

Real Options in the Valuation of Intangibles: Managers' Perception

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Abstract: The aim of the present is to verify the degree of applicability of the financial valuation method developed by Rodríguez-Castellanos et al. (2006a, 2007) for the valuation of real option-based intangibles in the Spanish region of the Basque Country. The field study consisted on a telephone survey of CFOs in a random sample of Basque Country's firms, selected using segmentation criteria based on size and business sector. Considering the 517 replies received it is stated that, despite three of every four CFOs answering that options were included in their intangibles, approximately one of every five is actually capable of identifying such options. When we consider the difficulties encountered in estimating the model's parameters, the conclusion is that less than 10% of the region's firms are likely to be in a position to directly apply the method proposed for the valuation of real option-based intangibles, which means a preliminary phase of analysis and diagnosis is required before the method can actually be applied in practice. The present paper makes a substantial contribution because it's the first study that tries to verify the utility of a method for the financial valuation of intangible resources to take into account the associated real options. It could be useful from an academic and managerial point of view.

Keywords: real options, intangible resources, core competencies, financial valuation, intellectual capital, intangibles' valuation

1. Introduction¹

The management of intangible resources –also called *intangibles*–is a major preoccupation for businesses today. Knowledge-related resources, also called *intellectual capital*², give particular cause for concern (Hussi, 2004; Kaufmann and Schneider, 2004). The proportion of intangible of a company's total resources is often greater than its material assets. However, the value of most *intangibles* does not appear on the financial statements, largely because the lack of transparency and the absence of a benchmark market make it difficult to value them (Lev and Zarowing, 1998).

Some authors think providing explicit information on a company's business intangibles is unnecessary, because the market does this through the valuation of firm's securities. However this approach does not solve the problem of individual intangible valuation. Besides, to apply such valuation to non-quoted companies it's always necessary the arguable reference to similar quoted companies. A further problem is that such reference is based on the equally questionable assumption that the stock market is continuously efficient.

Intangibles, and knowledge-related intangibles in particular, are vital to the generation of competitive advantage and value creation in firms (Hall, 1992; Teece, 1998). The obvious limitations of the information provided by stock markets encouraged research in identifying and valuing business intangibles. The growing store of knowledge on intangibles and their valuation is helping to reduce information asymmetries on the market. It also helps to improve the way a company manages its intangibles, enabling it to assign its assets more efficiently and give greater guarantees when looking for financial resources (Rodríguez-Castellanos *et al.*, 2006a).

The search for true and simple methods and models for the financial valuation of intangibles is not easy. We consider more appropriate the models which combine cash flow discounts with the real options approach.

^[1] The paper includes results from the University-Business Research Project UE05/A24, financed by the University of the Basque Country (UPV) and the Management & Finances Forum. This is an association of CFOs from leading firms in the Basque Country.

^[2] The concept of *intangible* is wider than *intellectual capital*, since it includes resources as corporate image, shared values, and so on, that not are referred directly to knowledge (Seetharaman *et al.*, 2002). But most of intangibles include combinations of knowledges, emotions, values and desires, for what many authors use the terms *intellectual capital* and *intangibles* as synonymous (Lev, 2001).

These methods allow bearing in mind the possibility of some intangible having an additional value because it contains real options. These proposals are based on the distinction between the effect of intangibles on a company's current earnings and the possibility of a positive influence on company earnings in the future.

Most attempts at implementing intangible valuation models have involved large companies. Very little research has focused on valuation methods and models that might also be applicable to small and medium enterprises. As Andriessen (2005) notes, research seeking to compare and contrast the potential for the practical application of intangibles' valuation methods is scarce, even though the need to establish their validity and applicability is clear. This is especially true in case of real option approach because of the major technical complexity of the method, as compared with the traditional models.

The present paper focuses on verifying the applicability of the model developed by Rodríguez-Castellanos et al. (2006a, 2007) for the financial valuation of intangible, taking into account the associated real options. It is part of a wider research programme undertaken with members of the Management & Finances Forum.

The main concern of the study is to know if the CFOs are conscious about the possibility of some intangible having an additional value because they contains real options, and if CFOs are able to identify them and quantify the parameters required to value the identified options. It has directly used the opinions of a representative sample of firms from all sectors of business and company sizes, facilitating comparisons in size and sector.

The results show that very few firms are likely to be in a position to a direct application of the real option-based valuation method. Only one in every five firms was capable of identifying intangible-related options. Roughly half of these would not be able to estimate any of the required inputs. It's disclosed that in most cases a preliminary phase of analysis and diagnosis would be required before the method could be applied practically. The complexity of the preliminary phase would depend on the degree of managers' knowledge about the intangibles and the options associated with them.

Section 2 of the paper provides a review of the main contributions on the financial valuation of intangibles. This section pays particular attention to the real options approach. Section 3 summarizes the intangibles' valuation method used as a reference herein. Section 4 presents the methodology used and the way the firms were selected. Section 5 shows the results of the empirical study. Conclusions are given in section 6.

2. The financial valuation of intangibles

2.1 Some approaches

Research on the assessment of intangibles that began in earnest in the 1990s focused principally on measurement. Measurement performs two tasks: first, it seeks to identify and classify intangibles, i.e. to discover what types of intangibles there are in particular firm, which of them are generators of core competencies and how they interrelate. Second, it searches for indicators to measure them, to see how they develop and when appropriate, this information is used to compare the company's situation with other benchmark organizations. These indicators are mainly ratios. This means the measurement of intangibles has basically been approached in non-monetary terms. Contributions by Brooking (1996), Edvinsson and Malone (1997), Kaplan and Norton (1997), Roos *et al.* (1997), Sveiby (1997) and Bueno (2003) are of particular interest. Subsequently attempts were made to measure in monetary terms the contribution of each factor in firm's intangible resources. This is what we mean by "financial valuation".

Methods used fall into three groups³:

- ones based on the assumption of stock market efficiency (Rodov and Leliaert, 2002),
- ones based on cash flow discount, including Khoury (1998), Andriessen and Tissen (2000), Lev (2001), Gu and Lev (2001), Andriessen (2004), Rodríguez-Castellanos *et al.* (2006a, 2007) and McCutcheon (2007),
- ones based on the options theory, e.g. Pakes (1986), Newton and Pearson (1994), Mayor *et al.* (1997), Kossovsky (2002), Bose and Oh (2003) and Rodríguez-Castellanos *et al.* (2006a, 2007).

^[3] For a more extensive debate on the subject, see Rodríguez and Araujo (2005).

All three have advantages and drawbacks⁴. The search for true and simple methods and models for the financial valuation of intangibles is not easy. Between the existing methods we have choice the intangibles' financial valuation method propose by Rodríguez-Castellanos *et al.* (2006a, 2007), that is appropriate for valuing the intangibles of large companies, and also small ones where large databases are nor available. This method combines cash flow discounts with the real options approach. This combination is based on the distinction between the effect of intangibles on a company's current earnings (valuation as *basic project*) and the possibility of a positive influence on company earnings in the future (valuation as *real option*). The possibility lenfof both situations occurring at the same time is also admitted.

2.2 The real options approach

Originally conceived to value options on financial assets (*financial options*) (Black and Scholes, 1973; Merton, 1973), the options valuation methodology was rapidly adapted to the valuation of other assets. These included investment projects and tangible assets, leading to the "real options approach" (Dixit and Pindyck, 1994; Kogut and Kulatilaka, 1997; Amram and Kulatilaka, 1999).

A real option is a right – not an obligation- to take an action on an underlying nonfinancial, real asset. Real assets may include real state, projects, intellectual property, etc. most of which are not usually traded. If the action taken is to buy the underlying asset (new investment or increasing exiting one) is a call option. Otherwise, if the action is to sell the underlying asset (sale or exit from investment) it's said to be a put option. Further, the underlying characteristics of these options can also be applied to knowledge-related resources and other intangibles, thereby facilitating their valuation as options (Kogut and Kulatilaka, 2001; Bose and Oh, 2003; Andrikopoulos, 2005).

If knowledge is considered as an asset, and different option categories are very often found in all kinds of assets, the options valuation model can be applied to knowledge. Indeed, some elements of intellectual capital clearly have option characteristics. Patents, for example, may be considered as call options, as they give the right, but not the obligation, to exploit a product commercially (Pakes, 1986; Damodaran, 2002; Bose and Oh, 2003). The same is also true, in general, of intellectual property (Kossovsky, 2002) and even of R&D (Mitchel and Hamilton, 1988; Newton and Pearson, 1994, Bodner and Rouse, 2007), IT (Benaroch, 2002) or market research (Mayor *et al.*, 1997). The options approach may also be used to analyze and value the flexibility of industrial organization (Nembhard *et al.*, 2005), human resources management (Bhattacharya and Wright, 2005) and human resources training (Jacobs, 2007).

Therefore, the real options approach gives a framework where knowledge-related resources can be better valued, including their options characteristics (*knowledge options*). The options valuation methodology (formulae, parameters, and so on) has been devised and developed to value financial options, and therefore must be adapted to the real asset context. The valuation of knowledge options cannot ignore the major differences between these options and financial options, showed in Table 1. The uncertainty associated with their main features, pointed out in Table 1, i.e. the value and volatility of the underlying asset, exercise price and expiry date, makes it much more difficult to value knowledge options.

If the logic of financial options is strictly applied to the valuation of knowledge options, wrong decisions may be taken on the exercise of the last ones (Coff and Laverty, 2002). In knowledge options, there is a fair degree of autonomy to decide when the option should be exercised. However, while uncertainty over financial options totally dissipates when the option is exercised⁵, uncertainty may persist even when knowledge-based options are exercised. This is because, at the moment the option is exercised, manager receives weak signals about whether the desired competitive advantage will be achieved, i.e. about the value of the underlying asset⁶.

Uncertainty also exists about the exercise price. When a knowledge option is acquired, the exercise price is usually unknown. The attendant uncertainty can only be reduced by increasing the (often tacit) knowledge. Therefore, decision-makers may be tempted to delay systematically the decision to exercise the option.

^[4] Rodríguez-Castellanos *et al.* (2007) provide a review of methods for the financial valuation of intangibles.

^[5] Exercise price and exercise date are established beforehand. This eliminates uncertainty at the moment the option is exercised.

^[6] These signals may include glimpses of the evolution of technological knowledge, threats of rival firms entering, the skills of workers required to launch the project, etc.

Objective signals about the suitability of the decision are rarely forthcoming. Although such delay may reduce uncertainty, missed opportunities may also have harmful effects for the firm in a highly competitive environment.

Table 1: Differences between financial options and knowledge-based options

Facet	Financial option	Knowledge option
Initial uncertainty about value of a full-scale investment	Increases the value of purchasing an option	Increases the value of purchasing an option
Underlying asset value	Financial asset is traded in a competitive market and its current value is well known	Idiosyncratic knowledge-based asset lacking a competitive factor market is hard to value
Variance in asset's value	Fully specified: variation is available for publicly traded securities	Lack of competitive market thwarts calculating variance of value of the underlying asset
Ex ante specification of exercise price	Fully specified in option contract	Typically unknown at the time option is established
Ex ante specification of date option expires	Fully specified in option contract	Typically unspecified and flexible
Implication for option purchase decisions	Determine the value of purchasing options using rigorous option pricing models	Apply real option heuristics or frameworks in lieu of applying formal pricing models

Source: Coff and Laverty (2002, p. 36)

Another major factor differentiating knowledge options from financial options is the dependence of knowledge on other company resources. Knowledge management seeks to share knowledge. The aim is to spread knowledge throughout the organization to assure it generates as much value as possible. This complicates hugely the exercise of knowledge options. If a knowledge option is abandoned, the firm loses what it cost to acquire (or build up) the option, but the company also incurs additional costs. It has to disassemble the structures, processes and routines created to integrate the knowledge in the organization. Abandonment costs are very difficult to anticipate, as they depend on the links associating the project with other resources and routines, which evolve over time. The more integrated a knowledge option is with other resources, the higher the costs incurred by the company by allowing the option to expire.

Delay in exercising options combined with the growing cost of eventually abandoning them may induce bias in the exercise of options. If a decision to exercise or abandon an option has to be made and the cost of abandonment has greatly increased, it will probably seem better to exercise rather than abandon. Ultimately, more knowledge options would be exercised than the optimum.

A company can make the mistake of rejecting attractive projects if it applies the discounted cash flow model exclusively to value knowledge-based investment projects. By not valuing the knowledge options the projects might include, investments are likely to be lower than required. But the automatic application of the logic of financial options to knowledge options raises the risk of embarking on too many projects. Caution is therefore required when applying the logic of financial options to knowledge options.

3. Method for financial valuation of intangibles as real options

3.1 Benchmark method

For our empirical analysis, we take into account the method of financial valuation of intangibles proposed by Rodríguez-Castellanos *et al.* (2006a, 2007). This method is based on a specific taxonomy that distinguishes between “intangible assets” and “core competencies”, as intangible resources generators of value in business.

Intangible assets are taken to be those assets of a company that do not have a physical basis, and which are also “codified”: the relevant rights or the company’s appropriation capacity regarding the results generated have to be established by means of a contract, a regulation or some other deed of right. Patents, concessions, trademarks, licences and so on are therefore intangible assets.

Core competencies are those corporate characteristics or factors that give the firm a more or less sustainable competitive advantage over its competitors, generating significant value or benefit for the client (Hamel and Prahalad, 1994). We consider core competencies to be the main source of value in the company. The associated value depends on factors such as its sustainability and the degree of appropriability by the company of the results generated. They are usually associated with some knowledge category, particularly of a tacit type.

The method is designed to identify and quantify intangible resources in monetary terms. It assumes that intangible business value is to be found essentially in the firm's core competencies, as suggested by Andriessen and Tissen (2000), Viedma (2001) and Andriessen (2004). It is therefore mainly oriented towards such competencies.

According to the type of intellectual capital to which they are associated, core competencies are classified as related to Human Capital, to Structural Capital and to Relational Capital.

The method:

- starts from a strategic analysis of the firm to identify its core competencies.
- facilitates the individualized valuation of intangibles.
- is based on the discounted cash flow and real option valuation models. The election of the specific valuation model depends on the temporal dimension of the returns associated with the intangibles.
- considers standardized information from the financial statements and the perceptions of managers to maximize the information available for valuation.
- explicitly includes the possible existence of synergies between intangibles.
- is appropriate for the valuation of intangibles not only in large companies, also in small ones, non-quoted and/or that do not have large databases.

This paper only analyzes the degree of applicability of the method of valuation of intangible resources as real options.

3.2 Intangible resources as real options

A core competence or an intangible asset includes real options if the present possession or availability of that competence or intangible asset may affect company earnings in the future. The effect may be because it will permit the future acquisition of other assets or competencies, or because it will enable investment projects to be implemented in the future. In this case, they are investment or growth options, that are characterized like call options. The exercise of call options involves a payment to buy the underlying asset or to develop the new investment or the new core competence. However, the effect on future earnings could be related to the exit, total or partial, from an investment or current core competence, that are characterized like put options. The exercise of put options involves giving up receiving future cash flows and obtaining the sale value of investment.

Though it is not possible to reject, a priori, that the analyzed core competence or intangible asset contains options related to decisions of disinvestment, the model takes into account the options associated to a growth strategy, which carries the acquisition or incorporation of new assets, that is, call options.

Nevertheless, the characterization of these real options is not easy. First, the "underlying assets" need to be established. That is, the assets, competencies or projects that the current holding of the assets or competencies in question will enable the company to acquire or pledge in the future have to be identified. Then, to value the real option⁷ is necessary to estimate several parameters related to these underlying assets⁸, which is even more difficult. Such parameters include the moment in the future when the option can be exercised, the exercise price, the value of the underlying asset and its future volatility.

⁷ The valuation method derives from Black and Scholes (1973)'s famous proposal.

⁸ The only one of the basic parameters in the valuation of real options that is not related to the characteristics of the underlying is the risk free rate.

The first parameter involves estimating the time required for the new asset, competence or potential project to be developed. The date is clearly associated with the exercise of the option, because then the decision has to be taken on whether to take advantage or not of the potential benefits of the newly available asset, competence or project. In conventional option terminology, this is the *exercise date* of the option.

An estimate is also required of the future cost of acquiring the new asset, generating the new competence or undertaking the new project. At the moment the option is exercised, the acquisition of assets or competencies, or the start of a project must have some cost. Otherwise the value of the option would simply be the current value of the underlying asset. So an estimate is needed of the cost required by exercising the option, i.e. the *exercise price*.

We must also estimate the impact, and its sustainability, of the new asset or competence on net company earnings. This facilitates the calculation of the *value of the underlying asset*, i.e. the expected value, at the exercise date, of the new competence, the new asset or the new project. To do this we need to estimate its expected effects on the company's future net cash flows and for how long they will continue; so that, suitably discounted, they provided the expected value.

A decisive feature in the characterization of an option is the degree of risk associated with it. Uncertainty about the value of the future asset, competence or project is the key aspect of the value of options. Thus, *volatility* is an essential element in option valuation. The nature of the underlying assets considered makes estimating real option volatility difficult. CFOs were therefore given the opportunity to answer using a Likert scale, from 1 to 5, that would be "translated" into a quantitative estimate by the valuation team.

4. Methodology and sample selection

4.1 The questionnaire⁹

A field study was proposed to find out what companies thought about the financial valuation of intangibles and the degree of applicability of the method under review.

Data were collected via telephone survey. The questionnaire was submitted to a pre-test with members of Management & Finances Forum to identify problems regarding the interpretation of items. The definitive questionnaire's 20 questions were divided into three sections:

1. Questions 1 to 7 explore the importance of financial valuation of intangibles for firms in the Basque Country and the reasons for that importance.
2. Questions 8 to 13 provide information about the applicability of the financial valuation model for the company's intangibles as basic project.
3. Questions 14 to 20 analyze the applicability of the financial valuation model for the company's intangibles as real option that this paper refers.

4.2 Selecting the population

The study concentrated on firms of the Basque Country, an Autonomous Community of Spain, using selection and segmentation criteria based on size and business sector.

The territory was chosen for several reasons. Situated in the north of Spain, the Basque Country is a region with legislative capacity in certain areas and its own government. With a population of just over two million, the region accounts for roughly 5% of the Spanish population. The region has tax autonomy, collects all taxes and has the capacity to establish tax characteristics. It has suffered from a prolonged lack of natural resources, and not enjoying other advantages such as "economies of proximity" to the Spanish capital. Despite these drawbacks, it has one of the strongest industrial and business traditions in Spain. The economic crisis of the 1970s and 80s badly affected the major industries, and today SME provide the backbone of Basque business. In the aftermath of the crisis, commerce and services developed strongly. SME today employ 60% of the active population (Rodríguez *et al.*, 2003). The lack of natural resources and economies of proximity should make Basque firms value their intangible resources more highly.

⁹ The appendix shows the questions of the survey related to the analysis of this paper.

Information was obtained from the SABI database. Microbusinesses (< ten employees or < €2 million of annual turnover) were excluded from the initial population of 44,637 companies as being too small. This cut the population under consideration to 3,477.

Three criteria for size are habitually used: the number of employees, turnover and total assets. We chose the first one as being more stable over time and less subject to temporary factors. The population was subdivided into 2,451 small, 813 medium and 213 large companies.

To guarantee a minimum number of observations in each subgroup, businesses were grouped into four large sectors: (1) Primary, (2) Industry, (3) Construction and (4) Commerce and Services, subdividing the population into 34 businesses in the primary sector, 1,371 in industry, 447 in construction and 1,625 in commerce and services (Table 2).

Table 2: Distribution of population by size and sector

	SMALL	MEDIUM	LARGE	Total Sector
PRIMARY	24	9	1	34
INDUSTRY	881	394	96	1,371
CONSTRUCTION	332	97	18	447
COMMERCE & SERVICES	1,214	313	98	1,625
Total Size	2,451	813	213	TOTAL: 3,477

4.3 Obtaining the sample

We obtained a random sample of 517 companies. This gave a confidence level of 95% and a maximum level of error of ±4%. Table 3 shows the minimum number of questionnaires to be answered in each size and sector segment to comply with the desired levels of error and significance and the questionnaires answered.

Table 3: Distribution of sample by size and sector

SECTOR	Population	Target sample	Questionnaires answered
Primary	34	30	18
Industry	1,371	173	184
Construction	447	137	118
Commerce and services	1,625	176	197
SIZE			
Small (10-49)	2,451	182	241
Medium (50-499)	813	159	222
Large (≥500)	213	103	54

Minimum sample sizes were not achieved in “Large Companies”, “Primary sector” or “Construction”, despite the questionnaire being sent to all firms in these segments. The total sample size required (517 questionnaires) was reached by increasing the sample in the other segments.

A Call Centre conducted the field work trying an average 2.6 contacts with firms answering the questionnaire. Prior to the survey, a letter of presentation, enclosing the questionnaire, was sent to 1500 firms’ CFOs.

Table 4 summarizes the basic characteristics of the study.

Table 4: Technical details of study

Population	3,477 companies domiciled in the Basque Country
Sample	517 valid questionnaires to CFOs
Sample segmentation	Size and sector
Random error	For the entire sample, random error of ±4%, with confidence level of 95%, p=q=0.5
Data collection technique	Telephone survey of CFOs
Calendar	20 November 2007 to 14 January 2008

The answers obtained were subjected to a descriptive analysis, including the use of non-parametric tests depending on the characteristics of each question. Since the results relative to the third section of questions are given as qualitative distributions, the statistic χ^2 was used to perform the contrasts.

5. Results

5.1 Future development of new assets or competitiveness factors from current intangibles

The third section of questions began by enquiring about the possibility of some intangible resources having an additional value because it contains real options. In other words, CFOs were asked if at least one of their firms' key competitiveness factors, whether in isolation or combined with others, might permit the development in the future of new assets or competitiveness factors.

70.2% of CFOs answering the questionnaire considered there were options in their intangibles. However 69.1% of CFOs answering positively said they were unable to identify them. In short, just 21.7% of all CFOs answering the questionnaire considered options existed and was capable of identifying them. These results show that most of CFOs thinks that the intangibles have associate possibilities of future developments with options' characteristics, but the majority is unable to specify or identify them. A possible explanation may be that they ignore the real options framework or because even knowing it they consider that its application could be too complex and / or costly.

These findings are coherent with the scarce literature about the use by CFOs of the real options approach in analyzing and valuating business investments. Busby and Pitts (1997), analyzing how financial managers in the UK perceive real options, state that very few firms integrate the real options approach in their decision-making processes, although, in general terms, they are taken into account. Lander and Pinches (1998) point out the real option model has not been as widely used in companies the expectations predicted. Andrikopoulos (2005) concludes that CFOs had to understand the real options approach before they could use it to evaluate and manage knowledge-based assets. The technical complexity and limitations of the methods used hindered mastery of the method. Consequently, CFOs prefer to use other procedures, such as discounted cash flow or EVA, in the evaluation of knowledge-based assets.

Taking into account the segmentation by size, 67.2% of small enterprises considered their intangibles could potentially facilitate the development of new assets or competitiveness factors in the future. The proportion increased to 80.6% in medium enterprises and to 70.4% in large firms. However, only 27.8% of CFOs at small companies, 31.3% at medium enterprises and 44.7% at large companies were able to identify these future opportunities. As Table 5 suggests, just 18.7% of all small firms, 25.2% of medium enterprises and 31.5% of large companies considered there were options associated with their intangibles and were in a position to identify them, being the differences significant to 10%. Large firms are clearly more aware of their intangibles. This may be due to the fact, as Salojärvi (2004) noted that they have greater resources available to identify and manage them.

More CFOs at companies whose key competitiveness factor was linked to structural capital said there were options associated with such capital (80.7%), as opposed to CFOs at firms whose key competitiveness factor was associated with human capital (73.5%) or relational capital (65.4%). A greater proportion of the first group, 35.4%, declared it was able to identify the options associated with intangibles, as opposed to 28% in the second group and 26.4% of the third. These differences were significant to 10% between structural and relational capital. Significant differences in the other comparisons were not found. We did not find a theoretical basis to explain this difference. We believe, however, this is due to the fact that larger firms (which claim to be able to identify options to the greatest extent) give greater importance to structural capital. This may in turn be because they have a greater need to generate mechanisms to transfer knowledge and competencies individuals possess to the rest of the company's staff.

A larger percentage of CFOs in the commerce and services sector was able to identify future assets or competitiveness factors (Table 5). However, the differences are not statistically significant.

The rest of the analysis only took account of the answers from the 118 firms in the sample able to identify such options, so as to verify the applicability of the real option approach. Data for this sub-sample, segmented by sector and size, is given in Table 5:

Table 5: Ability to identify options by size and sector

SECTOR	Questionnaire sample	Capable of identifying options	%
Primary	18	3	16.7%
Industry	184	35	19.0%
Construction	118	26	22.0%
Commerce and services	197	54	27.4%
SIZE			
Small	241	45	18.7%
Medium	222	56	25.2%
Large	54	17	31.5%

As this is a sub-sample of the population surveyed, sample error increased to $\pm 8.87\%$. Subsequent conclusions must therefore be treated with caution. However, the results are of interest for guiding further research.

From this point on, the items in the questionnaire were oriented towards finding out whether the CFOs surveyed could actually quantify the parameters required for value the identified options: exercise price, the moment when the option may be exercised, the value of the underlying asset and its future volatility.

5.2 Need for new investments for developing new assets or competitiveness factors

In some cases, the option implicit in the intangible resource may be a put option. However, in our model we considered, in general, that for the new asset or competence to materialize some investment would be required. It would therefore be a call option. A further question was whether it would be necessary to undertake new investments to develop the new assets or competitiveness factors. 92.4% of CFOs surveyed in this sub-sample considered new investments would be required. Only 46.8% of them were capable of saying how much the investment would be. No significant differences were found depending on any of the segmentation criteria (size, sector or type of intangible resource). Only 51 companies, of the 379 that considered options existed, was able to identify them and say how much the exercise price would be. That is only the 13.5%. The fact that less than 10% of all CFOs surveyed felt able to do this shows how difficult it is to use an options approach directly in intangible valuation.

5.3 Time required developing new assets or competitiveness factors

The next question was how long it would take to develop the new resource. 11% was incapable of determining the time needed or did not reply. However, a majority (55.9%) considered the period to be less than 3 years. 32.2% forecast a period of between 3 and 5 years. Only one company estimated a period longer than 5 years, having been incapable of determining the investment required in the previous question. The results show a high degree of immediacy in the emergence of new opportunities associated with firm’s main intangibles. Time is in fact the main brake on the imitability of a competitiveness factor. In the light of these results, companies planning to develop new resources associated with their intangibles would not be able to delay such decisions too long¹⁰.

Table 6: Time needed to develop options depending on type of intellectual capital

	< 3 years	3 to 5 years	> 5 years	Impossible to say
Human Capital	38.1%	47.6%	4.8%	9.5%
Structural Capital	67.6%	23.5%	0%	8.8%
Relational Capital	56.8%	31.8%	0%	11.4%
TOTAL	55.9 %	32.2%	.8%	10.2%

Human capital-associated intangibles needed more time to develop new assets or competitiveness factors. 47.6% of firms whose key competitiveness factor was linked to human capital considered a period of 3 to 5 years would be necessary, as opposed to 23.5% whose factor was linked to structural capital and 31.8% when

^[10] So it would seem that, at least in the companies surveyed, the “bias towards delay in exercising the option” discussed in subsection 2.2 does not take place.

it was associated with relational capital. Only the difference between the first two was significant to 10%. Several studies suggest human capital usually only impacts on company results indirectly, by way of structural and relational capital. It is therefore reasonable to assume the generation of new resources in human capital takes longer. Statistically significant differences were not found in answers to this question as regards size and sector.

5.4 Calculating returns generated by new assets or competitiveness factors

The main return from future assets or competitiveness factors developed from current intangibles would be an increase in sales (83.9%) and a reduction in operating costs (61.9%). Just 29.7% felt there would be an increase in sales price and 49.2% a reduction in non-operating costs.

The new resources emerging from structural capital-associated intangibles would generate a reduction in operating and non-operating costs in the view of 85.3% and 61.8%, respectively. Table 7 shows structural capital is most closely related to internal aspects of a company. However, considering the type of intangibles, the only statistically significant difference, in this case to 1%, comes in answers concerning the reduction of operating costs.

Table 7: Improvements generated by new intangible resources according to type of intellectual capital

	Δ Sales	Δ Sales price	∇ Operating costs	∇ Non-operating costs
Human Capital	76.2%	38.1%	52.4%	52.4%
Structural Capital	85.3%	14.7%	85.3%	61.8%
Relational Capital	88.6%	36.4%	47.7%	36.4%
TOTAL	83.9%	29.7%	61.9%	49.2%

The value of the new resource developed from a current intangible is determined by the returns it can generate. CFOs were asked if they could estimate these returns and the period during which they could be obtained. 45.7% of them would be able to calculate the returns. 64.7% of these CFOs are from larger companies and 42.6% from SME. These results suggest that large companies know their intangibles better and the elements associated with them. Once again, firms whose main intangible is associated with human capital have greater difficulty in quantifying returns, with 33.3% of positive answers, being this percentage 47.1% in firms with intangibles related to structural capital and the 50% when intangible it's associated to relational capital. In none of the criteria were the differences in answers statistically significant.

5.5 Sustainability and variability of yields generated by new assets or competitiveness factors

The final two questions were answered only by CFOs capable of estimating returns that comprised 54 companies. 29.6% of this firms said such returns would be obtained for fewer than three years. 31.5% reckoned on three to five years and 27.8% established a period longer than five years. Table 8 shows a trend towards longer periods when the intangible with which the options are associated is linked to human capital. With structural capital the trend is towards shorter periods. Differences in return periods depending on the type of intangible were significant to 10%.

Table 8: Sustainability of returns from new intangibles depending on type of intellectual capital and the total

	< 3 years	3 to 5 years	> 5 years	Impossible to say
Human Capital	0%	42.8%	28.6%	28.6%
Structural Capital	50%	31.3%	18.7%	0%
Relational Capital	22.7%	22.7%	36.4%	18.2%
TOTAL	29.6%	31.5%	27.8%	11.1%

The last question refers to the volatility of returns generated by the new resource developed from a current intangible. 44.5% of CFOs would be capable of estimating the variability of such returns using quantitative methods and 37% using a Likert scale. Only 18.5% would not be capable of doing it or did not reply. It must be underlined the high percentage of CFOs (81.5%) capable of estimating this parameter, considering that it is probably the most difficult to estimate. The firms answering this question in the affirmative had already shown a greater degree of knowledge of their intangibles. Ultimately, they only account for 8.5% of sample companies.

No statistically significant differences were found regarding either the type of intangible, sector, or size. Curiously, the largest percentage of firms that stated they were capable of estimating volatility using quantitative methods were small businesses (50% as opposed to 45.5% of large firms and 39.1% of medium enterprises). Firms claiming their principal intangible was linked to human capital also said they were more capable of estimating volatility using quantitative methods (57.1% as opposed to 45.5% link to relational capital-related and 43.7% link to structural capital).

6. Conclusions

Intangibles have become the basic resources for generating competitiveness advantages and one of the main challenges in the field of business management. Management of intangibles faces numerous difficulties, mainly due to lack of information, which is precisely the result of their intangible nature. The value of most *intangibles* does not appear on the financial statements, largely because the lack of transparency and the absence of a benchmark market make it difficult to value them.

Many intangibles have obvious “real option” characteristics. An intangible includes real options if its holding or current availability may affect future net income, either because it allows other resources to be acquired in the future, or because it allows investment projects to be carried out in the future. Therefore, the real options approach gives a framework where intangibles can be better valued, including their options characteristics.

The search for true and simple methods and models for the financial valuation of intangibles is not easy. The research seeking to compare and contrast the potential for the practical application of valuation methods appropriate to small and medium enterprises is scarce, even though the need to establish their validity and applicability is clear. This is especially true in case of real option approach because of the major technical complexity of the method, as compared with the traditional method.

The present paper focuses on verifying the applicability of the model developed by Rodríguez-Castellanos *et al.* (2006a, 2007) for the financial valuation of intangible taking into account the associated real options. The main concern of the study is to know if the CFOs are conscious about the possibility of some intangible resources having an additional value because it contains real options, and if they are able to identify them and quantify the parameters required to value the identified options. It has directly used the opinions of a representative sample of firms from all sectors of business and company sizes.

The first interesting point is the high percentage of CFOs surveyed who thought options were contained in their intangibles (70.2%). However, only 21.7% said they would be capable of identifying them. The ability to identify options in intangibles is greater in large companies and in those whose key competitiveness factor was linked to structural capital. When CFOs were asked to quantify the investment necessary for the potential new asset or competitiveness factor to materialize, the difficulty in using the options approach in the valuation of intangibles became clear. Less than 10% of CFOs surveyed said they could do it.

The 55.9% of firms, that are able to identify options, felt they needed less than three years to develop the new opportunities associated with their principal intangibles. 88.1% of the CFOs said their firms would not need more than 5 years. This gives an idea of the high degree of immediacy in the appearance of new opportunities. The term of development for new competitiveness factors was shorter when the intangible was linked to structural capital. Human capital-based intangibles required more time.

Results for new resources developed from current core competencies or intangible assets mainly involve increases in sales and reductions in operating costs. Companies whose main competence was associated with structural capital thought to a greater extent that the new resources would lead to reductions in operating and non-operating costs. Large firms claim to be more capable than SME of quantifying the returns yielded by the future resources. Companies whose main intangible was linked to human capital appeared to have the greatest difficulty in quantifying such returns. Only 10.4% of CFOs surveyed said they could identify options in their intangible resources and quantify the returns the underlying asset would generate.

The CFOs that could quantify the returns also answered about their sustainability and variability. The response to how long such returns could be maintained was distributed uniformly over a period of three to five years. Longer terms were considered when the intangible the options are associated with was linked to human

capital. The 81.5% of these CFOs claimed they were capable of estimating the volatility. There were no statistically significant differences depending on the type of intangible, sector or company size.

This research shows that most of the CFOs surveyed consider that there are options associated to intangibles, although very few companies are suitable for a direct application of the real option-based valuation method. Only one in every five firms was capable of identifying intangible-related options. Roughly half of these would not be in a position to provide the estimates for any of the inputs required.

One of the main reason that could be behind this result it's that the real options framework is unknown for the managers, or even knowing it they consider that its application could be too complex and/or costly. This could be especially true in the SMEs where the management is less professionalized. In this respect, larger firms surveyed, which usually devote more resources to identifying and analyzing their intangibles, had fewer difficulties in applying the method. Even for the managers who know the real options approach, the mathematics of these models could make the results non-intuitive and therefore hard to use, for what they would prefer the traditional investment models that are well known and wide-spread. In this respect, it could be of interest to make a new survey to know why the CFOs are unable to identify and quantify the options they perceive associated to the intangibles. Any way, there is a line of thinking that focus on 'option management' rather than on the exactness of calculations, that is, the logic of real options must be used, and the mathematics could be left out in favour of a qualitative assessment (Fredberg, 2007).

Considering the difficulties the companies have to directly apply the options framework to the valuation of intangibles, a preliminary phase of analysis and diagnosis would clearly be necessary. This task should be realized with the support of an external team of analysts. The phases and the complexity of the process will depend on the degree of managers' knowledge about the intangibles and the options associated with them. In the first stage, it is necessary to establish whether a strategic analysis of the company has identified its intangibles. If no strategic analysis has been performed, the team of analysts focuses on encouraging company managers to conduct an analysis by stressing the fundamental characteristics of the intangibles, considering specially the associated options. Once identified the options, it will be necessary to specify their characteristics to value them. This process will be carried out in narrow collaboration with the executives, taking into account both objective information and their perceptions.

Appendix: Questionnaire

Study: "Valuation of Intangibles of the Firms in the Basque Country"

This appendix shows the questions of the study "Valuation of Intangibles of the Firms in the Basque Country" related to the analysis of this paper.

Questionnaire

Intangibles are resources with no physical basis, they do not necessarily have to appear in the Balance Sheet, but they create value in the firm. For example: knowledge of employees, organizational culture, brands, patents, etc

	YES	NO	N/A
1.- Do you consider a financial valuation of intangibles to be important for your firm?	1	2	3

14.- Do you think that at least one of the firm's key competitiveness factor might allow, in an isolated way or in combination with other resources, to develop new assets or competitiveness factors in the future?			
- Yes, and I can identify it			1
- Yes, but I can't identify it			2
- No			3
- N/A			0

You have finished



15.- Is it necessary to make new investments (in assets, training, R+D, etc.) to develop the new assets or competitiveness factors in the future?	
- Yes, and I can quantify them	1
- Yes, but I can't quantify them	2
- No	3
- N/A	0
16.- How long which would be the most probable period of time to develop the new asset or to reinforce the competitiveness factor?	
- Less than three years	1
- Between three and five years	2
- More than five years	3
- It is not possible to quantify it	4
- N/A	0

17.- If the future asset or competitiveness factor were developed, what performances would it generate in your company?	YES	NO	N/A
- Increase in sold units/services	1	2	0
- Increase in the sale price	1	2	0
- Reduction in operative costs	1	2	0
- Reduction in non operative costs	1	2	0
- Others (please specify)			
- It's not possible to determine them	1	2	

18.- Could you somehow quantify this performance?	YES	NO	N/A
	1	2	0

You have finished



19.- Once developed, how long do you estimate this asset or competitiveness factor could generate returns?	
- Less than three years	1
- Between three and five years	2
- More than five years	3
- It's not possible to quantify it	4
- N/A	0

20- Could you estimate the risk or variability of the hypothetical new asset or future competitiveness factor' returns?	
- Yes, though quantitative methods	1
- Yes, though a scale (1 to 5: 1 minimum risk, 5 maximum risk)	2
- It's not possible to determine it	3
- N/A	0

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