

Article

# Incorporation of the Intangibles into the Spanish Start-Ups by Activity Sector and Region. Improving Their Economic Sustainability

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**Abstract:** Nowadays, start-ups, assuming increasing importance, have the possibility to include intangible knowledge as another resource on which they can carry out planning exercises, impact studies, evaluation and monitoring, protection, accumulation and exploitation. The study carried out in this paper allows us to analyze the influence that intangible knowledge has on the financial status of a start-up and, therefore, on its economic sustainability. This enables start-ups to present a good image, become more transparent, have more opportunities, reduce uncertainty, improve sustainability, etc. Moreover, the study presents a descriptive analysis of intangibles according to regions and activity sectors. An analysis of variance was carried out, to see if there is a relationship between the investment in intangible assets and the activity sector and/or regions to which the company belongs. The study concludes that, among all sectors, the differences in the incorporation of intangible assets into financial statements are most recognized in tourism, which may be a key factor for the sustainability of this sector, especially in periods of economic crisis, such as the one Europe and the planet are currently facing.

**Keywords:** entrepreneurship; knowledge; intellectual property; intangible; trademark; patent; start up valuation; ANOVA

## 1. Introduction

From the late 1990s to the present day, the business world and financial markets have undergone a series of changes and transformations that have brought about new risks and, in turn, many opportunities. As a result, the company has gone from a static situation with little relationship with the markets, to a situation of continuous change, increased globalization, the need to increase flexibility and a greater dependence on external agents (national and international administrations, financial entities, clients, suppliers, competitors, investors, etc.) [1]; and all this is in aid of seeking an adaptation to the new environment that is still being built today [2,3].

The following are among the most important changes:

1. We have moved from a traditional business model (a business model describes the logic of how an organization creates, delivers, and captures value. Alexander Osterwalder & Yves Pigneur (2010).

Business Model Generation. John Wiley & Sons, Inc., Hoboken, New Jersey), to an innovative business model [4], where technology has generated plenty of opportunities. Among the most disruptive technologies we can highlight: artificial intelligence, Internet of Things, digital manufacturing, robotics, the blockchain, unmanned air vehicles and virtual and augmented reality, among others.

The technologies mentioned above have given way to new business models that are changing the economy, our expectations and our behavior [5]. This process responds to a clear dynamic, to a structure that has taken place along all the technological waves and that follows a process that begins with: (1) a breakthrough in science, (2) that materializes in a new technology, (3) reaches the business world and (4) changes the economic and/or social organization.

There is a great variety of disruptive models of business arising, but, due to their relevance and impact, we are going to summarize them in four blocks: those derived from the digital company's transformation, the economy of platforms, the decentralized model and the pop-up economy and super fluid markets.

2. We have gone from being dependent on a national market to an international market.

3. We have passed from an enterprise where the source of value (economic value) was in the tangible assets to an enterprise, where the intangible assets have taken on a great importance.

That is why the assets such as patents, licenses, trademarks, databases, applications and any other intangible become the main source of value for any enterprise. This intangible or asset offers a range of opportunities and resources that allow the company to access both the current market and others that are continuously opened.

Nonetheless, this world of opportunities is not exempt of risks (risk is synonymous with change, uncertainty. Risk can be the possibility of losing and the possibility of winning. The risk must be seen from a positive point of view, without risk there are no opportunities, what we must learn is to manage that risk), many of them derived from the technological development that favors the capacity of some to take possession of the alien thing or, merely, to do damage by means of the proliferation of a computer virus in the network.

In this technological context, all assets related to information, information storage and intangible aspects of the enterprise and markets, which involves an increasing valuable recognition [6,7].

Thus, we can verify the value of the intangible in the enterprise is rising increasingly against the value of the tangible asset. This should also lead the enterprise to admit this situation in its financial statements, although the growth in the value of the intangible does not evolve to the same extent as the recognition of this intangible by the enterprise in its financial statements.

In this process of recognition of intangible in the financial statements by the enterprise, we have detected a series of situations:

1. The National Classification of Economic Activities (by its initials in Spanish, CNAE) activity codes do not correspond to the current reality of the enterprise, especially the multidisciplinary enterprises arisen from the New Economy that are not well recognized in these codes—for instance, Spanish biotechnology companies have been identified with more than 30 different codes—therefore, we think that an update of them is necessary, as well as a greater importance given to the election of the same by the enterprise.
2. Many companies that base their activity on the intangible do not recognize it in their financial statements. This recognition has advantages and disadvantages.

Advantages of recognizing the intangible in the financial statements:

- (a) The balance sheet represents the company's image to a greater extent;
- (b) Increases the value of own funds;
- (c) Increases ability to secure financing;
- (d) More resources for entrepreneurship;
- (e) Better image in the eyes of external agents, such as investors and financial institutions.

The drawbacks of recognizing intangible in financial statements:

- (f) The profit increases for what more taxes will have to be paid. If the company makes losses, this does not have a negative effect, quite the opposite, because its own resources would be reduced to a lesser extent;
- (g) If we abuse the recognition of intangible, we can alter the value of the company and excessively overestimate its value, with the risk of creating a bubble.

In general, the positive effects are much greater than the negative ones, especially in the long term [8,9]. Moreover, many of the drawbacks are not overly negative: if the manager leads a proper direction of the company and does not abuse certain accounting situations; these drawbacks are mitigated. On the other hand, in a world such as the current one, where globalization and the use of new technologies are increasingly present, companies are more and more dependent on external agents. Thus, they must try to make their financial statements represent their true image, otherwise they could cause many problems or the loss of opportunities, such as: fewer facilities to obtain financing through investors, public administrations, financial institutions, less ability to get good clients, less ability to negotiate charges and payments, etc.

Finally, it must be emphasized that entrepreneurship is a world full of risks and opportunities, that the risk should not be seen as a negative, but a positive, that without risk there are no opportunities, that what we need to know is to manage that risk, while maximizing opportunities and minimizing the negative “risks”. There are many ways to achieve this: forming a good team in order to realize our idea (multidisciplinary, dynamic), keep continuous training and be up to date with all new innovations, initiatives, diversifying activities, investments, and knowing how to exploit and manage the company’s intangibles (know-how, patents, products, brands). We will focus on this last point, the management of intangibles.

This article aims to identify the importance for the company of recognizing its intangible in its financial statements, in order to make a good image, be more transparent and improve sustainability [10–14]. In recent years, the importance of recognizing intangible assets has increased, as recognized by the previous work developed by KPMG [15] in Spain, where it was shown that the most important companies consider intangible assets as a fundamental element of sustainability, and crucial for their future investment processes (“it says that intangible assets are growing”). In this sense, sustainability, by definition, refers to meeting the needs of the present, without compromising the ability of future generations to meet theirs, ensuring a balance between economic growth, environmental care and social welfare. This is embodied in the integration of environmental, social and governance criteria into business strategies, known as Environmental, Social and Governance (ESG), and can be quantified through the company’s intangible assets. Companies and investors increasingly take this situation into account when making decisions, because it affects competitive position and long-term financial performance.

According to Daniel Wild (head of Sustainability Investment Research & Development and member of RobecoSAM’s Executive Committee, in the KPMG report [15]), “sustainability investment is the fastest growing segment in finance”. As more and more asset owners are integrating ESG considerations into their investment strategies, sustainability is gradually moving from being a niche investment concept to becoming a mainstream investment solution of the future.

However, for Wild, “while financial materiality is important for both companies and investors, these parties do not always agree on what is really relevant from an ESG perspective”. Companies can help manage this disagreement by demonstrating the financial materiality of specific ESG factors in their reports to shareholders. This, in turn, will encourage investors to integrate ESG factors and sustainability into their investment decision-making process.

On the other hand, research addressing organizational performance and how to achieve sustainable enterprise excellence, has received considerable attention from researchers [16].

Thus, a literature review will be presented. A variance analysis was carried out to see if there is a relationship between the investment in intangible assets and the activity sector and/or region to

which the company belongs. It should be noted that, although most start-ups [17], especially in their first years of life, depend on their intangible assets—brands, technological platforms, patents—only a small part of them recognize their intangible assets on their balance sheet [18], this may lead to the loss of opportunities in the medium term. Most of the articles that study intangibles in different activity sectors refer to publicly listed companies. This article refers to intangibles in start-ups, specifically to the relationship between the incorporation of intangibles and activity sectors in 6000 start-ups. The novelty of this work focuses on the incorporation of the intangibles in start-ups (young companies), and the number of 6000 companies studied in this paper, distributed in four regions.

## 2. Literature Review

Limitations in traditional financial accounting provide useful information on the external value of companies, and show the gap between the book value and the market value of companies listed on stock exchanges. This gap or mismatch, initially documented by Lev (2001) [19], also shows the existence of other sources of information, representative of value creation, which are taken into account by investors, and which impact on the market value of the companies which are directly linked to intangibles and, especially, to intellectual capital that is not reflected in traditional financial statements [20–22].

Other authors [23–38] have studied the relevance of intangible assets in different markets, such as the USA, Australia, Spain, Portugal, Canada, Argentina, France, UK, Brazil and the Philippines. To this end, they have studied the price and profitability of shares, stock market capitalization, and share prices.

Similarly, the relevance of the value of intellectual capital [39], measured through the share price, by the difference between the share price and the book value of the company, the added value, market capitalization and the market value/book value ratio and Tobin's Q ratio, has been studied in different markets (South Africa, USA, China New Zealand, Taiwan, Brazil, Italy, UK, Turkey, Tunisia, Indonesia, Philippines, Singapore and Thailand, Kuwait, India, Argentina and information technology companies) [37,40–58].

Intangibles include a wide range of items that can be classified into two main categories: intangible assets and intellectual capital. The IASB's definition, set out in its International Accounting Standard (IAS) 383, states that "an intangible asset is an identifiable non-monetary asset without physical substance".

The term "intellectual capital" represents a much broader concept for which a generally accepted definition has not yet been reached. However, based on the main characteristics present in most of the developed concepts, it can be said that intellectual capital refers to the set of interrelated intangible elements, among which the available knowledge stands out, both individually and as an organization. These elements are somewhat hidden, since they cannot be found in the financial statements prepared based on current regulations, and they allow the company to operate, in combination with the other resources inherent to it, as a source of competitive advantage and value creation [1].

On the other hand, some research shows the existence of a significant and positive relationship between the global figure corresponding to intangible assets, reported through the financial statements, and the market value of companies, as reflected in the studies carried out by Choi, Kwon and Lobo [23], Iñiguez and López [25] and Priotto, Quadro, Veteri and Werbin [30]. Along the same lines, but also working with complementary information to the financial statements, Pacheco, Rover and Rodrigues [37] obtained evidence that the level of disclosure of intangible assets, measured through an index that collects financial information and its explanatory notes, has an influence on the valuation made by the market.

However, regarding different categories of intangible assets, the evidence is solid when it comes to the valuation relevance of identifiable intangible assets, but is not entirely conclusive when it comes to the goodwill. Thus, Godfrey and Koh [24], Ritter and Wells [26], Dahmash, Durand and Watson [28], Oliveira, Rodrigues and Craig [29], Kimouche and Rouabhi [33] and Da Silva, Rodrigues and [34] confirm the evaluative relevance of the two categories. However, Ficco, Werbin, Díaz and

Prieto [36], obtain findings that show that identifiable intangible assets have a positive relationship with market prices.

The process by which the preparation of financial statements in accordance with the IASB's International Financial Reporting Standards (IFRS) has been made mandatory for listed companies, has given rise to a series of empirical studies focused on analyzing the impact of the adoption of the IFRS on the valuation of intangible assets.

Most of these studies have revealed an increase in the importance of intangible assets based on the adoption of IFRSs [27,38], due to the measurement criteria established by IFRSs, by replacing the systematic depreciation of this asset with periodic impairment testing, and, therefore, allowing more relevant and useful information to be produced for investors.

In the case of identifiable intangible assets, the evidence provides mixed results. Thus, the work of Chalmers [27], Ji and Lu [32] and Ficco and Sader [38] shows that these assets have lost relevance for the market when they are accounted for under the international regulatory framework, which is interpreted in relation to the greater restrictions imposed by IFRSs, and the recognition of this type of asset in relation to local accounting regulations, which results in financial statements with a lower information content. Finally, a summary table of the bibliographical review is provided (Table 1).

**Table 1.** Summary of the most relevant bibliographical contributions.

Author(s)	Country/s, Period and Sample	Main Results and Conclusions
[40] Swartz et al. (2006)	South Africa 1997–2004 154 companies from different sectors	Significant and positive relationship between capital employed and human capital with market prices
[23] Choi et al. (2000)	USA 1978–1994 219 companies from different sectors	The market values the recognized intangible assets positively but does not value the depreciation charge significantly
[24] Godfrey and Koh (2001)	Australia 1999 172 companies from different sectors	Intangible assets affect value, but the relation to R&D costs is not the same
[25] Iñiguez and López (2005)	Spain 1991–1999 152 companies from different sectors	Significant and positive relationship between recognized intangibles and share price
[26] Ritter and Wells (2006)	Australia 1979–1997 150 companies from different sectors	Significant positive relationship between prices and identified intangible assets
[27] Chalmers et al. (2008)	Australia 2005–2006 599 companies from different sectors	The information on intangibles produced under the International Financial Reporting Standards (IFRS) has lost value relevance
[28] Dahmash et al. (2009)	Australia 1994–2003 2611 observed (excluding financial and mining companies)	For the “average” Australian company, information on intangible assets has positive effects on value.
[29] Oliveira et al. (2010)	Portugal 1998–2008 354 observed for non-financial companies	Significant and positive relationship between prices and intangible assets Intellectual property and R&D investments are not relevant The change to International Financial Reporting Standards (IFRS) had no impact on the value of intangibles
[30] Priotto et al. (2011)	Argentina 2006–2010 18 leading companies	Significant and positive relationship between recognized intangibles and the market value of companies
[31] Ledoux and Cormier (2013)	Canada 2005–2010 97 non-financial businesses	The relationship between value and intangibles increased with the adoption of International Financial Reporting Standards (IFRS), but the value of voluntarily disclosed innovation information decreased with the adoption of IFRS

Table 1. Cont.

Author(s)	Country/s, Period and Sample	Main Results and Conclusions
[32] Ji and Lu (2014)	Australia 2000–2009 6650 obs. for companies in different sectors	The adoption of the International Financial Reporting Standards (IFRS) led to a decrease in the value of intangibles worldwide.
[33] Kimouche and Rouabhi (2016)	France 2005–2013 186 non-financial companies	Intangibles enhance the value of accounting information
[34] Da Silva et al. (2017)	Brazil 2010–2013 164 companies from different sectors	Intangibles do not lose explanatory power over time
[35] Infante and Ferrer (2017)	Philippines 2012–2016 30 companies from different sectors	Intangibles contribute to increasing the value of accounting information
[37] Pacheco et al. (2019)	Brazil 2017 75 non-financial businesses	Disclosure of intangibles influences the market value of companies
[38] Ficco and Sader (2019)	Argentina 2009–2015 40 non-financial companies	The value to intangibles ratio decreased with the adoption of the International Financial Reporting Standards (IFRS)
[41] Wang (2008)	USA 1996–2005 893 companies in the electronics sector	The number of employees, R&D and sales growth rate show a significant and positive relationship with value, while employee productivity and marketing expenses show a negative relationship with value
[42] Yu and Zhang (2008)	China 2003–2005 41 high-tech companies	Human capital, measured through an employee productivity indicator, and relational capital, measured through advertising spending, have a significant and positive relationship with the value of companies
[43] Whiting and Miller (2008)	New Zealand 2003 70 companies from different sectors	Only companies that review the value of their tangible assets show a positive and significant relationship among their “hidden value” and the voluntary disclosure of intangibles in their internal and external structural components
[44] Liu et al. (2009)	Taiwan 2001–2005 505 obs. for information technology companies	Intellectual capital and human capital have an impact both on the value of the company and in terms of created value
[45] Garcia et al. (2010)	Brazil 2003–2007 180 companies from different sectors	Contradictory results on the impact of human capital on value creation The simultaneous evaluation of all the variables of intellectual capital shows a significant influence of some intangibles on value creation
[46] Ferraro and Veltri (2011)	Italy 2006–2008 189 non-financial companies	Human capital has a moderating effect on the relationship between the other components of intellectual capital and market value
[47] Veltri and Silvestri (2011)	Italy 2006–2008 48 companies in the financial sector	Human capital has an indirect effect on price formation, since it is only relevant when it interacts with other components of intellectual capital
[48] Vafaei, Taylor and Ahmed (2011)	Great Britain, Australia, Hong Kong and Singapore 2005–2006 220 non-financial companies	The incorporation of intangible capital is positively associated with the market value of companies in two of the four countries (Great Britain and Australia) and in non-traditional industries
[49] Uyar and Kilic (2012)	Turkey 2010 129 manufacturing companies	The effect of the voluntary incorporation of intangible capital is noted when the market value of the company is measured through market capitalization

Table 1. Cont.

Author(s)	Country/s, Period and Sample	Main Results and Conclusions
[50] Ferchichi and Paturel (2013)	Tunisia 2006–2009 50 companies from different sectors	Significant and positive relationship between the incorporation of the intangibles and the market value of the companies
[51] Nimtrakoon (2015)	Indonesia, Malaysia, Philippines, Singapore and Thailand 2011 213 high-tech companies	Significant and positive relationship between the intangibles, measured globally, and the market value of companies
[52] Alfraih (2017)	Kuwait 2013 182 companies from different sectors	The incorporation of intangible assets is positively and significantly associated with the market value of companies
[54] Sharma (2018)	India 2007–2016 companies from different sectors	Intangible capital, measured globally, positively affects the value
[57] Sader (2019)	Argentina 2009–2015 47 companies from different sectors	Voluntary information regarding human capital and relational capital has no relation to value

### 3. Methodology and Analysis

This section identifies the companies created since 2012 that incorporate intangibles in their balance sheets in Spain and Andalusia, since it is within an intangible asset where the intangible of each business is located. To develop this epigraph, the SABI (a database marketed by the company Informa, SA and which registers the financial statements of most of the companies that make up the Spanish business fabric) database has been used.

A company can incorporate intangible or know-how in different ways:

- One of the partners can incorporate its intangible through social capital, so it can serve to create a company with a higher level of assets and own resources;
- The company may acquire the intangible through third parties;
- The company can generate its own intangible.

In the first two situations, intangible should be incorporated at market or sales value, and in the latter case, it should be recorded at production cost. In start-ups, the advantages of recognizing this intangible can be greater than in other group of companies, increasing their image, own resources and capacity.

#### 3.1. Methodology

The selection criteria for choosing the companies to work with are as follows:

- Companies created since January 2012. The life of a start-up is two years, the last official data of a company refers to 2018. The average life of the population is 4 years as of 2020; as of 2018, therefore, it is 2 years. Thus, the data has been taken since 2012, so that a company has the average life of 2 years, which is actually a start-up.
- Companies registered in Andalusia, Madrid, Catalonia and Valencia (regions in which the intangible is most important)
- Companies created by other companies or groups of companies are not taken into account.
- Active companies with sufficient information.
- Maximum number of employees: 9.

- (f) Companies with intangible assets accounted for in at least one of the last five years.

In order to identify the importance of the region and sector factors on intangible investment, a series of ratios that reflect the same should be defined. In financial theory, there are different indicators that define the level of investment in intangible assets of a company. After analyzing the latest work on the investment and valuation of intangibles and, fundamentally, starting from the type of available information, we decided to choose the existing relationship between intangible assets and non-current assets, as a representative indicator of the company's level of investment in intangible assets.

The methodology to use will be as follows: for each of the analyzed variables, a prior analysis of the data will be started, in order to try to find a certain uniformity in the behavior of the companies in the sample. In this way, a descriptive study will be carried out that will allow a first evaluation of the existence of differences in intangible investment by regions and sectors.

In a second phase, and in order to test whether there are significant differences in the behavior of the analyzed variables, according to the two considered characteristics of the companies—region and sector—we will use the statistical technique of analysis of variance (ANOVA), one for the sector factor and another for the region factor. The application of this statistical test requires the performance of the appropriate tests to know if the hypotheses necessary to implement it are met: normal distribution of the variable in the different subgroups determined by each factor and homogeneity of the variances. Once the analysis of variance has been completed and, on the assumption that the incidence of sector and regional factors on investment in intangible assets is compared, this statistical test should be completed with the multiple comparisons test, in order to identify which group is different, and with respect to which of the remaining groups show significant differences.

### 3.2. Descriptive Analysis

A total of 117,136 companies have been created in Spain since 2012, which remain active and have sufficient information. Only 22,404 of them include intangible assets in their balance sheet, which is 18.8% of total number of companies [59]. When analyzing start-ups, we find companies created by other companies or holding companies, so that they are made with a volume of sales and economic structure that does not correspond to those of a “normal” start-up; therefore, from the mentioned number of companies, the ones created from other companies will be eliminated, considering criterion “c”. This means that the number of companies created in recent years goes from 117,000 companies to 50,000 companies at the national level; and those that include immaterial assets in their balance go from 22,000 to 10,000 companies at the national level, with 2000 of them being from Andalusia. When it comes to regions, the most important are Madrid, Catalonia, Andalusia and Valencia, with nearly 6000 companies.

The distribution by activity sectors in Madrid, Catalonia, Andalusia and Valencia can be seen in the following Table 2.

**Table 2.** Number of companies with intangible assets according to activity sector and region.

	Andalusia	Madrid	Catalonia	Valencia	Total
Agriculture	21.00	10.00	17.00	9.00	57.00
Industry	104.00	95.00	204.00	144.00	547.00
Tourism	134.00	189.00	219.00	144.00	86.00
Construction	141.00	161.00	171.00	161.00	634.00
Service	386.00	697.00	717.00	400.00	2200.00
Commerce	431.00	390.00	580.00	466.00	1867.00
Total	1217.00	1542.00	1908.00	1324.00	5991.00

Source: prepared by the authors based on data provided by “Registro Mercantil”.



In this case, it can be seen how the distribution of activities that incorporate more intangible in their balance differs between the different regions and, in case of Andalusia, differences in the tourism, construction, services and trade sectors can be observed.

In the following lines, we will analyze investment in intangible assets, both in absolute and relative terms.

In the first place, it can be seen that the start-ups that incorporate the most the know-how technique in their balance are in Andalusia, Madrid, Catalonia and Valencia.

In Spain, the recognition of intangible assets of companies with an average life of 4 years stands at EUR 45,000 (average) and EUR 3,000 (median). In the case of Andalusia, for an average life of 4 years, the recognition of the intangible is at EUR 33,000 and EUR 2000 for average and median, respectively. We can see that, on the average level, intangibles are more recognized in Spain than in Andalusia. Among the sectors, we highlight that, in the case of agriculture, construction, services and commerce, most intangibles are recognized in Madrid. When it comes to industry and tourism, Catalonia precedes the list, while Andalusia stands below the Spanish average in all sectors except from agriculture (Figures 1 and 2).

Moreover, if we analyze the relative weight of intangible assets over non-current assets, we will see if the importance of intangible assets over the company’s investments coincides or not with the investment in absolute terms.

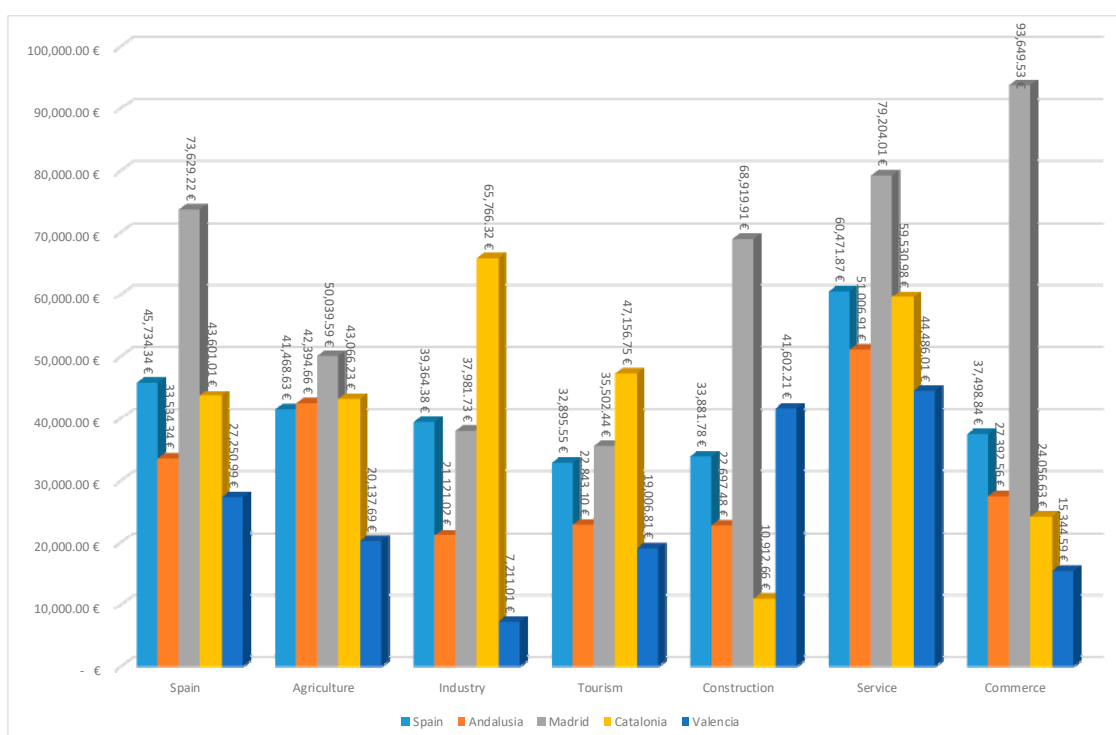
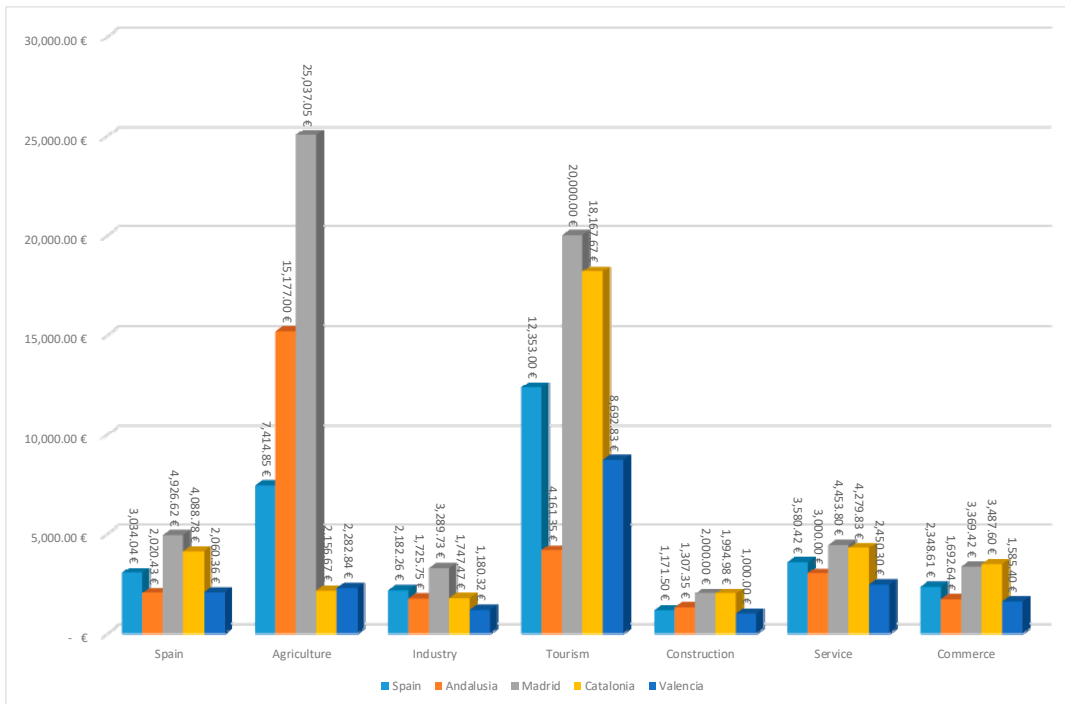
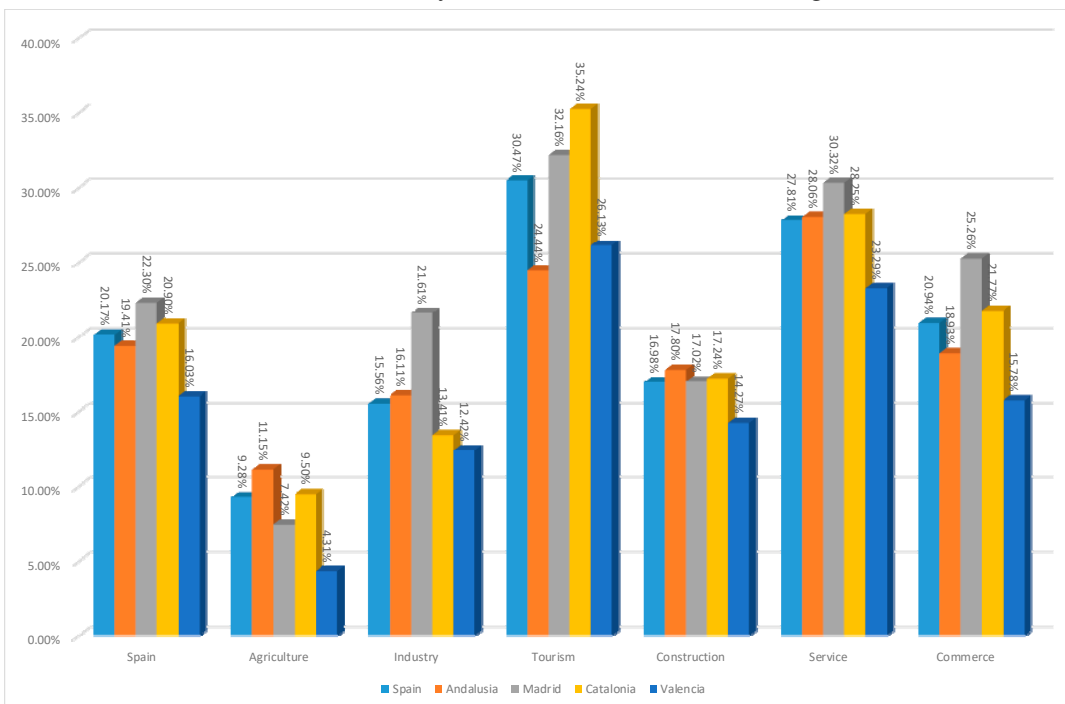


Figure 1. Intangible fixed assets (average) according to activity sectors. Source: prepared by the authors based on data provided by “Registro Mercantil”.

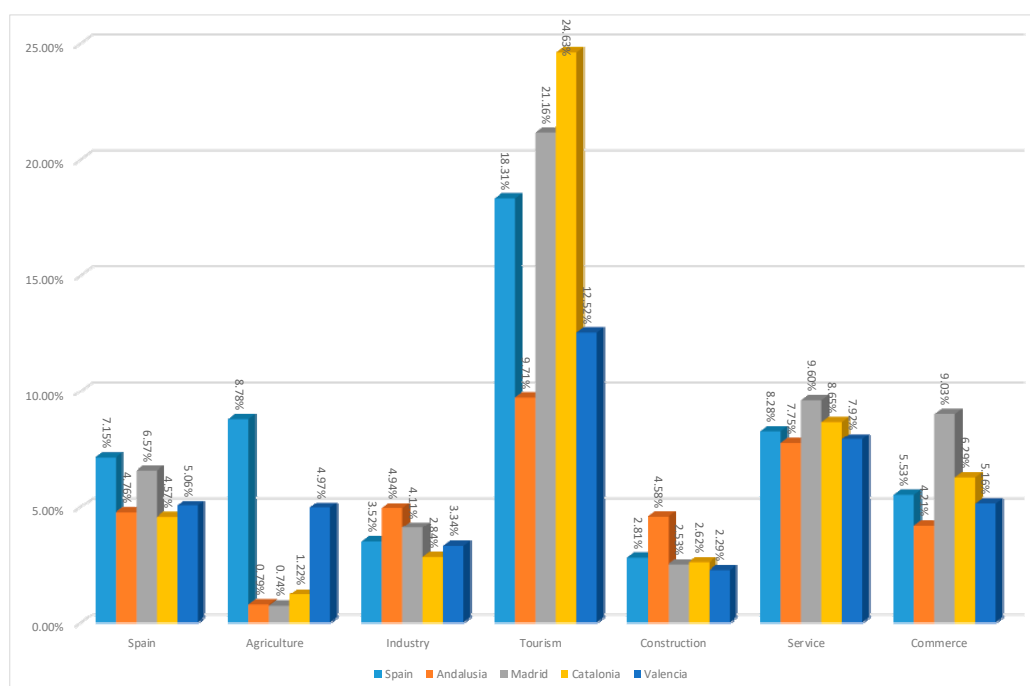


**Figure 2.** Intangible fixed assets (medium) according to activity sectors. Source: prepared by the authors based on data provided by “Registro Mercantil”.

In this case, we see how the distribution by activity sectors is different in relative and absolute terms. Thus, in relative investment, the most important sector is tourism; however, in absolute investment, the trade, service and industry sectors are above tourism (Figures 3 and 4).



**Figure 3.** Intangible fixed assets/non-current assets (average) according to activity sectors. Source: prepared by the authors based on data provided by “Registro Mercantil”.



**Figure 4.** Intangible fixed assets/non-current assets (medium) according to activity sectors. Source: own elaboration.

On the other hand, if we analyze the intangibles according to the sector and regional factors, we obtain the following in Tables 3 and 4.

**Table 3.** Intangible fixed assets/non-current assets (descriptive analysis) according to regions.

	Numbers of Companies	Average	Standard Desviation	Error	95% Confidence Interval		Minimum	Maximum
					Lower Limit	Upper Limit		
ANDALUSIA	1214	19.42%	30.43%	0.008733	0.1989	0.2332	0.00%	100.00%
MADRID	1539	22.37%	33.63%	0.008572	0.2539	0.2875	0.00%	100.00%
CATALONIA	1905	20.96%	31.85%	0.007296	0.2283	0.2569	0.00%	100.00%
VALENCIA	704	16.04%	26.60%	0.010027	0.1745	0.2139	0.00%	100.00%
SPAIN	5597	20.17%	31.32%	0.004187	0.2288	0.2452	0.00%	100.00%

Source: own elaboration.

**Table 4.** Intangible fixed assets/non-current assets (descriptive analysis) according to activity sectors.

	Numbers of Companies	Average	Standard Desviation	Error	95% Confidence Interval Mean		Minimum	Maximum
					Lower Limit	Upper Limit		
AGRICULTURE AND LIVESTOCK	57	9.28%	19.80%	0.02623	0.03811	0.14320	0.00%	95.81%
INDUSTRY	504	15.56%	24.93%	0.01111	0.13491	0.17855	0.00%	100.00%
TOURISM	647	30.47%	31.68%	0.01245	0.28025	0.32916	0.00%	100.00%
CONSTRUCTION	572	16.98%	26.70%	0.01116	0.14951	0.19336	0.00%	100.00%
SERVICES	2104	27.81%	34.44%	0.00751	0.26581	0.29526	0.00%	100.00%
TRADE	1713	20.94%	29.14%	0.00704	0.19454	0.22216	0.00%	100.00%
SPAIN	5597	20.17%	31.32%	0.00419	0.22880	0.24521	0.00%	100.00%

Source: own elaboration.

The largest investments in intangible assets are in Madrid and Catalonia, and, according to sector factor, services and tourism stand out. In terms of investment by sectors and regions, there is a greater dispersion in the region than in the sector factor.

Finally, after the analysis carried out so far, we can say that there is no clear relationship between the variable investment in intangible assets and the activity sector and regional factor; therefore, it is necessary to carry out an analysis of variance, where it could be seen whether this relationship exists or not.

### 3.3. Analysis of Intangible Variance by Region and Activity Sector

Following our line of work, and after carrying out the descriptive analysis—which does not clearly confirm the existence of differences between the investment in intangible assets of start-ups according to the sector and the region they belong to—we must contrast the results with more rigorous statistical techniques.

Our objective is to establish whether there are differences in the behavior of the analyzed variables, according to two factors of the considered companies: sector and region, or what behavior is the same if these factors (sector and region) have a significant impact on investment in intangible assets [59–61]. In this way, the statistical tests should be oriented towards the contrast of the differences observed in the measures of central and medium position, and of the chosen indicator or indicators, which is achieved with the analysis of variance of a factor. Therefore, we will try to carry out two ANOVA tests, one for the region factor and another for the sector factor, and as a dependent variable, we will take the indicative of the investment in intangible assets (investment in intangible assets/non-current assets). Specifically, the hypotheses we want to test are:

In relation to the region:

**Hypotheses H1 (H1).** *There are no differences in the investment in intangible assets of the companies according to the region to which they belong.*

**Hypotheses H2 (H2).** *There are differences in the investment in intangible assets of the companies according to the region to which they belong.*

In relation to the sector:

**Hypotheses H3 (H3).** *There are no differences in the financial structure of the companies according to the sector to which they belong.*

**Hypotheses H4 (H4).** *There are differences in the financial structure of companies according to the sector to which they belong.*

Before starting the study, we must carry out the appropriate tests to find out if the necessary conditions are met, in order to carry out the contrast of our hypotheses using the statistical technique ANOVA. Parametric contrasts, such as ANOVA, require normal distribution of the dependent variable and homogeneity of variances, elements that are not necessary in non-parametric contrasts. The result achieved in the latter is, therefore, less robust.

Normality of the dependent variables. In our sample, the hypothesis of normality according to the Kolmogorov-Smirnov test is not accepted, since its level of significance is less than 5%. However, according to the central limit theorem, even in the absence of normality, parametric contrasts continue to show robustness when the sample size is large enough, as is the case here, since we work with all the companies in the population that meet the defined requirements to configure our study sample (Table 5).

After testing whether the necessary that conditions for the application of variance analysis are met, we observed that the application of this technique implies problems for the sector and region factors, so we could not directly apply the ANOVA.

However, due to the size of the used sample and the difference of companies between region groups and sectors, we can use robust tests, for example, the Brown-Forsythe test for the region and sector factor, respectively (Tables 9 and 10).

**Table 5.** Region normality test.

REGION	Kolmogorov-Smirnova			Shapiro-Wilk			
	Statistics	g	Next	Statistics	g	Next	
Current Inmat/ANC Fixed Assets	1.0	0.243	1214	0.000	0.724	1214	0.000
	2.0	0.221	1539	0.000	0.774	1539	0.000
	3.0	0.232	1905	0.000	0.754	1905	0.000
	4.0	0.233	704	0.000	0.739	704	0.000

a. Correction of meaning of Lilliefors.

Note: g is a statistical parameter provided by the model. Source: own elaboration.

Homoscedasticity. In order to contrast the equality of variances of the dependent variable in the different subgroups defined by each factor, the Levene statistic is applied. The values of this test allow us to affirm that in both the region and sector factors, this condition is not fulfilled (Tables 6–8), since its level of significance is below 5%.

**Table 6.** Normality test activity sector.

SECTOR	Kolmogorov-Smirnova			Shapiro-Wilk			
	Statistics	g *	Next	Statistics	g *	Next	
Current Inmat/ANC Fixed Assets	1.0	0.368	57	0.000	0.516	57	0.000
	2.0	0.265	504	0.000	0.665	504	0.000
	3.0	0.168	647	0.000	0.848	647	0.000
	4.0	0.260	572	0.000	0.684	572	0.000
	5.0	0.225	2104	0.000	0.774	2104	0.000
	6.0	0.237	1713	0.000	0.727	1713	0.000

a. Correction of meaning of Lilliefors

Note: g \* is a statistical parameter provided by the model. Source: own elaboration.

**Table 7.** Homogeneity test for the factor region.

		Levene Statistician	g1	g2	Next
Current Inmat/ANC Fixed Assets	It is based on the average	31.970	4	5592	0.000
	It is based on the median	12.100	4	5592	0.000
	It is based on the median and with adjusted g1	12.100	4	5502.174	0.000
	It is based on the clipped average	29.612	4	5592	0.000

Note: g1 and g2 are statistical parameter provided by the model. Source: own elaboration.

**Table 8.** Homogeneity test for the activity sector factor.

		Levene Statistician	g1	g2	Next
Current Inmat/ANC Fixed Assets	It is based on the average	67.438	5	5591	0.000
	It is based on the median	32.157	5	5591	0.000
	It is based on the median and with adjusted g1	32.157	5	5383.301	0.000
	It is based on the clipped average	66.710	5	5591	0.000

Note: g1 and g2 are statistical parameter provided by the model. Source: own elaboration.

**Table 9.** Robust tests of equality of averages for the region factor.

Current Inmat/ANC Fixed Assets				
	Statistics	gl1	gl2	Next
Welch	10.525	4	1355.869	0.000
Brown-Forsythe	11.011	4	3476.783	0.000

a. F. distributed asymptotically.

Note: gl1 and gl2 are statistical parameter provided by the model. Source: own elaboration.

**Table 10.** Robust tests of equality of averages for the sector factor.

Current Inmat/ANC Fixed Assets				
	Statistics	gl1	gl2	Next
Welch	37.479	5	539.920	0.000
Brown-Forsythe	40.118	5	2535.604	0.000

a. F distributed asymptotically.

Note: gl1 and gl2 are statistical parameter provided by the model. Source: own elaboration.

We then apply multiple comparisons and, specifically, the Games-Howell test, which is used when we do not assume equality of variances.

In this way, this test tells us that in some conditions of the dependent variable investment in intangible assets between non-current assets, the null hypothesis is rejected, so that the region factor and the sector factor influence the level of investment in intangible assets of the companies. For the intangible investment variable between non-current assets, the null hypothesis is rejected; for an alpha of less than 5%, the null hypothesis would be accepted, while for a higher one, the null hypothesis would be rejected. We opt for a 95% confidence level, so, in some cases, we will not accept the null hypothesis for this variable.

Next, and bearing in mind that investment in intangible assets by companies differs according to region and sector, we are going to contrast the influence of the factor between the different groups of companies, because this objective is not achieved with ANOVA.

In other words, we must carry out an analysis to distinguish between which groups of companies these differences are significant, or, in other words, which groups are homogeneous. To do this, we will perform the multiple comparisons test, also called the post hoc test. We will apply the Games-Howell method, because the homogeneity of the variances was not met.

Then, in order to identify in which groups these differences are significant, that is, which groups are homogeneous, the multiple comparison test, also called the post hoc test, is performed. In this way, the Games-Howell method is applied (Table 11).

When it comes to the region factor, the results of these multiple comparisons allow us to say that Andalusian companies act significantly differently from those in the region of Madrid (a lower investment of 5.47%), showing no difference with the rest of the regions. In the case of the region of Madrid, there were differences with Andalusia (5.47% higher investment) and Valencia (7.65% higher investment). Catalonia only differs from Valencia (with a volume of investment almost 5% higher). Valencia only differs from Catalonia and Madrid. The regions with a greater recognition of intangibles are Madrid and Catalonia, in that order (Table 12).

**Table 11.** Multiple comparisons for the region factor (Games-Howell).

Games-Howell						
(I) REGION		Mean Difference (I-J)	Error	Next	95% Confidence Interval	
					Lower Limit	Upper Limit
1.0	2.0	−0.054670477190805 *	0.01223711766017	0.000	−0.088073156491642	−0.02126779788996
	3.0	−0.02655560293383	0.01138009332313	0.135	−0.057619174652506	0.00450796878484
	4.0	0.021868246481812	0.01329706067615	0.469	−0.014443781217201	0.05818027418082
2.0	1.0	0.054670477190805 *	0.01223711766017	0.000	0.021267797889969	0.08807315649164
	3.0	0.028114874256974	0.01125657030679	0.091	−0.002607969253747	0.05883771776769
	4.0	0.076538723672617 *	0.01319150005321	0.000	0.040516450290305	0.11256099705492
3.0	1.0	0.026555602933831	0.01138009332313	0.135	−0.004507968784844	0.05761917465250
	2.0	−0.02811487425697	0.01125657030679	0.091	−0.058837717767696	0.00260796925374
	4.0	0.048423849415643 *	0.01240061083447	0.001	0.014556308180189	0.08229139065109
4.0	1.0	−0.02186824648181	0.01329706067615	0.469	−0.058180274180824	0.01444378121720
	2.0	−0.076538723672617 *	0.01319150005321	0.000	−0.112560997054929	−0.04051645029030
	3.0	−0.048423849415643 *	0.01240061083447	0.001	−0.082291390651096	−0.01455630818018

\* The main difference is significant at level 0.05. Source: Own elaboration.

**Table 12.** Differences according to the region factor (Games-Howell).

	1	2	3	4
1	-	−5.47%	−2.66%	2.19%
2	5.47%	-	2.81%	7.65%
3	2.66%	−2.81%	-	4.84%
4	−2.19%	−7.65%	−4.84%	-

Source: own elaboration.

On the other hand, when the comparison is made, taking into account the different groups of companies defined according to their activity sector, we can affirm that some sectors present significant differences, such as agriculture, tourism, services and commerce, and others offer homogeneous groups, such as agriculture, industry and construction.

In this case, the differences are more significant than in the regions. In summary, we can say that the agricultural sector differs from tourism, services and commerce, with a difference of investment in intangibles of almost −22%; the industrial sector differs from tourism, services and commerce with an investment in intangibles of −15%; the tourism sector is the one that, in relative terms, invests the most in intangibles, and differs from all sectors except services; the construction sector differs from tourism and services with an investment in intangibles of −14%; the services sector differs from all sectors except tourism; and the commerce sector differs from all sectors except construction.

To check whether this influence exists, the Games-Howell method has been applied, which is used when the homogeneity of variances is not met. Thus, with this method, we can say that in start-ups investment in intangible assets (in relative terms) differs both in regions and activity sectors, but the greatest differences are seen in the activity sectors. The most important sector is tourism, with intangible investments 21.4%, 14.8%, 13.3% and 9.6% higher than agriculture, industry, construction and commerce, respectively (Tables 13 and 14).

**Table 13.** Multiple comparisons according to the activity sector factor (Games-Howell).

Games-Howell						
(I) SECTOR		Mean difference (I-J)	Error	Next	95% Confidence Interval	
					Lower Limit	Upper Limit
1.0	2.0	-0.06607014	0.02848424	0.19886364	-0.1493051	0.01716485
	3.0	-0.21404741029401 *	0.02903629	0.00000000	-0.2987395	-0.12935523
	4.0	-0.08077572	0.02850741	0.06262723	-0.1640708	0.00251943
	5.0	-0.18987838499156 *	0.02728351	0.00000003	-0.2699747	-0.10978203
	6.0	-0.11769009322847 *	0.02715853	0.00072194	-0.1974635	-0.03791660
2.0	1.0	0.06607014	0.02848424	0.19886364	-0.0171648	0.14930512
	3.0	-0.14797727447823 *	0.01668558	0.00000000	-0.1956067	-0.10034779
	4.0	-0.01470559	0.01574722	0.93773601	-0.0596620	0.03025092
	5.0	-0.12380824917579 *	0.01340495	0.00000000	-0.1620814	-0.08553503
	6.0	-0.05161995741270 *	0.01314870	0.00129792	-0.0891671	-0.01407279
3.0	1.0	0.21404741029401 *	0.02903629	0.00000000	0.12935523	0.29873959
	2.0	0.147977274478236 *	0.01668558	0.00000000	0.10034779	0.19560676
	4.0	0.133271686085087 *	0.01672511	0.00000000	0.08553371	0.18100967
	5.0	0.02416903	0.01454121	0.55729491	-0.0173389	0.06567703
	6.0	0.096357317065536 *	0.01430533	0.00000000	0.05551812	0.13719651
4.0	1.0	0.08077572	0.02850741	0.06262723	-0.0025194	0.16407088
	2.0	0.01470559	0.01574722	0.93773601	-0.0302509	0.05966209
	3.0	-0.13327168608508 *	0.01672511	0.00000000	-0.1810096	-0.08553371
	5.0	-0.10910266078264 *	0.01345412	0.00000000	-0.1475083	-0.07069701
	6.0	-0.03691437	0.01319883	0.05872363	-0.0745962	0.00076746
5.0	1.0	0.189878384991568 *	0.02728351	0.00000003	0.10978203	0.26997474
	2.0	0.123808249175793 *	0.01340495	0.00000000	0.08553503	0.16208147
	3.0	-0.02416903	0.01454121	0.55729491	-0.0656770	0.01733898
	4.0	0.109102660782644 *	0.01345412	0.00000000	0.07069701	0.14750831
	6.0	0.072188291763094 *	0.01029206	0.00000000	0.04284398	0.10153261
6.0	1.0	0.117690093228475 *	0.02715853	0.00072194	0.03791660	0.19746359
	2.0	0.051619957412700 *	0.01314870	0.00129792	0.01407279	0.08916713
	3.0	-0.09635731706553 *	0.01430533	0.00000000	-0.1371965	-0.05551812
	4.0	0.03691437	0.01319883	0.05872363	-0.0007674	0.07459620
	5.0	-0.07218829176309 *	0.01029206	0.00000000	-0.1015326	-0.04284398

\* The mean difference is significant at level 0.05. Source: Own elaboration.

**Table 14.** Differences according to the sector factor (Games-Howell).

	1	2	3	4	5	6
1	-	-6.61%	-21.40%	-8.08%	-18.99%	-11.77%
2	6.61%	-	-14.80%	-1.47%	-12.38%	-5.16%
3	21.40%	14.80%	-	13.33%	2.42%	9.64%
4	8.08%	1.47%	-13.33%	-	-10.91%	-3.69%
5	18.99%	12.38%	-2.42%	10.91%	-	7.22%
6	11.77%	5.16%	-9.64%	3.69%	-7.22%	-

Source: own elaboration.

#### 4. Conclusions

In general, it can be concluded that, despite a period of transformation of business models, the importance of innovation, knowledge and technology is increasing. Although this change does not translate into recognition of it in corporate financial statements, and only 18% of created companies take it into account. This recognition would be a key factor in increasing opportunities and improving sustainability in periods of crisis for the company, in an increasingly volatile ecosystem. Intangible resources are recognized as the most important in achieving business objectives [59,60]. However, a significant part of these resources is hidden and cannot be identified in the financial statements of companies (Lev, 2003 [15]), due to the restrictive requirements of accounting regulations regarding their identification, measurement and valuation.



In particular, we can highlight:

The distribution of activities, by number of companies, that incorporate more intangibles in their balance sheet differs between the different regions, and there are substantial differences in the tourism, construction, services and trade sectors [61,62]

In absolute terms, the recognition of intangible assets of companies with an average life of 4 years stands at EUR 45,000 (average) and EUR 3000 (median). In the case of Andalusia, for an average life of 4 years, the recognition of intangible is at EUR 33,000 and EUR 2000, average and median, respectively. We can see that, on the average level, intangibles are more recognized in Spain than in Andalusia. Among the sectors, we highlight that, in the case of agriculture, construction, services and commerce, most intangibles are recognized in Madrid. When it comes to industry and tourism, Catalonia precedes the list, while Andalusia stands below the Spanish average in all sectors, except from agriculture.

In relative terms, it can be seen how the distribution by activity sector is different compared to absolute terms. Thus, in relative investment, the most important sector is tourism; however, in absolute investment, the commerce, service and industry sectors are above tourism.

From a descriptive point of view, it can be seen that the largest investments in intangible assets, in relative terms and according to the region and activity sector factors, are in Madrid and Catalonia, and that, among all sectors, services and tourism stand out. Regarding investment by sectors and regions, there is a greater dispersion in the region factor compared to the sector factor. However, we cannot state that the region and activity sector factors influence investment in intangible assets.

Finally, it can be concluded that applying the Games-Howell method, the incorporation of intangible assets in Spanish start-ups differs both in regions and activity sectors, although the greatest differences are seen in activity sectors. The most important sector is tourism, with investments in intangibles being 21.4%, 14.8%, 13.3% and 9.6% higher than in agriculture, industry, construction and commerce, respectively. This incorporation and recognition of intangible assets in the tourism business can be a key factor for its sustainability, especially in current crisis situations.

This corresponds to the incorporation of 423 intangible assets in Spanish start-ups, which differ both in regions and activity sectors, although the greatest differences are seen in activity sectors. This is in line with previous research, which posits that the activity sector of the start-ups could influence research outcomes regarding business sustainability, as shown by Fonseca and Domingues in the context of environmental management system transition [63].

As far as future work is concerned, it should be noted that we are currently working with the economic and financial data of more than 6000 start-ups (Andalusia, Madrid, Catalonia and Valencia). Based on this information, it will be possible to develop sectorial balance sheets and income accounts through the distribution functions of the different variables, and see their potential by applying the real options methodology with a Monte Carlo Simulation.

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