Mat-2.177 Seminar on case studies in operation research

IPR Valuation and Pricing

Case: Asperation Oy

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Executive Summary

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This report is written for Helsinki University of Technology as a part of the course Seminar on case studies in operation research.

The report introduces couple of techniques and methods used in valuation found from literature and then introduces a framework that has been built to assess the value of a high technology intellectual property right under severely uncertain circumstances and limited input of varying accuracy.

The framework consists of steps in valuation process beginning from characterizing the IPR and ending in follow-up procedures of the valuation process. Customer perceived view is used as the basis for the end product pricing in the framework, which uses value trees and dynamic system charts to simplify the big picture. The main phases of the framework are 1) overall picture; understanding the IPR and the situation, 2) detailed views; identifying stakeholders and their benefits etc., 3) forming the value; synthesizing the stakeholder factors and assessing the value, 4) bargain related; sales arguments and follow-up.

An example valuation for an actual case (client company Asperation Oy) is made using the framework introduced in the report. The example goes through the steps in the framework (if applicable on the example case) and builds up the value for the IPR. The sensitivity of these results as well as the compatibility of the framework is discussed.

The example case doesn't describe the complete valuation process done in the project, because of confidentiality issues, but tries to give the reader a certain understanding of the framework steps and phases included in a valuation made with this framework. The nature of the example IPR and the target market of its end product are kept secret throughout the report. No actual figures considering the market, the product or pricing are revealed.

Keywords: Intellectual property rights valuation, license pricing, decision aiding framework, customer perceived value, licensing an IPR

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1. Introduction

The project is done as part of the course Mat-2.177 Seminar on case studies in operation research in spring 2005. All the documents concerning this project returned to the Helsinki University of Technology are public. The details of the project are classified and therefore deemed to be kept secret due to the high confidentiality of the work. The terminology used in the example case part of this report is very general and all the figures are tampered with in order to sustain the competitive business advantage of the client company.

This project concerns valuation and pricing of technology based intellectual property. The value of an IPR lies in the future and therefore it is crucial to establish a firmly constructed way to assess the value under the highly uncertain circumstances.

The first section (chapter 2) of this report briefly presents some of the existing valuation methods and techniques found in literature.

Chapter 3 introduces a customer perceived value (CPV) based framework in which the problem of valuating an IPR is approached from the end customer perspective. The framework develops value from CPV adding other necessary factors compiled in to modules and then adds the possibility of valuating the license for the IPR.

The last part of the report concerns an actual valuation case example made for Asperation Oy, the client of this project. Asperation Oy is a joint venture company founded by Aspocomp Group Oyj and Perlos Corporation Oyj. Asperation Oy creates new, commercially viable integrated components, interconnection and packaging technologies for mobile communication and electronic applications.[1]

1.1. The Project

The project was conducted by the authors in association with Mark Mehtonen, Janne Mettovaara and Jukka Ranta from Asperation Oy. Professor Ahti Salo from HUT System Analysis Laboratory was consulted during various phases of the project.

The project's scope was to form a model for high technology IPR valuation and make an example valuation on an actual business problem of Asperation Oy. The example valuation was limited to one target industry only.

The project was scheduled into four different phases as stated in Figure 1.

[1] www.asperation.com

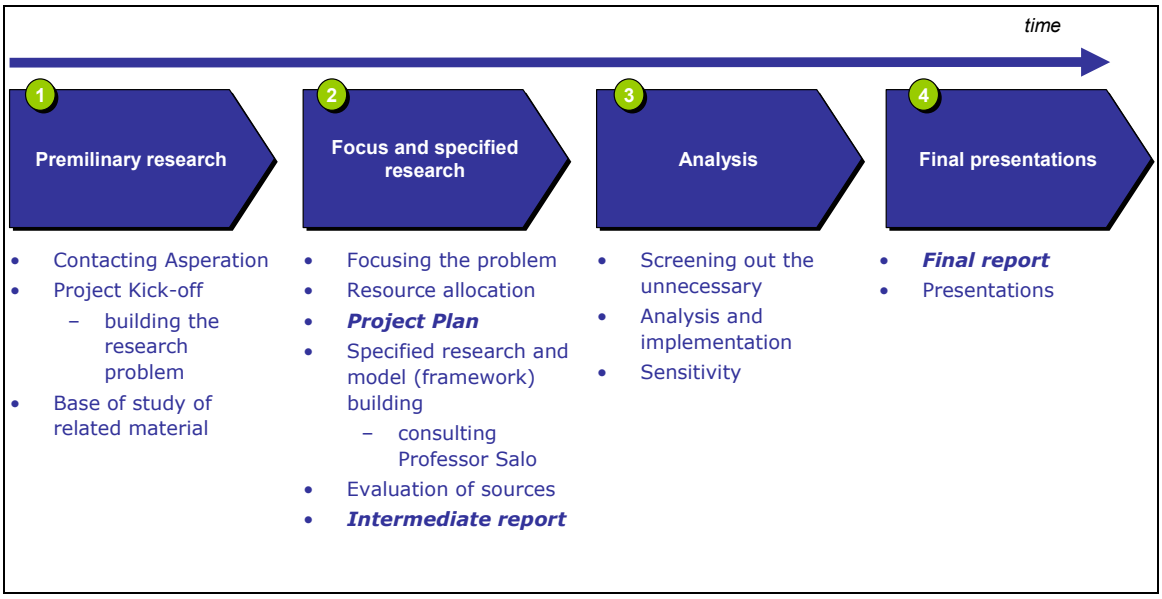

Figure 1: The rough cut schedule

The project's completion and meeting of goals as well as other post-project issues are addressed in the end of the report (chapter 6).

2. Literature Review

Here is presented methods which are used most frequently in valuation area. The first chapter introduces mathematical ones and subjective ones are later. There's no need to use all of them but it's more important to recognize which methods fit the situation. The descriptions of the methods are quoted mainly from other reports, but the sources are stated at the end of the paragraph.

2.1. Mathematical Methods in Valuation Area

2.1.1. PRIME

PRIME (Preference Ratios In Multi-attribute Evaluation) is a method for approximating specification of preferences. In assessing his preferences the decision maker does interval-valued ratio statements. The ratios are entered as intervals of numbers. PRIME is related to the trade-off technique as attribute ranges are used explicitly in the weighting procedure. This normatively attractive feature encourages to develop and to operationalize further the PRIME method.[2]

The PRIME method supports analysis when information imprecision is present in multi-attribute weighting models. As a result the most preferred alternative is identified. In valuation the PRIME method could be used to determine for example markets and market shares.

2.1.2. PAIRS

PAIRS (Preference Assessment by Imprecise Ratio Statements) is a Preference Programming technique in which intervals are directly given to constrain both the weight ratios of any attribute pairs and the ratings of the alternatives. For example, instead of giving an exact weight ratio $w_1/w_2=2$, the DM can define that ratio $w_1/w_2 \in [1, 4]$, i.e. the ratio is at least 1 but no more than 4. The given intervals constrain the feasible region of the weights.[3]

The PAIRS method fits the situation in which it's easier to determine relations than actual values. Because the ratios are compared in pairs, the multiple attributes complicate situation greatly.

2.1.3. SMART / SWING

SMART and SWING are simple multi-attribute weighting methods based on ratio estimation.

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[2] http://www.sal.hut.fi/Research/act94re-2.html
[3] http://www.sal.hut.fi/Publications/pdf-files/mlin.pdf

In SWING, the decision maker (DM) is first asked to consider a hypothetical alternative which has all the attributes on their worst consequence levels. Then, he is asked to identify the most important attribute, i.e. an attribute whose consequence would most preferably be changed from its worst level to its best level. This is given hundred points. Next, the DM is asked to identify an attribute, whose consequence he next preferably would change to its best level. To this, the DM is asked to assign points (less than 100) to denote the relative importance of the change in this compared to the change in the most important attribute. The procedure continues similarly on the other attributes. The actual attribute weights are elicited by normalizing the sum of points to one.

In SMART, the DM gives ten points to the least important attribute. Then, he/she gives more points to the other attributes to address their relative importance. After evaluating all the weights they are normalized by dividing each with the sum of all the points. However, it has been stressed that the comparison of the importance of the attributes is meaningless, if it does not reflect the consequence ranges of the attributes as well (von Winterfeldt and Edwards, 1986; Manuscript (January 16, 2004) Edwards and Barron, 1994). These can be included by applying SWING weighting to SMART. That is, in the comparison of the importance of the attributes, the DM should explicitly focus on the attribute changes from their worst consequence level to the best level. Edwards and Barron (1994) named this variant as SMARTS (SMART using Swing), but the term SMART is also commonly used for this method.[4]

The SMART / SWING could be used to assess weights in situation where it's easy to determine worst or best scenario and to compare other scenarios to that.

2.1.4. NPV

Dollar today is more valuable than dollar tomorrow for which reason time needs to be considered in valuation. The net present value method (NPV) of evaluating a major project allows consideration of the time value of money. Essentially, the discounting process helps in finding the present value in "today's dollars" of the future net cash flow of a project. The cost and total inflow can be compared more reliably.

If the NPV is greater than the cost, the project will be profitable (assuming, of course, that the estimated cash flow is reasonably close to reality). If there is

[4] http://www.sal.hut.fi/Publications/pdf-files/mmus.pdf

more than one project on the table, NPV for each project can be computed. The one with greatest NPV should be chosen.[5]

2.2. Subjective Methods in Valuation Area

2.2.1. Brainstorming

Brainstorming is a way of developing creative solutions to problems. It is a lateral process which helps people to come up with brilliant ideas. Brainstorming is designed to help people come out of the patterns of thinking and generate as broad and odd ideas as possible. During the sessions there is no criticism. After the sessions conventional approaches may be used to explore the solutions. Brainstorming can be conducted individually or in groups and in case ideas dry up a seed word may be used. To run a brainstorming session effectively following steps should be taken:

1. Define the problem you want solved clearly, and lay out any criteria to be met.
2. Keep the session focused on the problem
3. Ensure that no one criticizes or evaluates ideas during the session. Criticism introduces an element of risk for group members when putting forward an idea. This stifles creativity and cripples the free running nature of a good brainstorming session.
4. Encourage an enthusiastic, uncritical attitude among members of the group. Try to get everyone to contribute and develop ideas, including the quietest members of the group
5. Let people have fun brainstorming. Encourage them to come up with as many ideas as possible, from solidly practical ones to wildly impractical ones. Welcome creativity.
6. Ensure that no train of thought is followed for too long
7. Encourage people to develop other people's ideas, or to use other ideas to create new ones
8. Appoint one person to note down ideas that come out of the session. A good way of doing this is to use a flip chart. This should be studied and evaluated after the session. [6]

In valuation brainstorming is a good way to find factors affecting final price.

2.2.2. Delphi

The objective of most Delphi applications is reliable and creative exploration of ideas or the production of suitable information for decision making. The

[5] http://www.toolkit.cch.com/text/P06_6530.asp
[6] http://www.mindtools.com/pages/article/newCT_04.htm

Delphi Method is based on a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback.

Ten steps for the Delphi method:

1. Formation of a team to undertake and monitor a Delphi on a given subject.
2. Selection of one or more panels to participate in the exercise. Customarily, the panelists are experts in the area to be investigated.
3. Development of the first round Delphi questionnaire
4. Testing the questionnaire for proper wording (e.g., ambiguities, vagueness)
5. Transmission of the first questionnaires to the panelists
6. Analysis of the first round responses
7. Preparation of the second round questionnaires (and possible testing)
8. Transmission of the second round questionnaires to the panelists
9. Analysis of the second round responses (Steps 7 to 9 are reiterated as long as desired or necessary to achieve stability in the results.)
10. Preparation of a report by the analysis team to present the conclusions of the exercise[7]

The Delphi method is more advanced than brainstorming. Because of this, it's more recommended to use Delphi in situation where accuracy of estimates could be increased at the expense of creativity.

2.2.3. Expert Opinions

"Expert opinions" is a procedure of asking opinion of someone whose education, training, and experience establish his or her expertise in the objective analysis of data. An expert is a person who has special skills, training and experience in the subject area and is recognized by his / her peers or those conducting the study. In the process there should be as broad spectrum of views as possible and various experts. It is vital that the compensation for the experts drives them to produce the most accurate opinion they are able to.

2.3. Decision Structuring Dialogue

By focusing on the conversational aspects of problem-contexts Decision Structuring Dialogue facilitates collective structuring of problems with plural and conflicting views. It can be used as complement to other problem structuring methods. By understanding dialogue complex problem situations

[7] http://www.iit.edu/~it/delphi.html

can be enlightened and structuring of the problem profited. The article Decision Structuring Dialogue (Slotte and Hämäläinen 2004) provides clear guidelines for the facilitation of thinking and guidance for communication in groups.[8]

The decision structuring dialogue could be useful at the problem formulation phase. At the later phases there is no need for this method.

2.4. System Dynamics

System dynamics is a methodology for studying and managing complex feedback systems. It identifies a problem and develops a dynamic hypothesis explaining the causes. While the word system has been applied to all sorts of situations, feedback is the differentiating descriptor here. Feedback refers to the situation of X affecting Y and Y in turn affecting X perhaps through a chain of causes and effects. One cannot study the link between X and Y and, independently, the link between Y and X and predict how the system will behave. Only the study of the whole system as a feedback system will lead to correct results. To better understand the system structures which cause the patterns of behavior graphical notation is used. An example of a graphical notation is illustrated by the diagram in Figure 2, which is constructed based on a figure in Richardson and Pugh (1981)[9]. In this diagram, the short descriptive phrases represent the elements which make up the sector, and the arrows represent the causal influences between these elements[10].

[8] http://www.sal.hut.fi/Publications/pdf-files/E13.pdf

[9] G. P. Richardson and A. L. Pugh III, Introduction to System Dynamics Modeling with DYNAMO, Productivity Press, Cambridge, Massachusetts, 1981.

[10] http://www.public.asu.edu/~kirkwood/sysdyn/SDIntro/SDIntro.htm

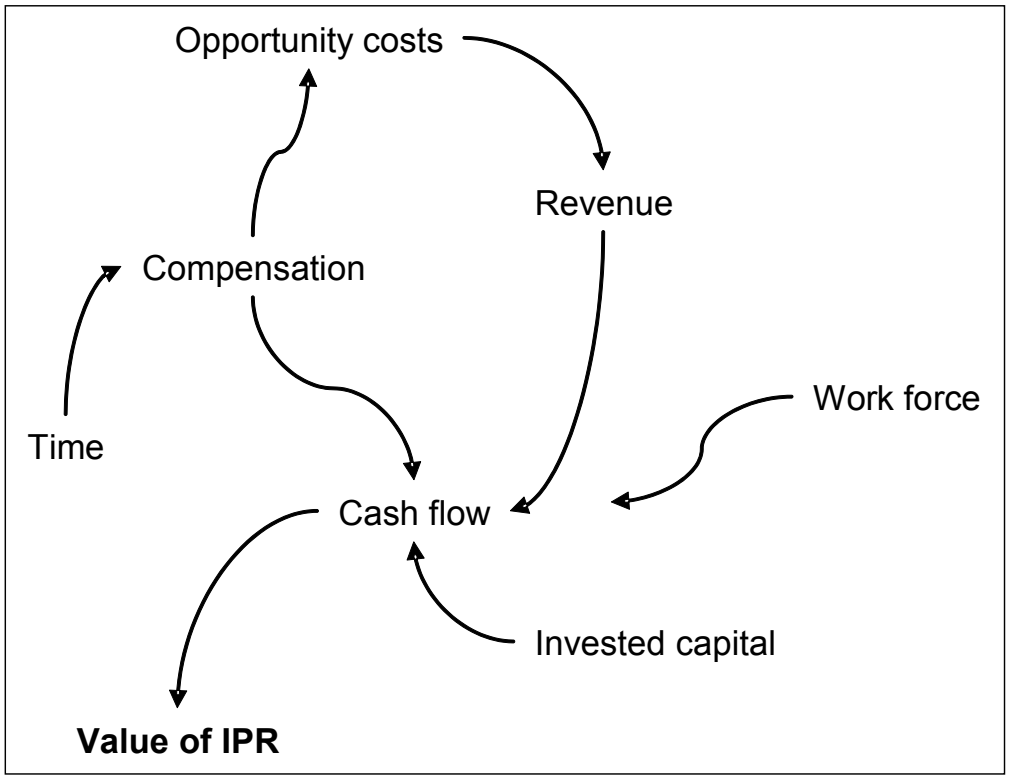

Figure 2: An example of graphical presentation of system dynamics

2.5. Sensitivity Analysis

Sensitivity analysis is a procedure to determine the sensitivity of the outcomes to changes in its parameters. If a small deviation in parameters results in large changes in the outcome, the outcomes are said to be sensitive to that parameter. The value of the parameter may then have to be determined very accurately or an action taken to change the model to be less sensitive.

3. Valuation Framework

In this chapter the phases of the IPR valuation are presented. In the list there is only description of the step and perhaps some examples. The actual figures and numbers will be presented later in chapter 1. More details can be found in Appendix 1.

The order of the phases does not have to be the same as presented. The steps can overlap, they can be skipped or their order can be changed. Naturally this does not apply to every step; the tree must be formed before it can be filled.

1. Functional Analysis of the IPR

The first step in the valuation is to review all the properties that might be useful for someone. The basic question to answer is "How this IPR benefits someone".

2. Defining markets / industries / applications

After discovering the benefits of the IPR the next step is to define potential customers. They can be industries, geographical areas, markets or even individuals; the point is to recognize all the parties willing to pay for the IPR.

3. Selection of the market to valuate

If there are multiple market areas benefiting from the IPR, next step is to cut down the list. This could be done by aggregating or discarding the small ones. Having done this all the remaining steps should be taken individually for each market.

4. System dynamics recognition

When the target market for valuating has been selected, it's time to familiarize oneself with it. This step includes drawing system dynamics diagram for the IPR related to the particular market. It describes all the cause-effect relationships between various factors (both positive and negative) helping to see the big picture. While all the following steps are based on this one, this phase is the most critical one. One should spend enough time and resources for this step.

5. Building up the Customer Perceived Value tree

If the system dynamics chart has been done carefully, it's not a problem to pick up factors concerning customer perceived value. With these factors one creates a value tree to evaluate the monetary value of the customer benefits.

Value tree does not include factors that can not be expressed in monetary terms. Quality, for example, is a subjective extent but it can be quantified by evaluating checking and repairing costs and thus presented in the value tree.

6. Assessing customer benefits

After the CPV tree is formed, every node in it should be assessed. Consultancy with the end customer, experts or a third party is recommended to provide as exact numbers as possible. Instead of exact numbers, the assessment may lead to a function. Actually, functions are recommended as they are more applicable and provide more information. However, they are much trickier to formulate as well.

7. License / Contract tree

The L / C tree can be constructed from the system dynamics chart. The purpose of this step is to distinguish the license related factors from others. The tree should contain all the issues to be considered and defined when drawing up the license.

8. Options for license constraints combinations

This step corresponds to filling the value tree. There can't be estimated values for nodes in the L / C tree so any unfeasible combinations should be discarded. For example, if it takes one year before manufacturing can be started, the absolute minimum for license duration is one year. In addition the manufacturer most probably wants also some time to earn revenues and cover investments.

9. Building up the manufacturer / license owner tree

This step is fairly similar to building up the CPV tree. The only difference is the object; this time it's the manufacturer / license owner.

10. Assessing manufacturer's benefits

Rules are the same as in step 6, Assessing customer benefits.

11. Updating system dynamics diagram

By building up all value trees one may have discovered new factors for the system dynamics diagram, which should be now updated to correspond to the whole system.

12. Risk assessment

In this step the purpose is to distribute the risks between stakeholders. The question is whether the manufacturer is willing to bear all the risk, or should the license seller also take his part. One option is to find a third party (risk financing) to carry the risk, but it naturally decreases margins.

13. Synthesis

Synthesis' objective is to provide pricing intervals for the product. It visualizes the final price's intervals by comparing it to CPV, manufacturing costs, margins, license price etc.

14. Cost / Value distribution

In this step the costs and margin should be distributed just like risks before. Every stakeholder will maximize his profit, but the purpose is to estimate a solution that everyone can accept. However, depending on the negotiating skills and arguments these estimates can be quite different to actual numbers.

15. Forming the cash flows

After all the estimates have been done, it is time to calculate the cash flows with actual numbers. This step could have been done right after building up the value trees, but it would have been a function depending on risks, costs etc. Now there are numeric estimates available for margins and prices.

16. Calculating value scenarios

The next step is to analyze different scenarios. The question is whether it is most profitable to sell the license, manufacture the products self or wait for better offers.

17. Sensitivity analysis for critical parameters

The sensitivity analysis provides information about the effects changing parameters' values has on total price. This helps to concentrate on the most essential issues in the negotiations.

18. Pricing the license

After completing all the analysis steps the pricing shouldn't be hard. It's important to formulate price to each scenarios, not just average price. Each risk scenario should be treated individually.

19. Gathering information to sales arguments

This step's purpose is to create a list of good and convincing sales arguments. Having read the list the license buyer should be more than willing to pay whatever the price is.

20. Follow-up (post bargain action)

The last step is to gather information about decision's quality. It is important to distinguish the results and quality of the decision. Good decisions do not implicate good results and good results don't require good decisions.

4. Valuation of an IPR for Certain Target Market

4.1. Background

In this part of the research the introduced IPR valuation framework is applied to a specific valuation case. This example case is based on a real business problem that Asperation is facing at the moment.

As this document is available for public distribution and the information of the valuation case is confidential the concepts and monetary values are discussed on a very general level.

4.2. Implementing the Framework

4.2.1. Defining the product, application, industry and market (Steps 1 - 3)

IPR-product of Asperation is an innovative technology that is applicable in several industries. Currently there are similar products available but they are based on different technical solutions and are considerably more expensive. The IPR-product of Asperation is considered to have approximately two years' technological lead over other potential competitors who could develop the similar cost-effective innovative technology. Product is assumed to be disposable which has a significant effect on the CPV.

The valuation of the IPR-product is performed to specific industry and certain company in this industry. The IPR-product is related to processing and follow-up of industry's products. The target company is a global player with annual volumes of approximately 1 billion homogeneous products. That is 1% of the total of 100 billion products' market size.

4.2.2. System dynamics diagram (Step 4)

The system dynamics diagram is presented in Appendix 2.

4.2.3. CPV (Step 5)

This chapter presents potential categories for additional value when using the case IPR-product.

Processing

Usage of the case specific technology would enable time savings in day to day processing of end products. Time saving would be one minute on basic stock keeping unit level. This time saving would decrease the required labor

content of specified working processes and personal equipment used in processing.

Follow-up

Technology would enable automated follow-up of the client's end product processing in all areas it is applied. This would provide precise data of product flow and enable more sophisticated decision making, optimization of product flow, and statistical analysis. Additionally, general follow-up time would possibly be reduced due to more automated system.

Company image and experience in using advanced technology

Adoption of advanced solution also effects company's image. The using of advanced technology could make the usage of target company's core competencies more efficient. Early adoption of the IPR technology would provide more experience and the results of learning could be seen in reduced technology related costs and more effective usage of tools compared to latter-movers.

The representation of all customer perceived values recognized is presented in Figure 3.

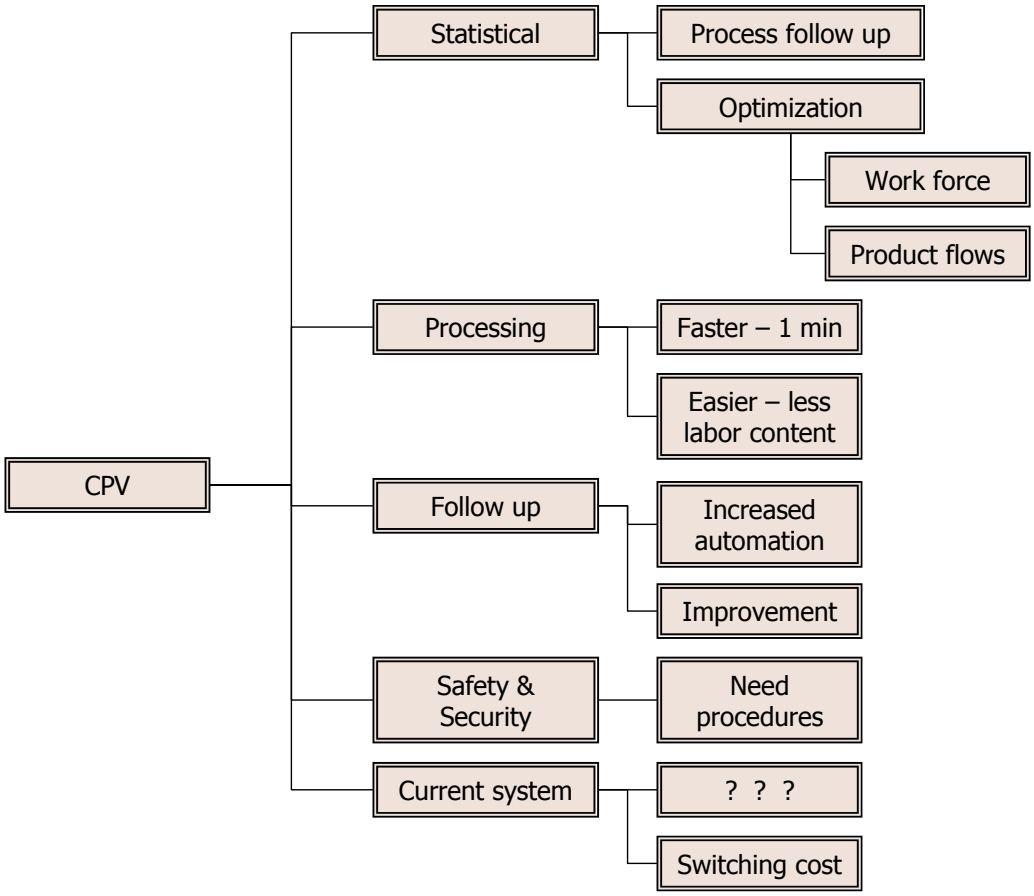

Figure 3: Aspects that affect the Customer Perceived Value

4.2.4. Quantifying CPV (Step 6)

Processing

Implementation of case specific technology would cut processing time per basic processing unit with one minute. In Table 1 is presented the monetary value of one minute saving with employee cost of 2,5 (from insurance, taxes, overhead, training) times employee salary in the particular business area. The factor 2,5 is based on non profit seeking labor leasing company's pricing and 8,5 € / h is the basic salary of target industry employee.

Table 1: Calculation of saving per processing

Category	Amount	Explanation
Salary	8,5	€ / h
Factor	2,5	
Total cost per hour	21,25	€ / h
Total minute saving	**0,354**	€ / min

Follow-up & other customer perceived values

In this particular case there was no actual data available that would enable calculating of CPV for benefits created by advanced follow-up. Evaluation of the other CPV related issues was not performed due to the lack of information on the case specific industry. These evaluations should be performed with industry specialists in order to find exact values. Most of the end-customers of the IPR-product are willing to pay more than 2 € per product which implicates that total CPV gained is more then 2 €. The CPV gained from savings in processing is relatively small and it is very important to quantify other customer perceived values.

4.2.5. License Contract Framework (Steps 7 and 8)

In Figure 4 are presented the aspects influencing the amount of compensation received by allowing the technology usage. In this case the values are calculated for restricted license to a certain industry's sub market. The selection of the form of compensation depends on e.g. the length of the license and risk sharing by Asperation and its client.

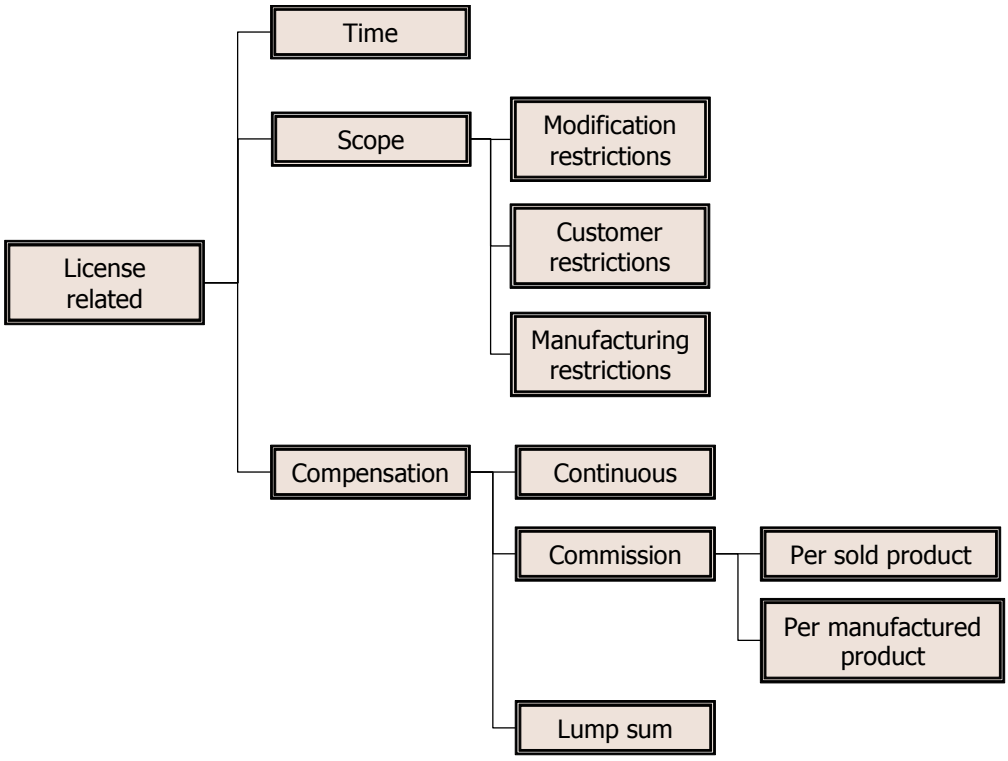

Figure 4: Aspects considering contract terms

4.2.6. Manufacturer and License Owner Framework (Steps 9 and 10)

In Figure 5 are presented the factors influencing license buyer's or manufacturer's share of the IPR technology value. Invested capital will bring adequate profits if the technology can be implemented profitably in the way introduced later in the analysis. Experience and image are almost impossible to quantify with the data available. Expert opinions or further information on the industry are required. Successful implementation of the IPR technology would solve a globally recognized, remarkable processing problem and would certainly receive notable attention in the specific industry.

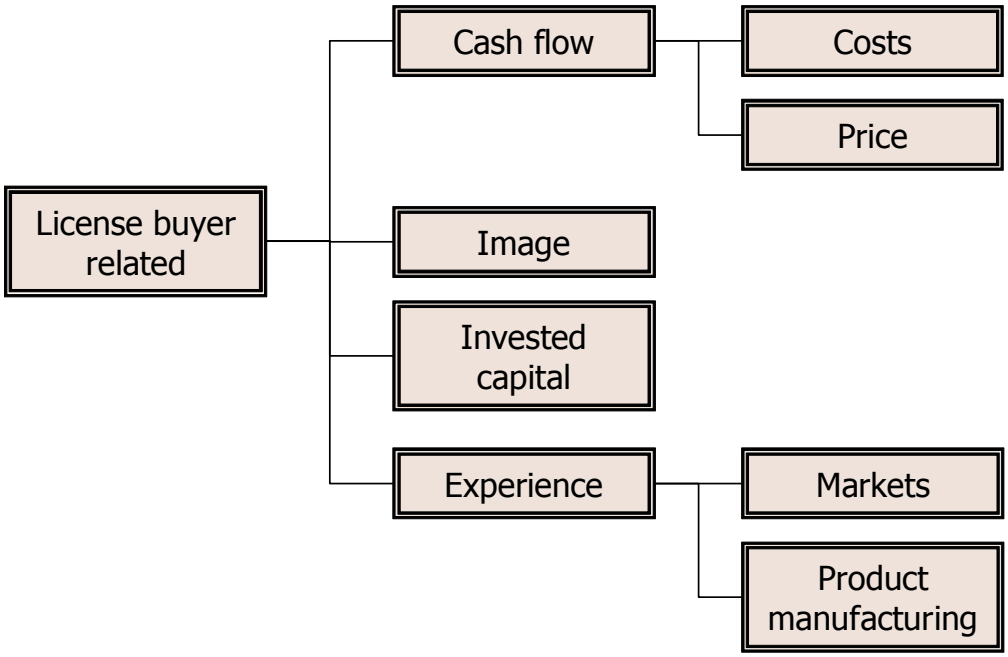

Figure 5: Value creating aspects considering license buyer or manufacturer

4.2.7. Risk assessment and operation models (Step 12)

Implementation of the new technological application causes several risks starting from manufacturing process up to the sales process. Practical risks related to the manufacturing the IPR-product in question are recognized by Asperation and must be taken into consideration in the evaluation process. The application area is introduced to the end-customer who has shown interest in applying the IPR-product. This reduces the need for marketing and the risks related to actual sales being much smaller than anticipated. This is not a case of introducing entirely new product to unknown customers. Inefficient or wrong utilization of the IPR-product compared to the potential CPV is one of the possible risks which could be partly reduced by Asperation.

There are two alternative operation models for Asperation: to take response for the IPR-product manufacturing or to make a license agreement and outsource manufacturing responsibility to the license buyer. By making a license agreement the risks related to the manufacturing would not concern Asperation.

IPR-product of this case could be applied in several industries and potential application areas are multiple. The IPR-product of Asperation could be slightly customized and be possibly applied to other industries which would provide much greater CPV for other customers. If license agreement is made to include opportunities to produce IPR-product to other industries, the pricing process would be more complicated due to the multiplied evaluation of the revenues from other industries. In this case license agreement is assumed to concern only the case specific industry.

4.2.8. Pricing interval of IPR-product (Step 13)

The principle of pricing interval is to evaluate the difference between product-related manufacturing costs and customer perceived value. The approximated manufacturing costs are 0,2-0,5 € per product and most of the end-customers are willing to pay more than 2 € for the IPR-product. Based on the information received from Asperation, the CPV of processing is approximately 0,354 € per basic processing unit which requires two IPR products. Only labor savings of processing were quantified to CPV and the end-customer's paid price was significantly higher than evaluated CPV of labor savings. The pricing interval is in this case from 0,2 € to at least 2 €. The reason for this kind of inconsistency is insufficient data to calculate the total CPV or false information of the total CPV experienced by the end-customer.

4.2.9. Cost and value distribution (Step 14)

The four main stakeholders related to the specific valuation case are: IPR owner (Asperation), IPR-product manufacturer, product distributor (sales organization) and end-customer. In Figure 6 gained CPV per product is divided into four pieces which should be divided between the stakeholders. The target of this evaluation is to find the appropriate Technology Stake which would belong to Asperation. The end customer is prepared to pay 2 € per product what covers the manufacturing costs and the size of Technological Stake is about 1,5 -1,8 €. On the other hand Asperation should be able to evaluate the CPV and by calculating an attractive end customer margin with seller's margin could demand probably greater price for the product.

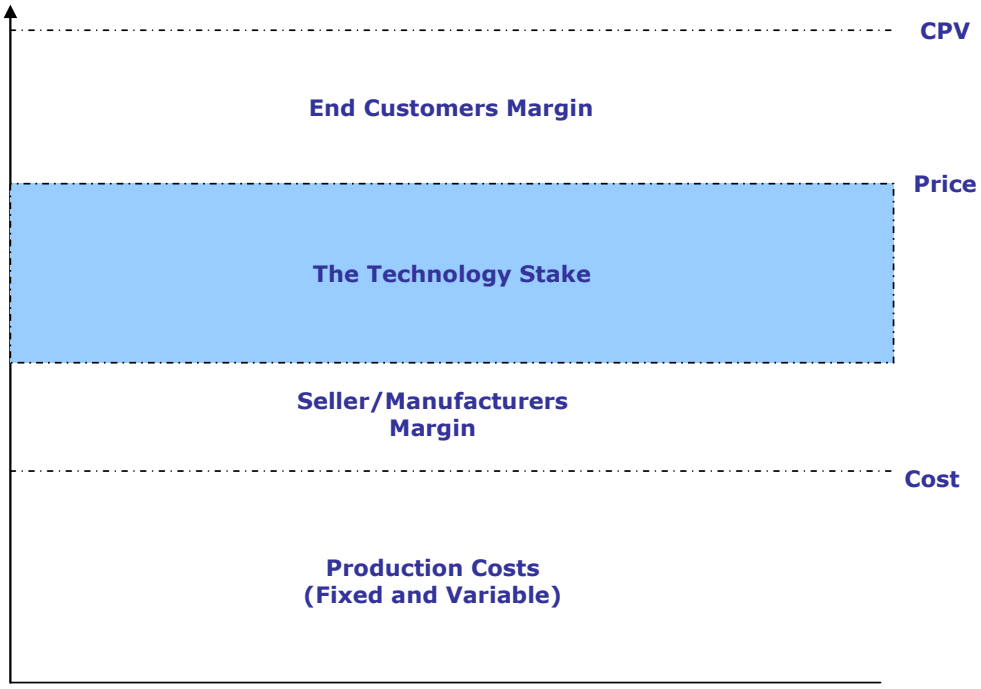

Figure 6: Distribution of costs and values per product

4.2.10. Manufacturing costs and investments

The needed volumes require estimated investments of 5,9 M€. Manufacturing cost on unit level in small scale is 2,83 times the amount of direct labor savings. In large scale manufacturing the manufacturing cost is 1,12 times the direct labor savings. If the same technology can be applied twice during the process the manufacturing costs are 56 % of the direct labor savings. In the particular case the technology would be applied in large scale. Naturally the direct labor savings do not represent all potential savings achieved by implementation of case specific IPR technology.

4.2.11. Cash Flows and Value Scenarios (Steps 15 and 16)

In Table 2 is presented the revenue for scenarios with one or two processing done with IPR technology combined with two possible prices of applying technology.

Table 2: Different scenarios for direct processing benefits

Scenario	Processed once, large scale costs	Processed once, small scale costs	Processed twice, large scale costs	Processed twice, small scale costs
Volume	24000000	24000000	24000000	24000000
Used times	1	1	2	2
Benefit per usage	0,354	0,354	0,354	0,354
Total benefit	8496000	8496000	16992000	16992000
Cost per usage	0,4	1	0,4	1
Total cost	9600000	24000000	9600000	24000000
Revenue / Loss	-1104000	-15504000	**7392000**	-7008000

4.2.12. Cumulative Cash Flow Sensitivity (Step 17)

The assumed investments into production process to achieve the needed capacity are 5,9 M€. The manufacturing costs are evaluated to be 0,2 or 0,5 € per product. The sales price has been analyzed with values of 1, 2 and 3 €. Cash flows for different scenarios are presented in Figure 7.

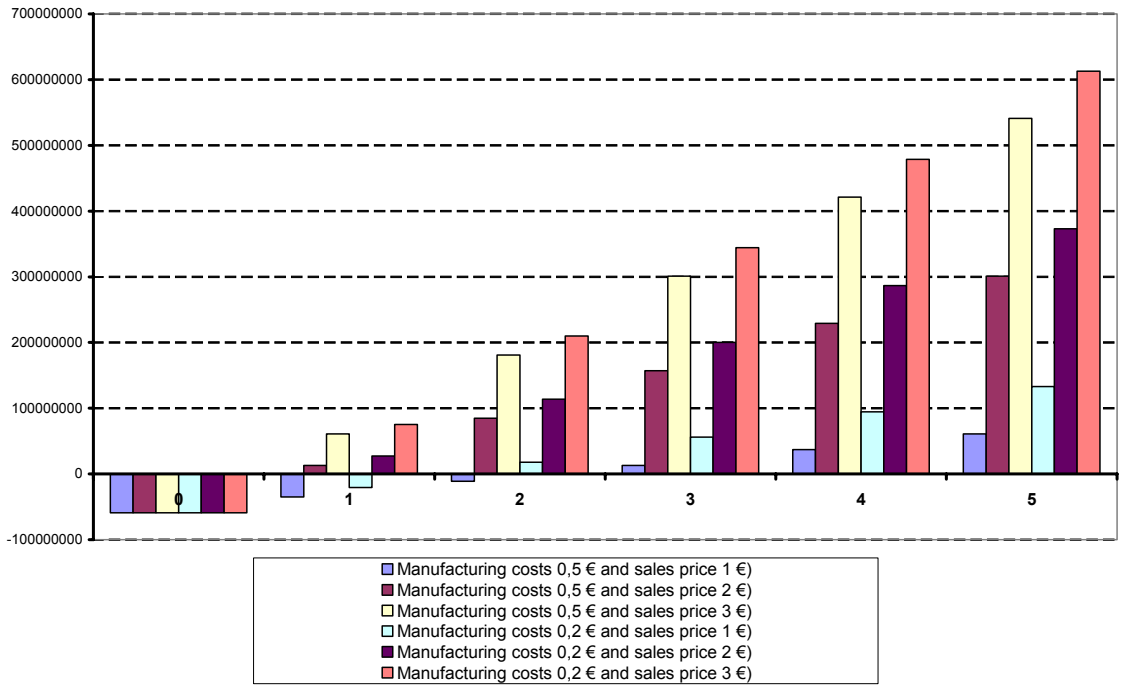

Figure 7: Cumulative cash flows in different scenarios of manufacturing costs and sales prices for 5 years

The results indicate that variation in sales price has more influence on the cumulative cash flow. All 6 scenarios are profitable and repayment period varies from half year to 2,5 years.

4.2.13. CPV (Step 17)

As information considering the present processing system was not at the research group's disposal the only concrete value was the professional estimate of the reduction of the process labor need. The calculated CPV takes into account only labor savings. It is not possible to calculate the total CPV as only labor reduction apparently does not provide adequate estimate of the total CPV. It is recommended for Asperation to gain information considering the aspects which are not estimated here as well.

4.2.14. Sensitivity Analysis (Step 17)

The labor savings are linear compared to both labor total cost and the potential time savings created by the implementation of the advanced technology.

One processing and large scale volumes

The costs of producing the CPV should drop by 11,5 % for the direct labor benefits to make the implementation profitable.

Processing twice and using large scale volumes

The savings in labor costs could drop with 48 % and the investment would still be slightly beneficial in operative usage. Or the cost of producing the CPV could rise by 78 % and the investment would be still slightly beneficial. If the initial investment would be distributed for five years it would make the yearly benefits 16 % smaller.

In Figure 8 is presented sensitivity of profit per product with alternative changes in benefits and costs. In this figure basic sales price is 2 € and basic cost is 0,4 €. This profit assumes one processing with IPR technology.

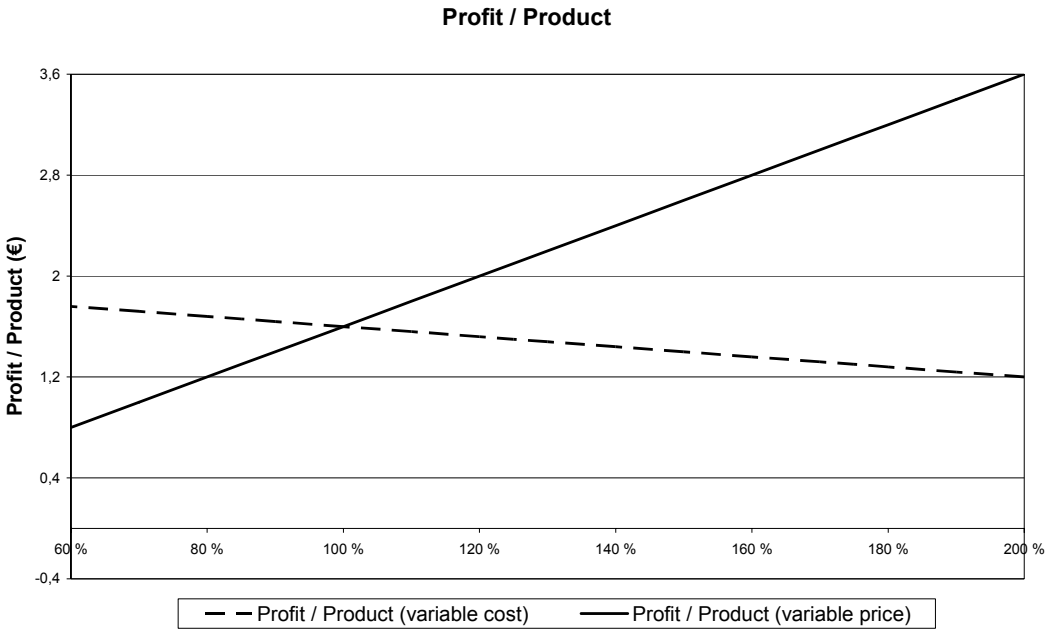

Figure 8: Sensitivity of profit per product with alternative cost and benefits changes (in percentage)

In Figure 9 is presented sensitivity of CPV value of labor benefits with processing done twice with the IPR technology. Parameters for sensitivity are amount of benefits and cost of products enabling the benefits.

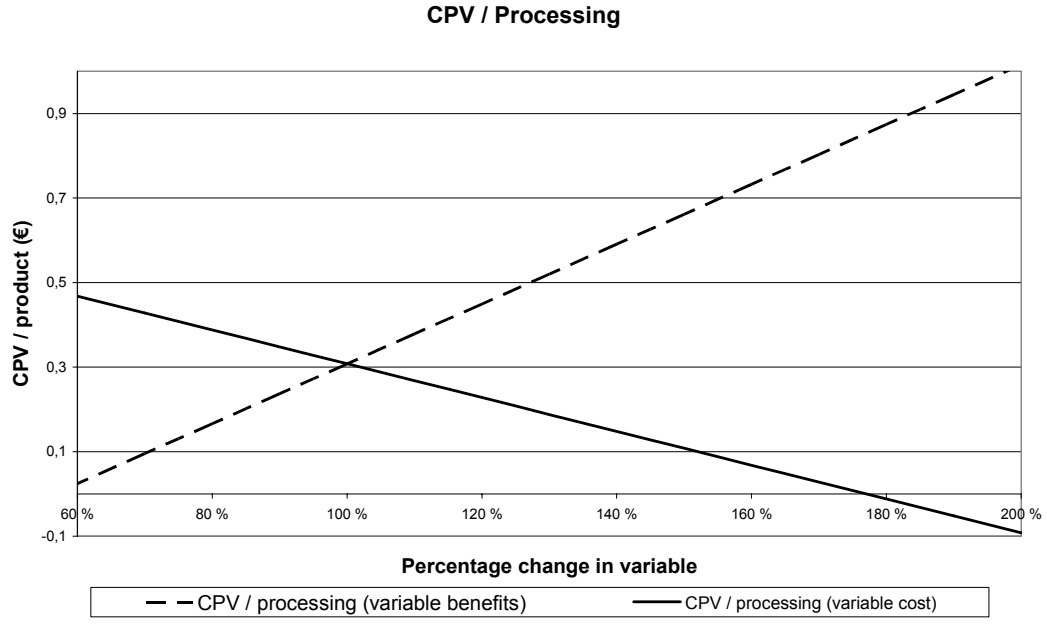

Figure 9: Sensitivity of benefits of processing with alternative cost and direct labor benefits, Processing twice with IPR technology

4.2.15. Sales Arguments (19)

The usage of case specific technology would decrease labor need per basic processing unit with one minute. Automation would decrease human labor content and reduce processing and data entry errors. Better availability of information would allow more thorough optimization and decision making based on fact knowledge. A known fact is that in order to evaluate one's performance, measurement is required.

5. Conclusions

As the data was not available to perform an extensive analysis, Asperation should acquire the data needed to quantify the intangible benefits up to some amount. Quantifiable benefits can certainly be found in the operational data management. To estimate these benefits Asperation should try to find out the present status of the potential customers operations and perform quantification of values related to operational data management.

If it will be decided to sell the license for the IPR technology, Asperation should restrict the usage of technology to certain market of certain customer. This is due to the fact that the technology can be applied to many different usages in other industries where CPV achieved could be much greater. If deciding to sell the technology license to concern other industries the valuation process will be more complicated consisting of applying the framework to different markets.

If the end product sales price will be 2 € there will be adequate "beef" available for Asperation. With end product sales price of 2 € the profit after investments will be between 3 – 4 M€ for 5 years with present end product volumes.

The amount which Asperation might have in this particular case is something between 0 € and 4 M€ depending on negotiation skills. If the manufacturing is done by Asperation or its owners they shall receive all profits but in this scenario they bear all the risks.

If Asperation decides to sell license for manufacturing products to particular customer, the sales price should cover part of new product development (NPD) costs of Asperation. This part should cover at least the estimated proportion of sales volume related to these products per estimated total usage of the IPR technology. Compensation should in addition to this provide better profits than the opportunity cost for the invested NPD costs. On the other hand the NPD costs are sunken costs and they should be treated as such. (Proportion of) Investment and opportunity costs are the minimal compensation which makes operation at Asperation profitable.

6. Aftermath

As a whole, the project was quite complicated because of the vague subject. At first the "big picture" was hard to comprehend and new aspects and views just kept appearing to make the situation even more complicated. However, the strict scoping and cumulating understanding made the framework building possible.

The framework was attempted to be built on a general level, but the deepened knowledge of the example case had effect on the framework adapting it towards the example case. For example, the assumption of an end customer product as the result of the IPR isn't always the case. Also the licensing option has quite a lot of room in the framework although it might be more like an exception in a valuation case. The framework isn't an ultimate framework, but it is something to build on and proved to be very helpful in sketching the complete valuation process and the details of every step.

The finding of input data for the example valuation proved to be hard for two reasons: 1) the input must be as accurate as possible to prevent garbage-in-garbage-out effect 2) due to the confidentiality of the project aggressive information gathering was out of the question. This led to some simplifications and leaves the actual information gathering for the client company.

Another issue that came up during the project was the somewhat conflicting objectives for the project. Not all the information and experience gathered along the project are reflected in this final report, because of the confidentiality. This led to some friction in along the project but was handled in the end with delicate precaution by emphasizing both views as needed. In the end the main objective altogether was to learn and this certainly was the case.

6.1. Post-project Activities

The results of the project have not yet been presented to the client company, which of course calls for swift reconciliation. Once again this has to be done apart from the presentation held for the course.

Hopefully some contact towards the client is kept open even after the final presentation. The project team would like to see what kind of effects their work has had and learn if there is something that should have been done better or otherwise.

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Target Market References:

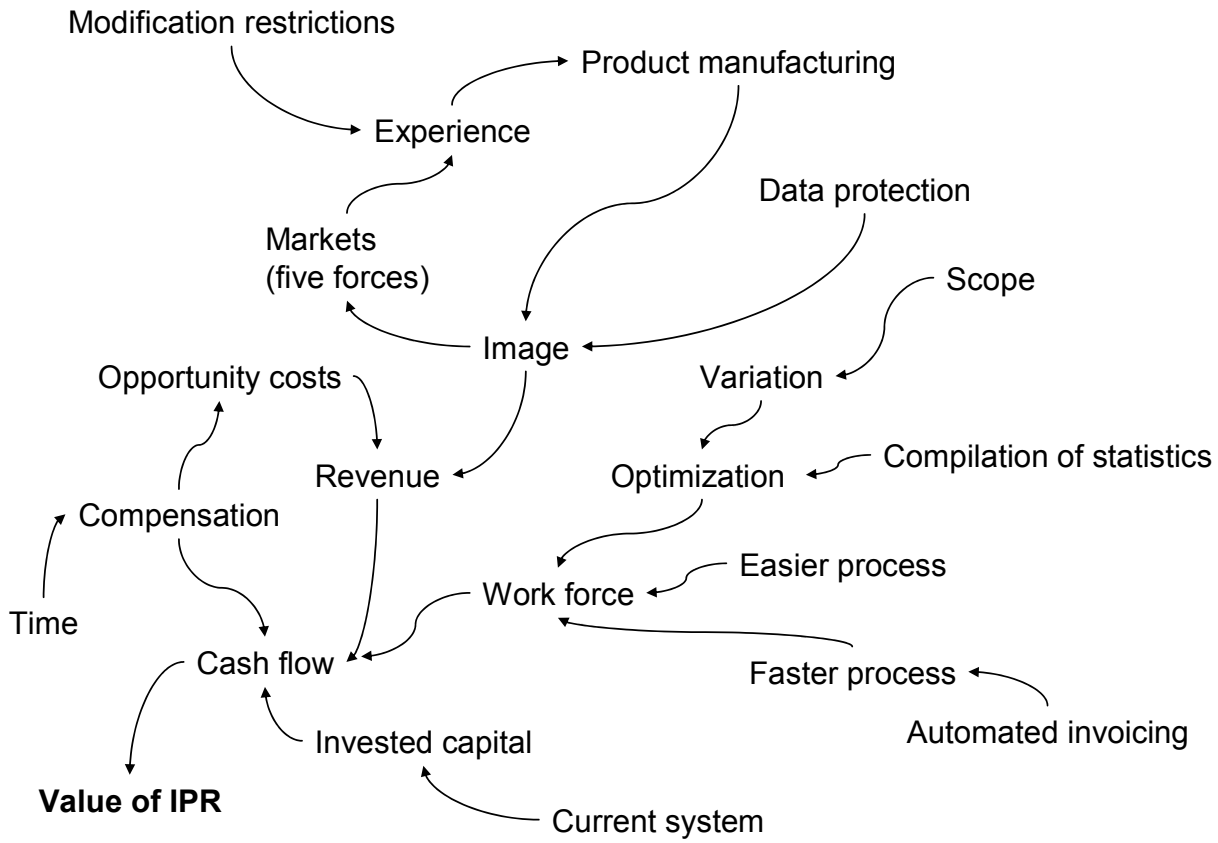
Confidential

8. Appendices

Appendix 1

	STEP	Description	Objective	Questions to be answered	Participation	Tools / Methods / Techniques	Critical parametres	Output
OVERALL PICTURE	1	Functional Analysis of the IPR	Defining the possible use of the IPR, advantages, comparison to existing solutions	How is the IPR used? What benefits it gives?	Project team, Technology advisors, IPR patent owners	Brainstroming	End product lifecycle	
	2	Defining applications / markets / industries	Potential markets identification and characterization	Where should / would / could the IPR be used?	Project team, Experts	Prime method for market potential assesment	Market potentials	
	3	Target market selection	Selecting the markets under inspection in the valuation	What markets are most interesting? In which markets the competencies are greatest?	Project team, project steering group			
	4	System dynamics recognition	Understanding the big picture through visualization	What factors have effects on others and how on conceptual level?	Project team, Cross functional knowledge			System dynamics chart
DETAILED VIEWS	5	Building up the Customer Perceived Value tree	CPV value tree	What are the customer benefits?	Project team, end customer knowledge	Brainstorming		Sales arguments for the end customer
	6	Assesing customer benefits	Filling the tree		Experts, End customer	Delphi method	All factors	
	7	License / Contract tree	L / C value tree	What are the constraints? What factors affect the license decision?	Project team, (license owner)		All factors, if licensing is the case	
	8	Options for license contraints	Finding feasible license constraints	How is the license / contract defined?	Project team, license owner			
	9	Building up the manufacturer / license owner tree	M / LO value tree	What issues affect the manufacturing / license owner position?	Project team, manufacturer / license owner			Sales arguments for the manufacturer / license buyer
	10	Assesing manufacturers / license owners benefits	Filling the tree		Experts, License owner, manufacturer	Delphi method	All factors	
	11	Updating system dynamics chart	Bringing the chart up to date		Project team			
FORMING THE VALUE	12	Risk assesment	Assessing the risks between the possible stakeholders	What are the risks? Who bears the risks?	Project team, license owner		Value proportions dependant on risk bearing	
	13	Synthesis	Pricing interval	What are the feasible pricing options?	Project team			
	14	Cost / Value distribution	Distributing the value to each stakeholders	How the value is distributed between factors? What is the technology stake?	Project team			
	15	Forming the cashflows		What are the future cashflows, how much and when? What is the time horizon?	Project team	Mathematical calculations, Excel	Penetration rate, Investements	Cashflows
	16	Calculating value scenarios		What is the value under different scenarios?	Project team	Mathematical calculations, Excel, NPV		Values for scenarios
	17	Sensitivity analysis for critical parametres	Finding out the effects of varying parametres	How does the value change when parametres?	Project team	Excel		Sensitivity Charts
	18	Pricing the license		What is he price for the license?	Project team, project steering group			Price
BARGAIN RELATED	19	Gathering information to sales argument	Providing the list of sales argument					
	20	Follow-up		Was the decision right? Were the results good? What should have been done different?	Project team			

Appendix 2


Modification restrictions
Product manufacturing
Experience
Data protection
Markets
(five forces)
Scope
Image
Opportunity costs
Variation
Revenue
Optimization
Compilation of statistics
Compensation
Easier process
Work force
Time
Cash flow
Faster process
Automated invoicing
Invested capital
Value of IPR
Current system