes the relative likelihood for an event to occur at a given point in the observation space. The area under the PDF is equal to 1 (see Figure 3.1).

Fig. 3.1 Probability Density Function for a uniform distribution (**Mathworld 2010a**)



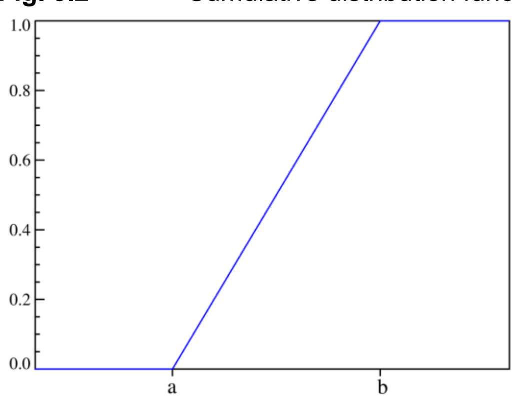
The form of the PDF is:

$$\begin{cases} \dfrac{1}{b-a} & \mathit{for}\ x \in [a,b] \\ 0 & \mathit{otherwise} \end{cases} \tag{3.1}$$

where: $-\infty < a < b < \infty$, $x \in [a,b]$

The cumulative distribution function describes the probability that a random variable with a given probability distribution will be found at a value less than or equal to x. Intuitively, it is the "area so far" function of the probability distribution (see Figure 3.2).

Fig. 3.2 Cumulative distribution function for a uniform distribution (**Mathworld 2010a**)



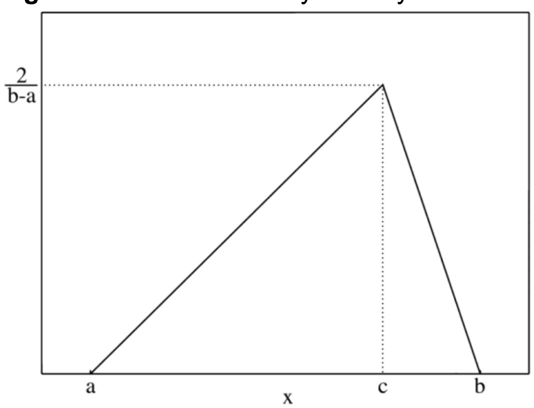
The form of the CDF is:

$$\begin{cases} 0 & for\ x \le a \\ \dfrac{x-a}{b-a} & for\ x \in [a,b] \\ 1 & for\ x \ge b \end{cases} \tag{3.2}$$

where $-\infty < a < b < \infty,\ x \in [a,b]$.

Triangular Distribution. Unlike the uniform distribution, the triangular distribution has a node $c \in [a,b]$ as illustrated in Figure 3.3.

Fig. 3.3 Probability Density Function for a triangular distribution (**Mathworld 2010b**)



The form of the PDF is:

$$\begin{cases} \dfrac{2(x-a)}{(b-a)(c-a)} & for\ a \le x \le c \\ \dfrac{2(b-x)}{(b-a)(b-c)} & for\ c \le x \le b \end{cases} \tag{3.3}$$

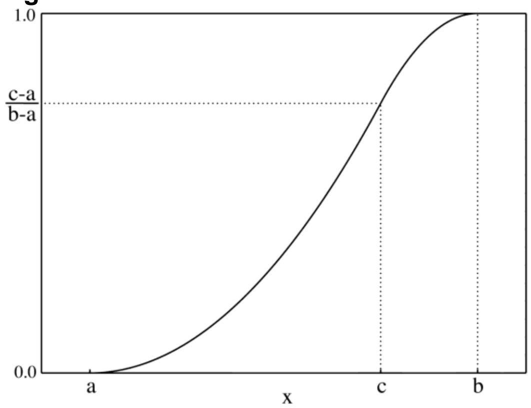
where $\begin{matrix} a \in (-\infty,\infty) \\ b > a \\ a \le c \le b \end{matrix}$.

The CDF of the triangular distribution is represented in Figure 3.4.

The form of the CDF is:

$$
\begin{cases} \dfrac{(x-a)^2}{(b-a)(c-a)} & for\ a \le x \le c \\ 1-\dfrac{(b-x)^2}{(b-a)(b-c)} & for\ c \le x \le b \end{cases} \tag{3.4}
$$

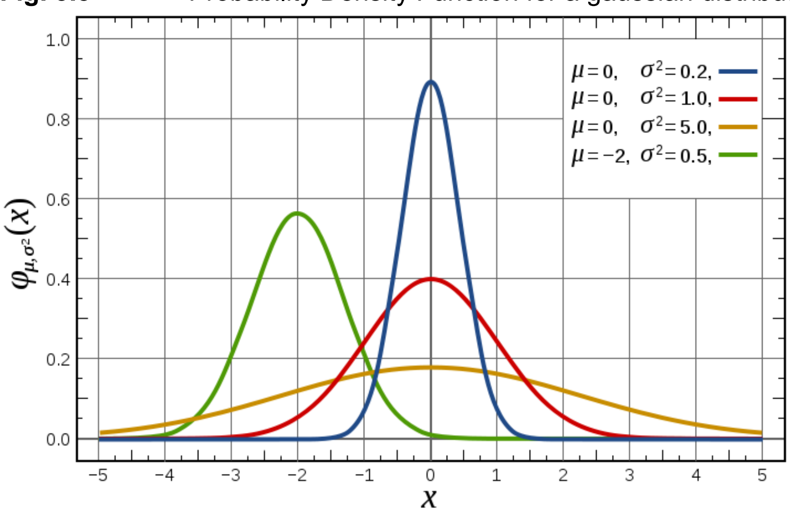
Fig. 3.4 Cumulative distribution function for a triangular distribution (**Mathworld 2010b**)



The CDF of a triangular distribution will look differently depending on the type of project: simple, medium or complex. The values of a, b, and c parameters will be modified accordingly. For instance, a smaller project will have a smaller value for c, while a complex project will have a larger value for c, as the expenses will be higher.

*Gaussian Distribution (*or normal distribution*)*. The form of the PDF for a Gaussian distribution is indicated in Figure 3.5.

Fig. 3.5 Probability Density Function for a gaussian distribution (**Mathworld 2010c**)



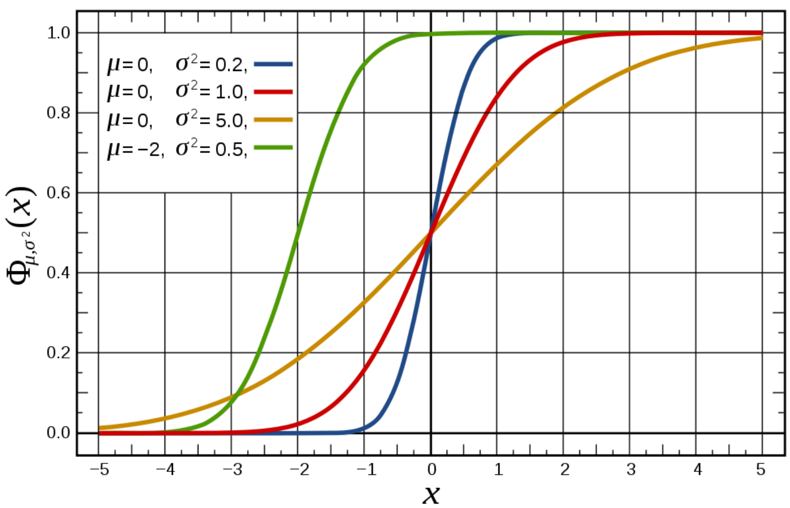
The form of the PDF is:

$$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \tag{3.5}$$

where
$$\begin{aligned} &\mu \in \Re \;-\; mean \quad (location) \\ &\sigma^2 \geq 0 \;-\; variance \quad (squared \quad scale) \\ &x \in \Re \quad if \quad \sigma^2 > 0 \\ &x = \mu \quad if \quad \sigma^2 = 0 \end{aligned}.$$

The CDF of the gaussian distribution is represented in Figure 3.6.

Fig. 3.6 Cumulative distribution function for a triangular distribution (**Mathworld 2010c**)



The form of the CDF is:

$$\frac{1}{2}\left[1 + erf\left(\frac{x-\mu}{\sqrt{2\pi\sigma^2}}\right)\right] \tag{3.6}$$

where:

$$erf(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} = \frac{2}{\sqrt{\pi}}\left(t - \frac{t^3}{3} + \frac{t^5}{10} - \frac{t^7}{42} + \frac{t^9}{216} - \dots\right) \tag{3.7}$$

is an error function.

3.6 Explanation of Tabs

3.6.1 Definition Tab

The first tab of the EXCEL Tool is the *Definition* tab (see Figures A.1 to A.4, Appendix A). Here general parameters are defined:

- staff cost in €/hour for each phase and type of staff,
- training cost, as the sum of training fees and salary,
- office space cost in €/month/employee,
- work space cost in €/month/employee,
- number of employees included in DOA,
- risk allowance, as percentage of total costs,
- a, b and c values for the triangular distributions for small, medium and complex projects.

It also includes the definition/distribution of:

- amount of miscellaneous and sales costs in €, foreseen for every project
- project lead time for projects lasting between 1 and 8 quarters as well as the definition of the number of quarters allocated for each phase,
- type of staff in percentage; default values are 60 % internal, 30 % external and 10 % experts,
- costs per phase, depending on the complexity of the project: small, medium, complex,
- training costs per phase, depending on the intensity of the training: light, medium, intense.

The user can change the default values in the *Definition* tab. The results will be automatically adjusted. To note is the fact the tool currently accommodates a number of 20 projects, for the five foreseen years.

3.6.2 Project Zero Tab

The second tab is called *Project Zero* tab (see Figure A.6, Appendix A). In the frame of this unprofitable so called Project Zero, the user has the possibility to define all the expenses required as an initial investment towards the vision Completion Center:

- Initial training costs required are calculated from the number of employees and the duration of the training; the default values can be overwritten by the user.
- EASA fees are calculated depending on the number of persons included in the design organization (inputted in *Definition*) and based on the type of activity; the user can choose from the drop-down menu one of the three possibilities: TC holder; Changes and Repairs

under STC; Minor Changes and Repairs under DOA (for which no approval is required). Default is, of course, unrestricted changes and repairs under STC; for the calculation of the fees yearly inflation factors[4] are required.

- IT costs are inputted as a block sum. The accuracy of this input depends on the suggestions of the IT experts at ELAN.
- Total Project Zero costs are calculated automatically.

3.6.3 Global Project Timeframe Tab

This tab has the purpose to display in a Gantt Chart-like layout the projects foreseen for the period 2011 – 2015 (see Figure A.6, Appendix A). The user defines the number of projects as well as their complexity and duration. The maximum number of projects that the tool can accommodate is 20. The user can define less than 20 projects, by simply deleting the lines of the rest of the projects in the Global Project Timeframe sheet.

Project-related inputs required are:

- complexity (small, medium, complex),
- duration (in quarters),
- starting year,
- starting quarter of the year,
- ending quarter of the year,
- ending year,
- total men quarters (available / required),
- training intensity (light, medium, intense, none),
- foreseen project value.

This data is read by the corresponding project sheets and used for the calculations. This sheet also includes the plot of the cash flow in order for the user to immediately see the effects of his changes. The plot is repeated in the Summary sheet, along with other results. Once the user changes values in the *Global Project Timeframe* sheet, he needs to press the *re-plot cash flow* button, in order to see the effects on the cash flow.

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4 The inflation factors until 2010 are defined by EASA (**EASA 2010b**). The other inflation factors (until 2015) are obtained through a random function which uses values that lie in a range of plus or minus 10 % of the highest and lowest inflation factors defined by EASA.

3.6.4 Project Tabs

Each project defined in the *Global Project Timeframe* will have its own calculation sheet, where all the costs, according to the CBS, are calculated (see Figure A.7, Appendix A). For a better overview, at the beginning of each sheet the basic parameters are recalled from the *Global Project Timeframe* sheet:

- type of project,
- duration in quarters,
- total men quarters,
- training intensity.

Cost calculation are performed for each element of the CBS.

The *risk allowance* is calculated from the total cumulative costs (i.e. the sum between direct and indirect costs) with the default value of 5 % for the risk allowance factor (read from the *Definition* sheet).

The *turnover* will be the project value estimated by ELAN, and inputted in the *Global Project Timeframe*. The turnover comes usually at the end of the project, therefore the turnover will not be distributed within each quarter, but it comes in at the end of the project.

The *cash flow* will be calculated as the difference between the estimated expenses and the turnover. The *gain* will be the difference between the total cumulative expenses and the project value (or turnover). Cumulative cash flow is displayed.

The *profit-turnover ratio* (German: *Umsatzrendite*) is displayed in percents.

3.6.5 Summary Tab

The *Summary* tab gathers the results in three major tables (see Figure A.8, Appendix A):

- total costs,
- personnel,
- cash flow.

The same Gantt Chart-like style is used to express expenses over the 5 year period, for each quarter. This gives the user the possibility to visualize overlapping costs, as well as their quarterly sum.
The variations are then plotted in order to allow interpretation and analysis of all the scenarios inputted. The cash flow is „refreshed" by pressing the *re-plot cash flow* button.

The *Summary* tab also displays the *minimum investment required in quarter one*, the *gain after five years* and the r*eturn on investment*. The minimum investment required will be the minimum amount between the cash flow of each quarter. The gain after five years will be the cash at the end of the five year period (quarter 20). The ROI is calculated from Equation (2.2).

4 Assumed Ramp Up of a Completion Center

In order to extract meaningful statements regarding the business case as well as to identify sensitive parameters, the tool was used to analyze a number of three scenarios:
Scenario 1: small investments, small number of projects
Scenario 2: medium investments, small number of projects
Scenario 3: large investment, large number of projects

In order to be realistic, every scenario begins with smaller projects, while the growing capability is achieved over the five years time. All three scenarios include the expenses of Project Zero.

4.1 Scenario 1

4.1.1 Project Gantt Chart

The number of projects foreseen for this scenario is 10, out of which most of them are small. The strategy adopted here is to start with a small core team that will increase its efficiency in the un-experienced fields by working in small and safe projects, and by assuming the risk of potential initial losses. In order to keep the risks at an acceptable level, the projects can only be small up to medium.

The description of the scenario as well as the proposed Gantt chart is illustrated in Figures 4.1 and 4.2.

Number	Complexity	Project Lead Time (quarters)	Starting Quarter of the Year	Starting Year	Ending Quarter of the Year	Ending Year	Total ManQuarters	Training Intensity	Project Value
1	Simple	1	1	2011	1	2011	20	Medium	150000
2	Simple	2	2	2011	3	2011	40	Medium	300000
3	Simple	2	4	2011	1	2012	40	Medium	300000
4	Simple	2	2	2012	3	2012	40	Medium	350000
5	Medium	3	4	2012	2	2013	60	Light	500000
6	Medium	3	3	2013	1	2014	60	Light	700000
7	Simple	1	2	2014	2	2014	20	None	300000
8	Simple	1	3	2014	3	2014	20	None	350000
9	Simple	2	4	2014	1	2015	40	None	300000
10	Medium	3	2	2015	4	2015	60	None	1000000

Fig. 4.1 Scenario 1: Projects description from the Global Project Timeframe sheet

Project Profit	2011				2012				2013				2014				2015			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
-45.796 €	X																			
1.724 €		X	X																	
1.724 €				X	X															
51.724 €						X	X													
124.041 €								X	X	X										
324.041 €											X	X	X							
150.270 €														X						
200.270 €															X					
47.790 €																X	X			
645.310 €																		X	X	X

Fig. 4.2 Scenario 1: Distribution of projects and their duration over time from the Global Project Timeframe sheet

4.1.2 Cash Flow Curve, Investment and Return on Investment

A summary of the resulting finances are illustrated in Figure 4.3. The cash flow distribution over the 20 quarters for Scenario 1 is shown in Figure 4.4.

The initial project produces less money than required to cover expenses. The profit at the end of quarter 20 (after 5 years) reaches 645.310 €. The minimum investment that would be required for this scenario in order not to have losses is given by the minimum cash flow value among the 20 quarters. The minimum for this scenario is 214.317 €. In this case the return on investment, ROI, is 32 %.

The total costs involved, as well as the personnel required along the 5 years period are shown in Figure 4.5 and 4.6.

Quarters	Total Cost	Personnel	Cash Flow
1	€ 1.481.012	20,0	€ -45.796
2	€ 87.810	5,5	€ -94.911
3	€ 196.262	14,5	€ 1.724
4	€ 100.479	5,5	€ -94.911
5	€ 196.262	14,5	€ 1.724
6	€ 87.810	5,5	€ -94.911
7	€ 196.262	14,5	€ 51.724
8	€ 86.418	4,0	€ -79.336
9	€ 129.013	7,0	€ -214.317
10	€ 155.674	9,0	€ 124.041
11	€ 73.369	4,0	€ -79.336
12	€ 142.845	7,0	€ -214.317
13	€ 155.674	9,0	€ 324.041
14	€ 142.600	20,0	€ 150.270
15	€ 142.600	20,0	€ 200.270
16	€ 90.933	5,5	€ -82.415
17	€ 163.790	14,5	€ 47.790
18	€ 70.169	4,0	€ -75.799
19	€ 120.773	7,0	€ -202.202
20	€ 161.745	9,0	€ 645.310

Fig. 4.3 Scenario 1: Total costs, personnel and cash flow over quarters

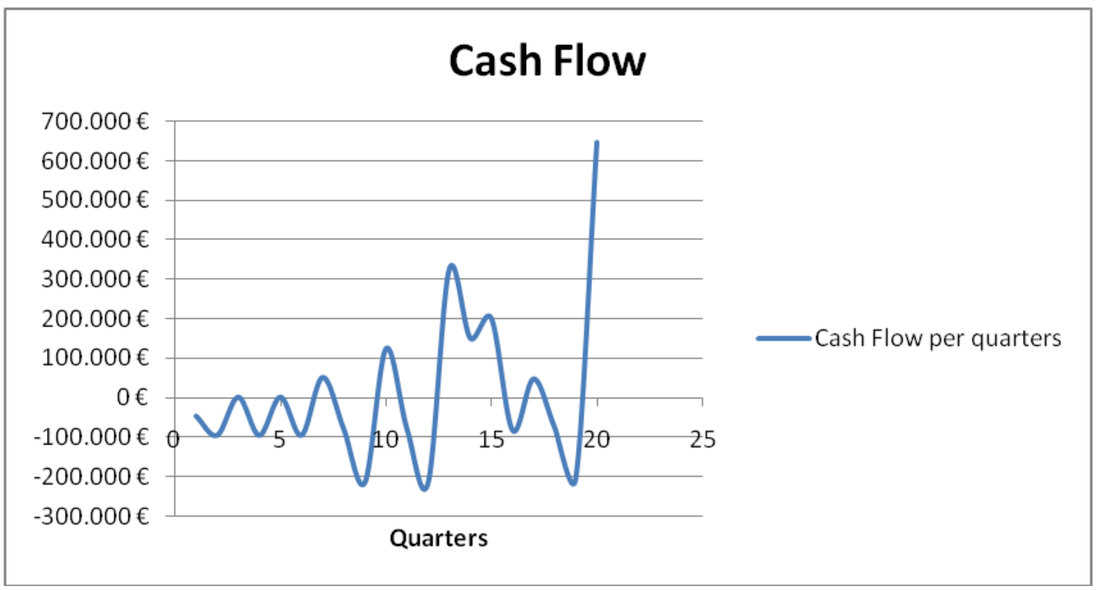

Fig. 4.4 Scenario 1: Cash flow curve

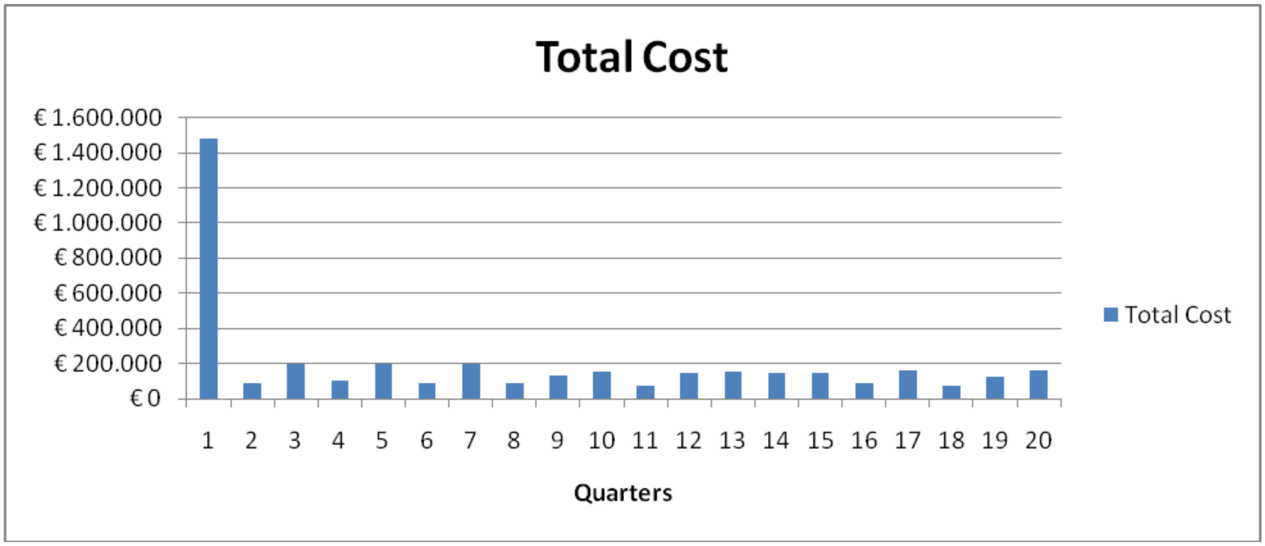

Fig. 4.5 Scenario 1: Total costs distributed over quaters

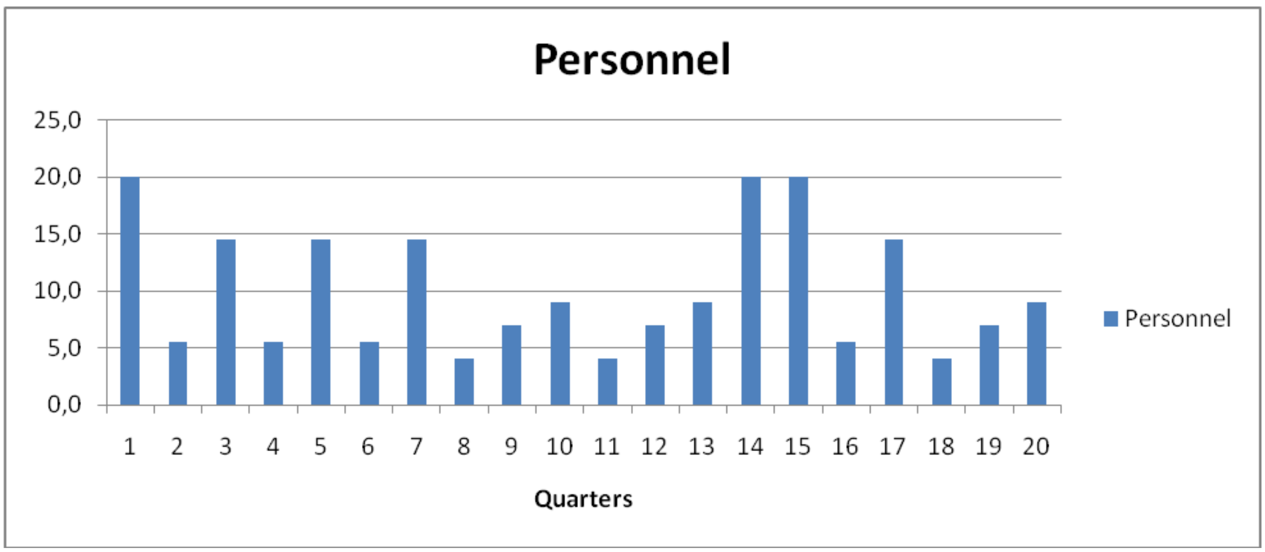

Fig. 4.6 Scenario 1: Amount of personnel distributed over quaters

4.2 Scenario 2

4.2.1 Project Gantt Chart

The number of projects foreseen for this scenario is 10, from simple to medium and complex. The main purpose in the beginning will be to create the capability of building up the design organization, and less to make profit. The characteristics of the projects and their proposed distribution in a Gantt chart are illustrated in Figures 4.7 and 4.8.

Number	Complexity	Project Lead Time (quarters)	Starting Quarter of the Year	Starting Year	Ending Quarter of the Year	Ending Year	Total ManQuarters	Training Intensity	Project Value
1	Simple	1	1	2011	1	2011	20	Intense	150000
2	Simple	2	2	2011	3	2011	40	Intense	200000
3	Simple	2	4	2011	1	2012	40	Intense	250000
4	Simple	2	1	2012	2	2012	40	Medium	350000
5	Medium	3	2	2012	4	2012	60	Medium	500000
6	Medium	3	1	2013	3	2013	60	Medium	950000
7	Medium	4	1	2013	4	2013	80	Light	800000
8	Simple	2	4	2013	1	2014	40	Light	300000
9	Complex	6	1	2014	2	2015	120	None	1500000
10	Medium	4	1	2015	4	2015	80	None	1000000

Fig. 4.7 Scenario 2: Projects description from the Global Project Timeframe sheet

	2011				2012				2013				2014				2015			
Project Profit	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
-86.620 €	X																			
-139.100 €		X	X																	
-89.100 €				X	X															
51.724 €					X	X														
99.244 €						X	X	X												
549.244 €									X	X	X									
321.561 €									X	X	X	X								
26.521 €												X	X							
1.130.188 €													X	X	X	X	X	X		
542.830 €																	X	X	X	X

Fig. 4.8 Scenario 2: Distribution of projects and their duration over time from the Global Project Timeframe sheet

4.2.2 Cash Flow Curve, Investment and Return on Investment

A summary of the resulting finances are illustrated in Figure 4.9. The cash flow distribution over the 20 quarters for Scenario 1 is shown in Figure 4.10.

Again, the initial projects produce less money than required to cover expenses. However the profit at the end of quarter 20 (after 5 years) can reach 542.830 €. The minimum investment required in quarter 1 for this scenario has the value of 594.281 €. In this case the return on investment, ROI, is 13.9 %.

The total costs involved, as well as the personnel required along the 5 years period are shown in Figure 4.11 and 4.12.

Quarters		Total Cost		Personnel		Cash Flow
1		€ 1.519.892		20,0		€ -86.620
2		€ 97.962		5,5		€ -106.035
3		€ 224.990		14,5		€ -139.100
4		€ 110.691		5,5		€ -106.035
5		€ 312.800		20,0		€ -184.011
6		€ 274.431		18,5		€ -32.805
7		€ 138.133		7,0		€ -229.025
8		€ 178.417		9,0		€ 99.244
9		€ 151.574		7,3		€ -163.631
10		€ 196.096		9,3		€ -371.784
11		€ 309.490		15,3		€ 256.670
12		€ 274.893		13,8		€ 233.960
13		€ 256.309		17,0		€ -55.677
14		€ 48.781		1,5		€ -136.234
15		€ 110.600		3,5		€ -252.089
16		€ 126.852		3,5		€ -369.812
17		€ 213.772		7,8		€ -594.281
18		€ 194.724		6,8		€ 700.297
19		€ 136.620		6,3		€ -279.635
20		€ 187.268		8,3		€ 542.830

Fig. 4.9 Scenario 2: Total costs, personnel and cash flow over quarters

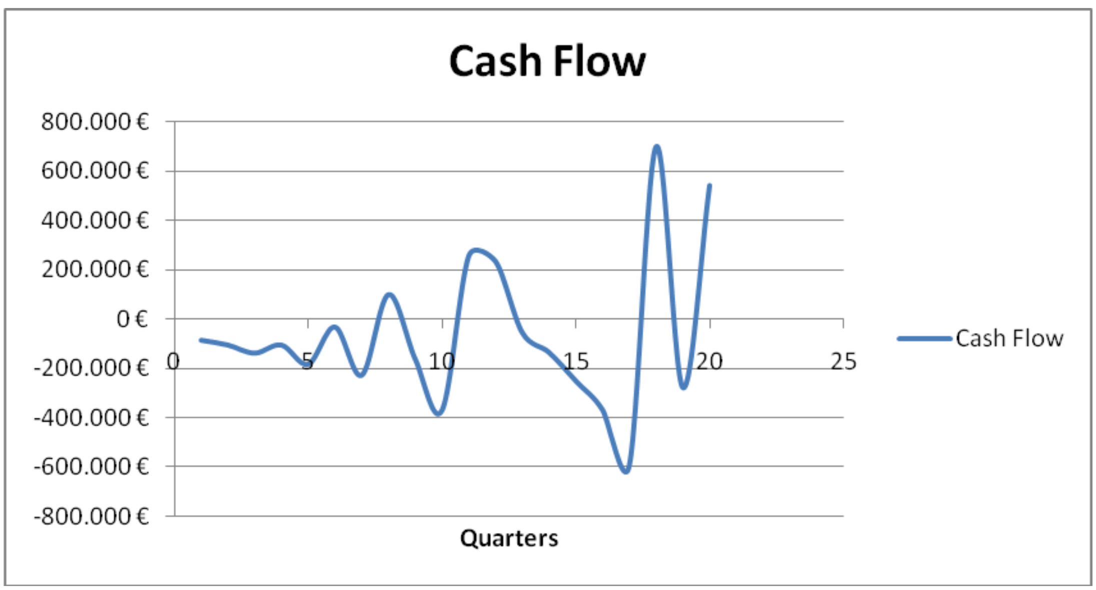

Fig. 4.10 Scenario 2: Cash flow curve

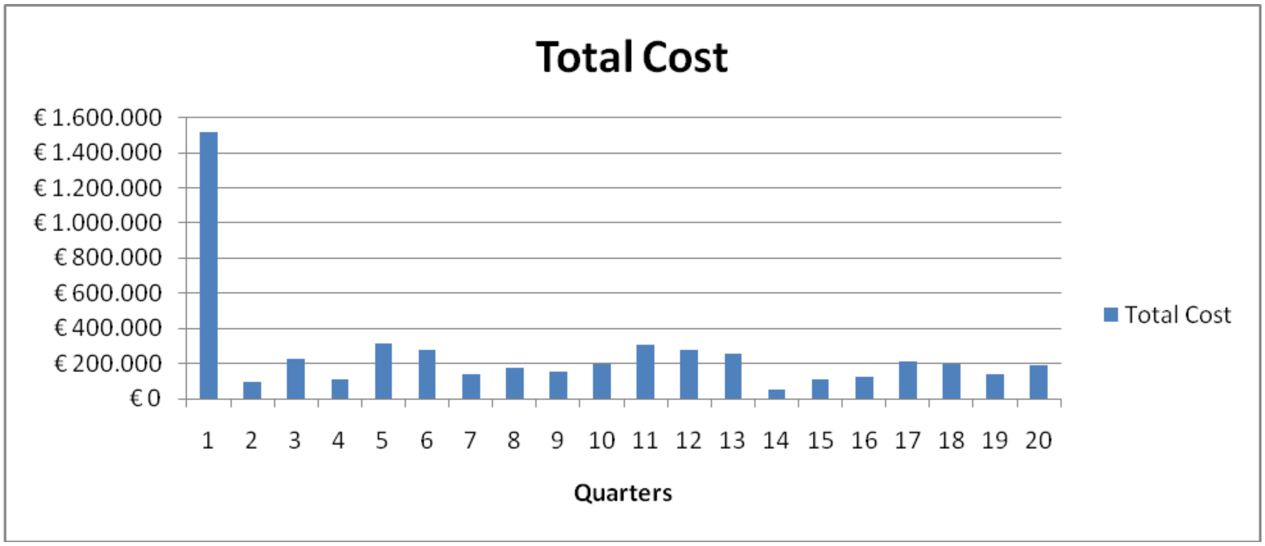

Fig. 4.11 Scenario 2: Total costs distributed over quaters

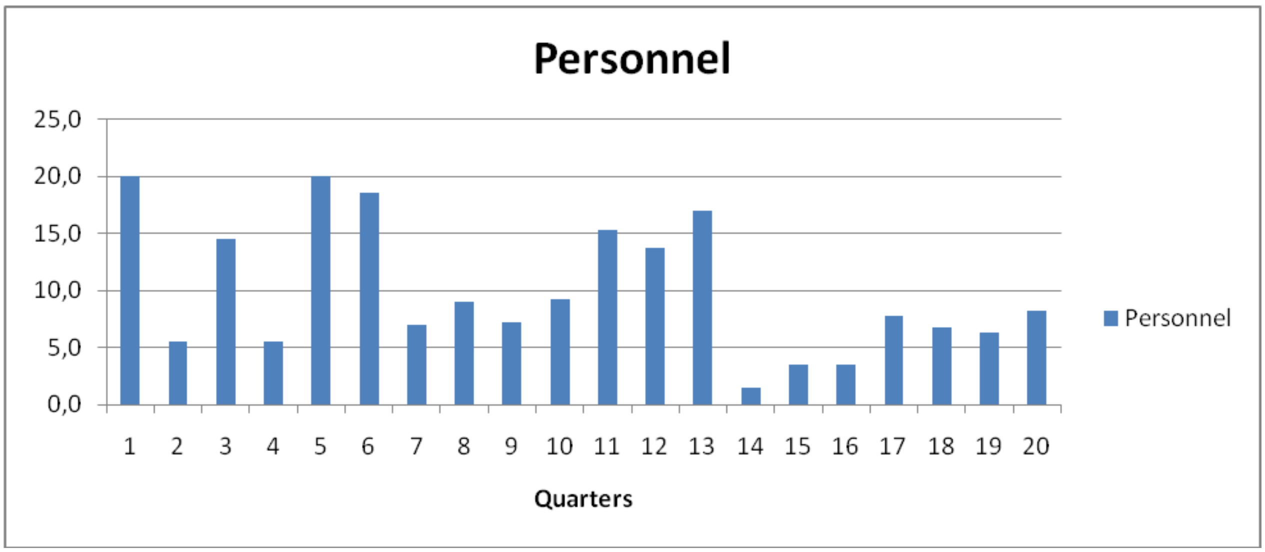

Fig. 4.12 Scenario 2: Amount of personnel distributed over quarters

4.3 Scenario 3

4.3.1 Project Gantt Chart

The number of projects foreseen for this scenario is 20, out of which most of them are medium and complex. Figures 4.13 and 4.14 illustrate the characteristics of each selected projects as well as their distribution over time.

Number	Complexity	Project Lead Time (quarters)	Starting Quarter of the Year	Starting Year	Ending Quarter of the Year	Ending Year	Total ManQuarters	Training Intensity	Project Value
1	Simple	1	1	2011	1	2011	20	Intense	250000
2	Simple	2	2	2011	3	2011	40	Medium	300000
3	Simple	2	3	2011	4	2011	40	Light	250000
4	Simple	2	4	2011	1	2012	40	Medium	350000
5	Medium	4	3	2011	2	2012	80	Intense	500000
6	Medium	3	1	2012	3	2012	60	Medium	950000
7	Complex	5	2	2012	2	2013	100	Light	2000000
8	Simple	2	3	2013	4	2013	40	None	300000
9	Complex	6	1	2013	2	2014	120	Medium	1500000
10	Medium	4	2	2013	1	2014	80	Intense	1000000
11	Simple	2	3	2013	4	2013	40	Medium	300000
12	Complex	7	1	2014	3	2015	140	Light	1700000
13	Medium	4	3	2014	2	2015	80	Medium	500000
14	Simple	2	4	2014	1	2015	40	None	300000
15	Complex	5	4	2014	4	2015	100	Medium	2500000
16	Medium	4	3	2014	2	2015	80	Light	500000
17	Simple	2	3	2015	4	2015	40	None	300000
18	Simple	1	4	2015	4	2015	20	None	300000
19	Medium	3	2	2015	4	2015	60	Light	1500000
20	Simple	2	2	2015	3	2015	40	None	450000

Fig. 4.13 Scenario 3: Projects description from the Global Project Timeframe sheet

Project Profit	2011				2012				2013				2014				2015			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
13.380 €	X																			
1.724 €		X	X																	
-23.479 €			X	X																
51.724 €				X	X															
-44.060 €			X	X	X	X														
549.244 €					X	X	X													
1.646.786 €						X	X	X	X	X										
47.790 €											X	X								
1.103.366 €									X	X	X	X	X	X						
455.940 €										X	X	X	X							
1.724 €											X	X								
1.329.149 €													X	X	X	X	X	X	X	
-3.236 €															X	X	X	X		
47.790 €																X	X			
2.130.866 €																X	X	X	X	X
21.561 €															X	X	X	X		
47.790 €																			X	X
150.270 €																				X
1.124.041 €																		X	X	X
197.790 €																		X	X	

Fig. 4.14 Scenario 3: Distribution of projects and their duration over time from the Global Project Timeframe sheet

4.3.2 Cash Flow Curve, Investment and Return on Investment

A summary of the resulting finances are illustrated in Figure 4.15. The cash flow distribution over the 20 quarters for Scenario 3 is shown in Figure 4.16.

The profit at the end of quarter 20 (after 5 years) reaches 3.216.386 €. The minimum investment for this scenario is 1.171.283 €. In this case the return on investment, ROI, is 30,02 %.

The total costs involved, as well as the personnel required along the 5 years period are shown in Figure 4.11 and 4.12.

Quarters	Total Cost	Personnel	Cash Flow
1	€ 1.519.892	20,0	€ 13.380
2	€ 87.810	5,5	€ -94.911
3	€ 360.273	23,3	€ -175.275
4	€ 344.983	22,3	€ -279.584
5	€ 439.635	24,8	€ -365.680
6	€ 405.143	17,6	€ -340.918
7	€ 217.537	10,8	€ 423.711
8	€ 67.965	1,8	€ -185.793
9	€ 243.431	8,3	€ -440.377
10	€ 357.275	13,1	€ 1.184.718
11	€ 348.817	16,8	€ -608.385
12	€ 660.436	38,8	€ -679.994
13	€ 439.541	15,0	€ -186.487
14	€ 197.187	5,8	€ 649.425
15	€ 258.822	9,4	€ -418.228
16	€ 384.512	15,2	€ -816.948
17	€ 625.534	31,7	€ -1.171.283
18	€ 721.504	31,7	€ -975.344
19	€ 680.264	36,7	€ 446.981
20	€ 708.345	51,8	€ 3.216.386

Fig. 4.15 Scenario 3: Total costs, personnel and cash flow over quarters

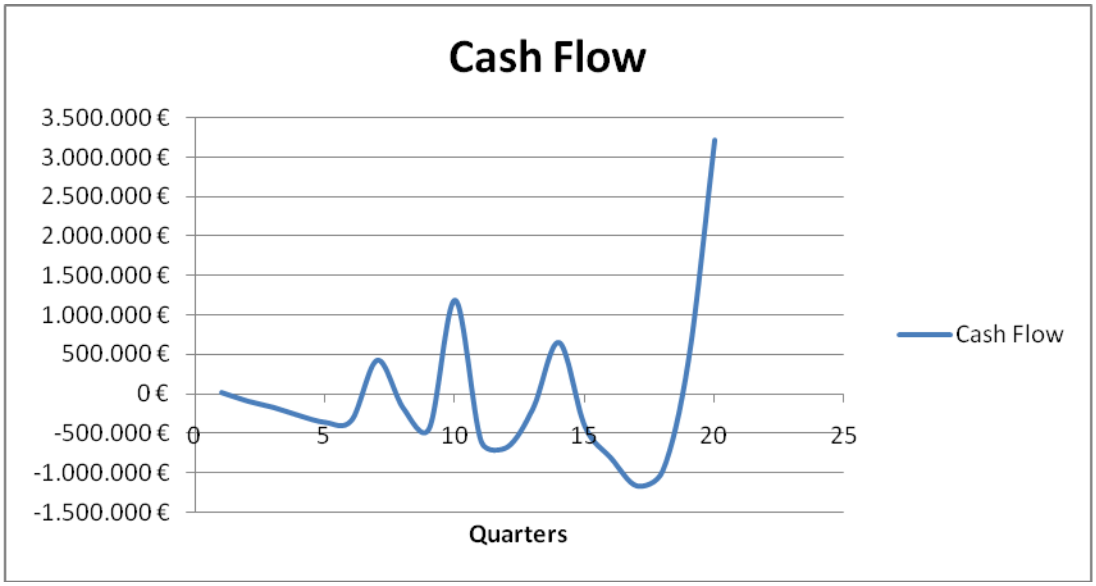

Fig. 4.16 Scenario 3: Cash flow curve

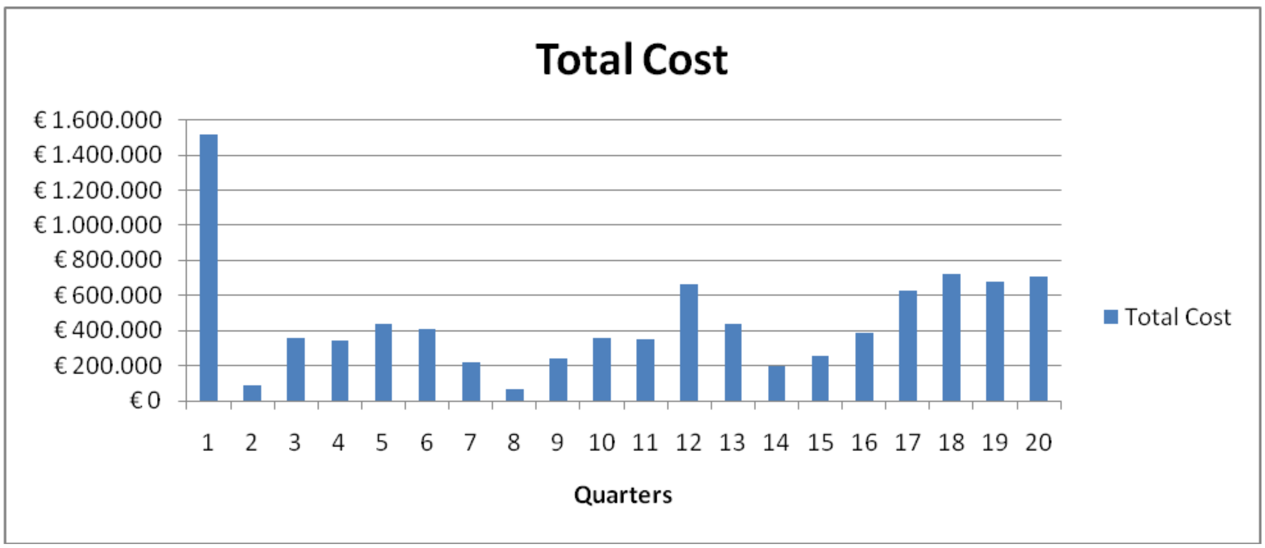

Fig. 4.17 Scenario 3: Total costs distributed over quaters

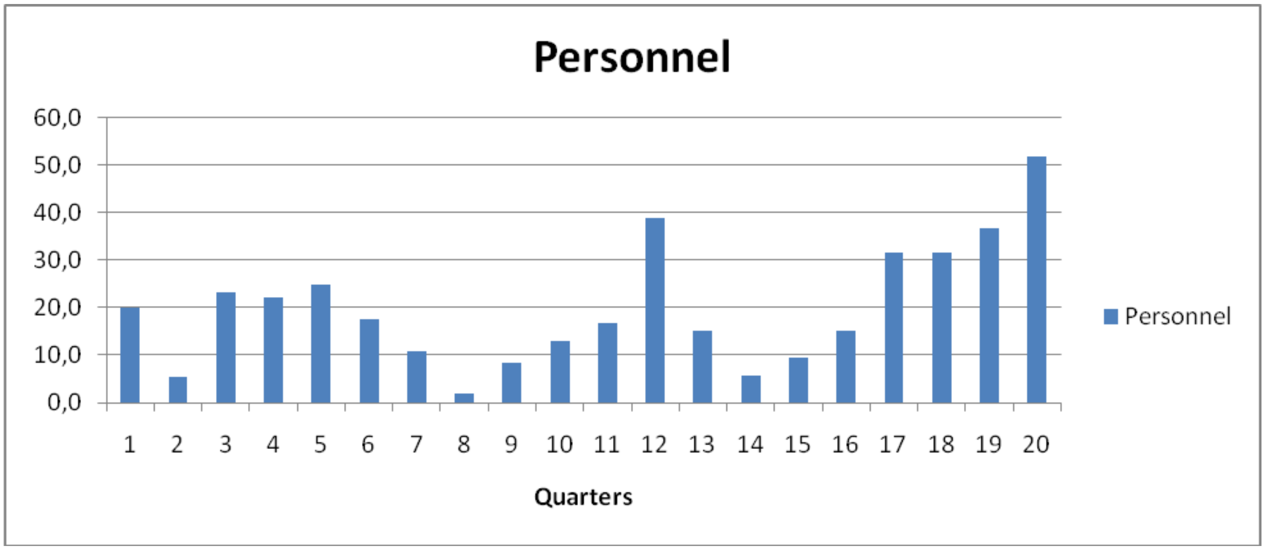

Fig. 4.18 Scenario 3: Amount of personnel distributed over quaters

4.4 Sensitivity Analysis

There are two factors that may change the cash flow curves, therefore two sides where improvements can be achieved: *expenses* and *turnover. Expenses* are calculated from total costs, by adding the risk allowance factor. Expenses can be controlled through factors like number of men quarters, number of trainees and training intensity, number of experts or external employees. *Turnover* needs an accurate estimation (to be remembered that this value is inputted in the *Global Project Timeframe* Sheet).

From the definition of *profit* (turnover minus expenses) results that a higher profit is obtained if *turnover is increased* and *expenses are reduced*. The turnover (i.e. the project value) depends first of all on the amount of work estimated during offer. This sets the price that is to be paid by the customer. A certain price flexibility should be allowed in order to face competition.

Expenses can be improved if several factors are modified. Parameters that can be varied are:

- staff costs (internal, external, experts)
- training costs
- indirect costs
- risk allowance
- sales costs
- miscellaneous costs
- „k" factors

- Number of people for DOA
- Number of men quarters

Table 4.1 illustrates the impact on *profit*, *minimum investment* and *ROI* of part of the above-mentioned parameters. To note that the variation of the „k" factors was from 0.6 to 0.7 (i.e. + 17 %) for „k" factors for internal staff, from 0.3 to 0.2 for „k" factors for external staff (i.e. -33 %), while the same experts requirement was considered (i.e. 0 % deviation for „k" factors).

The question a sensitivity analysis arises is how a certain factor is being influenced when another factor is varied. This is expressed through partial derivatives:

$$\frac{\partial\, out}{\partial\, in}\begin{cases} < 0, \text{if one parameter drops, then the other increases} \\ = 0, \text{indiferent change} \\ > 0, \text{if one parameter drops, the other also drops} \end{cases} \tag{4.1}$$

For example, the effect of the decrease of internal staff costs on return on investment is – *0.5*. This is calculated as follows:

$$\frac{\partial(ROI)}{\partial(Internal\_Staff\_Costs)} = \frac{+10\,\%}{-20\,\%} = -0.5 \tag{4.2}$$

The minus sign indicates that if one parameter drops (costs), the other one will increase (ROI).

Table 4.1 Variation of parameters and their impact on gain, investment and return on investment

Parameter	Symbol	Devia-tions	Gain after 5 years	$\frac{\partial\, out}{\partial\, in}$	Min. invest-ment	$\frac{\partial\, out}{\partial\, in}$	ROI	$\frac{\partial\, out}{\partial\, in}$
Staff internal	SI	- 20 %	+ 4 %	- 0.2	- 11 %	+ 0.55	+ 10 %	- 0.5
Staff external	SE	- 20 %	+ 2 %	- 0.1	- 7 %	+ 0.35	+ 7 %	- 0.35
Staff experts	SX	- 20 %	+ 3 %	- 0.15	- 3 %	+ 0.15	+ 3 %	- 0.15
Training costs	T	- 20 %	+ 0.3 %	- 0.015	- 1 %	+ 0.05	+ 1 %	- 0.05
K staff factors	K	+17 % - 33 % 0 %	+ 0.8 %	- 0.04	- 3 %	- 0.15	+ 2 %	- 0.1
Combination of parameters	SI+SE+SX		+ 7 %	-	- 21 %	-	+ 20 %	-
	SI+SE+SX+T		+ 7 %	-	- 22 %	-	+21 %	-
	T+K		+ 1 %	-	- 3 %	-	+ 3 %	-
	SI+SE+SX+T+K		+ 8 %	-	- 24 %	-	+ 24 %	-

Staff costs (for salary or training) are the most significant costs. If all the staff costs are reduced and a higher percentage of internal instead of external employees is used, then an important increase in profit and return on investment can be achieved.

4.5 Discussion of the Results

As a middle solution scenario 2 seems not to be the best solution. It seems that only two ways are beneficial: either conducting small and safe projects one after the other with a smaller team and a smaller outcome, or adopting the strategy of „booming economy", i.e. investing strongly and have higher profit in the end.

Among the parameters that influence the costs, the most important are the staff costs. Most significant part of the staff costs is the salary. The reduction in costs for internal staff has of course the greatest impact, due to the higher number of internal employees. External staff follows shortly, due to the fact the higher costs. If both costs and amount of external employees are reduced, then the advantage is considerable and the internal staff costs could be kept constant (i.e. no salary reduction would be required).

Our analysis is meant only to prove the tool plausibility. It may not be realistic enough due to its roughly approximated inputs, out of which the most sensible one is the project value. The project value can be „tuned" so as to always get a positive balance from every project. It would be then in the responsibility of the sales directors to make these project values realistic and find customers willing to pay the price.

5 Summary, Conclusions and Recommendations

This Technical Note aimed to aid the evaluation of the business case Completion Center. It first delivered background information about business economics, summarizing basic elements about chances and risks, revenue and profit, investment and cash flow. It then applied it for a management tool conception.

The management tool was build to analyze the different possibilities to proceed towards this vision. Most important roles of the tool are:

- to estimate the amount of money required to obtain positive cash flows over the five years period[5],
- to help selecting a vision strategy by using the tool to analyze different scenarios.

The user of the tool has the advantage of fast input changeability and intermediate visualization of the results. The tool can accommodate a maximum number of 20 projects for a period of five years. For this period three hypothetical, but very likely scenarios have been illustrated: 1.) small investments, small number of projects; 2.) medium investments, small number of projects; 3.) large investment, large number of projects. The tool allows the adaptation of the inputted data to match a required output. The user has the flexibility to practically build its own cash flow curve by changing parameters like project value, number of staff, training intensity, etc.

The examples discussed in this TN are used first of all to illustrate the functioning of the tool. The results are very sensitive to parameters like project value, which can be „tuned" to match the cash flow. Only ELAN engineers can appreciate realistic project values. However, based on this limited evaluation, it seems that two alternatives bring ELAN forward towards the vision „completion center": one with higher profit (Scenario 3) and one with less profit (Scenario 1). A middle alternative seems to be too costly for the predicted gain.

Staff costs have the highest share in total costs. These costs can be reduced by adopting several alternatives:

- limited use of external staff and experts,
- involvement of a smaller number of DOA members,
- optimization of training costs.

5 i.e. minimum investment at the beginning of quarter 1

Some of the trainings (for instance for the utilization of a new PDM platform, or for structural design) could be in-house performed, by ELAN engineers or engineers from the mother company EDAG.

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Appendix A

The EXCEL Spreadsheet

Definition Sheet

General Parameters

Staff Costs

Offer		Engineering		Certification		Production		Installation	
Staff	Cost [€/hour]	Staff	Cost [€/hour]	Staff	Cost [€/hour]	Staff	Cost [€/hour]	Staff	Cost [€/hour]
internal	25 €	internal	25 €	internal	25 €	internal	25 €	internal	25 €
external	35 €	external	35 €	external	35 €	external	35 €	external	35 €
experts	50 €	experts	50 €	experts	50 €	experts	50 €	experts	50 €
Hours per month	160								

Training costs

Phase	Training Cost [€/hour]	Salary Cost [€/hour]	Total Cost [€/hour]	Hours per month
Offer	25 €	25 €	50 €	160
Engineering	30 €	25 €	55 €	160
Certification	40 €	25 €	65 €	160
Production	30 €	25 €	55 €	160
Installation	35 €	25 €	60 €	160

Indirect costs

Office Space	50	[€/month/employee]
Workspace	200	[€/month/employee]

Factors

Risk Allowance	5%	of Total Costs

Number of People for DOA	**50**

Fig. A.1 Definition Sheet: input of general parameters

Input for Miscellaneous and Sales

Project	Miscellaneous	Sales
1	20.000 €	10.000 €
2	20.000 €	10.000 €
3	20.000 €	10.000 €
4	20.000 €	10.000 €
5	20.000 €	10.000 €
6	20.000 €	10.000 €
7	20.000 €	10.000 €
8	20.000 €	10.000 €
9	20.000 €	10.000 €
10	20.000 €	10.000 €
11	20.000 €	10.000 €
12	20.000 €	10.000 €
13	20.000 €	10.000 €
14	20.000 €	10.000 €
15	20.000 €	10.000 €
16	20.000 €	10.000 €
17	20.000 €	10.000 €
18	20.000 €	10.000 €
19	20.000 €	10.000 €
20	20.000 €	10.000 €

Fig. A.2 Definition Sheet: input of miscellaneous and sales

Project Lead Time Definiton

Quarters	Offer	Engineering	Certification	Production	Installation
1	1	1	1	1	1
1	1	1	1		
2		1	1	1	1
1	1	1	1		
2		1	1	1	
3		1	1	1	1
1	1	1	1		
2		1	1		
3		1	1	1	
4		1	1	1	1
1	1	1	1		
2		1	1		
3		1	1		
4		1	1	1	
5	1	1	1	1	1
1	1	1	1		
2		1	1		
3		1	1	1	
4		1	1	1	
5		1	1	1	1
6		1	1	1	1
1	1	1	1		
2		1	1		
3		1	1	1	
4		1	1	1	
5		1	1	1	
6		1	1	1	1
7		1	1	1	1
1	1	1	1		
2		1	1		
3		1	1	1	
4		1	1	1	
5		1	1	1	
6		1	1		
7		1	1	1	1
8		1	1	1	1

Total Number of Quarters	Table of Sums				
	Offer	Engineering	Certification	Production	Installation
1	1	1	1	1	1
2	1	2	2	1	1
3	1	3	3	2	1
4	1	4	4	2	1
5	2	5	5	2	1
6	1	6	6	4	2
7	1	7	7	5	2
8	1	8	8	5	2

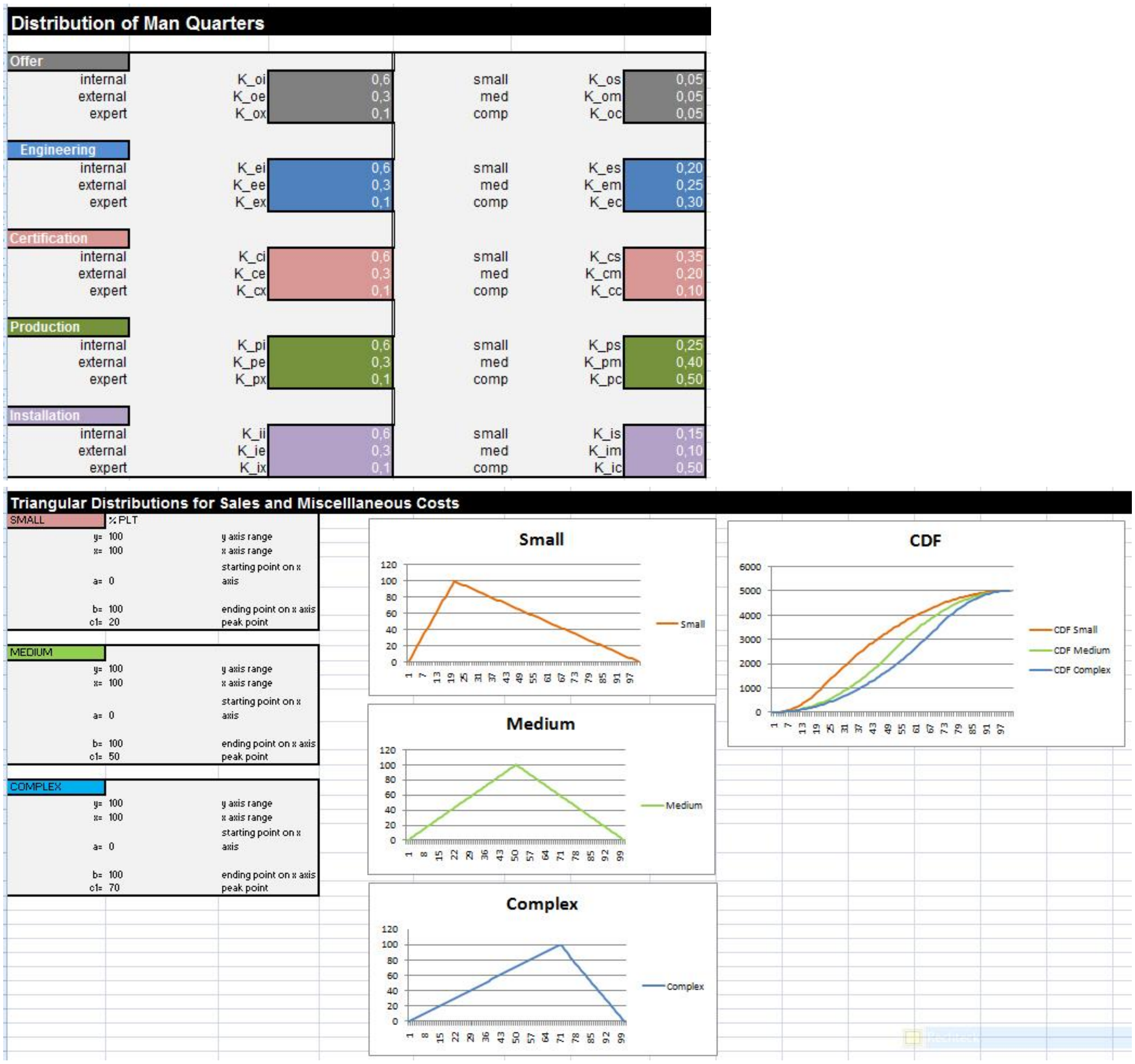
Definition of Cost per Phase

		phases				
	Order value (€)	offer phase	engineering	certification & documentation	production	Installation / WP-Support & Testing & Inspections
small	50.000 - 100.000	5%	20%	35%	25%	15%
medium	500.000 - 1.500.000	5%	25%	20%	40%	10%
complex	2.500.000 -	5%	30%	10%	50%	5%

Training Intensity

	percentage of employees per phases				
	offer	engineering	certification & documentation	production	Installation / WP-Support & Testing & Inspections
light	5%	10%	25%	25%	5%
medium	25%	30%	50%	50%	10%
intense	50%	60%	90%	90%	35%

Fig. A.3 Definition Sheet: turn on / off of phases throughout quarters, distribution of costs per phases, definition of training intensity



Distribution of Man Quarters

Offer					
internal	K_oi	0,6	small	K_os	0,05
external	K_oe	0,3	med	K_om	0,05
expert	K_ox	0,1	comp	K_oc	0,05
Engineering					
internal	K_ei	0,6	small	K_es	0,20
external	K_ee	0,3	med	K_em	0,25
expert	K_ex	0,1	comp	K_ec	0,30
Certification					
internal	K_ci	0,6	small	K_cs	0,35
external	K_ce	0,3	med	K_cm	0,20
expert	K_cx	0,1	comp	K_cc	0,10
Production					
internal	K_pi	0,6	small	K_ps	0,25
external	K_pe	0,3	med	K_pm	0,40
expert	K_px	0,1	comp	K_pc	0,50
Installation					
internal	K_ii	0,6	small	K_is	0,15
external	K_ie	0,3	med	K_im	0,10
expert	K_ix	0,1	comp	K_ic	0,50

Triangular Distributions for Sales and Miscellaneous Costs

SMALL	%PLT
y= 100	y axis range
x= 100	x axis range
a= 0	starting point on x axis
b= 100	ending point on x axis
c1= 20	peak point

MEDIUM	
y= 100	y axis range
x= 100	x axis range
a= 0	starting point on x axis
b= 100	ending point on x axis
c1= 50	peak point

COMPLEX	
y= 100	y axis range
x= 100	x axis range
a= 0	starting point on x axis
b= 100	ending point on x axis
c1= 70	peak point

Fig. A.4 Definition Sheet: distribution of staff, definition of triangular distribution

Project Zero Sheet

Initial Training Costs

	Number of employees	Months of Training	Cost
Certification	10	3	312.000 I
Engineering			
Stress	3	6	158.400 I
CAD/CAM	1	3	26.400 I
Electrical	2	6	105.600 I
Structure	4	6	211.200 I
Mechanical	2	3	52.800 I
Production			
Logistics	3	3	79.200 I
Kit Preparation	2	3	52.800 I
Quality & Inspection	4	6	230.400 I
Total			**1.228.800 I**

EASA Fees and Charges

Type of Activity	**STC/Changes/Rep**	**Unrestricted**	<-- choose from drop-down menu !
Resulting DOA Cate	2	A	2A

Approval Fee			1C		
		1B	2B	2C	
Staff Less Than/DOA Category	1A	2A	3A	3B	3C
10	11.250 I	9.000 I	6.750 I	4.500 I	3.600 I
50	31.500 I	22.500 I	13.500 I	9.000 I	-
400	90.000 I	67.500 I	45.000 I	36.000 I	-
1000	180.000 I	135.000 I	112.500 I	99.000 I	-
2500	360.000 I	-	-	-	-
5000	540.000 I	-	-	-	-
Over 5000	3.000.000 I	-	-	-	-

Surveillance Fee			1C		
		1B	2B	2C	
Staff Less Than/DOA Category	1A	2A	3A	3B	3C
10	5.265 I	4.500 I	3.375 I	2.250 I	1.800 I
50	15.750 I	11.250 I	6.750 I	4.500 I	-
400	45.000 I	33.750 I	22.500 I	18.000 I	-
1000	90.000 I	67.500 I	56.250 I	49.500 I	-
2500	180.000 I	-	-	-	-
5000	270.000 I	-	-	-	-
Over 5000	1.500.000 I	-	-	-	-

Application Fee	
New Approvals	1.500 I
Renewal	750 I

Inflation Factors					
2008	2,40%	2011	5,50%	2014	3%
2009	3,70%	2012	2%	2015	3%
2010	1%	2013	6%	2016	5%

Total Fee	as in 2010	
Application Fee	1.608,76 I	
Approval Fee	24.131,40 I	
Surveillance Fee	12.065,70 I	--> to be charged yearly depending on the inflation factors defined above

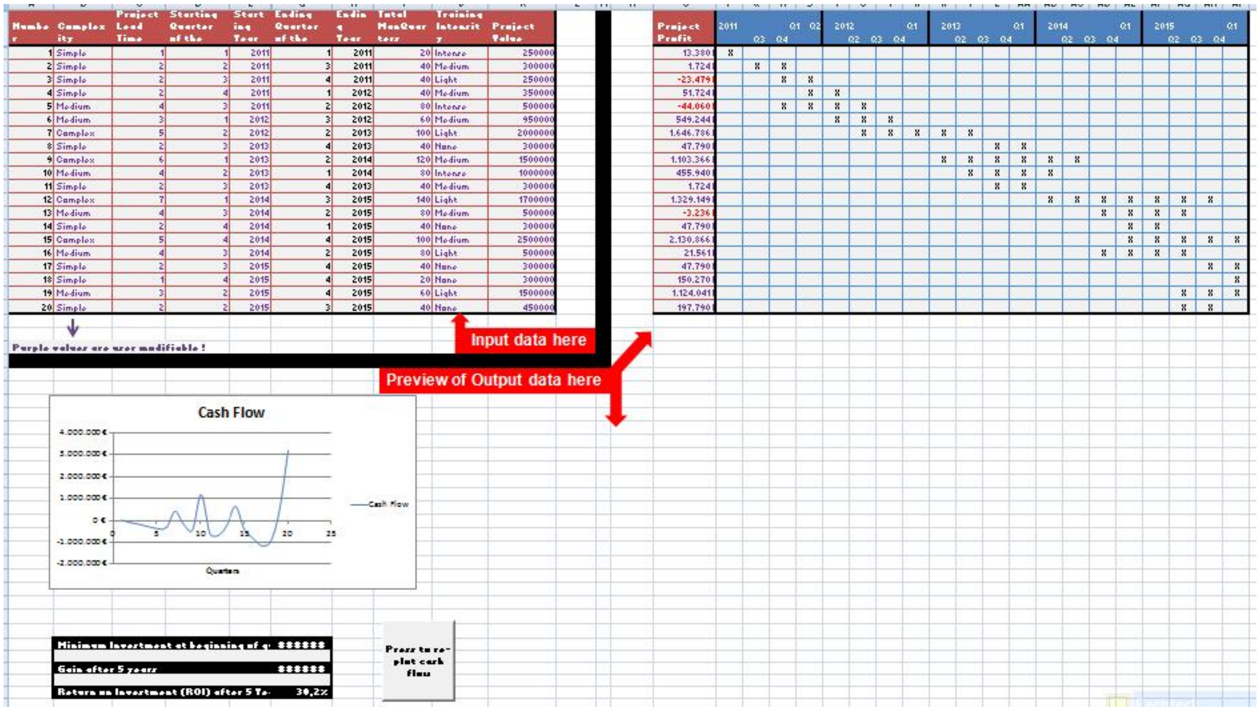
IT Costs	40.000 I

Total Project Zero Costs	1.294.540 I

Application fee and approval fee are charged in Project Zero, in quarter 1; in reality these costs come suposely sometime in 2013

Fig. A.5 Project Zero Sheet: initial training costs, EASA fees and charges, IT costs

Global Project Timeframe Sheet



Number	Complexity	Project Lead Time	Starting Quarter of the	Starting Year	Ending Quarter of the	Ending Year	Total ManQuarters	Training Intensity	Project Value	Project Profit	2011				2012				2013				2014				2015			
1	Simple	1	1	2011	1	2011	20	Intense	250000	13.380	X																			
2	Simple	2	2	2011	3	2011	40	Medium	300000	1.724		X	X																	
3	Simple	2	3	2011	4	2011	40	Light	250000	-23.479			X	X																
4	Simple	2	4	2011	1	2012	40	Medium	350000	51.724				X	X															
5	Medium	4	3	2011	2	2012	80	Intense	500000	-44.060			X	X	X	X														
6	Medium	3	1	2012	3	2012	60	Medium	950000	549.244					X	X	X													
7	Complex	5	2	2012	2	2013	100	Light	2000000	1.646.786						X	X	X	X	X										
8	Simple	2	3	2013	4	2013	40	None	300000	47.790											X	X								
9	Complex	6	1	2013	2	2014	120	Medium	1500000	1.103.366									X	X	X	X	X	X						
10	Medium	4	2	2013	1	2014	80	Intense	1000000	455.940										X	X	X	X							
11	Simple	2	3	2013	4	2013	40	Medium	300000	1.724											X	X								
12	Complex	7	1	2014	3	2015	140	Light	1700000	1.329.149													X	X	X	X	X	X	X	
13	Medium	4	3	2014	2	2015	80	Medium	500000	-3.236															X	X	X	X		
14	Simple	2	4	2014	1	2015	40	None	300000	47.790																X	X			
15	Complex	5	4	2014	4	2015	100	Medium	2500000	2.130.866																X	X	X	X	X
16	Medium	4	3	2014	2	2015	80	Light	500000	21.561															X	X	X	X		
17	Simple	2	3	2015	4	2015	40	None	300000	47.790																			X	X
18	Simple	1	4	2015	4	2015	20	None	300000	150.270																				X
19	Medium	3	2	2015	4	2015	60	Light	1500000	1.124.041																		X	X	X
20	Simple	2	2	2015	3	2015	40	None	450000	197.790																		X	X	

Fig. A.6 Global Project Timeframe Sheet: input table and preliminary output results

Project Sheet

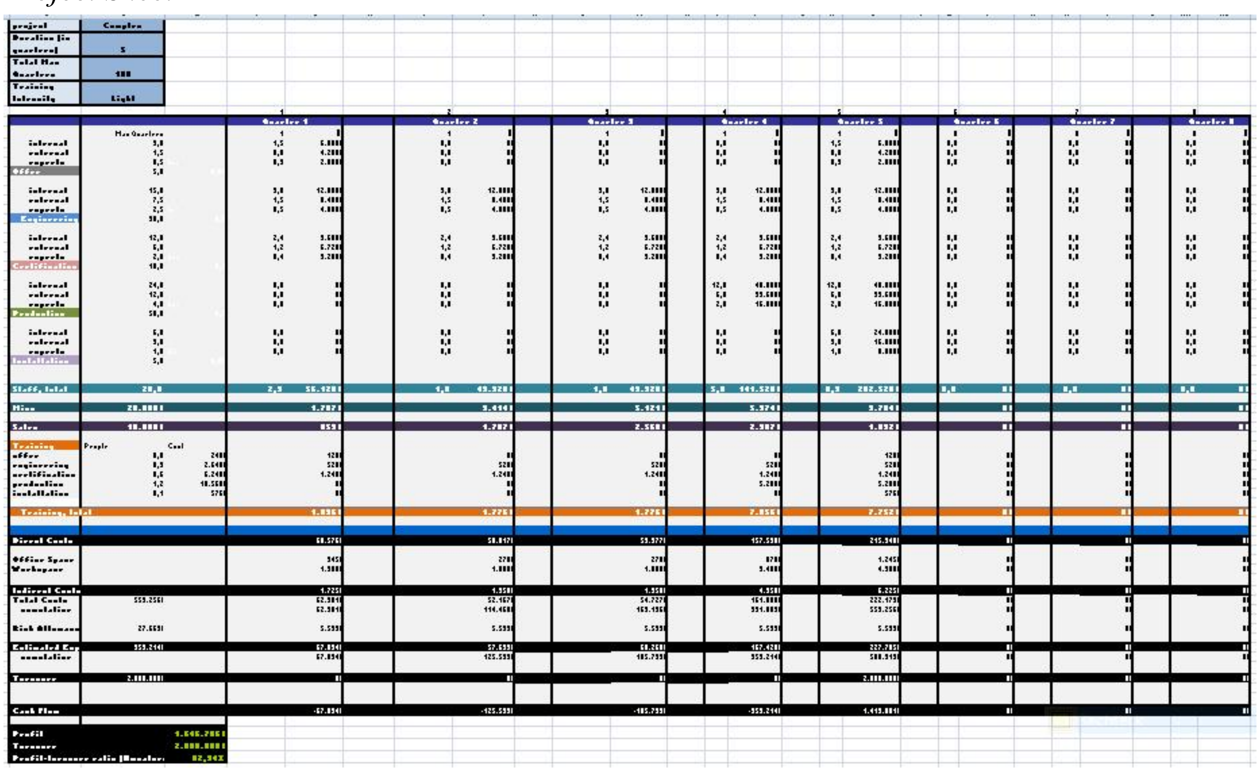


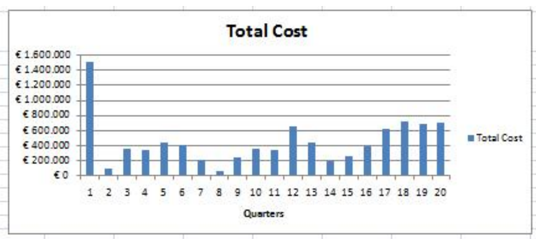
Fig. A.7 Project Sheet example

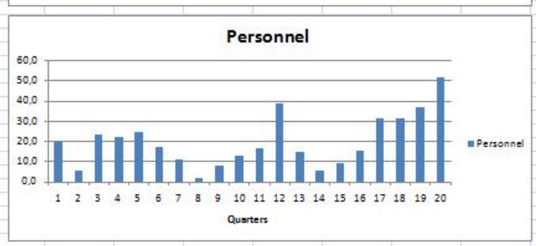
Total Costs	2011				2012				2013				2014				2015			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12	Quarter 13	Quarter 14	Quarter 15	Quarter 16	Quarter 17	Quarter 18	Quarter 19	Quarter 20
Project Zero	1.294.540																			
Project 1	225.352																			
Project 2		87.810	196.262																	
Project 3			81.090	179.366																
Project 4				87.810	196.262															
Project 5			82.921	65.319	165.204	204.708														
Project 6					78.169	138.133	165.370													
Project 7						62.301	52.167	54.727	161.888	222.173										
Project 8											76.410	163.790								
Project 9									81.543	52.181	119.280	121.148	152.083	148.237						
Project 10										82.921	65.319	165.204	204.708							
Project 11											87.810	196.262								
Project 12													82.750	48.950	108.172	109.619	110.873	145.621	141.579	
Project 13															77.245	60.843	152.280	188.904		
Project 14																76.410	163.790			
Project 15																65.085	54.471	57.031	169.472	230.813
Project 16															73.405	57.963	144.120	180.168		
Project 17																			76.410	163.790
Project 18																				142.600
Project 19																		73.369	129.013	155.674
Project 20																		76.410	163.790	
Surveillance Charges				12.609				12.987				13.701				14.181				14.819
Total	######	87.810	#####	345.103	#####	405.143	#####	67.714	#####	357.275	#####	#####	#####	197.187	#####	#####	#####	721.504	#####	#####

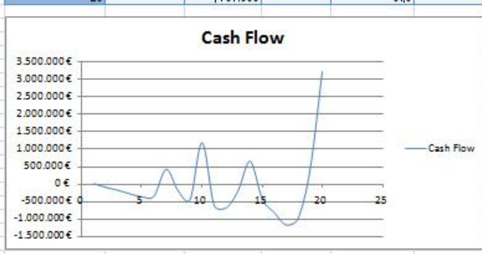
Personnel	2011				2012				2013				2014				2015			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12	Quarter 13	Quarter 14	Quarter 15	Quarter 16	Quarter 17	Quarter 18	Quarter 19	Quarter 20
Project 1	20,0																			
Project 2		5,5	14,5																	
Project 3			5,5	14,5																
Project 4				5,5	14,5															
Project 5			3,3	2,3	6,3	8,3														
Project 6					4,0	7,0	9,0													
Project 7						2,3	1,8	1,8	5,8	8,3										
Project 8											5,5	14,5								
Project 9									2,5	1,5	3,5	3,5	4,5	4,5						
Project 10										3,3	2,3	6,3	8,3							
Project 11											5,5	14,5								
Project 12													2,3	1,3	2,9	2,9	2,9	3,9	3,9	
Project 13															3,3	2,3	6,3	8,3		
Project 14																5,5	14,5			
Project 15																2,3	1,8	1,8	5,8	8,3
Project 16															3,3	2,3	6,3	8,3		
Project 17																			5,5	14,5
Project 18																				20,0
Project 19																		4,0	7,0	9,0
Project 20																		5,5	14,5	
Total	20,0	5,5	23,3	22,3	24,8	17,6	10,8	1,8	8,3	13,1	16,8	38,8	15,0	5,8	9,4	15,2	31,7	31,7	36,7	51,8

Cash Flow	2011				2012				2013				2014				2015			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12	Quarter 13	Quarter 14	Quarter 15	Quarter 16	Quarter 17	Quarter 18	Quarter 19	Quarter 20
Project 1	13.380																			
Project 2		-94.911	1.724																	
Project 3			-87.601	-23.479																
Project 4				-94.911	51.724															
Project 5			-89.398	-161.194	-332.874	-44.060														
Project 6					-84.530	-229.025	549.244													
Project 7						-67.834	-125.533	-185.793	-353.214	1.419.081										
Project 8											-82.415	47.790								
Project 9									-87.164	-144.966	-269.866	-396.634	-554.338	791.804						
Project 10										-89.398	-161.194	-332.874	455.940							
Project 11											-94.911	1.724								
Project 12													-88.090	-142.380	-255.892	-370.851	-487.064	-638.024	915.057	
Project 13															-83.236	-150.070	-308.340	-3.236		
Project 14																-82.415	47.790			
Project 15																-70.854	-131.094	-193.894	-369.134	1.894.284
Project 16															-79.101	-142.759	-292.575	21.561		
Project 17																			-82.415	47.790
Project 18																				150.270
Project 19																		-79.336	-214.317	1.124.041
Project 20																		-82.415	197.790	
Total	13.380	-94.911	#####	-279.584	#####	######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####

Quarters	Total Cost	Personnel	Cash Flow
1	1.519.892	20,0	13.380
2	87.810	5,5	-94.911
3	360.273	23,3	-175.275
4	345.103	22,3	-279.584
5	439.635	24,8	-365.680
6	405.143	17,6	-340.918
7	217.537	10,8	423.711
8	67.714	1,8	-185.793
9	243.431	8,3	-440.377
10	357.275	13,1	1.184.718
11	348.817	16,8	-608.385
12	660.105	38,8	-679.994
13	439.541	15,0	-186.487
14	197.187	5,8	649.425
15	258.822	9,4	-418.228
16	384.100	15,2	-816.948
17	625.534	31,7	-1.171.283
18	721.504	31,7	-975.344
19	680.264	36,7	446.981
20	707.696	51,8	3.216.386







Press to re-plot cash flow

Minimum Investment at beginning of quarter 1	1.171.283
Gain after 5 years	3.216.386
Return on Investment (ROI) after 5 Years	30,2%

Fig. A.8 Summary Sheet of output data

Appendix B

SWOT Analysis Template

Situation being analyzed: ____

<table>
<tr><td>criteria examples

Advantages of proposition?
Capabilities?
Competitive advantages?
USP's (unique selling points)?
Resources, Assets, People?
Experience, knowledge, data?
Financial reserves, likely returns?
Marketing - reach, distribution, awareness?
Innovative aspects?
Location and geographical?
Price, value, quality?
Accreditations, qualifications, certifications?
Processes, systems, IT, communications?
Cultural, attitudinal, behavioural?
Management cover, succession?
Philosophy and values?</td><td>strengths</td><td>weaknesses</td><td>criteria examples

Disadvantages of proposition?
Gaps in capabilities?
Lack of competitive strength?
Reputation, presence and reach?
Financials?
Own known vulnerabilities?
Timescales, deadlines and pressures?
Cashflow, start-up cash-drain?
Continuity, supply chain robustness?
Effects on core activities, distraction?
Reliability of data, plan predictability?
Morale, commitment, leadership?
Accreditations, etc?
Processes and systems, etc?
Management cover, succession?</td></tr>
<tr><td>criteria examples

Market developments?
Competitors' vulnerabilities?
Industry or lifestyle trends?
Technology development and innovation?
Global influences?
New markets, vertical, horizontal?
Niche target markets?
Geographical, export, import?
New USP's?
Tactics: eg, surprise, major contracts?
Business and product development?
Information and research?
Partnerships, agencies, distribution?
Volumes, production, economies?
Seasonal, weather, fashion influences?</td><td>opportunities</td><td>threats</td><td>criteria examples

Political effects?
Legislative effects?
Environmental effects?
IT developments?
Competitor intentions - various?
Market demand?
New technologies, services, ideas?
Vital contracts and partners?
Sustaining internal capabilities?
Obstacles faced?
Insurmountable weaknesses?
Loss of key staff?
Sustainable financial backing?
Economy - home, abroad?
Seasonality, weather effects?</td></tr>
</table>