Modern evaluation of patents

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Abstract. The number of patents is not so important as the market value. The market value is especially important for licensing of patents, make-or-buy decisions for technology procurement, corporate finance. Patents can be used as collateral for financing. Patents and credit approvals: without patents only 46% and with patents 54%. The value share of knowledge-based components to industrial products already reached 50% and it is still rising. OECD called these developments under the slogan "knowledge economy". German Norm-DIN 77100 provides a working method for monetary evaluation of a patent. The value of a patent arises from its use. A patent can be used to protect or to earn licensing revenues. An evaluation expertise is required in areas, such as marketing, finance, R & D and strategic planning. As an indicator of the value of a patent is often used the number of citations. The number of a patent citation refers to its meaning and value. Other indicators would be: size of the patent family, validity of the patent, result of objections against patent application, number and quality of claims. The analysis of 9.000 patents resulted that only 7.2% worth over 10 million euro and 68% below 1 million euro. The cost method: it is considered the cost that would be incurred for the development and patenting of a similar invention. The market method: are used the prices that have been achieved in comparable with recently transactions. The Income method: the potential reward is measured, which can arise from a patent. The evaluation will be in the following areas: legal status, technology, market conditions, finance and strategy. Each question relates to a different parameter of a value.

1. Introduction
Today's value of a company is based on the core competencies, which cannot be rebuilt or imitated. This creates a differentiation in relation to competition. It is estimated that besides human capital and management, patents and brands are the fundamental key for the value of a company.

The factor of production is considered to be more important as traditional production factors like land, labor and capital. Another new feature is the high speed, created with new knowledge, the existing knowledge being devalued. The value share of knowledge-based components to industrial products already reached 50% and it is still rising. Inventions are considered to be a fuel for innovation and thus for the growth of economic prosperity [1].

The Organization for Economic Cooperation and Development (OECD) named these developments under the slogan "knowledge economy". The technical knowledge exists in the patent documents in 85-90% [2].

The immaterial patrimony of a company is represented by the technologies protected by patents and their relations with the customers. The number of patents is not so important as the market value. Until now NASA has filed about 6.509 patents. In developing the A6, Audi filed 9.621 [3].
In 2012 IBM was granted the most U.S. patents for the 20th year in a row, with one year record of 6478 patents. There are annual licensing royalties of about one billion U.S. dollars. For the last 10 years in a row, IBM has been awarded nearly 67,000 U.S. patents [4].

Worldwide, China is first at patent application. The country's five-year plan predicts how many patents must be recorded at every 10,000 people, but their quality is not always on the first place [5]. In many areas of technology the patent information can serve as an early indicator of product prognosis. Often the products do not appear until much later on the market.

The increasing importance of intellectual property leads to the development of new methods of patent evaluation. At the same time, individual patents or patent portfolios will be integrated actively through licensing or guarantees for financial loans in the economic life.

It is investigated a method of evaluation with practical application.

2. Make money with patents

Previously it was: no one can have our know-how. In recent years, it is realized an economic rethinking in order to use these patents at least commercially.

Numerous companies buy and sell on the stock exchange patents. Often it is monitored by legal means whether the patent rights are infringed [6].

The market for patents and licenses lies only in U.S. at 300 to 500 billion U.S. dollars, because parallel investigations are eliminated. The fundamental problem of licensing or selling patents consists in finding a more realistic method for appreciation of their value. The notion of patent refers both at the monopoly aspect of the owner as well as the related technology.

According to a study made by American National Bureau of Economic Research, the application for a patent costs in the U.S. 100,000 dollars and in Europe approximately 30,000 euros. The Fraunhofer Society estimates in Europe, a total cost of more than 100,000 euros, for the first ten years after registration.

The patents may also serve as security for financing: practice had showed that credit approvals without patents lie at only 46% and with patents at 54%.

Patents can provide other advantages: security of one's own monopoly position, protection against the monopoly positions of third parties.

In each development project, the patents are researched and evaluated, according to the prior art and foreign intellectual property rights [7].

There are excluded double research and collisions. In addition, a monitoring of competitive activities is carried out.

The patents are traded on the stock exchange. Patent auctions and funds offer new opportunities, which are not consisting in selling of used knowledge in the form of technology transfer.

Ocean Tomo LLC, the leading Merchant Bank for the financial evaluation of the intellectual property wants to bring out numerous financial products on the market, that provide for companies a control of risks and rewards of Intellectual Property (IP)[8].

The worldwide main suppliers are:

- Acacia Research ICBM, Ocean Tomo Houston, Chicago;
- Inflexion Point Strategy LLC and IPotential LLC in all USA;
- IP Value Management, - IP Auctions GmbH-Patent Agency PVA IPB Hamburg.

OCEAN TOMO Houston USA has a turnover of more than U.S. $ 800 million from selling patents per year [8].

As examples of completed transactions can be cited the following:

- in 2011 NORTHEL had sold patents for $ 4.5 billion to Apple and Microsoft;
- in 2012 KODAK had 1100 patents and demanded $ 4.5 billion. Apple and Google offered only U.S. $ 150-250 million. Ericsson, Schweden and Apple have resolved their patent dispute around more than 40 patents. From licenses and intellectual property, Ericsson Company expects in the current year total sales to 1.5 billion euros [9].
3. Patent evaluation

The evaluation of an enterprise and its patents is important in case of sale, merger or procurement of capital from the investment banks.

The value of a patent must necessarily include the prior costs of research and development.

The difficulties of patent evaluation depend much of the field applicability. In the pharmaceutical industry the relationship can be 1-1 patent-product, while at a vehicle motor can be hundreds of patents and the patent assessment weight is very difficult.

According to a study made in Europe, were analyzed 9,000 patents and as a result only 7.2% of these worth over 10 million euros and 68% for less than 1 million euro [10].

In many cases it makes more sense to evaluate whole patent clusters as individual patents. A general patent evaluation is not possible, because there must be considered both destination and date of patent evaluation.

The value of a patent arises from its use and it depends on bankruptcy, ongoing production, recyclers, bank and market users.

A patent can be used to protect products or to earn licensing revenues. As examples can be mentioned: the company evaluation for buying or selling, join ventures, patent infringement, service-offers such as technology transfer.

At the companies with many patents it must be analyzed an entire portfolio of patents, that may include improvement, basic and protection patents.

Numerous authors have researched this topic, one of the most appreciated being the St. Gallen approach to strategic management of technologies and patents [7].

The evaluation procedure of patents can be defined as in figure 1:

![Figure 1. Patent evaluation process.](image)

Quantitative methods are trying to establish a monetary value or a value based on monetary indicators.

The German standard DIN 77100 provides suggestions for the monetary patent evaluation. The valuation is based on the costs for the development and maintenance of patents.

Method "Cost Approach" or the price to purchase a similar patent: the price is defined by the utility of acquisition.

Often it is very difficult to appreciate the value of one patent. It must be analyzed the entire production process from the factors of production until marketing and business [11].
Method "Market Approach" or the price on the market or at the stock exchange, is the most used and it is based on the amount, that could be obtained through sale or similar prices with similar sold products. In this case it must be used a multiplier factor, that include both the actual price of the analogue patent as well as the annual income obtained by the analogue object. In the case of new, revolutionary developments there is no term of comparison. At the same time it must be analyzed the actuality of a technology in addiction with the time from its development. The practical difficulty is that the most of the data is secret.

Method "Income Approach" means the cash income that can be generated by the patent in the future: besides income it counts the savings obtained through not-payment of licenses.

Non-monetary assessment methods are based on indicators of patents, such as the number of countries in which the patent is protected, the patents legal status, number of citations, etc. [12]. There were developed various models of assessment based on abstract parameters similar with the assessment of building services. Among parameters are included the economic period, the remaining term, the number of the earning lawsuits and their value, the number of technology quotes made by neutral experts, etc. Based on these data correlated with values from the past was developed by IP Bewertungs AG a practical model of evaluation [12].

The value of a patent depends on several factors:

- **technological factors** - if a patent solves a technological problem, then either the products have a high quality and thus it can be achieved a better price for sale or the production costs decrease and the selling prices become more attractive compared with the competition. This advantage persists as long as the technology is not accessible to the competition. The benefits can also result from the partial sale of licenses or patents, that protect new technologies, which are still not applied in production, so they are substitute patents, but their use is excluded by the competition. It is important if the new technology is in production phase/sales or it is barely introduced into production. It must also be taken into consideration the cycle of innovation duration, the life cycle of the product correlated with the duration of patent validity. In general the life cycle of a product has several periods: introduction, growth, maturity and degeneration.
- **the legal factors of influence** refer to the territorial area of protection, protection area, patent age, etc.

Qualitative methods try to determine the importance of a patent without establishing a monetary value.

In the due diligence method are appreciated both the valuable positive and negative factors, that influence the value of a patent in order to minimize the risks of financial transactions. In the rating/ranking method there are studied various features of the patent and the evaluation is made by a set of values. Among these features are remembered: the market conditions, technological and financial aspects, legal status and strategic goals.

The method examines only the objective criteria or so-called empirical indicators, which are determined from statistical studies and related to the patent value. This allows the creation of a credit rating of patents. Within the non-monetary methods were developed some practical applications. European Patent Office- EPO has developed a specific software called IPscore [4], which based on evaluation standards in number of 40 can determine a rating, respectively ranking [13]. The U.S. Patent Quality Measurement together with Ocean Tomo Ratings ™ systems have found over 50 discrete patent attributes, that are tested for each patent and awarded points. The maximum score is 100. EPO holds PATSTAT database [14], which includes biography of patents and the patent legal status from the most important industrialized countries. There can be set directly online many parameters necessary for the analysis of a certain patent.
The EPO has also acquired, adapted and distributed the software "IPscore" [15] to the national patent offices of the EPO member states. IPscore was developed by Danish Patent and Trademark Office in collaboration with Copenhagen Business School and industry as a tool for the qualitative evaluation of patents. With the IPscore methodology were assessed technologies, patents and patent portfolios by the producer. This assessment is used in five areas, legal stand, technology, market conditions, finance and strategy.

Each question refers to a different parameter of value. For each answer, the patent will be evaluated depending on its strengths and weaknesses on a scale from 1 to 5.

As a strong indicator of the value of a patent is often the number of citations called "forward citations", this expression means how oft the patent is mentioned in future documents. The visible result of a corresponding analysis is a so called "citation network" that demonstrate connections and is used for evaluation. The number of citations of a patent refers to its scientific importance and therefore its value.

Other indicators for the value of a patent are: the size of the patent family, the validity of the patent, the result of objections against patent application, the number and quality of claims.

4. Patent activity
The patent activity indicates how many patent applications or issued patents can produce a company, but also prevents the competitor to apply an invention for the patent. The patent quality is measured using the patent citations and it is the most important indicator. There are forward and backward citations. Self-citations of patents refer to the citations and references to patent documents of the same applicant or inventor.

The recovery rate means the proportion of patents granted to all the patent applications of a company and is also a quality criteria. The patent width [16] contains the technical and legal width. Wider patents ensure a higher security against imitation. The technical width is measured by the number of notes of the International Patent Classification (IPC).

The legal width means the legal scope of protection, which is approximated by the number of claims per patent. Legal attacks on patents [16] refer to the opposition procedures or they can occur in the form of invalidation procedures. It is assumed, that the contested patents or the patents which have survived a lawsuit, are especially valuable because the uncertainties have been resolved.

5. The simplified method of patents comparison
The assessment is a process for determining the value of the benefits or the strength of a solution in relation to defined objectives.

The actual characteristics of individual solutions can be compared with the appropriate target characteristics or objectives. The points rating according to VDI 2225 [17] consists in essence of a series of operations that are supported by a scale of values.

The establishment of assessment criteria and investigation of their importance and definition of weight factors can be determined by the customer surveys, estimation in a team or by pair comparison. The assessment solution must be made in the scoring procedure by means of cost-benefit analysis. The criteria are divided again in technology, right standing, market conditions, finances and strategy.

The valuation in the scoring procedure consists of:
- the choice of criteria;
- the criteria weighting of 0 to 100%;
- the scoring system from 0 to 10.

The method underlies the acceptance that the overall benefit is greater, it can be achieved partial uses and the individual partial uses are higher. Therefore are determined the partial uses systematically by point rating for each patent and then added to a total value.
The overall benefit is equal to the sum of all benefits. A comparison between two patents in the field of the exhaust gas sensors for automobiles is studied in the Tab. 1. The patent solution 1 with a value of 39.30 weighted points is a better solution. Preferably, there should be determined the values, which correspond to the level of approximation of a solution to an ideal solution.

### Table 1. Patent Evaluation.

| Evaluation Criteria | Requirements | Weighting 0 - 100 % | Patents | Unit Value |
|---------------------|--------------|---------------------|---------|------------|
|                     |              | Points 0 - 10       | 0 - 10  |            |
|                     |              |                     |         |            |
| Technology          | Patent Quality | 25                 | 9       | 225        |
|                     | Forward Citation | 5                  | 7       | 35         |
|                     | Size of the Patent Family | 10                | 8       | 80         |
|                     | Technological Alternative | 45               | 7       | 315        |
|                     | Patent Wide | 5                   | 6       | 30         |
|                     | Number and Quality of Claims | 10             | 5       | 50         |
|                     | Validity of the Patent | 30              | 8       | 240        |
|                     | Result of Objection | 15              | 10      | 150        |
|                     | Patent Activity | 10              | 7       | 70         |
|                     | Share Quote | 10                  | 6       | 60         |
|                     | Objection Procedure | 15              | 10      | 150        |
|                     | Worldwide Patent Protection | 20         | 10      | 200        |
| Right Stand         | Opportunities | 50                | 9       | 450        |
|                     | Competitors | 30                  | 2       | 60         |
|                     | Technology Market | 20            | 5       | 100        |
|                     | Market Approach | 20              | 8       | 160        |
|                     | Income Approach | 30             | 9       | 270        |
| Market Conditions   | Non Monetary Evaluation | 20        | 8       | 160        |
|                     | Due Diligence | 15               | 7       | 105        |
|                     | Rating / Ranking | 15              | 6       | 90         |
|                     | Resources | 40                  | 10      | 400        |
|                     | Patent Culture | 10               | 8       | 80         |
|                     | Research | 50                  | 9       | 450        |
| Finances            | Valence | 39.30                |         |            |
| Strategy            | Rang Follow | 1                   |         | 2          |

6. Conclusions
The number of patents is not so important as the market value. The market value is especially important for licensing of patents, make-or-buy decisions for technology procurement, corporate finance. Patents can be used as collateral for financing. The value of a patent arises from its use. A patent can be used to protect or to earn licensing revenues. An evaluation expertise is required in areas, such as marketing, finance, R & D and strategic planning. As an indicator of the value of a
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The evaluation will be in the following areas: legal status, technology, market conditions, finance and strategy. Each question relates to a different parameter of a value. This paper proposes a method of comparison based on the German standard principle VDI-Ri 2225 between two patents in the exhaust gas sensors field at the vehicles.

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