

# Factors influencing technological asset value

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**Technological assets play an indisputable role in the development of an organisation's core competency (Harvey and Lusch, 1997; Korniczky and Stuart, 2002; Lev, 2001; Morris, 2001). Whenever these resources are exchanged on the market, and whatever the form of commercial transaction (Chiesa, et al., 2003), the determination of technological asset's value could present problems, because it is often affected by subjective estimations.**

**Questions concerning the economic value of technological asset have attracted interest of economists for years both from theoretical and empirical standpoint. In literature several issues have been discussed and several authors have identified and analysed the many different factors influencing the valuation of an technological asset, focusing for example on (i) their characteristics (Chiesa et al., 2003); (ii) the structure of commercial transactions (Anand et al., 2000) and (iii) the characteristics of the owner and the potential buyer (Berkman 2002).**

**The paper aims to make a step further in research in this field. More specifically, the paper aims at contributing to a better understanding of (i) which factors usually affect the value of an technological asset, (ii) how these factors actually impact on value, and (iii) whether and how a logical framework can be defined that links these factors to technological asset's value.**

**In order to answer to the research questions above, the first step of the research has been based upon a deep analysis of the current literature and several interviews with intellectual property managers of Italian firms and Intellectual Property consultants. This allowed elaborating a tentative framework that links the value of technological asset to a set of relevant factors concerning the characteristics of the technological asset, such as its uniqueness, its useful life, its usefulness for the buyer/seller and the strength of its legal protection. Then the framework identified other factors affecting indirectly the technological asset's value, for example the firms' patenting strategy. Afterwards, a case study has been carried out, in order to apply the proposed framework. The case study helped the authors to enrich the framework, pointing out its main advantages and limits.**

## 1. Introduction

Some authors (Lev, 2001; Morris, 2001; Utunen, 2003) agree on the fact that intangible assets, especially technological ones, create company's value. A technological asset (TA) is a combination of intangible asset and property assets that a company exploits for enhancing its value (Utunen, 2003).

There is no absolutely clear definition of what

constitutes an intangible asset, but OECD refers to “non material factors that contribute to the growth and performance of firms without being included in the traditional category of fixed (or monetary) assets”. The intangible assets covered by legal protection are called “intellectual properties” (also known as property assets). WIPO gives some examples of intellectual property (IP), which includes patents, trademarks, industrial design, copyright, and trade secrets (Harvey and Lush, 1997).

Among these resources, it is possible to identify

particular assets, which are technology-based, e.g. patents and technical know how. The paper is focused on technological assets because of growing in importance and value of these assets. Their rising in importance is due to a global change in general and some authors (Giordani, 2002; Lev, 2001; Rivette and Kline, 2000) indicated the key features of such changes in the globalisation of production, the massive increases in the mobility of capital, the digitalisation of computer and telecommunications.

Driving the recent surge in technological assets (and more in general of intangible assets) is the combination of two related economic force (Lev, 2001):

- the former is represented by the intensified business competition, brought about by the globalisation of trade and deregulation in key economic sectors, such as electricity and telecommunications);
- the latter is represented by the advent of information technologies.

These two fundamental developments (one economic-political, the other technological) have changed the structure of companies and have catapulted intangibles into the role of the major driver of business in development economies.

With the emerging of technology-intensive venturing business and the advent of knowledge-based economy, demand for technological asset valuation has increased. In fact it is treaded as an economic asset, that is an asset whose exploitation produces future economic net benefits (Boutellier, 2001).

Since the half of the 20<sup>th</sup> century, transactions for acquiring technological assets were occasional in frequency. The reason probably is because hi-tech company preferred to introduce an innovation by developing it in house (Giordani, 2003). Today the interest in external sources of technology asset is rising. In fact increased global competition is pushing companies to ever-shorter product and service life cycles, which in turn, require faster development cycle time. Consequently companies are recognising that they must turn to all sources of technology to improve speed (Chatterji, 1996).

The trend underlines the importance of technological asset value. In fact, in private sector, venture capitalists, consulting firms and technology brokers need systematic valuation methods for making decision on investment, licensing and strategic alliance (Park and Park, 2004).

Consequently there has been growing recognition that worth of a company cannot be gauged without knowing the value of technological asset. In response various valuation methods have been developed and used. The methods may differ one another in terms of criterion and procedure and the value of technological asset could be expressed in score, index or monetary value. Among them the monetary models attempt to measure the monetary worth of technological asset and for this reason they are the most desirable since they should produce real meaning of value (see Tab. 1 for a brief presentation of valuation methods).

However even if these methods are used, they are disappointed in the practice. The reason is mainly due to the lack of reliability in estimating parameters required to

the proper methods application. In fact, for example, the income approach requires the identification of several parameters such as the future benefits or actualisation rate. These parameters are assessed basing on assumptions, which can be misleading.

Methods	Cost	Market	Income
<b>Definition</b>	Valuing based on cost reproduce or replace subject	Valuing based on the price of comparable subjects in market	Valuing based on the present worth of future income flow
<b>Advantages</b>	Easy to calculate if cost data is available	Possible to calculate the most rational value if market data is available	Possible to capture present worth based on profit generating capability
<b>Disadvantages</b>	Ignorance of future potential of subject	Lack of market data on comparable assets	Chance of error due to subjective estimation

Table 1. Comparison of three basic methods (Park and Park, 2004).

Consciously of this problem, the paper aims at analysing and understanding (i) which factors usually affect the value of a technological asset (such as the uniqueness of technology or its stage of development, (ii) how these factors affect the value of technological assets and (iii) how the accuracy of collected information impact on it. The paper intends defining a logical framework able to link factors to the value of technological assets.

## 2. The state of the art

In the academic and consulting literature, several contributions are dedicated to underline value that is embedded in a technological asset. These contributions presented and analysed factors and elements affecting the value of a technological asset.

Park and Park (2004) in their work classified factors influencing the value of a technological asset into two sub-factors:

- intrinsic factor
- application factor

Intrinsic factor represents natural characteristics of subject technology. Specifically intrinsic factors consist of proprietary position, level and life of technology, and degree of standardization.

Application factor accounts for the practical usage of subject technology. This sub-factor is comprised of type of technology, contribution ratio scope of application, degree of completeness. The authors gave an operational definition of intrinsic and application factors (see Table 2).

Other authors presented several elements in determining the value of technological assets in the following typologies of transaction (Anand and Khanna, 2000; Epstein and Marcus, 2003; Goldsheider, 1995; Kamien and Tauman, 1986; Mendi, 2003; Sommer 2002; Yau-Young and Ziemer, 1992) (Table 3):

- the transfer of ownership (such as the assignment

for money consideration);

- the transfer of the right of use (such as the licensing of patent or know-how).

Intrinsic Factors	Operational definition
Proprietary position	Degree of protection
Level of technology	Technical level of subject technology as compared to state of the art
Life of technology	Incoming generating duration of subject technology
Degree of standardization	Degree of standardization and interoperability of subject technology
Application Factors	
Type of technology,	It can be product, process or material technology
Contribution ratio	Contribution ratio of subject technology to total value
Scope of application,	Variety or extent of fields to be marketed or applied
Degree of completeness	Readiness for commercialisation of subject technology

Table 2. Operational definition of intrinsic and application factors (Park and Park, 2004).

Elements affecting the value of technological asset in different typologies of transaction
Exclusivity
Proprietary position (strength of patent coverage)
Stage of development
Geographic territory
Special characteristics of technology (unique breakthrough vs. improvement)
Remuneration forms
Uniqueness of technology
Length of agreement
Availability of technology release

Table 3. Elements affecting the value of technological asset in different typologies of transaction.

Medius Associates (2001) elected to undertaken survey in order to identify and investigate the factors that affect the value of a technological asset. The survey highlight the factors listed in Table 4.

Factors affecting the value of technological asset
Strength and scope of intellectual property rights
Territorial extent of rights
Exclusivity of rights
Level of innovation
Durability of technology
Availability of other technologies
Inherent risk
Stage of development

Table 4. Factors identified by Medius Associates' survey (Medius Associates, 2001).

Likewise, Pharmalicensing (2000) agreed the technology value depend on factors listed in Table 5.

Analysing the contributions presented in academic and consulting literature, authors identified and proposed different factors influencing the valuation of a technological asset. The factors can to be grouped into two classes (table 6):

- the former refers to the specific technology asset (class 1);
- the latter refers to the structure of commercial

transactions (class 2).

Pharmalicensing's factors
The strength of the intellectual property
The exclusivity of the rights granted
The territorial extent of the rights granted
The uniqueness of the technology transferred
The stage of development of the technology
The risk associated with the product

Table 5. Pharmalicensing's factors (Pharmalicensing, 2000).

Class 1
Availability of other technologies
Application fields
Contribution ratio
Degree of completeness
Degree of standardization
Durability of technology
Inherent risk
Level of innovation
Life of technology
Special characteristics of technology (unique breakthrough vs. improvement)
Stage of development of the technology
Strength of the intellectual property
Type of technology
Uniqueness of the technology transferred
Class 2
Exclusivity of rights
Remuneration forms
Territorial extent of rights
Length of agreement
Availability of technology release

Table 6. Factors influencing the valuation of technological asset.

Other authors in their works stressed the importance of a viable alternative in valuing technology asset. The viable alternative can be represented by having (i) more than one counterpart interested in accessing to technological asset (Abbott, 2003; Choi and Weinstein, 2001) and (ii) the opportunity to exploit internally the technological asset (Berkman, 2002).

In contrast with this literature, a complete and systematic analysis of factors affecting (i) the definition of technological value and (ii) how these factors actually impact on value is lacking.

Thus, considering what the academic and consulting literature said, the paper aims at:

- studying in depth the valuation issue, identifying factors affecting the value of a technological asset;
- understanding how the above factors influence the technological asset value, recognizing the critical problems to be solved during the analysis; and
- describing the relationships between these factors and the value ,

### 3. Methodology

As said above, this paper focuses on the identification of critical factors affecting the valuation of a technological asset and consequently the estimation of the technological asset value.

According to the aim of the paper, and to the state of the art literature, the methodology adopted for the research is based on the involvement of several interlocutors such as IP managers and directors and consultants in IP rights (Table 7).

Institutions	Brief institutions' description	Role of interviewed people
Bianchetti Bracco Minoja	Consulting and assistance in patent and trade mark field	Consultants
EPO	European Patent Office	Examiner
Italtel	Supplier of telecommunications devices	Intellectual Property Manager
Newron	Biopharmaceutical company	Vice President, Business Development
Pavia Ansaldo	Law Firm	Attorney
Pirelli	Group operating energy cables, telecom and tires businesses	Intellectual Property Manager
Politecnico di Milano	Technical University	Director of Technology Transfer Office
Saes Getters	Scientific and Industrial Application company	Intellectual Property Manager
Snamprogetti	Engineering company of the ENI Group (petrochemicals)	Licensing & Technology Planning Department Manager
STMicroelectronics	Global semiconductor company	Intellectual Property Manager
Studio Torta	Industrial Property Consultants	Attorney

Table 7. Institutions involved in the research.

Data and information have been collected through more than two direct interviews for each institute.

The institutes had been selected considering:

- the presence of intellectual property division in the institute, and
- the availability of institute and its interest in topic.

The interviews had been conducted using open questions focused on four macro topics: intellectual property importance topic, legal protection topic, valuation process topic, and valuation methods topic.

The development of the findings was done through an iterative process of ongoing comparison between the existing data (results of the interviews and literature analysis) and the emerging constructs (the framework of the factors determining intangible asset value) (Eisenhardt, 1989). Initially, emphasis was on making rough frameworks that would guide later interviews. As an intermediate step, the emerging data was related to the received literature pertaining to the intangible asset valuation issues and the focus on the questions and the framework was sharpened.

Finally, a more systematic comparison was made between data and the emerging findings, and the concept developed was discussed with several respondents. Moreover, a case study has been considered in which a company has to value its own technical know how for licensing out. The case study gave some more insights to enrich the conceptual framework, to improve its validity,

and to define its potential use and the opportunity for further research.

## 4. Factors influencing the value of technological asset: a reference framework

The following findings are the result of interviews and an in-depth literature analysis. The factors emerging as critical in the definition of the value of a technological asset has been classified into four groups:

- asset related;
- firm related;
- context related;
- risk related.

For each feature identified, a description and an operational definition and measure are given.

All factors are reported in Figure 1.

### 4.1 Asset related factors

Factors affecting the value of a technological asset can be referred to the specific characteristics of asset. In particular two types of characteristics have been identified. The former is referred to *technological feature* of asset; the latter is referred to the *legal feature* of particular legal form (eventually).

Technological feature represents the natural characteristics of subject assets. They comprise the *uniqueness of technology* and the *relevance of technology*.

Legal feature represents the degree of protection usage of asset. It is a measure by the *strength* and *duration of legal protection*.

Firms usually hold more than technology assets protected by legal right. In this case, firms hold a *technology asset portfolio*. Some portfolio characteristics can increase (or decrease) the value of each portfolio element.

(These factors have been identified with the contribution of Italtel, EPO, Newron, Pirelli, Saes Getters Group, Snamprogetti, STMicroelectronics)

#### 4.1.1 Uniqueness of technology

The uniqueness of technology refers to the extent to which there are competing technologies. The uniqueness of technology can be measured considering:

- novelty of technology level (described by the technological distance between the patented invention and the prior art)
- difficulty to invent around
- presence of alternative technological solutions
- feasibility of alternative technological solutions level

#### 4.1.2 Relevance of technology

The relevance of technology addresses the extent to which the asset is able to create customer value. Its value is measured by the extent to which it can be used in applications the firm can commercialise and the extent to which it contributes to satisfy customer needs. It is a

consequence of (Jones *et al.*, 2002):

- useful life of technology, which is the result of (i) technological family cycle of life; (ii) development stage of asset; and (iii) remaining time to market.
- usefulness of technology, This attribute concerns the contribution of technology to the creation of customer value. It is related to the extent to which the technology is critical to fulfil the key product (process) functions. It is the result of (i) number of different applications in which the technology can be embedded; (ii) number of industrial sector in which the technology can be applied; (iii) technological superiority, that is advantages over prior or existing technology; (iv) technology reproducibility, that is the extent to which the technological knowledge base which is behind the new asset; (v) contribution ratio, in fact a technology can be a part of a product or system; (vi) cannibalisation of existing asset.

#### 4.1.3 Strength of legal protection

This factor reflects the extent to which the technological asset can be protected against imitators.

Patenting is the most common legal protection used for technological assets. It can be defined as the patent's ability to protect the technology as well as the reasonable assurance that the firms will be successful in potential infringement cases.

The strength of legal protection depends on adopted legal protection strategy. The main strategies are (Warnik, 2000, Granstrand, 1999; Harrison and Rivette, 1998):

- single patent strategy. In this case the company protects its technology asset with a single patent; and
- multiple patents strategy. The company defends its technological asset with multiple patents. The strategies can be classified as:
  - (i) blanketing strategy: the efforts are made to turn an area into a "minefield" of patents. This strategy is the less structured way of tracking out multiple patents. In this case a company patented not only the base technology but also to patent peripheral and non-related technology;
  - (ii) fencing strategy: different patents are ordered in some way to block certain lines or directions of R&D (e.g. a range of variants of a chemical process);
  - (iii) surrounding strategy: a strategic patent is fenced in or surrounded by other patents. The surrounded patents are, generally, less important than strategic patent, but collectively block the commercial use of patent, even after its expiration;
  - (iv) networking strategy: a technological area is protected with a close network of patents filings.

Other factors affecting the strength of legal protection are (Aharonian, 2000):

- number of patent citations;
- supported expenses to create the legal protection and to maintain the protection legal;
- countries (and the number of countries) in which the legal protection is extended ;
- willing of the inventor to begin legal actions in case of patent infringements;
- portfolio position (the value of a single patent

depends on the overall portfolio to which the patent belongs).

#### 4.1.4 Technology asset portfolio

Several data and information are needed to value a technological asset embedded in a portfolio.

The relative size of portfolio is an element considered for valuing a technological asset; in fact, assuming that all things being equal, the larger the portfolio, the greater the value (Weinstein and Huang, 1999).

Another element is the quality of each portfolio. The quality of portfolio can be measured considering the portion of useful technological asset in the portfolio. The greater the portfolio's quality, the greater the technological asset's value.

#### 4.2 Firm related factors

A founding partner of Valuation Consulting Kelvin King (2001) said that the value of a technological asset "cannot be stated in the abstract, but it must be stated in a particular place, at a particular time and in particular circumstances".

Consequently, features of firm exploiting the technological asset can affect its value. The identified factors are referred to features of the potential user of technology asset; they are its *exploitation capability* and *intellectual property behaviour*. Another element is represented by the *viable alternative* for exploiting the technology asset.

(These factors have been identified with the contribution of Bianchetti Bracco Minoja, Newron, Pavia Ansaldo, Politecnico di Milano, Snamprogetti, Studio Torta)

##### 4.2.1 Exploitation capability

The exploitation of a technology asset depends on the availability of asset and competencies, such as production marketing, distribution and after sale service capabilities, which are complementary to the technological capabilities (Teece, 1986). These capabilities are thus the determinants of technological asset value (Chiesa, 2001). The strategic and marketing policies influence the market position of technology asset's user. Influencing the number of customer accessed to technology asset, these capabilities affect the value of asset (in fact, the greater the market share, the higher the future income flows).

##### 4.2.2 Intellectual property behaviour

Not only features directly backing to the asset or to the asset's user influence the value of a technological asset, but also the strategic importance ascribed to the asset and its role in corporate business strategy (Sullivan, 2000).

The strategic importance of a technology asset legally protected is connected with two dimensions:

- intellectual property intent, and
- intellectual property portfolio management

The former is focused on the reason that/why the legal protection is filed and used. The following intellectual property intents have been identified:

- defensive intent. The legal protection is considered a

weapon enabling the company to exclude competitors and secure as large a market share possible. (Thumm, 2001; Bhaduri and Mathew, 2003). It is also a tool to secure sufficient payback for R&D investments, especially in an environment of increased national and international technological competition (Ernst, 1995). Sometimes the legal protection can be used in the management of human resources, as a means of encouraging the creativeness of employees (Rahn and Scheer, 1993);

- offensive intent. The legal protection is considered an instruments able to cover technology likely to be need by or is useful to competitors (Capria, 1999);
- making money intent. The legal protection is used for economic reason (Thumm, 2001). Revenues can be generated in different ways for example the direct sale of products legally protected, licensing rights to the products or strategic alliances formed to reach new markets for the products (Rahn and Scheer, 1993; Sullivan, 2000; Bennet, 2002);
- increasing bargaining power intent. The legal protection allows rising the provision of better negotiation positions for example in licensing agreements (Rahn and Scheer, 1993);
- imagine intent. The legal protection is considered an instrument aimed at bolstering a company's public image as a technologically strong enterprise (Rahn and Scheer, 1993; Thumm, 2000);

The latter dimension is referred to a company holding strong legal protection rights (portfolio) and how it is managed. A portfolio can be managed in different way according to the expectation a company has about the intellectual property contributions to the company's goal (Table 8).

Types of management	
no criteria	the legal protection is considered an instrument to protect firm's technology assets. The management of these assets does not follow any criteria. Having a very high number of patents is the only guideline of this management
cost cutting	the legal protection is an instrument to protect firm's technology assets. The management of these assets is focused on reducing their costs. The company recognizes that the maintenance fees of legal protection are high and consequently refines and focuses both protection creation and portfolio to control costs.
revenue maximization	the legal protection is considered a business tool, an instrument able to generate additional incomes. So the management of intellectual property portfolio is driven by the idea to obtain and extract revenue
integration	the legal protection is embedded in the company's day to day operations and procedures. The focus is on intellectual property not only as an asset, both legal and strategic, but also as a support of decision making process
visionary	the legal protection is considered a tool to create opportunities for future margins. The companies try to foresee future trends and technologies. They place themselves as leaders in the field by acquiring or developing intellectual properties that could empower their position.

Table 8. Intellectual property portfolio management (Chiesa and Gilardoni, 2004; Davis, 1998, 2003; Harrison and Rivette, 1998; Petersson and Ekstedt, 2002; Sullivan, 2000:).

#### 4.2.3 Viable alternative

Having a viable alternative could influence the value of a technology asset. If the technology asset is appreciated in order to conclude a commercial transaction in which the technology asset's right of use is transferred<sup>1</sup> and if the licensor has suitable alternative licensee, he can threaten to leave the bargaining table and deal with an alternative licensee for obtaining the best deal (Choi and Weinstein, 2001). Having more than one licensee is the viable alternative. In other cases, a viable alternative could be represented by the licensor's opportunity to exploit internally the technological asset.

This element has to be considered on a double track: the licensor could have as viable alternatives the opportunity to exploit internally the technological asset or more than one licensee. Vice versa, the licensee could have the viable alternative to develop it internally or more than one potential licensor.

#### 4.3 Context related factors

Another group of factors could be introduced for in order to appreciate the technology asset value. This group collects factors referred to the characteristics of industrial sector of technology asset. Industrial sectors are absolutely different each other and they are characterised by specific features for example the innovation rate, the growth rate, the degree of competitiveness.

This variable has an impact on both asset related element and firm related element.

Consider for example a transaction of technology asset legally protected whose application is in an industrial sector characterised by a high innovation rate and competitiveness. The industrial features will affect:

- the firm's intellectual property behaviour. If technology assets are very innovative, firm will drive towards an integration of portfolio management in day-by-day operations (firm related factors), and
- the strength of legal protection. If the technology asset is very competitive, a strong strategy for protecting the asset will be chosen (asset related factors).

Finally, has to be considered factors linked with:

- conjuncture, the economic situation (in the specific market in which the asset impacts or worldwide) could influence the value. Specifically, favourable trends should increase the value whereas slumps should decrease it,
- cultural and social factors: this is a residual category which comprise (eventually) all non technical – economic factors which can affect the TA value (i.e. cultural traditions, legislation, social value scale). *Ceteris paribus*, these can potentially have an impact on the negotiation, and consequently on the TA value.

These, potentially, affect technological asset value.

<sup>1</sup> In this case the owner of a legal protection (licensor) grants to a third part (licensee) to use the asset legally protected, under the payment of a earning (Brooke & Skillbeck, 1994).

(These factors have been identified with the contribution of Bianchetti Bracco Minoja, Italtel, Newron, Pavia Ansaldo, Saes Getters Group, Studio Torta)

#### 4.4 Risk related factors

Another factors affecting the valuation of technology-based asset is the risk.

The dimensions of risk are the following:

- industry risk. Industrial sectors differ for example about growing rate. Consequently a level of risk could be defined to characterise the industry (see Table 9);
- purchasing power risk. Even if the expected stream of economic benefits from an investment could be determined with absolute certainty, risk still exists with regard to the purchasing power of the future money that are received;
- market risk. This dimension is associated with the “market psychology” (the demand for a specific technology asset can fluctuate) and the entering in a new market;
- technical risk. It represents the risk that (i) the technology asset does not achieve the desired level of performance and (ii) the development program does not end by the time required. This dimension of risk is influenced by two factors. The former is firm’s technological capabilities (internal and available or external but accessible)<sup>2</sup>. The latter is the distance between technology performance and state of the art<sup>3</sup>;
- manufacturability risk. Manufacturability risk refers to the risk related to the exploitation of the technology on an industrial scale. The risk is related to the conversion of a technology that has been demonstrated in a limited number of examples at lab scale into something that can be replicated many times at commercial scale;
- marketing-commercial risk. This component of risk refers to the possibility that a product could fail on the market or have a smaller market than expected. This type of failure is due to the actions of competitors and firm’s commercial capability;
- financial risk. This component of risk is related to the amount to be invested for bringing the technology-asset to the market. Sometimes the amount required is so large that the failure of the technology asset could cause strong financial difficulties to the user.

(These factors have been identified with the contribution of all involved institutes)

Industry	Product	Risk
Pharmaceutical	Cancer therapy	Low
Pharmaceutical	Erythromycin antibody	Low
Pharmaceutical	Alzheimer treatment	High
/Biotechnology		
Pharmaceutical	Diagnostic test	High
Biotechnology	Nucleic acid probe technologies	High
Biotechnology	Polymerise chain reaction	Low

Table 9. Summery list of industry risk (Licensing Executives Society, 1996).

## 5. The case study

The case study concerns two firms: an Italian company operating as a supplier in the automotive industry, named IC for confidentiality reasons and a company operating in Japan, in the same sector of activity, (named JC) both involved in the valuation process of the same technological intangible asset during a collaboration negotiate.

### 5.1 The context

IC is an Italian company which offers a broad range of rubber based components for three different markets (corresponding to three business units): Cars, Compounds and Truck & Railway & Industry (T&R&I). The case study is focused on the T&R&I division, which produces: air springs, anti-vibration systems and brake hoses for the Truck and Railway markets; dock fenders and expansion joints for the Industry market. Anyway, the main business of the division is the production of air spring systems for the truck sector. The air spring production technology represents a critical competence for the business unit, but it concerns a mature and quite diffused technology.

In 2002, the T&R&I business unit of IC and JC, one of its most important Japanese clients, started the valuation of a technological collaboration. The content of the collaboration should have been IC’s know how in the air spring systems development, testing, prototyping and production technology.

JC is a manufacturing firm, which works in the sector of automotive components (wipers, precision parts, brake parts, anti-vibrations) and other non-automotive businesses. The relationship between IC and JC is a very long-term one (more than 25 years) and the Japanese company plays a very important role in maintaining the presence of IC in the Far East market. In fact they buy from the Italian company different products (also the air spring systems) and sell them to the most important car and truck producers in Japan. JC intended to learn from IC the know how necessary to realize a testing and prototyping laboratory in Japan, in order to develop by themselves highly customized air spring systems and to offer their clients a very high service level in term of aftermarket assistance, seen this variable seems to be very important to gain a competitive advantage in the automotive market.

The companies decided to sign up a technical licence

<sup>2</sup> It could be measured for example by level of R&D expenditure, quality of human resources employed in technology development activities, breadth and depth of the technological knowledge available and level of equipment used in the R&D activity.

<sup>3</sup> It measures the technological superiority of asset. It could be measured considering if the technology is (or is not) radically new. In other words, it represents (or does not represent) a strong discontinuity with the existing state of the art.

agreement, according to which JC will receive technical assistance from IC in order to learn the air spring production technology and realize a testing and prototyping laboratory in Japan. This agreement will not give JC the right to produce air spring systems based on IC's proprietary technology by itself: the Japanese firm will go on buying the product from IC and selling it to its clients. Moreover, JC will pay for the technical assistance an initial fee and a royalty calculated as a percentage of the future sales of air springs imported from IC on the Far East market.

## 5.2 Factors influencing IC's technical know how value

The factors previously identified as the variables capable of influencing technological asset value, are now considered with respect to the case of IC and JC. The objective of the analysis is to understand whether they have influenced the process of valuation of IC's know how in the air spring systems technology or not, together with the impact they've had on this assessment (the factors have been divided into *not relevant*, *quite relevant*, *relevant* or *very relevant* variables).

### 5.2.1 Asset related factors

- Uniqueness of technology: very relevant. This element influences the value of IC's technical know how, that is concerned with a mature and quite diffuse technology, with valuable alternative solutions. In fact, whether JC hadn't have obtained what it wanted from IC, it would have been simple for them to find another player ready to sell this specific know how or an alternative technology;
- relevance of technology: very relevant. IC's technological asset is very important in order to create customer value; JC, in fact, considers that being capable of developing by itself highly customized air springs and offering their clients a very high service level in term of aftermarket assistance is a critical variable to gain a competitive advantage in the automotive market. Moreover, even if it is a completely developed technology, its remaining time to market seems to be very long (there aren't any new solutions capable of replacing it) and it can be used in different industrial sectors and products, significantly contributing to fulfil their key functions;
- strength of legal protection: quite relevant. The transaction between IC and JC takes the form of a licence agreement, according to which JC does not have the right to produce and sell air spring systems based on IC's proprietary technology by itself. In this case the value of the technological asset is not considerably influenced by the legal protection strategy adopted by IC, because the advantages for JC do not significantly depend on the extent to which the technology is protected against imitators;
- technology asset portfolio: not relevant. The transaction between IC and JC is strongly focused on a single and specific technology, whose value is not

appreciably influenced by the size or the quality of the portfolio that it belongs to. Moreover, it doesn't seem that IC owns a significant technical portfolio whose wideness or usefulness can affect the value of the technological asset that represents the object of the transaction.

### 5.2.2 Firm related factors

- Exploitation capability: very relevant. In the assessment of IC's technical know how it is very important to consider whether JC has all the complementary assets to make the most of the technical know how acquired from the Italian company or not. In particular, JC is a big manufacturing firm which supplies the most important truck producers in Japan, and owns the marketing, distribution and after sale service capabilities to exploit IC's technological asset in the best way;
- intellectual property behaviour: relevant. From JC point of view the intent is defensive. The JC wants to increase its turnover on the sales of air springs, developing by itself highly customised products for its clients and offering them an aftermarket technical assistance, that is relevant for the competition in the sector;
- viable alternative: very relevant. IC does not have any alternative licensees with which bargaining for obtaining the best deal. If the Italian company wants to exploit its technical asset in order to gain an extraordinary income, the only way it has is to sign a deal with JC. IC nowadays exploits the air spring technology internally, in spite of this, some geographical markets are accessible only by a Japanese company. On the JC side, the internal development of the technology is disadvantageous because it requires a very high level of investments but JC could easily obtain the same license by other companies different from IC. Moreover, during the bargain, IC had considered this agreement as starting point of a wider collaboration.

### 5.2.3 Context related factors

In the case of the technological transaction between IC and JC, the characteristics of the industrial sub-sector they belong to are very relevant in influencing the value of the traded technical know how. In particular, the market of the suspension systems for trucks or heavy vehicles (where air springs are used) have neither a high innovation rate nor a significant degree of competitiveness, but it is characterized by a relevant growth rate, especially in the Far East and by saturation in the western markets.

Those variables have a deep influence on the uniqueness of the technology, on its relevance and on the strength of needed legal protection. At the same time, they impact on the intellectual property behaviour of the licensee and on the risk that affects the technological transaction. Conjunction and cultural – social factors, even actually found in the case study, seems to don't have affected the transaction value.

#### 5.2.4 Risk related factors

The following dimensions of risk are capable of influencing the valuation of IC's technical know how, more specifically:

- industry risk. The sector of suspension devices for heavy vehicles is characterized by a low degree of inherent risk and turbulence;
- purchasing power risk. The assessment of IC's technological asset value is obviously affected by the variation over the time of the purchasing power of future money that are received;
- market risk. There is no market risk in the case of IC and JC, in the sense that the demand for the air spring technology seems to be very steady, the market in which it is used is well known and it doesn't have a high innovation rate;
- technical risk. There are no risks that the technological asset does not reach the desired performances, seen it is a mature technology, completely developed and tested;
- marketing-commercial risk. The stream of economic benefits that IC will obtain licensing out the air spring technology, cannot be defined with absolute certainty. In fact the part of the payment by JC represented by the royalties on its future sales has uncertain entity, because of the high unpredictability of its sale volumes;
- financial risk. The amount that JC has to invest in order to realize a laboratory, which is necessary for developing customized air springs for its clients and offering them after sale assistance, is not very large. This means that there isn't a high risk that the failure of the technological asset can cause strong financial difficulties to JC.

On the other hand, the manufacturability risk is not relevant in assessing IC's technological asset value. In fact, it is not possible to talk about this kind of risk, because JC does not licence in the technology in order to produce by itself the air spring systems.

#### 5.2.5 Final remarks

The application of the framework to the case study doesn't have disclosed any other factor, apart from those presented in the previous paragraph. Moreover, during the valuation process the relevance of these factors has been demonstrated. In fact, applying for example the income method, it results a transaction value, which is not reported for confidentiality reasons. But, the real price, paid by JC, was significantly different. The selected method has been applied without considering the aforementioned factors and this explains this difference. In this case, asset and firm related factors influence the valuation while others (especially in context and risk categories) do not. In Table 10, are presented in details all case study factors and the qualitative importance they hold in the specific analysed agreement.

Factors	Impact of the factors
<b>Asset related factors</b>	
Uniqueness of technology	Very relevant
Relevance of technology	Very relevant
Strength of legal protection	Quite relevant
Technology asset portfolio	Not relevant
<b>Firm related factors</b>	
Exploitation capability	Very relevant
Intellectual property behaviour	Relevant
Viable alternative	Very relevant
<b>Context related factors</b>	
Industrial sector	Very relevant
Conjuncture	Not relevant
Cultural and social factors	Not relevant
<b>Risk related factors</b>	
Industry risk	Not relevant
Purchasing risk	Not relevant
Market risk	Not relevant
Technical risk	Not relevant
Marketing-commercial risk	Quite relevant
Financial risk	Not relevant
Manufacturability risk	Not relevant

Table 10. The impact of the factors in the case study

## 6. Theoretical and practical considerations

The literature analysis and the extensive empirical research over factors affecting technological asset value have showed their presence and grouped four categories. These factors have to be taken into account during the valuation process, cause of their potential relevance and capability to influence the value and determining deep differences in the final result. What emerged is that factors may have a direct impact (in terms of increasing or decreasing) on the technological asset value (i.e. the uniqueness of technology) as well others have to be contextualised in the specific transaction to understand which role they play (i.e. cultural and social factors). In this phase, the impact these factors produce on the accuracy of the value estimation has been indicated in a qualitative way, here summarized:

- asset related:
  - uniqueness of technology: the fewer the alternative technologies, the higher the value of the TA;
  - relevance of technology: the higher the relevance of the technology, the higher the value;
  - strength of legal protection: the stronger the legal protection, the higher the value;
  - technology asset portfolio: the larger and the greater portfolio's quality, the greater the value;
- firm related:
  - exploitation capability: the higher the exploitation capability of the firm, the higher the value;
  - intellectual property behaviour: even if this can be considered as a contextual factor, some suggestions emerge from IP intent and portfolio management:
    - IP intent: only an image intent should decrease the TA value;
    - IP portfolio management: only a cost cutting

portfolio management should decrease the value;

- viable alternative: the fewer the viable alternatives, the higher the value;
- context related:
  - industrial sector: the impact on the value depends on contextual factor;
  - conjuncture: favourable economic conjuncture increases the value;
  - cultural and social factors: the impact on the value depends on contextual factor;
- risk related: : the lower the risk associated, the higher the value.

The limit of this framework consists into the qualitative approach followed, which, suggesting factors and effect on the value, doesn't support the decision maker in determining their quantitative impact on the final monetary value. A further step in the research will be exactly the intent to link together each impact to a size to quantify a monetary value.

## 7. Note and references

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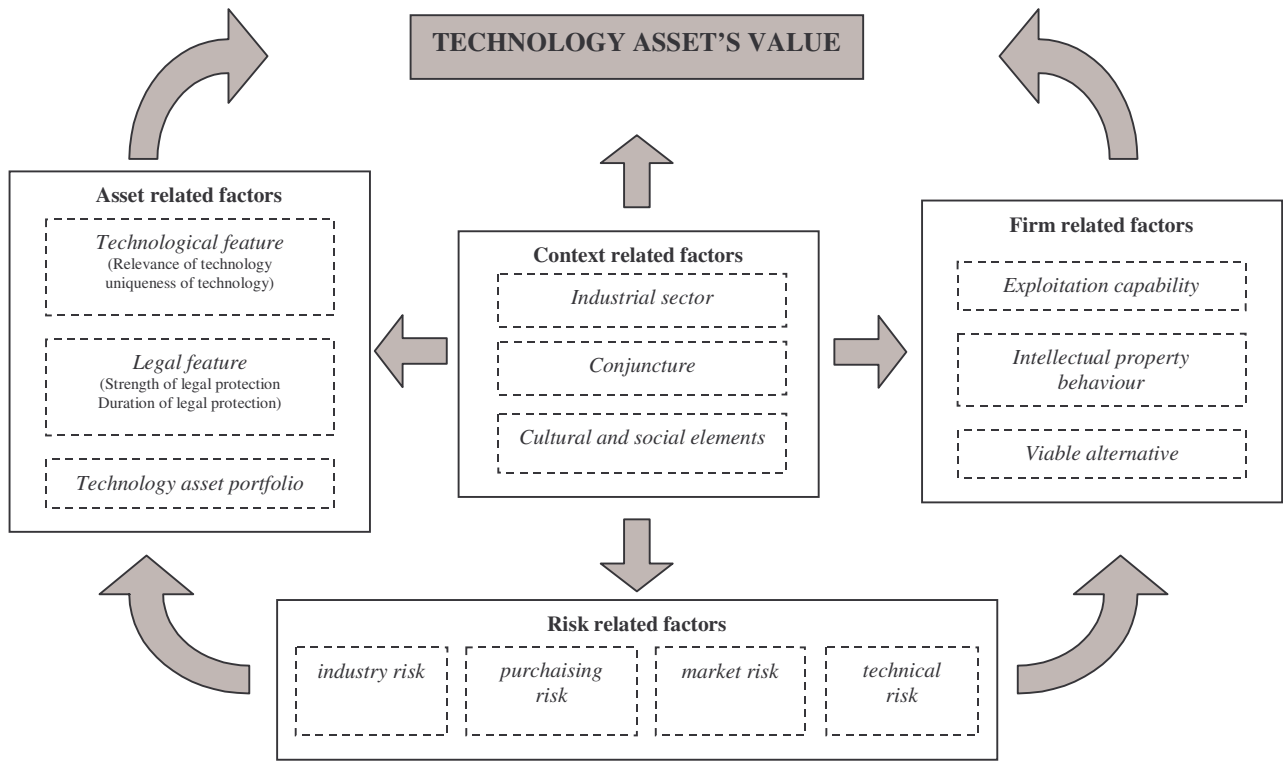


Figure 1. The framework explaining the impact of the factors, and their relationships, on technology assets value