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A Review of the Methods for Valuing Intellectual Property Rights

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Contents

1 Introduction and Motivation

Earlier on, plant or equipment were the most important assets for most enterprises. Nowadays, intellectual property (IP) is seen as vital for creating wealth in almost all industries. In knowledge-based economies IP plays a crucial role in economic growth and business performance. The role of IP is increasingly important in today's innovative and dynamic business environment.

Continuously growing intellectual property business has urged researchers to develop new valuation approaches and methods for IP. Valuation of IP is important as it plays an important role when, for example, buying or selling a company. There is no right approach to valuate the IP. There are only methods and approaches that are more or less suitable for certain type of IP.

This literature review covers different methods of IP valuation. Based on a study of the current literature on the IP valuation, we present two common valuation approaches, quantitative and qualitative. Each approach is divided into groups of methods. This study analyzes these methods but also analyzes one method — the multi-period excess earnings method (MEEM) in more detail. There is ongoing debate both in the industry and in the literature on which method is more efficient. Hence, this work analyzes the two main approaches and provide reasons why methods from both approaches should be used to find a reliable value.

This study is structured as follows. Section 2 analyzes basic characteristics of IP and presents the definition of a patent. Section 3 is about valuation approaches and commonly used IP valuation methods. Section 4 describes the MEEM, which is used as an numerical example in the section 5. Section 6 concludes by discussing the main ideas in this study.

2 Characteristics of Intellectual Property

Intellectual property refers to creations of the mind: inventions and artistic works as well as symbols, names, and images that are used in business. IP is divided into two categories: industrial property and copyright. Industrial property comprises patents for inventions, industrial design, and trademarks. Copyright includes literary works, films, music, artistic works, and architectural design.

Intellectual property rights (IPR) are like any other property rights. They allow creators or owners of intangible asset to benefit from their own investment in a creation process of the asset. The importance of intellectual property was first acknowledged in the Paris Convention for the Protection of Industrial Property (1883) and the Berne Convention for the Protection of Literary and Artistic Works (1886). Both of them are administered by the World Intellectual Property Organization (WIPO). [2]

This study focuses on patents. Thus, in the following sections is specified what is a patent, what special characters each patent must fulfill, as well as how to determine a useful life for a patent or other IPR.

2.1 Patent

Patents are unique assets in a technology driven company. They provide competitive advantage and enable the rights' owner to gain appropriate returns from the invention. Without patents, competitors could easily copy company's technology with a minimal effort and investment.

For example, in mining industry the development of mining machines and extraction techniques requires a lot of investments and time, it also involves a lot of uncertainty. If an inventor could not protect the resulting product or technique, probably nobody would have the courage to develop such a product, as once it is invented, competitors could jump the train and profit from the work. Consequently, it is important to protect company's IP, research and development results and moreover allow a certain time slot, when inventor can exploit his or her product on an exclusive basis.

Patents apply to inventions and deal with how things are made, what they are made of, what they do, and how they do it. According to WIPO [2], a patent is an exclusive right granted for an invention, which is a product or process that provides new ways to do something or offers a new technical solution to a problem.

A patent provides patent owners with protection for their inventions. Protection is granted for a limited period, generally for 20 years. Patents are negative rights as they give owner a right to prevent third parties from producing such a product. Therefore, anyone who is thinking of manufacturing a product should first check if there is a patent preventing it. [3]

Although, not all inventions are granted protection and for example ideas are not patentable. An invention must fulfill the following conditions to be protected by a patent which can also be seen in Table 1.

For a patent to be granted it must be...
novel,   industrially applicable,   and have an inventive step.

Table 1: For a patent to be granted, an invention must fulfill these standards according to WIPO. [2]

Invention must show an element of *novelty*, meaning some new characteristic that is not part of the body of any existing knowledge of the technical field. The body of existing knowledge is called prior art. Invention must be of practical use and show an *inventive step* that could not be invented by an amateur person with average knowledge of the technical field. An invention involves an inventive step when a person skilled in the art would not have, by following the obvious steps in the development, come up with the same solution. An invention must also be *industrially applicable*, thus it must solve a technical problem, or have a technical effect. After the patent application fulfills all these characters, it may be granted as a patent and thus, the invention and the claims tight to it in the patent are protected. [2]

Patents provide certainty and exclusive rights to an inventor but they are also a valuable source of information for competitors and business partners. They contain information related to industrial property rights, but also business information such as where competitors operate, new market areas and technologies, interrelationships between competitors, and cooperation partnerships. This information can be utilized, for example, when forecasting new technology trends or analyzing global distribution of technology. [2, 4]

2.2 Useful Life

The useful life of an IP asset is the estimated time in which the IP asset is able to produce revenues. Therefore the useful life for IP asset is the time frame it is useful for business while the patent is still valid.

To determine the useful life of the subject IP asset many factors are considered. First the longevity of the asset is determined. With patents and some other intangible assets such as technology, order backlog, customer relationships and most brands the lifetime is usually finite, for example, the maximum granted time for a patent is 20 years. On the other hand, a trademark can be valid unlimited time, as long as the registration fees are paid.

Also technical, technological, commercial, or other types of obsolescence are considered. In addition, changes in any part of the business product's the market share — industry, demand, competitors, must be accounted for. Also the flexibility and the evidence of ability to adapt to changes in market conditions have an important part when determining the useful life. [2, 5]

3 IP Valuation Methods and Approaches

Accurate IP valuation is needed for many purposes of financial reporting and accounting including the reporting of fair estimates in annual reports. International accounting standards require companies to report values of their IP assets, which are comparable to other companies.

When experts are seeking an intellectual property valuation tool they can use several different methods to find a satisfactory solution. For business purposes, methods can be divided into two approach: quantitative and qualitative. Before any other aspects of the valuation process are analyzed is decided between a qualitative and a quantitative approach. Different valuation approaches are required if the target audience comprises prospective investors or internal management. [6]

In the following sections we will explain differences between qualitative and quantitative approaches, as well as the most commonly used methods. [7]

3.1 Quantitative Approach

The quantitative approach seeks to determine the monetary or economic value of the IP. Thus method can be implemented as a tool using any numerical information or measurable data. In a review by Wirtz [8], the quantitative approach can be divided into three main methods: a cost method, a market method and an income method. Each of these three methods comprises several techniques which have the same valuation principle but differ in their individual application. [9]

Figure 1 illustrates relationships between methods and approaches more visually. Although in the literature a "new method" is presented, many of them are more or less a combination of these basic methods.
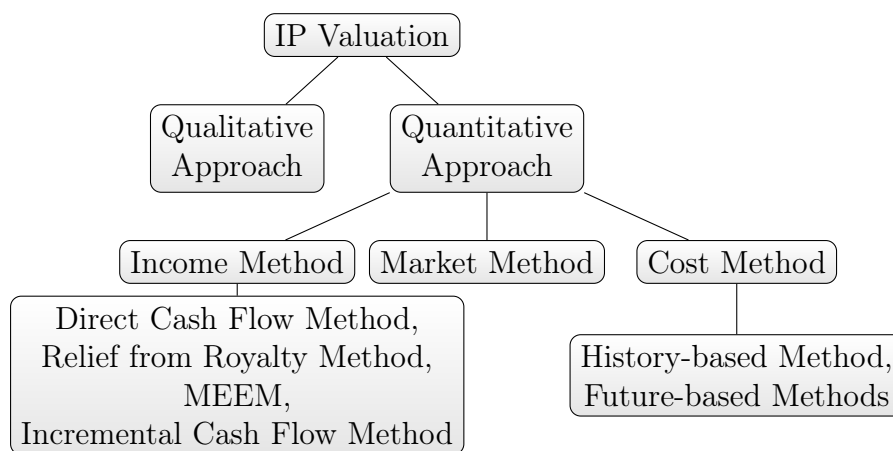

Figure 1: Relations between approaches and methods.[8]

3.1.1 Cost Method

In an article by Lagrost C. et al. [6], the cost method is described to rely on the principle that there is a link between the costs incurred during the development of an IP asset and the final value of this asset. The basic assumption of this method is that the cost to build or buy a property equals the value of its ownership. Consequently, there is a direct correlation between the costs and the value. This method is based upon the economic principles of the substitution and the price equilibrium. An investor will pay no more for an investment than the cost to obtain a similar investment of the equal utility. Diverse cost methods, which can be applied to valuate IP assets, are derived form the same idea.

Cost methods includes two techniques: the history-based and the future-based.[4]

In the historical cost trending method, you must valuate how much the intellectual property right has cost during the creation and the development from the beginning until the present moment. All the costs incurred with the IP creation process such as material, overhead, and human resources are needed to make a satisfactory solution.

The future-based method has two popular methods called the reproduction cost method and the replacement method. The replacement cost method estimates the cost of the production or purchase of a good with an equivalent benefit. The replacement cost method estimates how much it would cost to replace an IP asset with another IP asset which has similar use or function as the original IP asset. The equivalent IP can be created with the different path or materials and have a different form or appearance but it must recover the full utility of the subject IP. [10, 11]

All costs related to the purchase or the creation of a duplicate of the IP asset under valuation are valuated in the reproduction cost method. Estimation is made by following an identical process of creation and development using the same components as an original IP asset. Basically it analyzes what is the price if an identical IPR would be created by using same information, methods and materials. It is easiest to think of this as measuring the cost of buying the already developed IP from an external source. [10, 11]

Cost methods, both history-based and future-based, are commonly used in accounting and bookkeeping. It is generally agreed that cost methods are only useful for bookkeeping purposes or as an addition to the income method [8]. The benefit in cost methods is the ease of collecting and processing the required data. Cost methods are applicable in the cases where the IP is partially complete and thus it is not bought or sold and does not generate any revenues.

The disadvantage in cost method is that difficulties may arise when determining indirect costs.[8] It is demanding to estimate expenditures if they do not appear separately in the firm's financial statement. Moreover the method does not relate to any market value or future profits. Consequently, the crucial weakness is that it does not appraise the future benefits arising from the asset. Therefore the assumption that costs create value is problematic in this context and thus it is generally used in accounting statements. When analyzing for business cases, usually some other method is used to get more satisfactory solution or the cost method is used to get the credible check of values calculated by other methods.

3.1.2 Market Method

In the market method the value of the IP asset is affected by the law of demand and supply which leads to a price equilibrium in the competitive markets, according to Reilly and Schweihs [11]. The valuation of the IP asset is based on the comparison of two similar IP assets of which one is not on the market and the other is on the market and its value is known. Hereby, an attempt is made to valuate the non-market IP asset based on market information received from the first one.

In market method an active market is required for the IP assets. This means that the traded assets have to be homogeneous, willing buyers and sellers can be found at any time and prices are publicly known.[11] Usually IP markets do not fulfill these requirements. Thus, the estimator seeks similar and comparable transactions and therefore a multiplier for transferring the important prices can be calculated. The demanding part in the market method is to find appropriate comparable transactions and satisfactory multipliers. [8]

This method is widely used and often advantageous when the determination of the input parameters in the cost method is difficult due to a high degree of uncertainty. Although the method is quite straightforward and simple, the problem is that finding a comparable IP asset or enough public information about licensing. The market method is useful for estimating an overall value of the assets. Because it requires an existing market it cannot be applied to unique assets. The market method lacks the knowledge from the IP asset market, as there is only limited amount of public information about the market action such as transactions and trade secrets. It is also challenging to find similar IP assets because they are always more or less unique. In order to ensure that the market transactions are comparable, sufficient information is needed concerning pricing, scope and any terms and conditions related to the exchange or sale of the IP asset.

Any transaction objective, for example a patent, is by definition unique and therefore the number of transactions is limited. Therefore one can question whether a concrete price can be seen as a price equilibrium. IP asset is not similarly exchangeable product like many tangible products. Thus the market method valuates the IP asset more or less based on somebody else's estimation of some similar asset. Thus the estimation made based on the market method is largely based on the hope that people who valuated the comparable asset knew better than one self and their analyze can be applied to the own valuation situation. That is why the market method is not recommended to use as the only method. [9]

3.1.3 Income Method

In the income method there are different ways to determine the future income streams generated by the IP asset being valuated. So the value of property can be measured by the present value of the net economic benefit to be received over the IP assets lifetime. The value of the IP asset is based on the various cash flows generated by IP asset in form of projects, licenses or services. [11]

These cash flows can accumulate from different sources. If patented technology is used for goods' production, the application of the technology can lead to cost savings or higher quality which allows higher prices and maybe an expansion of sales. On the other hand, a patent can also be acquired to only prevent competitors from using a technology or entering a certain market. However, in all these cases the IP produces advantages in the market which allows higher prices and sales as well. [9]

According to Anson et al. [10] the crucial parameters in the income method are: (i) the future cash flow, (ii) the duration of the cash flow and, (iii) the risk involved with generating the cash flow. The cash flow is characterized by the size of the cash flow and the probability to occur. Important costs in the valuation process are filing costs for national and international applications and the annuity costs as well as the costs concerning the office action. The discount rate depends on the company working on the IP and the expected scenario of the IP. The income method is widely used, but one must decide how to measure the "income" attributable to the asset. According to Wirtz [8], commonly used income methods are direct cash flow method, relief from royalty method, multi-period excess earnings method (MEEM) and incremental cash flow method.

Direct cash flow method uses cash flows that have directly resulted from the subject asset.[8] A condition for this is that the cash flows can be measured directly. Wirtz states that this is possible for example if the technology is not used in production processes by the owner himself but is made available to third parties and competitors by licensing. Licensed revenues can be quantified relatively easily and with high reliability, at least near in the future. The direct cash flow method is the most commonly used technique and it is seen as a reliable method. However, if there is no income, the firm has no value.

In relief from royalty method the idea is that the income due to the ownership of the IP can be calculated based on the saved license fees which would have been paid, if the property had been licensed from another owner. The method requires that licensing agreements for similar assets can be observed and transmitted. Therefore

this method is more or less a combination of the income and market methods. A disadvantage is that it tends to be oversimplified and inappropriately applied in many situations. [8, 10]

The MEEM tries to isolate the cash flows generated by the IP by deducting fictive fees for all other assets from the entire cash flow of the unit. Those charges can be seen as rent or leasing fees for the use of those assets. Since the IP creates cash flows regularly only in combination with other assets, financial planning is typically done for such combined units. As a result, the MEEM uses the opposite way of the relief from royalty method. While that method calculates fictive fees for the IP, the MEEM calculates fictive charges for all other assets. [10]

The incremental cash flow method seeks to valuate the benefit of the IP by comparing the income of the considered unit with the property to a situation without it.[8] The difference between the cash flows for each period in the two situations shows the additional cash flow that can be attributed to the asset being valuated. Usually this is used for the brand valuation and the comparison is between product with a brand and a similar unbranded product. The value of the IP is the difference between the branded and the unbranded product.

Income methods require the discounted cash flow technique or a valuation multiple. It focuses on the income generated from the IP through sales, profit and other income sources. The variables used to calculate future cash flows are: (i) income stream from sales or license, (ii) the estimated life time of the IP, (iii) the discount rate, and (iv) different risk factors involved. [10]

The income method suits investors, because they prefer to know how much income the IP will generate in the future, how big is the risk involved in the investment, and how soon cash flows will pay back the investment. The income method gives the maximum value of the return and includes profits, which is positive for IP owners and investors.

However, identifying the assets, estimating future value and determining risk always involves estimation errors. It can be difficult to project reasonable future cash flows: for example, it may be that there is no existing market or the economic climate can change. It is also difficult to predict future outcomes such as probability of success or to assess the risk involved when estimating the discount rate for the present value. The risk behind the IP is different from the company risk and there is no standard value for the risk measurement of beta on these technologies. This shows how future cash flows can be very uncertain.

3.2 Qualitative Approach

The qualitative approach includes a precise analyzis of the current or intended use of the IP by examining its properties, characteristics or states. These results analyzed by the qualitative approach are usually not in monetary terms. The qualitative approach provides a valuation guide trough the rating and scoring of the IP asset. [5]

As assumed, the qualitative valuation methods are not used as much as the quantitative ones. Qualitative methods are mostly used for the purpose of the IP management and the business strategy. They are used for comparing, categorizing and ranking the IP of the firm. [12]

Different factors affect the scoring and work as valuation-indicators. Qualitative data is often public which provides the opportunity to compare against competitors' IP. The disadvantage is that it is very dependent on the information provided.

3.3 Review

The qualitative approach gives more generic overview of the IP. Therefore it does not require a numerical valuation process. Instead it summarizes the quality of the IP using valuation indicators. On the other hand, this requires a lot of information about the IP which might not be available. If this information is lacking then the qualitative valuation is obviously less precise than the quantitative one. Nevertheless, the qualitative methods do not acknowledge profit and other key factors for valuation, which are an important part for investors.

The quantitative approach presents the financial value of the IP. Moreover it also analyzes the business today and in the future. Quantitative methods fail to incorporate the legal aspects of the IP which may have an effect to the value of the IP.

Each valuation method uses different techniques when valuing the IP. It is usual that when calculating a value to an IP asset to overvalue it. The additional value is called *goodwill*. Possible reasons for this could be a mismeasurement, a misidentification or uncertainty about an appropriate value. There can be a misidentification of what should or should not be added in the value of the IP asset. Thus, there is no right or satisfactory method to be used solely. To get an appropriate and realistic solution more than one valuation method should be used, preferably a combination of two methods. [9]

4 Multi-Period Excess Earnings Method

This section analyzes more precisely the multi-period excess earnings method (MEEM) which valuates the IP asset by analyzing the cash flow attributable to an asset after deducting appropriate contributory asset charges (CAC) used to generate the income stream. Excess earnings are discounted to their present value using an appropriate risk-adjusted rate.[5] In the following subsections the calculation with MEEM is explained more precisely.

Valuation using MEEM is performed in the following order [13]:

1. The future income stream or cash flow is determined for the IP assets useful life.

2. Contributory asset charges are determined and reduced from the cash flows.

3. The discount rate involved with generating the cash flow is calculated.

4. Excess earnings are discounted to get present value of the IP asset.

First the future cash flows are determined from the business area or areas, in which the IP asset is included. Estimation of revenue and operating income generated by the IP asset may be challenging if the cash flows generated by the certain IP is not separately in the firm's financial statement.

After that contributory asset charges are applied. CAC are activities that should be taken into consideration. For example, they can be operating capital, machinery and equipment, other rights, labor, land or buildings. They are applied based on the required rates of return on working capital, capital assets, brand, and the assembled work force used to generate the after-tax cash flows.[13] These should be considered as having to pay a financial rent for the activities in order to be able to use them in your production.

Finally, it is necessary to calculate the present value of future cash flows - in other words, what the expected future profit for the IP is worth today. Determination of the expected remaining useful life of the specific IP asset is an important part of valuating the present value, as well as the discount rate which is appropriate with respect to time and risk. Often the cost of capital of the company is used as a basis when determining the risk and then adjusted to individual circumstances of the valuation object. Commonly the weighted average cost of capital (WACC) is used as a cost of capital. [14]

4.1 Weighted Average Cost of Capital

The capital funding of a company is made up of two components: the debt and the equity. Lenders and equity holders each expect a certain return on the funds they have provided. The cost of the capital is the expected return to equity owners and to debt holders, so WACC tells us the return that both stakeholders - the equity owners and the lenders - can expect. WACC, in other words, represents the investor's opportunity cost of taking on the risk of putting money into a company.

Thus, the cost of capital can be determined by the following formula [14]:

$$r_{WACC} = r_E \cdot \frac{E}{C} + r_D \cdot (1-t) \cdot \frac{D}{C} \tag{1}$$

where,

r_{WACC}	weighted average cost of capital
r_E	cost of equity
r_D	cost of debt
t	tax rate
E	market value of equity
D	market value of debt
C	market value of total capital.

The equation includes assumption that the company tries to maintain target leverage ratio. The cost of debt has to be multiplied by the factor (1-t), as it is deductible from the income for tax purposes.

4.2 Capital Asset Pricing Model

To determine the cost of equity r_E there are many options such as arbitrage pricing theory and the Fama-French Three Factor Model but usually the Capital Asset Pricing Model (CAPM) is used.[12, 15] The CAPM formula means the expected risk premium on an asset equals the asset beta multiplied with the expected risk premium on the market, which can be written as [14, 16]:

$$r_E - r_f = \beta \cdot (r_{Mkt} - r_f) \tag{2}$$

$$r_E = r_f + \beta \cdot (r_{Mkt} - r_f) \tag{3}$$

where,

r_E	cost of equity
r_f	risk free rate
β	beta of the asset
r_{Mkt}	market risk; expected return on the market
$r_{Mkt} - r_f$	expected premium on the market.

The starting point in CAPM is the risk free rate r_f, which can in practice be approximated by the interest rate of government bonds of financially solid states, which guarantees the almost risk free rate. The market risk stands for the rate of return of capital that an investor receives with a totally diversified portfolio. [8]

Regardless of which model is chosen, however, no model can fix incorrectly identified cash flows, a mistake that takes place when analysts confuse the kind of risk that can be discounted. A project-specific risk or diversifiable risk depend on what happens inside the company such as malpractice or failed projects. A market risk or a systematic risk depends on common events such as of the deep recession of the economy or some crisis that influence the whole economy. [12]

In CAPM the systematic risk is calculated with β-multiplier. This is a measure for the risk that cannot be reduced any more by diversification. An owner of an asset wants profit from the inflation as well as from the systematic risk that he or she is taking by owning the asset. Therefore the revenue must include the risk premium $(r_{Mkt} - r_f)$, which covers the market risk. Estimation can be made by checking the historic rates of the return. [14, 16]

As beta is a statistical measure, the estimation error must be considered. Beta is estimated from the stocks of company and how investors are valuing the stock, which is seen from the current transactions in the stock exchange. On the other hand if the stock is not sold or bought frequently enough, the observation data is not reliable. [15]

If the company is not exchange-listed, the beta estimation must be made trough comparison. The comparison is made between the estimated company and similar companies that are exchange-listed. The beta estimation is different when comparing with company that has debt or with a company that does not have debt at all. The easiest option is comparing to company with zero debt as then $r_{WACC} =$

r_E. Therefore the expected return of equity is the expected return of the company risk and thus r_{WACC} is called the unlevered cost of capital. [14]

On the other hand, there are different sources of error, when estimating the beta and moreover the r_{WACC}. Therefore to get appropriate estimation, multiple companies should be compared. The easiest option is to use the average beta of the compared companies. Anyhow the r_{WACC} we get is only performing the company's cost of capital. Therefore it should be adjusted to be the cost of capital for the certain IP asset. There is no accurate method for approximating the IP asset's cost of capital, thus it is more or less derived from the firm's cost of capital. [14, 15]

4.3 Present Value

After the CAPM is used and the equity cost of equity r_E is determined the r_{WACC} can be calculated.[14] With r_{WACC} we can calculate the discount factor, which is:

$$D = \frac{1}{1 - r_{WACC}}. \tag{4}$$

The present value of the IP asset can be calculated with the discounted cash flow method using the following formula [14]:

$$PV = \Sigma_{t=1}^{t=n} \frac{CF_t}{1 + r_{WACC}} \tag{5}$$

$$PV = \Sigma_{t=1}^{t=n} CF_t \cdot D \tag{6}$$

where,

PV	present value
n	useful life of the IP asset
CF_t	cash flow in period t
r_{WACC}	discount rate reflecting the riskiness of the estimated cash flows.

If the cash flows are presumed to occur in the same amount at the same discount rate every year i, then they can be valuated as a perpetuity and the formula is [14]:

$$PV = \frac{CF_i}{r_i}. \tag{7}$$

If necessary, tax benefits should be added to the current value by writing down the value over the period. This part is called tax amortization benefit (TAB). In order to reach the fair value of the asset, we have to multiply its value before amortization benefits by a tax amortization benefit factor (TAB factor). The TAB factor is a mathematical function of a corporate tax rate, a discount rate and a tax amortization period. In this review TAB is excluded from the calculations. [8]

4.4 Review

The IP asset valuation according to MEEM has many advantages. First of all it provides a theoretical method for allocating a cash flow earned from a group of assets to the individual assets contributing to the income stream. It is also widely accepted and utilized method for valuating the IP when the economic benefits are difficult to identify directly but clearly have value.

On the other hand, there are also challenges such as the method may overvalue the subject IP. It requires the identification and valuation of all assets in the group contributing to the income stream using other valuation methods. Moreover estimating the required returns on the contributory assets is subjective and the valuation of the subject IP can be sensitive to these inputs.

5 Example

This example demonstrates how to calculate value of a patent with MEEM. We assume the firm is Outotec Oyj and valuation for the patent is made using the principles and techniques from the previous section 4. Table 3 demonstrates the calculations for the next three years.

Costs, revenues, CAC as well as the tax presented in the Table 3 are examples. First the costs are reduced from the revenues and after that can be calculated net income from which is reduced taxes. CACs are reduced from the net income after-tax and the result is the cash flow after tax.

For the present value calculations using the equation (5) is needed the discount factor and moreover the r_{WACC}. The cost of capital r_{WACC} is calculated for Outotec

Oyj using equation (1). According to consolidated statement of financial position in the appendix A Outotec Oyj has total market value of equity 404.7 million€ and 1126.7 million€ total market value of debt (liabilities). Now values E, C, and D for the equation (1) are determined.

The cost of debt r_D for the company is the current market rate the company is paying on its debt. According to the Bank of Finland, the Finnish bond issues 2013 for Outotec Oyj at rate 3.75%. [17]

Next phase for determining the r_{WACC} is to estimate the equity cost of capital r_E, with equation (3). Assuming that investors require 7% return to compensate them for taking extra risk by investing in stock market the equity market risk premium $r_{Mkt} - r_f$ is 7%. The risk free interest rate is estimated according to the U.S. government bonds and it is currently approximately 2,25% for 30 years.[18] This rate is historically low due to current economic conditions.

The beta for the equation (3) is approximately 1.3, according to Reuters [19] calculations, but 2.37 according to Infinancials.[20] As a consequence we can see that beta is demanding to determine, because the differences between two estimations is large. Let's take the average of these and we will have beta 1.84 for Outotec Oyj.

Now the cost of equity r_E is calculated according to equation (3). The cost of equity is the market risk premium multiplied with the assets beta which is added to the risk free rate.

$$r_E = 2.25\% + 1.84 \cdot 7\% = 15.13\%$$

Now all necessary estimates are determined and the r_{WACC} can be calculated. The weighted average cost of capital is obtained from equation (1) as,

$$r_{WACC} = \frac{404.7 \, \text{million} \, €}{1531.4 \, \text{million} \, €} \cdot 15.13\% + \frac{1126.7 \, \text{million} \, €}{1531.4 \, \text{million} \, €} \cdot 3.75\% \cdot (1 - 0.3) = 5.93\%.$$

Table 2: The present value factor D for each year.

Year	0	1	2	3
Present value factor D	**0.944**	**0.891**	**0.841**	**0.794**

The discount rate for each year is determined with the equation (4), using the

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r_{WACC} and results are presented in Table 2. Now, the total present value can be calculated with equation (5). First the cash flows are multiplied with the discount factor D and then they are added up to get the total present value of the IP asset, this is represented in the Table 3.

Table 3: Example, [k€]

Year	0	1	2	3
Revenues	1,000.00	800.00	500.00	300.00
Costs	750.00	600.00	375.00	225.00
Pre-tax cash flows	**250.00**	**200.00**	**125.00**	**75.00**
Net income (after-tax 30%)	175.00	140.00	87.50	52.50
Contributory asset charges (CAC)				
Machinery and equipment	35.00	34.00	22.50	12.50
Working capital	25.00	17.00	8.50	6.50
Workforce	19.50	12.60	8.75	4.85
Total asset charges	**79.50**	**63.60**	**39.75**	**23.85**
Cash flow after tax	95.50	76,40	47,75	28,65
Present value of cash flows	90.154	68.086	40.172	22.754
Total present value	**221.166**			

In this example the total present value is 221.166, which means that the patent is profitable for its owner. If the present value were less than zero, the patent would be making loss.

5.1   Review

Several important but uncertain values such as beta and future cash flows are calculated and estimated in the multi-period excess earnings method. Therefore the valuation result and solution is dependent crucially of the estimation accuracy and realistic decision making.

The r_{WACC} calculated in the example is lower than required and there can be numerous reasons for that. Usually r_{WACC} is something between 7-15%. Some errors may occur as the beta is difficult to estimate and is an average from only two sources. Also the government bonds have really low interest rates these days. Moreover the r_{WACC} calculated is company specific and does not cover the volatility patent may have.

6   Conclusion

This study has explored what are the most commonly used IP valuation methods and how the methods can be divided into quantitative or qualitative approaches. Qualitative approach evaluates the IP assets using indicators that are important in the firm's strategy or management. Quantitative approach focuses on numerical measurement using the cost, the market or the income of the IP. Both approaches have their weaknesses and strengths. Qualitative methods do not take into account some significant financial factors for the valuation. However, the quantitative methods often provide a surreal and simplified valuation of the company due to the complexities and diversity of the IP.

As each IP valuation method and approach provides clear advantages and disadvantages the conclusion in this paper is that the combination of some these methods is the best solution. Thus, hybrid approach using both approaches and their strengths in the IP valuation would be the most appropriate when making decisions and strategic moves in the company.

7 References

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Appendix

A Outotec Oyj Financial Statement 2015.[1]

CONSOLIDATED STATEMENT OF FINANCIAL POSITION

EUR million	Note	31.12.2015	31.12.2014
ASSETS			
Non-current assets			
Intangible assets	14	405.0	350.5
Property, plant and equipment	15	83.0	78.1
Deferred tax assets	12	88.6	70.5
Investments in associated companies	16	0.1	0.4
Available-for-sale financial assets [1]	17	2.2	2.2
Derivative financial instruments	19	5.6	6.5
Trade and other receivables	21		
Interest-bearing [1]		1.9	1.4
Non interest-bearing		2.4	2.4
Total non-current assets		588.7	512.0
Current assets			
Inventories	20	202.2	170.0
Derivative financial instruments	19	3.5	6.2
Trade and other receivables	21		
Interest-bearing [1]		0.1	0.2
Non interest-bearing		436.2	471.8
Cash and cash equivalents [1]	22	300.7	281.9
Total current assets		942.6	930.1
TOTAL ASSETS		1,531.4	1,442.1

[1] Included in net interest-bearing debt.

The Notes on pages 22 to 63 are an integral part of these consolidated financial statements.

EUR million	Note	31.12.2015	31.12.2014
EQUITY AND LIABILITIES			
Equity attributable to the equity holders of the parent company			
Share capital		**17.2**	17.2
Share premium fund		**20.2**	20.2
Treasury shares		**-17.4**	-18.0
Reserve for invested non-resticted equity		**93.8**	93.0
Other reserves		**-14.2**	-13.1
Retained earnings		**319.6**	345.8
Profit for the period		**-17.3**	0.2
		401.8	445.3
Non-controlling interest		**2.9**	-
Total equity	23	**404.7**	445.3
Non-current liabilities			
Interest-bearing debt [1]	26	**291.4**	242.6
Derivative financial instruments	19	**1.0**	0.4
Deferred tax liabilities	12	**51.9**	36.7
Employee benefits	24	**51.8**	50.7
Provisions	25	**1.1**	17.4
Trade and other payables	27	**18.0**	10.3
Total non-current liabilities		**415.2**	358.1
Current liabilities			
Interest-bearing debt [1]	26	**47.7**	30.7
Derivative financial instruments	19	**5.4**	8.3
Current tax liabilities		**4.6**	21.5
Provisions	25	**81.4**	48.0
Trade and other payables	27	**572.4**	530.1
Total current liabilities		**711.5**	638.7
Total liabilities		**1,126.7**	996.9
TOTAL EQUITY AND LIABILITIES		**1,531.4**	1,442.1