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Do shareholders care about unrecorded intangible assets and, if so, how are they reported in an understandable, reliable, relevant and comparable way by quoted companies?

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I. Abstract

This research addresses intangible assets not recorded in the balance sheet in industries where these assets are becoming increasingly important. It focuses on the pharmaceutical and technology sectors by analysing annual reports, websites, and interviewing analysts from each of these sectors. This research demonstrates the importance of intangible assets in explaining the gap between the market value and the book value of companies in these sectors. This research also highlights the limited information shared by companies on intangible assets that cannot be recorded on the balance sheet. Finally, this research demonstrates the interest of investors and analysts for more information about intangible assets.

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1. Introduction

Corporate balance sheets have undergone profound changes in recent decades. The business world shifted from asset-heavy industries to capital-light companies, relying on innovation and employees to increase their value. In 2015, nearly 90% of the value of the S&P 500 companies was made up of their intangible assets, compared to just over 10% resulting from their tangible assets. This is a complete shift compared to the 1970s, when companies were mainly composed of physical assets, with as little as 15% of their value being explained by intangible assets, and 85% coming from tangible assets (Adams, 2018).

New companies such as Facebook, Uber or Airbnb have entered the market and virtually have no physical assets. Their value mainly comes from their intangible assets. However, the existing accounting rules do not provide a clear framework for reporting information about these assets. We are faced with companies with extremely high stock market values, with giants such as Amazon or Apple exceeding a trillion dollars (Salinas, 2018), while their book value is only a small fraction of that value. This difference between the market and book value can be compared to the difference in value between the components of an iPhone and the price of the phone once it is sold. This difference is not easily explained and is mainly due to the value that the Apple brand brings to the product, but also reflects the value of other intangible assets behind the manufacture of the phone.

The way in which company accounts are currently reported is no longer relevant or representative of how companies generate value (Adams, 2018). Given that the use of intangible assets has increased tremendously in recent decades, it is interesting to ask whether financial and non-financial information shares interesting information about these assets, or elements that can justify the difference between the market value and the book value of the company.

Moreover, transparency is now a major expectation that clients, investors and regulatory agents have of companies. The implications of such an increased transparency are numerous, from “helping appeal to socially conscious investors; keeping activists and reactive regulations at bay; attracting consumers, partners, and talented employees; boosting the morale of existing employees; and protecting the value and safety proposition around an industry, institution, service or product” (Miller, 2016). However, as discussed later,

transparency can be a two-way street: if a company gives too little information, it might be undervalued, however, it is equally tricky if the company shares too much information and doesn't meet the market's expectations. The stock market is easily disappointed and can be very severe.

To what extent do companies disclose information about what is not recorded in the balance sheet but yet create value? Does it have an impact on investors, and if so, do they care about this information?

2. Part I: Theoretical background

This research will be structured as follows: the theoretical background will cover the difference between the book value and the market value of the companies. Then, intangible assets and their characteristics will be defined and categorized. Once the major concepts used in this research have been defined, the current accounting rules to which intangible assets are subject will be developed, as well as the accounting methods used to evaluate these assets. Next, the difficulties that can arise from the definition and accounting rules relating to intangible assets will be discussed. We will then look at non-financial information sources, where we could find information about these particular assets. The different sectors will then be compared in terms of the importance of intangible assets, and finally, this research will highlight some of the solutions proposed by the literature to measure these assets.

2.1 GAP BETWEEN MARKET AND BOOK VALUE

According to Adams (2018), 87% of the total value of the S&P 500 companies would come from intangible assets. As shown in Figure 1, this is a major change from the previous century, when intangible assets represented no more than 20% of the total value of the S&P 500.

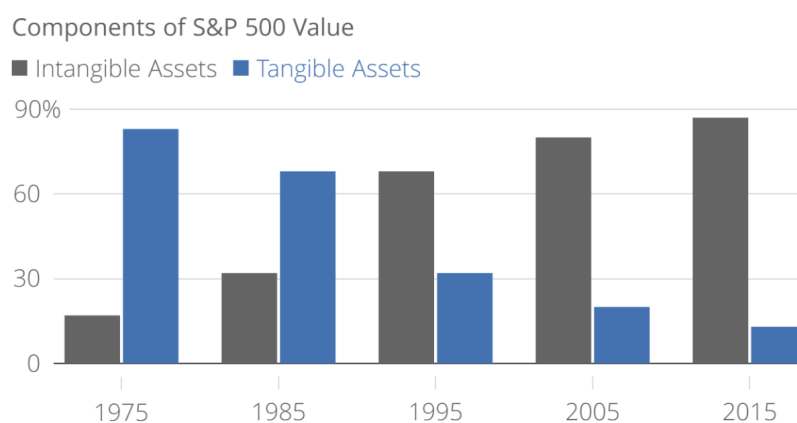


Figure 1: Components of S&P 500 (Adams, 2018)

The largest companies in the world have unprecedented high market capitalization due to their intangible assets, which increase the value of their companies. However, many of a company's valuable assets do not appear on the balance sheet, and this leads to the book value and the market value of a company to be significantly different.

Over the last decades, companies have increased the investments into intangible assets. As we can see in Figure 2, when measuring the investment made in a type of asset based on the percentage of the sector GDP, a major shift from tangibles to intangibles occurred in the 1990s.

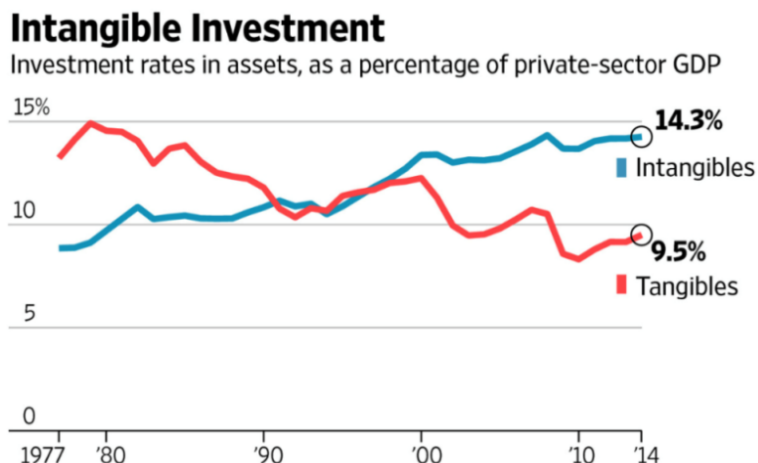


Figure 2: Investment rates in assets, as a percentage of private-sector GDP ("The Tangible Problem of Measuring Intangible Assets", 2019)

Even though investments in intangible assets increased, the accounting rules and disclosure practices used by companies haven't significantly evolved throughout the years. As argued by Sveiby (1997), the inability to observe or measure an intangible asset does not mean there is no point in taking it into consideration, or that these assets are not valuable.

2.2 INTANGIBLE ASSETS

In order to properly address this issue, defining what intangible assets are is essential. The definition of an intangible asset is derived from the general definition of an asset, which is defined as a source of economic benefit resulting from the past (Bragg, 2017). Intangible assets are assets that are not physical by nature (Investopedia, n.d.). They can be divided into two main categories:

- Acquired and licensed-in;
- Internally generated within a company.

This separation is very important, as accounting rules generally do not allow internally generated intangible assets to be capitalised. This is due to the fact that it is difficult to know

what the different phases of asset creation are, and therefore to know when they should be recorded as expenses and when they should be recorded as assets in the balance sheet (Ancuța, A. et al, 2017).

2.2.1 IMPORTANCE

Intangible assets are extremely valuable tools for companies. Properly measuring and managing them is essential and may results in a competitive advantage, as explained in a report written by Hadjiloucas, a partner at PWC (2014).

- “They provide barriers to entry;
- They differentiate products;
- They provide more stable and profitable earnings;
- They may provide international recognition.”

In addition, according to Pethokoukis (2018), these intangible assets can usually be used in different contexts, and create synergies with other assets. They usually are difficult to sell and offer spillovers, giving the opportunity to other companies to benefit from them.

Depending on the size of the firm and how much intangibles it must manage, the company’s strategy towards the disclosure and management of intangible assets will differ. Giving them more importance, compared to physical and financial assets that would, according to Sveiby, significantly increase shareholder value (1997). In addition, as mentioned by Skroupa (2017), “you can’t manage what you can’t measure”. This highlights the importance for management and employees to be aware of the intangibles assets that do not appear on the balance sheet, in order to develop synergies and other strategies to derive maximum financial and strategic benefits from these assets.

2.2.2 CHARACTERISTICS

In 2014, a working group set up by the French Ministry of the Economy and Finance created the CAP’Immatériel project, a synthetic grid of 26 indicators covering 10 classes of intangible assets. It was developed to understand the relevance and characteristics of intangibles and offer a specific methodology to measure their value. This initiative was taken over jointly by

Atemis, the DGE (Direction Générale des Entreprises) and the Observatoire de l'Immatériel in July 2018.

According to their report, intangible assets must have 7 specific characteristics. The following criteria, therefore, give the intangible asset its nature. That is to say, they are:

- Non-measurable or uncountable: there is no norm based on an objective basis;
- Resources that will evolve thanks to the firm's activity, depending on how efficient the firm is at developing these intangible assets. They can be both inputs and outputs as they can be used for production purposes, or be the result of the production;
- Resources associated with the human side of the firm: unlike the tangible assets, the intangible ones cannot be dissociated from the human side. Their contribution to the firm's activity will depend on the quality of the organization, and the management, as well as the internal and external dynamics of cooperation and the insertion of the firm in its environment;
- Results are indirect and non-proportional to the effort made: this is why it is complicated to evaluate these intangible assets: you can't base your evaluation on the results as they can't be guaranteed;
- Interrelated and inseparable resources: their value comes from their interactions;
- These resources never fully belong to the firm: there are internal and external factors;
- Risk of brutal and unexpected deterioration. (Cap'Immatériel, n.d.)

2.2.3 CATEGORIZATION

The way we decide to breakdown the intangibles differs depending on the insight the publishing organization has on the subject; depending on whether you rely on the World Intellectual Capital Initiative (WICI) or the Global Intangible Finance Tracker (GIFT), this breakdown might differ. The WICI report (2016), on the reporting framework for intangible assets, uses the concept of intellectual capital that is defined as: “the internal (competencies, skills, leadership, procedures, know-how, etc.) and external (image, brands, alliances, customer satisfaction, etc.) stock of dynamically inter-related intangibles available to an organization, which allows the latter to transform a set of tangible, financial and human resources into a system capable of pursuing sustainable value creation.”.

In order to have a clear categorization of these intangible assets, the classification presented in this paper is given by Lev (2001) and consists of the four following categories:

1. Discovery

R&D expenditures and related IP

Research is defined as the discovery and research of a contribution to the understanding of a scientific or technical problem. The development part is the implementation of this research, in order to improve a process or material, or product already on sale (The Association of Chartered Certified Accountants, 2019).

2. Human Resource

Human Capital

Human capital also refers to value created inside a firm, by the employees. Even though information about the number of employees, or how much they are paid is disclosed in the annual reports, a large part of the information about them is missing. Searchers, skilful, and loyal employees play a big part in the future value of a company and are considered as intangible assets.

3. Customer-related

Customer loyalty

Customer loyalty represents the extent to which a customer is attached to a brand. It indicates that the customer will probably choose this brand over another. This represents a real advantage in terms of competition for the company to which the customer remains loyal ("What is Customer Loyalty?", 2019).

Advertising, brands and related IP

A brand's value is considered an intangible asset. If the brand has never been sold, it will not be disclosed in the balance sheet. However, for some

companies, such as Apple, this brand value represents a major portion of their market value (Badenhausen, 2019).

4. Organisation Capital

Organisational capital is defined as “the value that enables human capital to function for supportive non-physical infrastructure, processes and databases of the organization” (WICI, 2016).

Competitive advantage

The organisational capital of a company is everything that brings value within the firm and differentiates it from the competition. It consists of the processes, that bring more value to a firm than the product or service itself. This would apply to catering companies for instance. It also represents the relations the firm has with its suppliers, as well as with its customers. It includes other types of relationships such as financial institutions’ and analysts’ evaluations of the company. All of these play an important role in the reputation of a company, which helps to attract and retain more customers.

Trade secrets

Trade secrets are also included in the intangible assets that cannot be recorded in the balance sheet. They are used by all companies in the world, large or small, and offer a competitive advantage to the company that holds them. (“The Valuation of Trade Secrets”, 2018). Trade secrets offer several advantages to a company. They can be sold or licensed to another firm and it might give the company prior user rights, defined as “the right of a third party to continue the use of an invention where that use began before a patent application was filed for the same invention” (United States Patents and Trademarks Office, n.d.). In order to be classified as a trade secret, information:

- “[...] is a secret in the sense that it is not known or readily accessible to a wide circle of persons;
- [...] has commercial value because it is secret;
- [...] has been subject to reasonable steps, by the person lawfully in control of the information, to keep it secret.” (European IPR Helpdesk, 2017).

These trade secrets allow companies to generate a profit deriving from their creation or innovation (Council Directive 2016/943/EU, 2016, p. 2). A trade secret can be anything that is not patentable, from an algorithm to a recipe or a software.

Another very important intangible assets, however difficult to include in one of the categories above, is the goodwill. It will be included in this classification in an additional category.

5. Goodwill

Goodwill is defined as the difference between the value of an acquisition and the fair value of the assets or liabilities at the date of the acquisitions. Goodwill is recognised in the event of an acquisition or merger between 2 companies. It represents the future economic benefits that will be derived from the assets acquired during a business acquisition that are not or cannot be individually recognised (Ancuța, A., et al., 2017).

The gap between the two values can have several origins, such as the premium a firm is willing to pay in order to acquire an asset or another firm that they think is worth more than its fair value. On the contrary, it can refer to the economic reality of the acquisition. The value of goodwill is reconsidered every year, in order to keep it aligned with the economic reality. This process is called the impairment and will be detailed further in this paper.

Goodwill may, in some cases, raise questions. For example, according to Gabison (2009), it is possible to manipulate this asset to increase the company's profits. If there is no impairment of goodwill, and the acquired company earns a profit, it will be recognised in the parent company's income statement, without any expenses being recognised in return. This has the effect of increasing the company's total profitability.

2.3 ACCOUNTING RULES

This section will focus on the accounting rules in effect, and the reasons why these assets are not always recorded on the balance sheet.

This paper will refer to listed firms, that publish consolidated accounts. This section will cover the international accounting rules used by companies in order to inform their investors about the economic state of the company. These accounting rules do not allow all the assets used by the companies to be recorded on the balance sheet.

2.3.1 IAS 9

Since 1977, the IAS 9 regulation covered the accounting for research and development but did not include all types of intangible assets. Over the years, this regulation has evolved, to the point of being replaced, in 1998, by IAS 38, a regulation solely about intangible assets. This was made possible thanks to rising interest and share of intangible assets in the balance sheet of many firms. IAS 38 is meant to give information regarding the accounting procedures for intangible assets that are not described in other IFRS regulations.

2.3.2 IAS 38

Intangible assets are defined by Bragg (2017) as identifiable, non-physical, and non-monetary resources that have “a useful life of greater than one year” and are available for use by a company (WICI, 2016). Intangible assets acquired externally, through business combinations, i.e. in mergers or acquisitions, will be recognized in the balance sheet at initial cost if they meet the following criteria (KPMG, 2018):

- Their future economic benefits will flow to the entity;
- They are measurable.

This includes patents, brands, and goodwill. When acquired externally, an asset’s value can be estimated with the fair value method or at historical cost, both these accounting methods will be developed later in this section. The criteria cited by IAS 38 do not apply to intangibles included to the following list:

- “Financial assets;
- Exploration and evaluation assets;
- Expenditures on the development and extraction of minerals, oil, natural gas and similar resources;
- Intangible assets arising from insurance contracts issued by insurance companies;
- Insurance assets covered by another IFRS.” (Deloitte, n.d.).

When it comes to internally generated intangibles not cited in the list above, the accounting rules are more complex. According to IAS 38, in order to be capitalised, these assets must meet the entirety of the following criteria:

- “The technical feasibility of completing the intangible asset so that it will be available for use or sale;
- Its intention to complete the intangible asset and use or sell it;
- Its ability to use or sell the intangible asset;
- How the intangible asset will generate probable future economic benefits;
- The availability of adequate technical, financial, and other resources to complete the development and to use or sell the intangible asset; and
- Its ability to measure reliably the expenditures attributable to the intangible asset during its development.” (The Association of Chartered Certified Accountants, 2019).

If one criterion is not met, the “directly attributable expenditure of preparing the asset for intended use” will be recorded as a cost in the income statement. For example, R&D is often classified as an expense and not an asset, therefore virtually not bringing any value to companies, while in reality, it is a major driver of value creation for many sectors, particularly the pharmaceutical and technological sector. There is an exception for expenses during the research and development phases of a software, which are capitalized as incurred.

When it comes to the other intangibles that influence the value of a company, but that do not correspond to the criteria cited above, companies don’t have any obligations to be disclosed in the financial statements of a company. From the customer base’s value to the employees’ or the brand’s value, numerous assets account for a large share of the market value of a company but are not shared with the public or the investors.

In order to have a good understanding of these intangible assets, it is important to be rigorous and methodical in how we approach them, and if how we measure them. The IAS 38 regulation states that these intangible assets must be organized by classes in order to be accurately disclosed (de Lurdes Ribeiro da Silva, Gomes Rodrigues & del Pilar Muñoz Dueñas, 2012). According to this regulation, a class of intangibles assets is “a group of assets of a similar nature and use in the operations of an institution”. There exist various ways to classify intangibles assets, depending on the country the firm is located in. CAP’Immatériel uses a classification divided into 10 categories, aiming at reinforcing the relevance of the management of the firm and support the dialogue between business executives and financiers.

Each of these categories has then been subdivided into specific topics. Moreover, it is essential to be aware that intangible assets are interlinked.

2.3.3 *FAIR VALUE OR HISTORICAL VALUE*

Different methods are available to assess the value of an asset. These different methods include the historical value, as well as the fair value, or mark-to-market value (Investopedia, n.d.). Historical value also called the historical costs method, is based on the value of the assets when it was first acquired by the company. For example, a building purchased 50 years ago would be recorded at the value of that time. As explained in the following paragraph, the depreciation of this asset over its useful life will reduce its value to zero, so this store location on Time Square purchased 50 years ago, will no longer appear on the balance sheet when in reality it will represent a much higher value for the company. Nevertheless, several factors, such as a change in the price level, can strongly influence the value of an asset. In the case of intangible assets, since it is very difficult to isolate their acquisition cost, it is complicated to use the historical cost method to value them.

Fair value, however, works as follows: it is "assets or liabilities that must be listed on the books on a mark-to-market valuation", which would be the price at which an asset would sell or be bought, or the value of an asset when a firm's accounts are consolidated with its parent company. It is often compared or used as the market value, even though they aren't exactly the same, due to market imperfections (Investopedia, 2018). Mark-to-market accounting essentially refers to using the market price of a security. The main approach to evaluate an asset or liability with the fair value method is to trade in on the stock exchange, and let the buyers and sellers give it a bid and ask price if they had no obligation to buy or sell. However, according to Nussembaum (2003), "there is no available market for a large number of intangible assets". Fair value has been a reference during the 19th and 20th century, but there was a shift to historical costs after the 1920 crisis. This latter method was then seen as more accurate and reliable. Nowadays, the accounting world agreed on using the fair value in order to evaluate these complex assets, by "estimating the future cash flows they can potentially generate". However, as described in the next section, intangible assets are subject to depreciation and impairment, but their value cannot be adjusted upwards.

2.3.4 *IMPAIRMENT OF AN INTANGIBLE ASSET*

When the useful life of an intangible asset can be defined with certainty, the value of this asset will, therefore, have to be depreciated, as for tangible assets, over its useful life. These intangible assets have no residual value and are therefore fully depreciated. They can be depreciated using the straight-line method, except in the case of an economic benefit in the future, and it is then necessary to follow the pattern of this benefit in order to depreciate the asset. In addition to this amortization, assets are tested for impairment once a year, or in exceptional circumstances, if the value of the asset may, for a number of reasons, have decreased. A report published by GIFT – the Global Intangible Finance Tracker – in 2017 states “that an annual impairment test is still required for [...]:

- Goodwill
- Intangible assets with an indefinite useful economic life and intangible assets not yet available for use.”

In case of impairment, an impairment loss must be recognized, which will, therefore, reduce the value of the asset, on which the applicable amortization will then be recalculated. They will also appear in the income statement and will, therefore, lower the firm’s income.

In addition, these impairment losses cannot be reversed. Once the value of an intangible asset has decreased, it is no longer possible to increase it. If the useful life of the asset is not known, then the value of the asset should be reassessed regularly to determine whether or not the life of the asset can be defined at that time (Bragg, 2017).

2.3.5 *DIFFICULTIES OF THE NOTION OF INTANGIBLE ASSETS*

According to the National Research Council (2009), a single measure of intangible assets, if any, can be problematic. First of all, it is important to know that, if a company increases the amount it spends on R&D, it doesn’t mean it’s gonna increase its output. A higher amount of research and development spent at Samsung will not necessarily lead to the development of a new technology. In addition, some of these intangible assets are not continuous input for the company. These assets are not observable, unlike tangible assets, “this presents a measurement complication and may be the principal reason that accountants have been

reluctant to try to capitalize them; there is too much latitude for discretion and all that it implies.” (National Research Council, 2009).

As a majority of these assets cannot appear on the balance sheet and are difficult to measure, it is complicated for investors to have a complete picture of the assets held and used by the company, and to justify the market value.

2.4 SOURCES OF NON-FINANCIAL INFORMATION

Many sources of information are available for investors. They include the financial statements, shared in their short or long-form and the management report. As previously mentioned, this paper will solely cover consolidated accounts.

In addition to these legally required documents, other sources of information, financial or not, are available to investors. Among these, the company's website, the analysts' reports, the and press releases made by the companies. Other information, such as an ESG – Environmental, Social and Governance – report, can be shared by companies. The European Commission requires the following companies to provide non-financial information about ESG matters: companies with more than 500 employees, and with a balance sheet exceeding €20 million, or with a turnover exceeding €40 million, whether they are listed or unlisted (European Commission, n.d.) However, Hoff and Wood (2008) have shown that these sources of information are not all equally important to investors. For example, they show that the company's website seems to be less appreciated compared to the annual report. In addition, this study indicates that disclosure about the CSR aspects of a company seems to be the least interesting for investors, although any additional disclosure is good to have. Finally, when it comes to non-financial disclosure, it seems that positive information is more important than negative information.

2.4.1 *RELEVANCE OF NON-FINANCIAL INFORMATION FOR INVESTORS*

In the context of this research, we consider how we could provide comparable, reliable, understandable, and relevant information to investors regarding intangible assets. However, the WICI report (2016) goes further and adds other criteria that this information should meet, including materiality, completeness, conciseness, future-orientation, and neutrality. According

to WICI, this would lead to better communication on intangible assets, which could then bring more value to the company. As later described in this research, other organisations, such as the Sustainable Accounting Standards Board (2011), the SASB, have created tools and reporting schemes that could be used by a large proportion of companies to create a comparable basis for these criteria levels, making them more relevant.

2.4.2 DISCLOSURE PRACTICES

This section will present the disclosure practices in place as of today regarding intangible assets.

According to the Association of Chartered Certified Accountants (2018), the British accounting body, an increase in the voluntary disclosure of information allows, among other things, to improve investor confidence, as well as to have a long-term view of the management strategy, which creates a relationship of trust with the employees. In addition, a better disclosure policy will help the investors to gain an overall picture of the company's relationships with its stakeholders such as customers, government, and employees. As we have seen in the definition of an intangible asset, these relationships cannot be recognized in the financial statements, however, they have value to the company, and it may be interesting to share information about them. Increasing information sharing could incentivise a company to improve these relationships, in order to be able to be disclosed in its annual report, and have a potentially positive impact on the company's image with investors. Having stable relationships with different stakeholders allow investors to have a positive image of the company in the long term, making investment more secure. Moreover, this will improve the internal processes and the business performance of multiple aspects of the company.

A study by Glassman (2003) showed that, with an improved disclosure policy, the price of a security could increase, and the cost of capital could decrease, given that managers have more information about the future of the company. According to Lang and Lundholm (1996), this would also allow analysts to have a clearer picture of the company and therefore make more accurate forecasts. In the other direction, according to Lang and Lundholm (1993), it would seem that an increase in the disclosure can be observed among companies with higher returns. Finally, according to a study carried by Botasan (1997), this link between a decrease in capital costs and an increase in disclosure would also be observed in smaller, unlisted companies that

are not monitored by analysts. On the other hand, a company sharing misinformation or omitting information can have a negative impact on investors' confidence both in themselves and on the share price.

Peter Drucker's saying "What cannot be measured cannot be managed", (cited by Skroupa, 2017) is another incentive for the firms to improve their disclosure policy. The management's will to understand what are intangible assets are present in their companies should increase as it is now understood that it isn't possible to manage what we do not know about.

However, transparency is a two-way street. Next to the advantages of an increase in the available information cited above, it is important to ask ourselves if an increased disclosure is always a good thing. Indeed, it can cause some problems. Hellman et al. (2018) identified three of them, which they called the disclosure problem. First, the information disseminated will only be relevant if it can influence the investor's decisions. In their view, if the financial statements do not provide enough relevant information, this could lead investors to make poor decisions. Second, an increase in irrelevant disclosure can be problematic for investors but also for the company. This can lead to confusion and too much information for investors, making it more difficult to focus and understand relevant information. In addition, it creates unnecessary costs for the company. Finally, if the information is not properly communicated, it makes financial statements more complicated to analyse in an investment decision, because of too much information shared. This could lead investors to miss information that is essential to a good valuation.

For instance, an increase in disclosure about a firm's innovation processes is supposed to enable investors to understand how the company operates internally and how it creates value, which leads to an increase in confidence in the company (Ernst & Young, n.d.). However, this information often doesn't have a numerical comparison available, which can lead to more confusion and decreases relevance and usefulness for the investors and analysts. Furthermore, as said by Hellman et al. (2018), too many criteria in a reporting scheme will flood the investors with too much unnecessary information. This can be illustrated with the following example: when driving your car, if too many information is displayed in front of you, you will not be able to see where you are going. This is similar to annual reports. If too much information is given to the investor, they will not know where to look and may end up losing time trying to understand irrelevant pieces of information.

Moreover, in regards to investors' ethical opinions, an increased disclosure on themes such as sustainability could raise new questions about the practices of a company. This could lead to these companies being removed from the investors' portfolio if they have a certain amount invested in them and if there is a misalignment between their ideas and their values. Many fund managers now have Socially Responsible Investing funds, or SRI funds, that include disclosure criteria. Companies that do not meet certain criteria can simply be removed from these funds (BNP Paribas Fortis, n.d.).

In conclusion, in order for the information to be relevant, a predefined comparison base would be necessary, which is made difficult as investors expect to be able to compare similar criteria, which will inevitably increase the number of metrics needed for a proper analysis.

There are 3 major theories that explain why companies can have different levels of disclosure about intangible assets (van der Laan, 2009):

- The agency theory, which is generally observed between shareholders and executives. This theory states that the shareholders might not know what the executives are doing with the money they are injecting in the company. Furthermore, they can have different levels of risk aversion than these executives and therefore not be aligned with the actions undertaken by the management. This can lead to a lower amount of disclosure from the management than expected by the shareholders;
- The legitimacy theory states that a company acts within a set of norms which leads to a voluntary disclosure about the environment and social aspects of the company and its mission. This aspect tends to cover CSR and sustainability, which is out of the scope of this paper;
- The stakeholders' theory, in opposition with the shareholders' theory, states that the executives should act in the best interest of all stakeholders and implies that the firm is responsible towards a larger group of people than just the shareholders.

Beyond the information available to the general public, and used by private or institutional investors, other sources of information are available only to a smaller portion of these investors. This difference in access to the information is called the asymmetric information

theory. This theory states that different parties may have access to different information about a transaction of goods or services (Investopedia, n.d.). In the financial world, equity analysts review these annual reports and financial statements in order to express an opinion on the company's value. These analysts generally have the opportunity to meet the management of these companies, in order to be able to ask their questions and express their concerns. This allows them to understand the reasons behind the decisions made by management, and sometimes to fill the information gaps that can be found in financial statements. However, these analysts obviously do not have access to all the information they would like to have. In addition, some of this information is therefore not available to the general public. Only investors using these equity specialists have access to this information. This can be referred to as the asymmetric information theory. In addition, these equity specialists have market expertise that allows them to quickly understand what information is relevant and what is not, as well as to anticipate how the company or market reacts to a certain level of disclosure. Equity specialists can then quickly inform their investors of the reasons for a significant change in the share price. For example, in March 2019, Biogen, a pharmaceutical company, stopped one of its clinical trials on Alzheimer's disease, and the stock dropped by 30% in a few hours (The Wall Street Journal, 2019). However, little information was provided on the reasons for the termination of this clinical trial, and this may raise questions about the amount of information that is required to be shared.

2.4.3 PROBLEMS OF A LACK OF INFORMATION

The lack of disclosure of a company's activity can lead to disastrous consequences. For examples, the biotech company Theranos was, in 2018, in the centre of a dispute (Kelly, 2019). The company had promised that the product it was developing would deliver tremendous results to its shareholders and patients. Investors had injected millions in the company that was being valued at 10 billion dollars in the stock market. The reality was that no progress was actually made on the product and the technology they spent 10 years developing wasn't actually working. Due to the strict regulations regarding internally generated intangible assets and trade secrets, the company didn't have to disclose any information about their ongoing research. This proves the difficulty of being informed and valuing intangible assets

Take also the case of Uber, which occurred in 2019. Some have valued the company at an amount as high as USD 120bn ("How Uber Could Justify A \$120 Billion Valuation", 2018). How can this value be justified? Uber probably has softwares and other technological advances planned for the coming years, and potential shareholders are expecting growth for the transport application. The article by Forbes (2018) does not mention at any time the intangible assets that would justify such a value. Albeit, as of April 22, 2019, Uber's market value is estimated at USD 76bn, and the total value of Uber's assets is USD 24bn, 3 times less than the company's market value.

2.5 METHODS OF MEASURING INTANGIBLE ASSETS

In a report about a more reliable non-financial reporting system, Ernst & Young (n.d.) states that “over the next few years, we expect more companies to be focusing their efforts on developing measurable, objective, relevant and complete nonfinancial reporting by defining criteria and measurement requirements for their nonfinancial information indicators, establishing robust data management processes and making the transition to external assurance.”.

The previous sections extensively discussed intangible assets, their importance for firms and the disclosure policies that apply to them. Various companies and associations have created frameworks and models to assess and value intangible assets. From the Balanced Scorecard to the Skandia Value Scheme (SVS) or the Key Performance Indicators (KPIs), different models are available, with some having a greater focus on intellectual capital. However, they all give different results and analysis of intangible assets and cannot, therefore, be considered as a consistent basis for comparison. The two last solutions are more contemporary. They are two different yet complementary new ways that could be used to address the grey area of intangible asset reporting.

2.5.1 *BALANCED SCORECARD*

According to O'Connor and Feng (2005), the scorecard balance is the tool favoured by the US Fortune 500 companies, and 60 % of them are using it, or are currently experimenting with it.

According to Kaplan and Norton (cited in Fernandez, 2019), the balanced scorecard is a strategic tool offering 4 different perspectives: the financial perspective, the client perspective, the operational learning perspective, and the internal process perspective. These 4 new non-financial perspectives are designed to be used in combination with traditional financial measures.

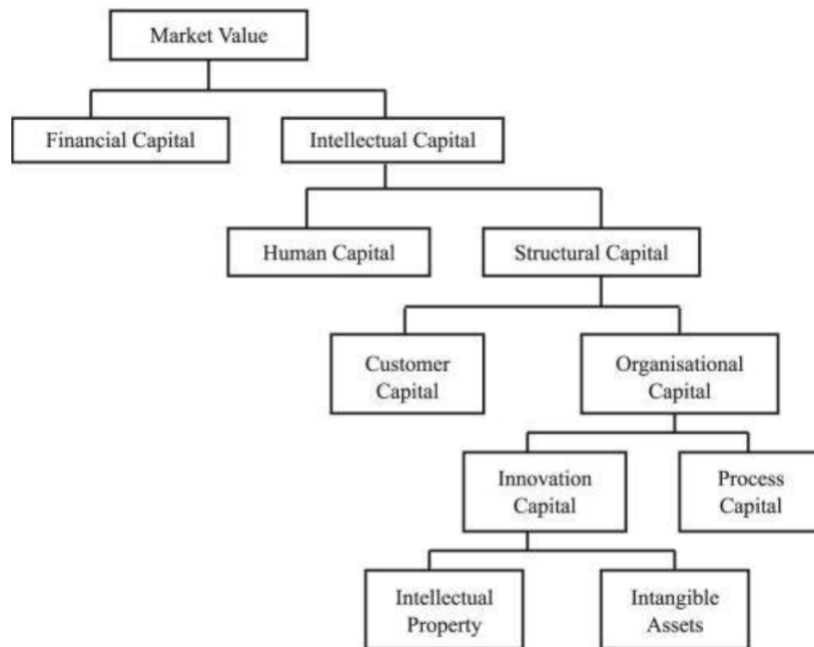
The financial perspective would represent the impact of performance on shareholders, while the client's perspective would represent the impact on the client. Internal processes would highlight the internal advantages of the company and finally the perspective of operational learning questions the possibility of progress and their implementation.

It is important, as the name suggests, that these different perspectives and objectives are balanced. There must then be a balance between financial and non-financial objectives, in the short or long term, as well as between past and future performance indicators.

This can be used for intangible assets to manage the innovation process and ensure that no over-investment is made. However, as Hussi and Ahonen (2002) argue, continuous investment and renewal of these intangible assets must be implemented if they are to be usable in the future.

2.5.2 *SKANDIA VALUE SCHEME*

Created by Edvinsson in 1993, the Skandia Value Scheme is presented below, in Figure 3. It divides the market value between shareholder equity and intellectual capital. The intellectual capital is divided between human and structural capital. The structural is divided between the customer and organisational capital. The organisational capital is divided between innovation capital and process capital and finally, the process capital is divided into intellectual property and intangible assets.



Source: Adapted from Edvinsson (1997)

Figure 3: Skandia Intellectual Capital Value Scheme (Yunus, Ariffin, Kamal & Kadir, 2016)

Then, it comes down to the assessment of the state of the relationships in each of these boxes by management, as well as giving them a value. Renewability and development are important for this concept, and that is what management should focus on. It is also essential to work on the balance between human and structural capital (Edvinsson, 1997).

This process of dividing the different kinds of capital, up to intangible assets, has the following purposes:

- « To identify and to enhance the visibility and measurability of intangible and soft assets.
- To capture and support packaging and accessibility by knowledge transparency and knowledge technologies.
- To cultivate and channel intellectual capital through professional development, training and IT networking.
- To capitalize and leverage by adding value through faster recycling of knowledge and increased commercialized transfer of skills and applied experience. » (Yunus, Ariffin, Kamal & Kadir, 2016).

2.5.3 INTANGIBLE ASSETS MONITOR

The Intangible Assets Monitor allows intangible assets to be measured using a few simple indicators. “IAM is interested in indicators that indicate change and knowledge flows.” (“Summary of Intangible Assets Monitor - Sveiby”, n.d.). As seen in Table 1, these indicators

provide an understanding of how these assets are developed, and an insight into their growth, renewal date, efficiency, and their level of risk. Therefore, when using this method, intangible assets must be seen as real assets. Sveiby (1997) states that creating a measuring framework focussed on intangible assets instead of tangibles would lead to a higher increase in shareholder value. These indicators will have to be adapted to the companies as they will not be appropriate for all companies or for all the skills developed by them.

The Intangible Assets Monitor		
External Structure	Internal Structure	Competence
Indicators of Growth/Renewal	Indicators of Growth/Renewal	Indicators of Growth/Renewal
Indicators of Efficiency	Indicators of Efficiency	Indicators of Efficiency
Indicators of Stability	Indicators of Stability	Indicators of Stability

Table 1: The Intangible Asset Monitor (Sveiby, 1997)

To measure growth and renewability, Sveiby (1997) suggests that calculating the total number of years that an employee has dedicated to a profession gives an image of the skills of a workforce in a company. Growth is also measured by the level of education or the cost of training the workforce. Other measures could be used such as the value-added per employee or professional, sometimes considered as a purer measure. Stability can be measured as a function of the age of employees, their seniority within the company, the turnover rate within the workforce, and finally, a measure of the internal structure. Thus, a large number of indicators can be found to measure the different aspects presented in Table 1. However, these measures are difficult to use if they are used only by a very small number of companies. The efficiency of a company could be measured by taking the number of professionals compared to the total number of employees. This will make it possible to calculate the leverage effect, which, in concrete terms, would measure the profit per professional within the company. This type of measure is probably of less interest to technology companies, although the calculation of the number of professionals could be replaced by the calculation of the number of people with a degree from a prestigious university.

According to Sveiby (1997), the process of measuring intangible assets has two main interests:

- External presentation: the Intangible Asset Monitor aims to provide all stakeholders with the necessary information about the company so that they have the most complete overview of the firm;
- Internal performance measurement: so that management can better assess and control these assets. This is in line with the expression "What cannot be measured cannot be managed".

Many other methods have been implemented, however, they will not be further explored in this paper. Below, two very recent methods will be introduced. They could be implemented to more accurately and efficiently measure these intangibles. They are currently being developed by the different responsible organisations.

2.5.4 KEY PERFORMANCE INDICATORS

As seen before, CAP'Immatériel (n.d.) uses a classification divided into 10 categories, aiming at reinforcing the relevance of the management of the firm and support the dialogue between business executives and financiers. In order to evaluate the performance of each of these categories, CAP uses Key Performance Indicators, customised for each sector.

The second option that could improve the recognition and reliable disclosure of intangible assets is the use of Key Performance Indicators, or KPIs. In a survey conducted by the Association of Chartered Certified Accountants (2018), 96% of investors believe that "quantitative KPIs are essential to assess the sustainable performance of companies", while the number of qualitative measures is 25% lower than the latter. "Companies should use a standardized reporting framework."

In the context of this paper, it is important to highlight one of the organizations that work on improving companies' performance and disclosure. This is what the Association of Chartered Certified Accountants aims to achieve; its mission, in order to be the world leader in the world of accounting, is divided into 3 main points, which would be as follows (The Association of Chartered Certified Accountants, n.d.):

- Enable data end-users to access data from anywhere;
- Create a highly consistent set of standards, with "the highest ethical, governance and professional standards";
- Awaken the public interest and teach them about nonfinancial information.

In the Association of Chartered Certified Accountants' report about a more comparable reporting (2013), discussed at the European Commission in September 2013, it was found that investors' expectations for non-financial information were as follows:

- 88% agreed that it would be important to create "new board oversight mechanisms";
- 84% agreed that external audit is essential to the reliability of the data presented to investors;
- 74% agree that shareholders should have the opportunity to discuss and approve "company non-financial disclosure at a general meeting of shareholders". However, not all companies will be required to disclose this information.

Some argue that the European Commission should perhaps not get involved in companies' disclosure policies, as they would probably know what is best for their investors to know.

In order to have a set of relevant information at its disposal, it is essential that the European Commission strives to make the publication of these regulations on the disclosure of non-financial information mandatory. To this end, some organisations, such as the Association of Chartered Certified Accountants or CAP'Immatériel, are working on coherent reporting frameworks that will provide companies with a reliable set of data that they can compare with other EU companies (n.d.).

In order to make it a reliable and useful source of information, this non-financial information should be synchronized with financial information, such as that presented in the financial statements. This improved disclosure can actually bring value to the company, according to Ralf Frank – Managing Director, DVFA-Society of Investment Professionals in Germany – from the Association of Chartered Certified Accountants' report.

Besides the Association of Chartered Certified Accountants, other organizations came up with new reporting frameworks for intangibles. WICI, created this framework in order to focus on the intangible assets not disclosed in the usual reports. Indeed, WICI decided to “focuses on non-financial reporting elements and not on the valuation of these resources.” (WICI, 2016).

This new reporting framework offers a new perspective on the valuation of intangible assets, by creating a set of KPIs that can be used to provide a comparable basis of measurement for intangible assets, thus increasing the willingness and incentive to have appropriate disclosure.

Finally, it would be important to make this information auditable, according to Robin Edme, Senior Advisor Responsible Finance at the Ministry of Ecology, Sustainable Development and Energy in France. This process would, in total, involve over 80.000 firms in the EU. The ultimate goal would be to create a set of integrated KPIs., similar to the ones presented earlier. According to him, ideally, this should be done on an industry-by-industry basis. This would then allow auditing, and easier and more accurate comparison of the different intangible assets presented (The Association of Chartered Certified Accountants, 2013).

2.5.5 FOUR LINES OF DEFENCE

In order to offer a greater quality of non-financial information disclosure, Ernst & Young created four lines of defence that would allow a greater non-financial information performance management (Ernst & Young, n.d.). These lines are the following;

1. Operational functions;
2. Control functions;
3. Internal audit;
4. External audit.

The first line of defence, operational functions, requires managers to learn more about and approve the sustainability performance data provided to them. It introduces two concepts: the control environment and the control activities. The control environment establishes the values and skills required or expected from an organization, as well as how senior management and the board of directors will manage the business. Control activities, however, are those that have been implemented to review and validate the management practices set up to align with the control environment. These control

activities will be carried out at all levels of the company, at any time. This phase also includes the creation of "performance dashboards to ensure transparency for internal users of information - including operations and management" (Ernst & Young, n.d.). This provides users with a basis for comparison that will allow them to analyse their own data in more detail. In addition, EY suggests that some companies should create an audit system that would review the non-financial information disclosed by the company and find the missing elements, before this information is verified, later in the process.

The second line of defence is called the control functions, or risk management and compliance functions. This step assesses the risks associated with change and the process of sharing information that is not 100% reliable. Observed risks and deficiencies are then reported. This can lead to the creation of new criteria for managing business performance.

The third line of defence, internal audit, is defined by the Institute of Internal Auditors (n.d.) as "an independent, objective assurance and consulting activity designed to add value and improve an organization's operations" that "helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes.". This audit process should determine and assess the adequacy, effectiveness and reliability of non-financial information. In addition, another objective is to confirm that the information complies with all applicable laws and regulations. The impact of this verification process has increased over the years, making it a crucial step. Internal audit leads to new recommendations on how to disclose it as how to present it.

The fourth and final line of defence is the external audit, which provides the firm with an external auditing process. Reports published with ISAE 3000, a regulation ensuring the rigour of non-financial information shared by companies (IAASB, 2013), the following review criteria must be used:

- Relevance: it must be useful in the final decision-making process;
- Completeness: they do not neglect any relevant factors;
- Reliability: to ensure that the disclosure and relevance of factors are similar; regardless of who the end-user of the data is;

- **Neutrality:** to ensure that there is no bias;
- **Comprehensibility:** it must be understood by the end-user. It is very important for the criteria to be relevant and suitable to the organization they will be applied to.

Assurance procedures will be undertaken to ensure a certain level of assurance of the information available depending on how likely it is that there will be misstatements, or if the subject isn't competent on the issue it's sharing. Moreover, "according to IFAC – the International Federation of Accountants – the level of assurance obtained by the practitioner is likely to [...] provide organizations with more in-depth feedback on issues or possible process improvements through a detailed management letter, enabling them to develop internal systems and controls." (Ernst & Young, n.d.).

Although some information may be provided about intangible assets, there is no common basis for any comparison which makes the information less relevant. In addition, in the absence of reporting policies, the information is unreliable because no control system is in place to ensure the quality of the information provided to investors. These different solutions used to measure and classify intangibles are meant to solve these comparison and reliability issues.

2.6 COMPARISON OF THE DIFFERENT SECTORS

This section will provide a more in-depth analysis of the disclosure of intangible asset information within different sectors. It will be introduced by the method used to measure the gap between the book and market value in this paper.

2.6.1 MEASURING THE GAP BETWEEN THE MARKET VALUE AND THE BOOK VALUE

In order to measure this difference, the price-to-book ratio will be used, which calculates the share price divided by the book value per share (Investopedia, n.d.).

The market value of a company is defined as the share price multiplied by the number of shares issued (Investopedia, 2018), while the book value is the value of assets on the balance sheet minus liabilities.

To understand how the market value is calculated, it is important to know that the main method of valuation of a company is the computation of the discounted cash flows, also called DCF. It is a sum of the future cash flows that a company is expected to produce. Therefore, it is essential for investors to have as much information as possible on the company's ongoing projects and its strategy (Gleason, and Klock, 2003). This value is very complicated to compute and is measured by equity analysts, and setting the target share price to what should be the actual valuation of a company. These valuations are based either on a DCF computation or on multiples based on comparable companies from the same sector or industry. However, they often have to be reassessed on a regular basis, or when new information about the company is available, from press releases, the publication of quarter, half-year or annual results. Thanks to these documents, analysts and equity specialists learn about the strategy implemented by companies, that should lead to an increase in the value of the company in the future, through better management of the company's tangible assets, but also by implementing better management of intangible assets. These changes in valuation can either widen or lower the gap between the market and book value. Therefore, a high price to book value ratio will reflect the expectations of the investors for the future of the company.

2.6.2 *MATERIALITY MAP*

In this section, we are going to analyse the SASB's Materiality Map® ("SASB Materiality Map", n.d.). This map is a tool that has been created by the Sustainable Accounting Standard Board, the SASB, in order to give companies within various industries a better framework for the disclosure of non-financial information and intangible assets, with accounting metrics that can be used by the firms, and later by the investors. Although the SASB's Materiality Map® being mainly focused on sustainability issues, many of the topics discussed in this map are related to intangible assets.

This map explains different topics which a company should disclose information. The SASB's intention is that these financial reporting standards should be required by the SEC and mandatory for certain types of companies. More precisely, "SASB wants their reporting standard to be required in annual reports and 10Ks" (Skroupa, 2018). These hopes have been reinforced by the broad participation of different industries.

This information is classified by sector, then into more specific industries within that sector, and then compared to different dimensions, from the environment to the economic model, and the innovation aspect. In total, 26 aspects of sustainability could, according to SASB, be relevant to corporate disclosure. They are displayed in Figure 4.

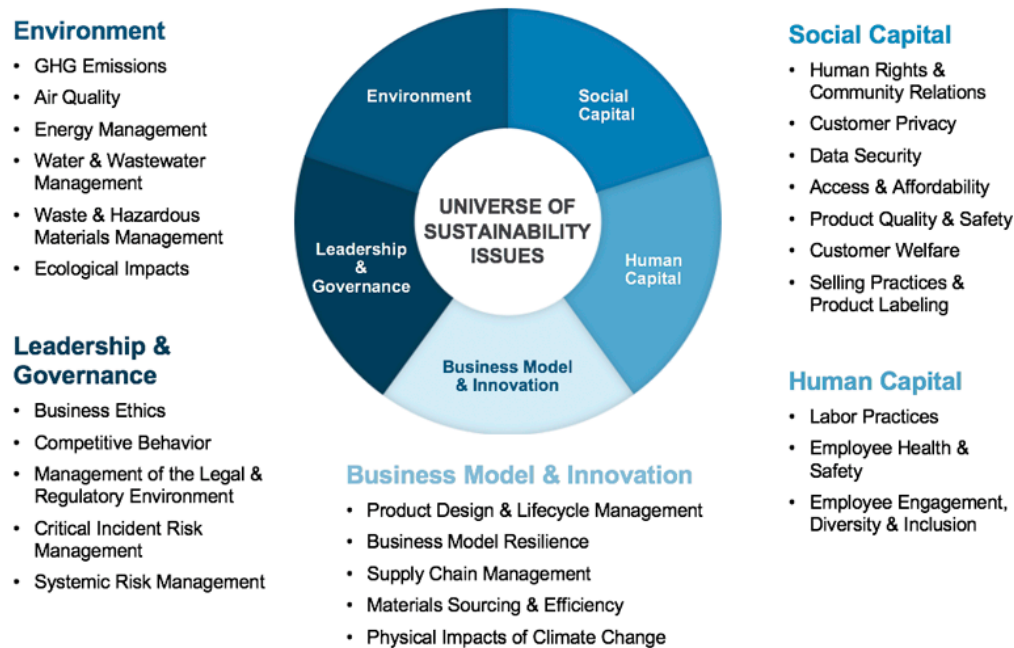


Figure 4: SASB Materiality Map (SASB, n.d.)

The areas highlighted by the Materiality Map will be covered in this section. They range from consumer goods, transport, finance, and resource processing. The objective of this map is to identify sustainability issues, as well as other issues related to intangible metrics that would have a significant impact on a company's performance or finances, and to understand what information investors are more interested in.

Among the 5 areas, social capital seems to be the main source of interest for investors. These areas are then divided into sub-sections, which, for each sector, describe what could be contributed to company reports, and how the metrics could be used.

These new standards were approved in October 2018 and will be applied over a 6-year period to test their relevance and use by companies. However, they are still optional, hence the importance of testing them over several years to find out how companies use them and how they will apply these rules in their financial and non-financial communication.

In the Association of Chartered Certified Accountants' report (June 2013), Michel Bande - Senior Executive Vice-President, Solvay SA - and Teresa Fogelberg – Deputy Chief Executive, Global Reporting Initiative (GRI) – indicate that the search for this materiality should not only be considered as a cost but rather as an investment for a company. Investing in this type of initiative would also represent an intangible asset for the company. Indeed, if a company shows a willingness to improve the way it manages new aspects of its business, this can have an impact on the company's image, and therefore potentially increase its value.

According to Miller (2016), and as mentioned above, transparency, especially with respect to clinical trials and innovation, is particularly important for the health care sector. The Good Pharma Scorecard or GPS is a tool available for pharmaceutical companies to assess the quality of their level of disclosure on this issue. It offers each year a ranking of the best pharmaceutical companies regarding clinical trial transparency. This ranking is based on ethics and public health performance ("Good Pharma Scorecard", n.d.).

As already mentioned, intangible assets are a growing source of value for companies, although the share of intangible assets to tangible assets varies from company to company. Figure 5 shows the ratios for each industry. While agriculture and mining hold a large number of tangible assets, such as machinery and factories, manufacturing companies have a higher ratio of intangible assets on their balance sheets (Arrighetti, Landini & Lasagni, 2014). In addition, the construction sector has seen its ratio of intangibles to tangible assets rise from around 70% to more than 150% in 10 years. Brands and patented innovation have had increased importance in this sector over the years.

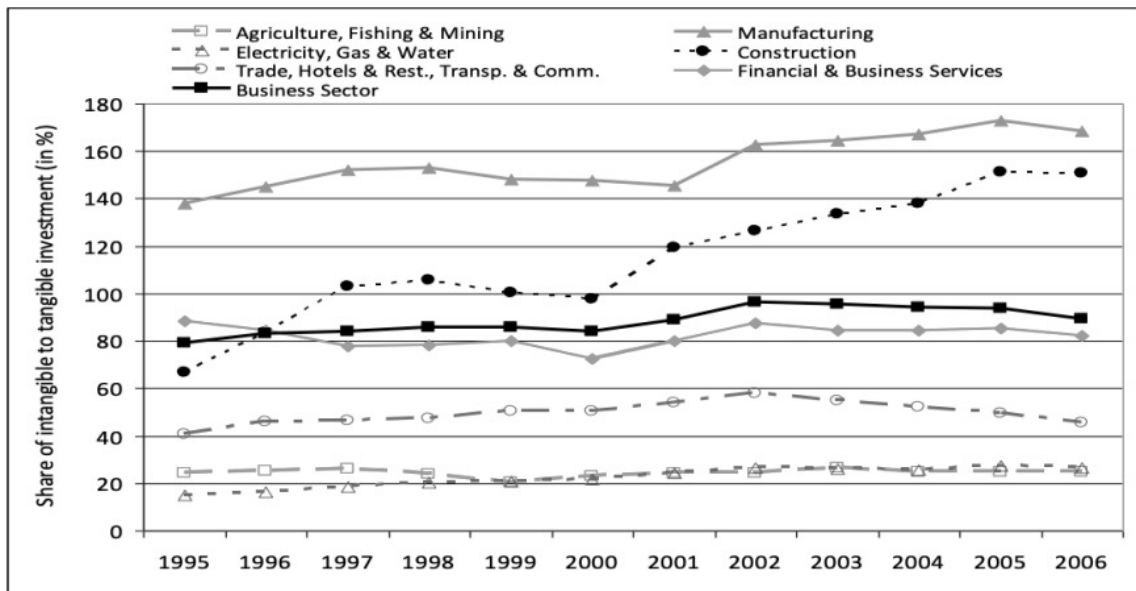


Figure 5: Share of intangible to tangible investments by sector, 1995-2006 (Arrighetti, Landini & Lasagni, 2014)

These numbers explain the need for greater interest for the intangible assets, their disclosure and their impact on the value of the company.

The 11 sectors presented in the SASB's Materiality Map are the following (Sustainability Accounting Standards Board, n.d.):

- Consumer goods;
- Extractives & Mineral processing;
- Financials;
- Food & Beverages;
- Health care;
- Infrastructure;
- Renewable resources & Alternative energy;
- Resource transformation;
- Services;
- Technology & Communications;
- Transportation.

Each of these sectors is then subdivided in more specific industries, and each subdivision is then compared to the different dimensions of the Materiality Map shown in Figure 4, and assigned a level of relative importance; high being important for more than 50% of the industries in the sector, medium being important for less than 50% of the industries in the

sector and low being important for no industry in the sector. These are the material dimensions which a company would most likely have to disclose information in order to appeal to investors.

In Table 2, it is apparent that the materiality of some dimensions is much higher for some sectors than for others. The complete version of Table 2 can be found in Appendix 5.4.

		Consumer Goods	Extractives & Minerals Processing	Financials	Food & Beverage
Dimension	General Issue Category [®]	Click to expand	Click to expand	Click to expand	Click to expand
Environment	GHG Emissions				
	Air Quality				
	Energy Management				
	Water & Wastewater Management				
	Waste & Hazardous Materials Management				
	Ecological Impacts				
Social Capital	Human Rights & Community Relations				
	Customer Privacy				
	Data Security				
	Access & Affordability				
	Product Quality & Safety				
	Customer Welfare				
	Selling Practices & Product Labeling				
Human Capital	Labor Practices				
	Employee Health & Safety				
	Employee Engagement, Diversity & Inclusion				
Business Model & Innovation	Product Design & Lifecycle Management				
	Business Model Resilience				
	Supply Chain Management				
	Materials Sourcing & Efficiency				
	Physical Impacts of Climate Change				
Leadership & Governance	Business Ethics				
	Competitive Behavior				
	Management of the Legal & Regulatory Environment				
	Critical Incident Risk Management				
	Systemic Risk Management				

Table 2: Materiality Map (SASB, n.d.)

For example, Table 2 shows that the environmental dimension has a major impact on the extractive and mineral processing industries, and a moderate impact on the food and beverage, infrastructure, renewable resources, and alternative energy sector. When sectors are divided into several industries, there are some differences. For example, with regard to the environmental dimension and the mineral extraction, and processing sector, while each issue

will be important for the building materials or metals and mining industries, only 3 out of 6 issues will be important for the oil and gas industry.

Other dimensions will be more material for other sectors. For example, in the health care sector, the social capital dimension will have the greatest impact, with health care delivery being the industry fulfilling the most subdivisions. Some sectors, such as the Consumer goods or the Financials sectors seem to have little material dimensions.

The price-to-book value ratio of each sector will, in this research, be used to compare the different sectors on a comparable basis. This measure gives more information about the market-to-book ratio of a firm. This ratio will be useful in understanding the discrepancies that can lead to such differences between market and book value, with multiples reaching numbers as high as 12 times a company's book value. The analysis will then be based on the data available on the NYU Stern School of Business website (NYU, 2019). The Excel spreadsheet used was updated on January 5, 2019, and includes the price-to-book ratios of 93 industries, for a total of 6519 companies. The industries presented in this spreadsheet are detailed in more varied divisions than they are in the Materiality Map. To be able to analyse them, they will be grouped according to the 11 industries presented in the SASB's Materiality Map.

Figure 6, below, provides an overview of the price-to-book value ratio for each sector as presented in the Materiality Map. The weighted average of each of these sectors was then computed, leading to the following results.

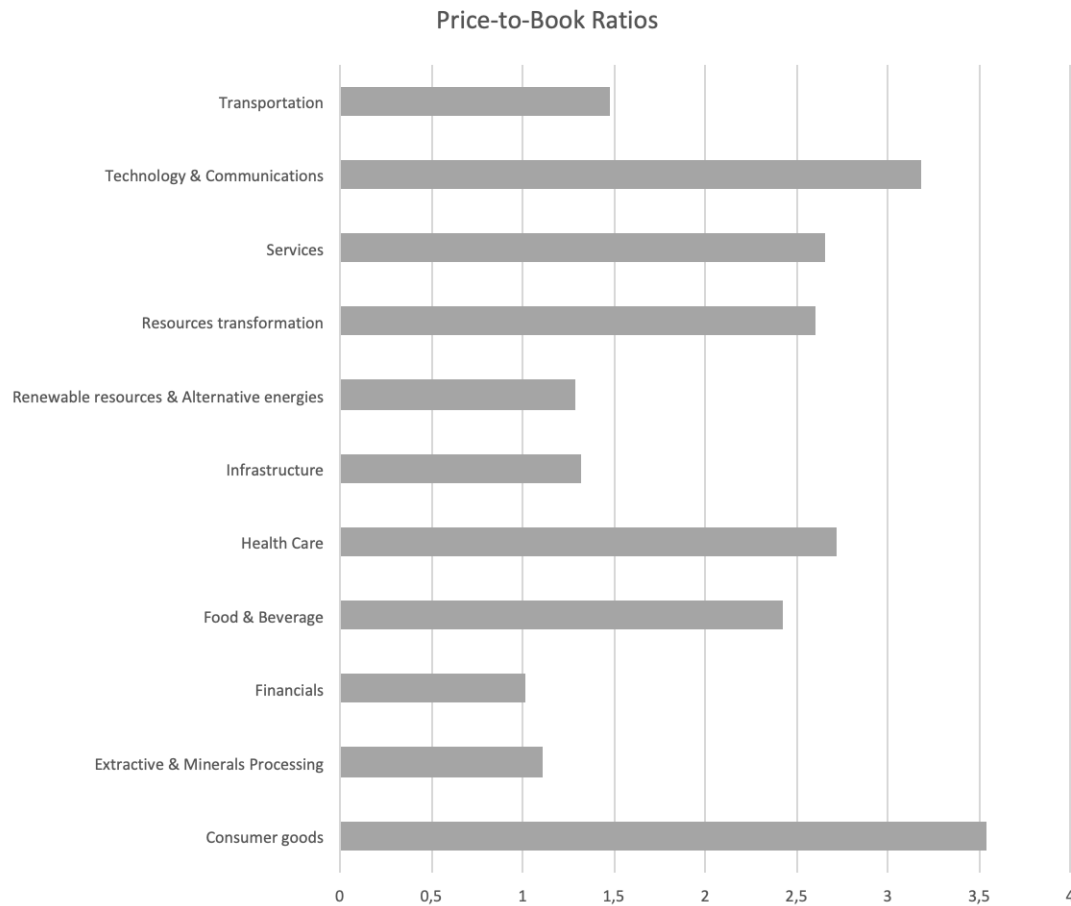


Figure 6: Price-to-Book Ratios

The first observation made is that more than half of the results are greater than twice the book value, two of them being greater than 3. This means that in half of the sectors mentioned above, the market value is twice as high as the company's book value. These values are smaller than expected, especially in some sectors such as technology and communications. This can probably be explained by the definition of the price-to-book ratio, as the book value “is equal to its carrying value on the balance sheet, or the current and non-current assets less the current and on-current liabilities (Investopedia, n.d.). Other measures are available to be compared to the book value. For example, it is likely that a ratio using enterprise value instead of market value would be significantly higher. The enterprise value corresponds to the company's market capitalisation to which is added the company's net debt, other liabilities and commitments (pensions for pensions or disputes, for example), as well as revalued minority interests and finally, revalued investments, are deducted (BNP Paribas Fortis, n.d.).

In some more specific sectors such as transport or extractive and mineral processing, many tangible assets are required to operate a business. For example, major investments in factories and machinery represent the largest portion of a company's assets. However, in sectors such

as health care or technology and communications, a significant portion of total assets are intangible assets, most of which are not included on the balance sheet, which is why the price-to-book value ratio is so important. In these sectors, a large part of the company's value comes from intangible assets, such as patents or R&D, while they have little need for tangible assets. Depending on these levels of intangible assets relative to tangible assets, the information disclosed by companies will vary.

2.7 HYPOTHESIS

The following hypotheses are derived from the literature review and will be confronted with the practical analysis of two sectors.

H1: The difference between the book value and the market value can be explained by intangible assets: In this hypothesis, we do not state that intangible assets are the only factor explaining the difference between the book value and the market value of a company, but rather that they are the main factor explaining this gap.

H2: Companies do not disclose information about intangible assets not recorded on the balance sheet: Here, goodwill and intangible assets that are capitalised will not be included, as disclosure about these two items is mandatory.

H3: An increased disclosure on intangible assets not recorded in the balance sheet would be beneficial for analysts and investors: This hypothesis states that more information available for all investors – individual and institutional, as well as analysts – would be beneficial in the way that it allows them to have a more precise idea of what the future share price of a company will be.

3. Part II: Practical analysis

Intangible assets, although precisely defined and with clear recognition criteria, do not have a real theoretical framework for measuring them. They're used at different levels in all companies around the world, no methods have been created to provide reliable, systematic measurement and a basis for global comparison. The financial and non-financial information available to investors was introduced in the theoretical background.

In the practical section of this research, the observations and hypotheses put forward in the theoretical section will be applied to the pharmaceutical and technological sector in order to draw conclusions regarding the reporting and importance of intangible assets. The focus of this section will be on information that is shared about the gap between the book value and the market value of pharmaceutical companies. The three hypotheses will be analysed within the two-sectors.

First, the pharmaceutical sector is interesting in terms of intangible assets, since value creation in this sector is almost entirely based on innovation, which, when generated within the company, does not appear in the financial statements. However, the pharmaceutical sector has, for public health reasons, very strict and particular rules regarding the disclosure of information about intangible assets (Branigan, 2019). This includes intangible assets that do not have to be disclosed, according to the IAS 38 accounting rules, appear on the balance sheet of the company (The Association of Chartered Certified Accountants, 2019). As it is a very specific sector, a second sector will, therefore, be used to confront the hypotheses set out earlier.

In order to better understand the difference between book value and market value, the second sector analysed is the technology sector. Thanks to digitalisation, in recent decades, tech companies have created new types of assets and services. The accounting rules regarding these new types of assets, however, have not evolved to match the changes in the technological sector. Therefore, this section will analyse the information shared in this sector, to understand there is a demand from investors for more information.

3.1 METHODOLOGY

3.1.1 DATA COLLECTION

For each company, the following information sources will be analysed in order to find out what information they share about unrecorded intangible assets:

- Annual report;
- Company's website;
- Press releases.

The information will be detailed in the annexes and summarized in a comparative table. For each company, this will give a clear comparison of the different criteria chosen.

Subsequently, analysts will be interviewed to obtain their views on the publication of information about these assets. These interviews will be semi-conducted in order to give guidance to the respondents towards the main subject of this paper while leaving them the opportunity to bring up new questioning if needed. During some interviews, it was difficult to follow the order of the predefined questions.

Most of these interviews were conducted face-to-face, to allow for better communication with the respondent. Unfortunately, some of the interviewees were located overseas and therefore it was not possible to meet them in person. In addition, the schedules of some analysts were very busy, making it difficult to meet them. Some contacts were therefore made by telephone or email.

3.1.2 DATA ANALYSIS

For the two sectors selected, 5 companies were chosen in order to be able to compare the disclosure regarding intangible assets. Each company will be promptly described. Then, the main relevant numbers and ratios will be compared in order to have a better understanding of the sector. After a detailed reading of the annual reports, websites and press releases of each company, the categorisation is given in the theoretical part will be used in order to compare these 3 sources of information on the same basis. Each category will be summarized in a comparative table.

This table and the interviewees' answers will then be compared with the 3 hypotheses.

3.2 PHARMACEUTICAL SECTOR

3.2.1 *SECTOR PRESENTATION*

The health care sector includes several types of industries, from drug retailers, care management, medical equipment, to health care delivery, medical technology, and, pharmaceuticals; on which I will focus. The pharmaceutical industry focuses on "the discovery, development and manufacture of drugs and medicines" (Dailey, 2019).

At the beginning of 2019, the pharmaceutical sector represented a total market capitalisation of 920 billion euros and a turnover of over 270 billion euros. Roche, Novartis, and Bayer are amongst the biggest players of this sector (Exane BNP Paribas, n.d.).

The pharmaceutical industry relies primarily on innovation alongside research and development to increase its market value (PwC, 2013). A large number of researchers and patents used in this industry make it an interesting case study. It raises the question of how much of a difference there is between their book value and their market value, and how these types of companies, which base most of their income on intangible assets, disclose information on these assets. In addition, the focus of this research will be on listed companies, as they are subject to stricter regulations than those that are not, and therefore have more information available for investors.

Although intangible assets are essential to this sector, not all of them are disclosed. A study showed that by 2012, 30% of clinical trials had not been reported in pharmaceutical company reports (Johnson, 2015). In the analysis of the sectorial price-to-book ratios, the ratio of the health care sector was 2.72 on average.

3.2.2 *DISCLOSURE PROBLEMS IN THE PHARMACEUTICAL SECTOR*

In the healthcare sector, the disclosure debate is still at the centre of attention. Indeed, nearly 75% of the population believes in the bad faith of companies; that they put profits before the well-being and needs of patients (Miller, 2016). To counter these allegations, healthcare companies are rely on greater transparency, particularly with regard to their clinical trials.

Some extreme cases of lack of transparency, such as the Theranos scandal, may explain such a high level of mistrust in the sector (Kelly, 2019).

3.2.3 *CHOSEN COMPANIES*

In order to have a complete database to analyse, this paper will focus on the five listed companies mentioned below. Using data found in their annual reports, on their website, and on Bloomberg to see what information is actually disclosed surrounding their intangible assets, especially those not recorded on the balance sheet. In order to ensure that this data is comparable, the information disclosed in the 2017 financial year, ending in December, will be used.

- **Bayer** is a German company. “Its business includes human and veterinary pharmaceuticals; consumer healthcare products; agricultural chemicals and biotechnology products; and high-value polymers” (Wikipedia, 2019);
- **Celyad** is a Belgian “biopharmaceutical company, specialized in CAR-T cell therapy” (Celyad, 2019);
- **Galapagos** is a Belgian company, “specialized in the discovery and development of small molecule medicines” (Galapagos, 2019);
- **Lonza** is a Swiss company, that “is one of the world's leading suppliers to the Pharma & Biotech” (Lonza, 2019);
- **Oxurion**, previously Thrombogenics, is a Belgian company, that is “developing innovative treatments to preserve vision for patients with diseases affecting the back of the eye” (Oxurion, 2019).

3.2.4 *NUMERICAL INFORMATION*

This section provides a numerical overview of the five companies analysed. The relevant data will be compared in tabular form. Lonza is a Swiss company, its financial data is therefore presented in Swiss francs. To provide a better basis for comparison, all the figures presented below have been converted into euros, based on the December 2017 CHF/EUR rate, i.e. 1 CHF = 0.8554 EUR.

The first table below, Table 3, provides a brief summary of each company. It gives their market capitalization, total assets, revenues, and profit and losses for the 2017 fiscal year. The companies are sorted by market capitalisation, in descending order.

Company	Market Cap	Total Assets	Revenue	Net Income/Loss
Bayer	86 000 000 000,00 €	75 087 000 000,00 €	35 015 000 000,00 €	3 375 000 000,00 €
Lonza	16 721 359 200,00 €	11 831 037 400,00 €	3 890 359 200,00 €	711 692 800,00 €
Galapagos	4 230 000 000,00 €	1 286 200 000,00 €	155 000 000,00 €	- 115 700 000,00 €
Celyad	341 500 000,00 €	77 600 000,00 €	3 500 000,00 €	- 34 200 000,00 €
Oxurion	129 500 000,00 €	150 500 000,00 €	9 100 000,00 €	22 800 000,00 €

Table 3: Companies' financial summary

The selected companies vary widely in size. Bayer and Lonza are giants in the pharmaceutical sector, while Galapagos, Celyad, and Oxurion are smaller in size. It is interesting to note the difference between Oxurion's balance sheet total and that of other companies: it is the only company whose balance sheet total exceeds market capitalisation. It is also of interest to note that both Galapagos and Celyad incurred losses in the fiscal year 2017. The difference in non-financial disclosure between profit and loss-making pharmaceutical companies could be interesting to analyse in a future paper, as a loss-making company might have an incentive to disclose more information about its doings to maintain shareholders' trust.

Table 4 provides the book value as defined in the theoretical part, i.e., the book value represents total assets minus total liabilities. This value is calculated by deducting the current and non-current liabilities from the sum of the current and non-current assets. These calculations are based on market capitalization and not on the value of the company, which takes into account more information than the market capitalisation itself, which includes only the value of a company's outstanding shares, and omits the company's net debt, as well as certain other parameters.

Company	Current and non-current assets	Current and non-current liabilities	Book Value
Bayer	75 087 000 000,00 €	38 226 000 000,00 €	36 861 000 000,00 €
Lonza	11 831 037 400,00 €	6 543 810 000,00 €	5 287 227 400,00 €
Galapagos	1 286 200 000,00 €	274 300 000,00 €	1 011 900 000,00 €
Celyad	77 600 000,00 €	30 000 000,00 €	47 600 000,00 €
Oxurion	150 500 000,00 €	17 100 000,00 €	133 400 000,00 €

Table 4: Book value

Using these values, the price-to-book ratio can then be calculated by dividing the market capitalisation by the book value calculated in Table 4. These ratios are presented in Table 5. However, before analysing the table below, it is important to know that these ratios vary considerably from year to year, making it difficult to observe a real trend in these sectors.

Company	Market Cap	Book Value	P/B
Bayer	86 000 000 000,00 €	36 861 000 000,00 €	2,33
Lonza	16 721 359 200,00 €	5 287 227 400,00 €	3,16
Galapagos	4 230 000 000,00 €	1 011 900 000,00 €	4,18
Celyad	341 500 000,00 €	47 600 000,00 €	7,17
Oxurion	129 500 000,00 €	133 400 000,00 €	0,97

Table 5: Price-to-Book ratio

The five multiples presented above are very different, ranging from 1 to more than 7. Celyad has the highest price-to-book ratio while Oxurion has the lowest. Galapagos and Celyad, the two loss-making companies for the fiscal year 2017, have the two highest ratios. The benchmark given by the NYU Stern report for the pharmaceutical sector was 2.72 (NYU, 2019). Only three out of five companies are above this figure. This means that nearly two-thirds of their market value comes from off-balance sheet values. The two companies with the ratios closest to these values are Lonza and Bayer, the two largest companies presented in this section.

In order to have a better understanding of the share of intangibles that are recorded on the balance sheet, the total value of intangible assets recorded in the balance sheet was compared with the total value of assets recorded in the balance sheet, as well as with the market capitalisation. Table 6 shows the percentage of intangible assets in relation to total assets, and in relation to total market capitalization.

Company	Market Cap	Total Assets	Total Intangibles	Share of Total Assets	Share of Market Cap
Bayer	86 000 000 000,00 €	75 087 000 000,00 €	26 425 000 000,00 €	35,2%	30,7%
Lonza	16 721 359 200,00 €	11 831 037 400,00 €	6 589 146 200,00 €	47,0%	39,4%
Galapagos	4 230 000 000,00 €	1 286 200 000,00 €	2 500 000,00 €	0,2%	0,1%
Celyad	341 500 000,00 €	77 600 000,00 €	36 500 000,00 €	55,7%	10,7%
Oxurion	129 500 000,00 €	150 500 000,00 €	23 600 000,00 €	15,7%	18,2%

Table 6: Comparison of the value of the total assets, the market capitalisation and the value of the intangibles

This percentage can be as low as 0.2% in the case of Galapagos. This means that only EUR 2.5 million of Galapagos' intangible assets are recorded on the firm's balance sheet, while the balance sheet total represents EUR 1.3 billion and the market capitalisation is worth EUR 4 billion. This gap is impressive. This may mean that the company recognises the assets under different asset names or that the intangible assets that explain the company's market value do not meet the definition of an intangible asset and therefore cannot be recognised on the balance sheet.

For other companies, this share can reach 55%. EUR 36.5 million of Celyad's intangible assets are recorded on the company's balance sheet, for a total of EUR 77.6 million in assets. Although Celyad has the highest percentage of intangible assets in relation to total assets, if we compare the value of these intangibles in relation to the total value of the company, it only explains up to 10% of that value. This justifies Celyad's high price-to-book ratio, amounting to more than 7.

Looking at the percentage of intangible assets in relation to market capitalisation, Bayer and Lonza both have the highest figures, reaching 31 and 40% respectively. For the companies listed above, such high ratios are due to the higher number of acquisitions made by these companies. They must then record goodwill in their balance sheet, which increases the value of the total intangible assets. Celyad also made an acquisition in 2015 ("Celyad: Réalise l'acquisition d'OnCyte", 2015), however, this seems to have had a smaller impact on the ratio between intangible assets and market capitalization, which reached 10%, although it significantly increased the percentage of intangible assets compared to the total assets held by Celyad.

In conclusion, the price-to-book value ratios of companies vary considerably, as does the percentage of intangible assets compared to total assets, or the company's market value. This

seems to be due to past acquisitions, although, as in the case of Celyad, the impact is not always significant.

3.2.5 *COMPARATIVE TABLE*

In this section, an analysis of the annual reports and websites of these companies will allow us to understand if additional information is given on these intangible assets that aren't recorded in the balance sheet.

To fully understand how and why these companies have such a high price-to-book value ratio, it is important to get a view of their pipeline, the innovation within the company, and the subsequent disclosure. To do so, a thorough review of the annual reports and website of the five companies was made as well as an analysis of the information shared about intangible assets. All the financial reports must comply with IFRS standards, making it mandatory for them to disclose financial information in the same way ("IAS 1 Presentation of Financial Statements", n.d.). Non-financial information, however, isn't regulated by the IFRS standards, and therefore, there is no consensus on what companies need to share. For example, American companies have very little information available to investors.

In order to present this data, the information found in these annual reports will be presented in a table. A detailed analysis of these annual reports can be found in the appendix. These intangible assets will be classified according to the categorisation presented in the theoretical part, to which will be added, when relevant, new criteria found during the reading of these reports. They will then be assigned a rating from 0 to 3, each with the following meaning:

- 0 means that the information is not present, or is promptly mentioned;
- 1 means that the information is mentioned in the annual report, but that the company does not elaborate significantly on it;
- 2 means that the company gives extensive information about the intangible asset it uses or creates. The company then gives, in several paragraphs or pages, the measures put in place to support this criterion;
- 3 means that the information shared about this asset gives the investor a comprehensive understanding of the impact of the intangible assets on the company

and the amount invested in them. 3 means that the company has a comprehensive disclosure and should be used as an example for others.

Categories	Bayer	Celyad	Galapagos	Lonza	Oxurion
Length of the report	3	1	1	3	1
Discovery					
R&D expenditures and related IP	2	2	2	2	2
Innovation	2	2	2	2	1
Pipeline	3	2	3	3	2
Human Capital					
Attract and Retain	2	2	2	2	1
Safety and Health	2	1	0	2	0
Customer-Related					
Customer Loyalty	1	0	0	2	0
Reputation	1	1	0	0	0
Advertising, brands and related IP	0	1	0	1	0
Organization Capital					
Competitive Advantage	0	0	0	0	0
Importance of intangible assets	1	2	1	1	2
Goodwill	2	2	0	2	1

Table 7: Comparative table for the pharmaceutical sector

Bayer's report is more than 300 pages long but covers very little information about the gap between the market value and the book value. Likewise, Bayer's website is full of information, to a point where it's difficult to understand which piece of information is or isn't valuable. Bayer and Lonza have the longest reports and the most complete websites, going well beyond legal requirements. They are also the two companies with the highest market capitalisations among all the companies analysed. Larger revenues allow these companies to

allocate more resources to these tasks. The additional information, although shared by these two companies, does not give a clearer understanding of the gap between market value and book value within these companies. Celyad has a high level of disclosure both in its annual report and on its website, even though it's the smallest firm. Therefore, the size of the company seems to not always be linked to the amount of information shared.

In all 5 companies, the pipeline is well covered. They give extensive information about the different products, phases, and expectations for the coming years. Oxurion is the only company with a smaller disclosure of its pipeline and innovation on its annual report, however, its website gives a complete breakdown of the ongoing clinical trials. All these companies give a clear and complete breakdown of their research and development costs for the fiscal year, as well as guidance for the future. In addition, Celyad gives a complete breakdown of the probability of success for each ongoing clinical trial, which could be of great help for the valuations of each product, made by analysts.

When it comes to human capital, most of these companies share information about their employees. This information tends to be related to ESG criteria, however, in some cases, the number of highly educated people are disclosed, which could be useful for the valuation. Larger companies, such as Bayer and Lonza, have an increased disclosure regarding their training programs. Celyad also has extensive coverage of the employees working for the firm particularly in regards to their talent and importance.

Regarding the customer-related intangible assets, such as the relationship with customers, the firm's reputation and advertising, the firms tend not to disclose too much information: Lonza and Bayer mention these subjects, while the smaller companies do not.

The intangible assets which have to be reported in financial statements are mentioned, in every report, even though only the legally shared notes to the financial statements are given, and their recognition criteria. Celyad and Oxurion gave a slightly more detailed breakdown of the intangibles in its company, dividing them into subcategories. In all companies, except Galapagos, that hasn't engaged in any acquisitions, goodwill is addressed in a similar way. Only information concerning the impairment of goodwill and the accounting applied to it is available. None of the companies gave figures regarding unrecorded intangible assets, although information is shared regarding the progress of specific projects and sections of the

company. As mentioned earlier, pharmaceutical companies are legally obliged to disclose some of their projects when they reach a certain stage of development. It is therefore normal that more information is available about innovation in these companies, compared to other sectors.

In conclusion, companies in the pharmaceutical sector publish a lot of information about their clinical trials and their pipeline, although their price-to-book ratio remains high. As mentioned above, pharmaceutical companies are legally obliged to disclose some of their projects when they reach a certain stage of development. Some of the information, which could be omitted, is sometimes shared by the company with investors. This is most likely due to competitive reasons. Finally, larger companies seem to disclose more information than the smaller ones, thanks to higher resources dedicated to the collection of information, as well as to its drafting.

3.2.6 INTERVIEWS

3.2.6.1 Presentation of the respondents

In order to better understand investors' attention to intangible assets, whether or not they are recorded on the balance sheet, two analysts and an equity specialist were interviewed.

The first analyst interviewed was David Evans, Senior Pharma Research Analyst at Kepler Cheuvreux, a French research, execution, and advisory company (Kepler Cheuvreux, n.d.). The 9 years spent in the role of pharmaceutical sector analysts provide him with significant expertise and a knowledge of the underlying aspects of the sector and insight that will add depth to my analysis.

The second analyst interviewed was Florent Cespèdes, who also is Senior sell-side equity analyst Pharmaceuticals but this time at Société Générale. His experience of more than 20 years in the pharmaceutical sector will enable him to answer, with accuracy, the questions raised in this work.

The third person interviewed was Sandra Vandersmissen, Senior Equity Specialist at BNP Paribas Fortis. Misses Vandersmissen is responsible for the coverage of the pharmaceutical sector and therefore has important insights into this sector.

3.2.6.2 Results

The transcripts of the interviews can be found in the Appendix 5.3. The results are summarized in this section.

When asked how they believe the difference between the market value and the book value can be explained, Vandersmissen argues that the book value doesn't include growth which could partly explain the difference between what is present on the balance sheet (a photo of the assets held by the company at a certain time) and the real value of the company. The company's capacity to be innovative is the most important intangible asset in the pharmaceutical sector. Without this ability to develop new treatments, companies can't be profitable. It is what competition in the pharmaceutical sector is all about. According to Evans, a good R&D unit's value comes from its potential to create value in the future, so these companies get a premium in their valuation, while some companies have less potential growth and innovation potential, such as Bayer. Commercial expertise and the know-how to successfully launch a new drug adds value to the company but is very difficult to measure. According to Vandersmissen, there is a higher level of trust in companies that have previously launched successful products. She insists that a large part of the market cap value is based on speculation, and once investors are disappointed, it is difficult to regain their trust. In addition, she believes the past and track record of the company, even though this can't be taken into account as a single measure, will have an important impact on the way investors value new investments. This relates to behavioural finance and has not been addressed in this work. It is an attempt to explain certain investor behaviours through psychology.

Both at Kepler Cheuvreux and Société Générale, the share price of a company in the pharmaceutical sector is measured by creating a mini DCF of the different divisions or products sold by the company, then by making a sum of the different NPVs. This is called a Sum of the Part. This gives the net present value of each product, plus a terminal value, calculated up to 2030. These numbers are extrapolated based on the previous sales and innovation of the company, and on the expectations of future earnings. These Sum of the Part can create a very large difference with the book value of the company.

These future earnings are influenced by how good a company is at generating a pipeline or how it manages its brand value and human capital. Brand value can be very important for

companies with a specific product, a specific target or those located in specific countries. For some pathologies, such as diabetes, the brand of the drug plays a major role in the patient's purchasing decision. According to Evans, in the USA, patients sometimes give more importance to the brand of the drug than to its price, and, if the choice is given, would prefer a more expensive branded-product than its generic version.

According to Evans, the external perception of management can lead to increased trust in the company's ability to generate value through investments. This is the case if the Return on Invested Capital (ROIC, defined as the net profit/capital employed – non-operating assets) is greater than the Weighted Average Cost of Capital (WACC). According to Evans, the Return on Capital Employed (ROCE) is a more relevant measure to compare to the WACC ("ROIC vs ROCE", n.d.). Both a ROCE including and excluding goodwill and intangibles are shared by analysts when giving forecasts about a company. In the interviewees' opinion, the more a firm invests and discloses about its pipeline and the way the company is managed, the more likely the analyst will increase the value the company at a higher price. This is a very important aspect of the valuation of a company. In addition, the sales are also modelled based on macroeconomic factors such as the Brexit, on the volume previously sold, on the price and the lifetime of a patent, and on the potential new products launched by the competition. In addition, elements such as barriers to entry in a sub-sector can impact this ability to generate earnings.

Only a small part of the modelling is, according to Evans, based on the intangibles recorded on the balance sheet, even though, for some recently acquired drugs they look at the assets recorded on the balance sheet to see if that correlates with their NPV assessment. Indeed, in this sector, when an intangible asset is recorded in the balance sheet, it should reflect the future earnings potential or the NPV of these particular assets. As stated in the definition of intangible assets, products resulting from the company's own research and development do not appear in the balance sheet, and expenses are simply recorded as they occur. The only intangible assets that may appear in the balance sheet are those that have been acquired or licensed-in. In addition, the process of testing intangible assets for write-downs (impairment or amortisation) is regulated, but any increase in value is not.

Both Vandersmissen and Evans both agree to say that not enough information is shared by companies about intangible assets. They believe disclosing more information about intangible

assets would be very hard for companies, even though the cost of doing so wouldn't be too material for the larger firms. Creating forecasts for the sales of each drug and divisions is what analysts do. In their opinion, if companies could, within the intangible assets section, give a more detailed breakdown of what value is attached to each drug or asset, it would be helpful for the valuation. In addition, it would be helpful to know what peak sales potential the company believes its assets have. As of today, firms give guidance of what they believe these sales will be but these calculations are not as advanced as those of analysts, which include not only the sales factors of the product but also the macroeconomic and competition factors mentioned above. However, Evans highlights the fact that this long-term guidance is probably the most valuable information for his valuation, even though it is not a proper NPV.

Some information shared by companies is, according to Evans, irrelevant for the valuation of a company. He has no interest in pension or lease accounting, however, he says this is probably relevant to a particular group of investor. On the contrary, Vandersmissen added that ESG publications had an impact on the valuation of some investors. She insists that this is not the case for all companies and that not all investors are sensitive to it. Some initiatives, such as a higher rate of drug distribution in developing countries, or a complete halt to animal testing can add value to the company. Some investment funds specialize in companies with specific ESG criteria, therefore, this type of initiative would be an incentive for these funds to invest more intensively in the companies implementing them.

Finally, according to these interviewees, judgement, building your own model, talking to sell-side analysts, and read analysts' research, or talking to experts in the sector analysed would be the best way to assess the value of each asset and understand the gap between the book and market value. According to Evans, Cespedes, and Vandersmissen, a large spectrum of skills and knowledge is required to provide an opinion on this matter.

In conclusion, the interviewees agree that the innovative capacity of a firm in the pharmaceutical sector is its main value driver. They believe that intangible assets such as brand, and human capital have a major importance for these companies, although the modelling they use do not include these assets. The analysts interviewed explain that they include these intangible assets in their value thanks to their expertise in the field and companies.

3.3 TECHNOLOGY SECTOR

3.3.1 *SECTOR PRESENTATION*

As the tech sector has progressed, tech companies' intangible assets have increased in value. The restrictive accounting framework doesn't allow this value to be fully included in financial statements. Therefore, in such a sector, accounting rules are becoming obsolete since they no longer provide a comprehensive picture of the company (OECD, 2012). As Clarke (2011) argues, some intangible assets may have a greater impact on the value of a company than others, and relatively young companies would tend to collect information about these assets in order to better manage them. This is in line with Peter Drucker's expression, which says that "you can't manage what you can't measure" (cited by Skroupa, 2017).

The main intangible assets bringing value to companies in the technological sector is the company's algorithms and databases, which generates value creation opportunities through advertisements (Monga, 2016). These companies tend to have very few assets recorded in their balance sheets, and a very high market value, which can't be attributed to tangible assets, but rather comes from intangible assets, more specifically from the intangible assets that are not listed on the balance sheet. What also seems to be important for these companies is their market share. Their quasi-monopoly and the very broad range of users reached allows the users' data to be collected and become the companies' major and most invaluable intangible assets (Barnett, 2011). "Google and Facebook accounted for almost all the revenue growth in digital advertising in America last year" (The Economist, 2017). Just the quantity of data they own about their users gives them an advantage compared to other smaller companies. Artificial intelligence increases the value of this data because it extracts more information and creates new uses and value creation opportunities for data.

In this sector, as in many others, there is a lack of information and disclosure about these assets not recorded on the balance sheet. Although the various assets that bring value to firms in this sector are known to the general public, little information is disclosed about them. This is why this section will compare the different hypotheses set out in the theoretical section within the technological sector.

3.3.2 DISCLOSURE PROBLEMS IN THE TECHNOLOGICAL SECTOR

A lack of information can be problematic. For example, Facebook was sued in 2018 for misleading use of the data the American giant was collecting on the billion daily users, questioning the growing importance of data usage for tech companies (Blumenthal, 2018). This data provides them with an extremely high value, with the cost of creating algorithms and storing data as a single expense. Investors and users are poorly informed about how data is collected, how it is used, and the value firms get from it, which leads to ethical issues. These tech giants have an eye on almost everyone's doings on the internet. Google knows what you are searching, Facebook knows what you share, and Alibaba knows what you buy (Galloway, 2017).

3.3.3 CHOSEN COMPANIES

In this section, the following firms will be analysed:

- **Alibaba:** Alibaba's company offers the following services: "core commerce, cloud computing, digital media and entertainment, and innovation initiatives" (Alibaba, n.d.);
- **Alphabet:** Alphabet Inc. includes different businesses and mainly Google Inc. "The Google segment includes its products, such as Search, Ads, Commerce, Maps, Youtube [...] as well as its hardware initiatives" It is "engaged in advertising, sales of digital content, applications and cloud offerings, and sales of hardware products" (Reuters, n.d.);
- **Baidu:** "Baidu [...] is a Chinese language Internet search provider. [...] Its business consists of three segments: search services, transaction services and iQiyi", an online video platform similar to Youtube (Reuters, n.d.). It is the 4th most visited website in the world;
- **Facebook:** The company's main source of revenue comes from the advertisement on its website (Pullen, 2012). It is the reason why Facebook's database is so valuable even though their value isn't recorded on the balance sheet. Facebook has over 1.5 billion daily users worldwide ("Top 15 Valuable Facebook Statistics", 2019);
- **Microsoft:** Microsoft is a company that "generates revenue by developing, licensing, and supporting a wide range of software products and services, by designing and

selling hardware devices, and by delivering relevant online advertising to a global customer audience.” (Microsoft, 2013). Microsoft owns platforms such as Skype and LinkedIn.

All these companies are listed in the U.S, on the NASDAQ or the NYSE and 4 of them are today amongst the largest companies in the world.

3.3.4 NUMERICAL INFORMATION

Similarly to the previous analysis, this section will detail the various data relevant to the analysis of the technology sector. The financial data given for Alibaba and Baidu are in Chinese Renminbi. The numbers were converted with the CNY/USD exchange rate of December 31st 2017, or 1 CNY = 0.1537 USD.

Table 8, below, provides a brief summary of each company. It gives their market capitalization, total assets, revenues, and profit or loss for the 2017 fiscal year. The companies are sorted by market capitalisation, in descending order.

Company	Market Cap	Total Assets	Revenue	Net Income/Loss
Alphabet	\$ 790 820 000 000,00	\$ 197 295 000 000,00	\$ 110 855 000 000,00	\$ 12 662 000 000,00
Microsoft	\$ 645 000 000 000,00	\$ 241 086 000 000,00	\$ 89 950 000 000,00	\$ 21 204 000 000,00
Facebook	\$ 521 620 000 000,00	\$ 84 524 000 000,00	\$ 40 653 000 000,00	\$ 15 934 000 000,00
Alibaba	\$ 480 240 000 000,00	\$ 73 630 000 000,00	\$ 22 994 000 000,00	\$ 5 989 000 000,00
Baidu	\$ 81 860 000 000,00	\$ 38 689 000 000,00	\$ 13 034 000 000,00	\$ 2 810 000 000,00

Table 8: Companies' financial summary

The market capitalizations of four out of these five companies were, in 2018, among the 10 largest companies in the world, in terms of market capitalization ("Biggest companies in the world 2018", 2018). In addition, Apple and Microsoft both reached \$1 trillion in market capitalization, respectively in August 2018 and April 2019 ("Apple is now a \$1 trillion company", 2018). All of these companies are making a profit of multiple billions, in opposition to the pharmaceutical companies.

As explained in the description of the sector, a majority of the revenue in the technology sector comes from advertising revenue. Databases and other algorithms and software held by companies in this sector are intangible assets that could explain the large difference between

book value and market value. However, most of them are not recorded on the balance sheet, and when they are, they are recorded at their fair value, which does not include the future growth that they could potentially bring to the company.

Using the same definition of book value as in the theoretical part (i.e. assets minus liabilities), the book value was then calculated. This value is presented below, in Table 9.

Company	Current and non-current assets	Current and non-current liabilities	Book Value
Alphabet	\$ 197.295.000.000,00	\$ 44.793.000.000,00	\$ 152.502.000.000,00
Microsoft	\$ 250.312.000.000,00	\$ 162.601.000.000,00	\$ 87.711.000.000,00
Facebook	\$ 84.524.000.000,00	\$ 10.177.000.000,00	\$ 74.347.000.000,00
Alibaba	\$ 77.896.775.383,48	\$ 28.079.524.146,20	\$ 49.817.251.237,28
Baidu	\$ 38.690.479.849,99	\$ 18.652.362.362,05	\$ 20.038.117.487,93

Table 9: Book value

By using the book value computation from Table 9 to divide the market value, the price-to-book ratios obtained are presented in Table 10. However, before analysing the table below, it is important to note that these ratios vary considerably from year to year, making it difficult to observe a real trend in these sectors.

Company	Market Cap	Book Value	P/B
Alphabet	\$ 790.820.000.000,00	\$ 152.502.000.000,00	5,19
Microsoft	\$ 645.000.000.000,00	\$ 87.711.000.000,00	7,35
Facebook	\$ 521.620.000.000,00	\$ 74.347.000.000,00	7,02
Alibaba	\$ 480.240.000.000,00	\$ 49.817.251.237,28	9,64
Baidu	\$ 81.860.000.000,00	\$ 20.038.117.487,93	4,09

Table 10: Price-to-Book ratio

The price-to-book ratios for the five companies listed above range from 4 to nearly 10. The price-to-book value ratio given by the NYU Stern Business is 3.18 for the technology sector (NYU, 2019). The only company with the ratio closest to the theoretical ratio is Baidu, while all other ratios are way above 4. As said earlier, these ratios vary widely year-over-year. However, these figures show that the value of a company such as Alibaba is not explained by the assets recorded in the balance sheet, and this to an extent of more than 85%.

Table 11 gives the total value of intangible assets recorded in the balance sheet compared to the total value of assets recorded in the balance sheet, as well as with market capitalisation.

This table shows the percentage of intangible assets in relation to total assets, and in relation to total market capitalization.

Company	Market Cap	Total Assets	Total Intangibles	Share of Total Assets	Share of Market Cap
Alphabet	\$ 790 820 000 000,00	\$ 197 295 000 000,00	\$ 19 439 000 000,00	9,9%	2,5%
Microsoft	\$ 645 000 000 000,00	\$ 241 086 000 000,00	\$ 45 228 000 000,00	18,8%	7,0%
Facebook	\$ 521 620 000 000,00	\$ 84 524 000 000,00	\$ 20 006 000 000,00	23,7%	3,8%
Alibaba	\$ 480 240 000 000,00	\$ 73 630 000 000,00	\$ 20 271 000 000,00	27,5%	4,2%
Baidu	\$ 81 860 000 000,00	\$ 38 689 000 000,00	\$ 3 269 000 000,00	8,4%	4,0%

Table 11: Comparison of the value of the total assets, the market capitalisation and the value of the intangibles

The percentages differ from the pharmaceutical sector, as none of them are above 30%. They range from 8 to 28% of the total assets and account for a very small share of the market capitalization of these companies.

As shown in Table 11, Baidu has the lowest share of intangibles compared to its total assets, reaching no more than 8,4%. Alibaba has 27,5% of its total assets recorded under intangible assets. Although having the largest market capitalisation by far, Alphabet has the second-lowest recorded amount of intangible assets amongst the companies in Table 11. Alphabet's intangible assets account for no more than 2,5% of its market value.

When the intangible assets are compared to the market value of these companies, the difference is much more important. The intangibles never account for more than 7% of the market capitalisation of these tech giants, although they most likely do explain a majority of their value. In sectors such as the technological one, goodwill accounts for a big share of the market capitalisation of companies, as the strategies of companies in this sector consist largely of mergers and acquisitions.

In the following section, the annual reports and websites of these companies will be analysed to determine if the difference between market capitalization and book value is explained.

3.3.5 COMPARATIVE TABLE

Due to the nature of their businesses, Alphabet, Facebook, and Baidu websites will not provide any valuable information on the way they use their assets or information about which asset isn't recorded on their balance sheet, yet brings value to the company. Similarly to the

pharmaceutical sector, the annual reports and websites of these companies will be analysed, then assigned a rating ranging from 0 to 3. As a reminder, each of these ratings has the following meaning:

- 0 means that the information is not present, or is promptly mentioned;
- 1 means that the information is mentioned in the annual report, but that the company does not elaborate significantly on it;
- 2 means that the company gives extensive information about the intangible asset it uses or creates. The company then gives, in several paragraphs or pages, the measures put in place to support this criterion;
- 3 means that the information shared about this asset gives the investor a comprehensive understanding of the impact of the intangible assets on the company and the amount invested in them. A 3 means that the company has a comprehensive disclosure and should be used as an example for others.

Annual accounts for American companies must be shared according to the U.S. GAAP accounting rules, which are very similar to the IFRS accounting rules, and only involves some minor change.

Categories	Alibaba	Alphabet	Baidu	Facebook	Microsoft
Length of the report	0	1	2	1	1
Discovery					
R&D expenditures and related IP	1	1	1	2	2
Innovation	1	2	0	2	2
Human Capital					
Attract and Retain	0	2	0	0	1
Safety and Health	0	1	0	0	1
Customer-Related					
Customer Loyalty	0	1	0	1	2
Reputation	2	1	0	2	2

Advertising, brands and related IP	2	1	0	2	1
Organization Capital					
Competitive Advantage	2	1	0	1	2
Importance of intangible assets	1	1	1	1	1
Goodwill	1	1	1	1	1

Table 12: Comparative table for the technological sector

The 0 rating given on the length of the report means that the firm has a very short annual report that doesn't give any extra information than what is legally required in the 10-K form. All the reports from the American companies comply with the SEC 10-K fillings and are approximately 100 pages. Baidu and Alibaba's annual reports are much longer, ranging from 300 to 900 pages long. Additional sustainability reports are available on the websites of these 5 companies.

The two main observations made during this analysis were that Baidu and Alibaba, the two Chinese companies cited above, have very little information available for the investors. Since Chinese companies' websites are in Chinese, this creates a language barrier, making communication with investors complicated. Being listed in the U.S., the majority of these companies' investors and analysts aren't Chinese and therefore have seemingly very little information regarding the firms' behaviour.

The research and development expenditures are legally required to be shared in the 10-K form and are therefore available. When it comes to the innovation within the company, Alibaba discloses part of it in press releases. Innovation is visible in Microsoft, Facebook, and Alphabet thanks to the emphasis put on artificial intelligence and other R&D projects they are working on. These three companies have websites linking to different platforms showing different projects launched and news sections dedicated to the ongoing projects. However, these different websites are very difficult to find from the initial website.

In addition, although the numbers of users on Facebook or Alphabet are given, no value or additional information can be found about these essential metrics. They can be found on separate websites but are not shared by the company itself.

While the presence of extremely talented and smart employees working for Alphabet or Microsoft might be common knowledge, very little information appears on the annual report or the website regarding their employees, even though Alphabet shares information about the where it is hiring its people from. Alibaba and Baidu do not share any information regarding these employees. The information available is mainly related to the quality of work within the company, such as compliance with ESG criteria, rather than the value these employees represent for the company.

When it comes to customer-related intangible assets, companies – except for Microsoft – do not disclose information about their relations with their consumers. Alibaba, Facebook, and Microsoft share information about the reputation of their firm, and their brand. Some information is available regarding the use of their brand in a different context. However, the value that the brand represents for the company is never shared, presumably for competitive reasons.

When it comes to intangible assets and goodwill, the minimum information required is shared with investors in the notes to the financial statements. No more quantified information can be found on the companies' websites about unrecorded intangible assets or about the gap between the book and market value. Indeed, this information can be detrimental to the company at several levels, and is therefore generally not communicated.

As mentioned earlier by Blumenthal (2018), the majority of the value of these companies comes from the data they collect from their users. However, information on the use of this data, which is so problematic today, is not available on the respective company websites. As mentioned above, since the Baidu and Alibaba sites are in Chinese, it is possible that this information is there but cannot be understood by investors.

In conclusion, these 5 companies, although gigantic, communicate little or nothing about intangible assets that are not recorded on the balance sheet, including data, although these are a huge source of value for the company. The difference in language between the company and the investor may hinder the latter's understanding of the assets used by the company. Employees are not mentioned much, although they bring a lot of value to the company. The available employee information is linked to ESG criteria. As can be seen in the following

section, which includes the conducted interviews, competition and obsolete accounting rules prevent companies from sharing more information about their intangibles.

3.3.6 INTERVIEWS

3.3.6.1 Presentation of the respondents

The first respondent was Koen De Leus, Chief of Economic Research at BNP Paribas Fortis. Although he is an economist and therefore does not have the view that an analyst should establish the value of a company's stock, he has a great interest in intangible assets, their accounting and the way they are communicated.

The second person interviewed was Luis Alberto, Performance Manager in the Financial Reporting department of BNP Paribas Fortis. Mister Alberto's insight will be more focussed on accounting.

The third person interviewed was Rudy De Groodt. He is Senior Equity Specialist at BNP Paribas Fortis and is a board member of the ABAF-BVFA, the Belgian Association of Financial Analysts. He teaches for investment programs at the KULeuven.

3.3.6.2 Results

The transcripts of the interviews can be found in the Appendix 5.3. The results are summarized in this section.

When asked how he believes the gap between the market value and book value could be explained, De Groodt explains that companies in this sector have a very different structure than most traditional companies, which he describes as companies with a lot of tangible assets, such as plants, machinery etc. In the technological sector, however, companies carry very little tangible assets on their balance sheet and often have more intangibles listed. In addition, companies in this sector tend to have negative earnings during their first years of activity. De Leus explained that the correlation between the book value and the profits decreased from 80% to 25%. The book value is less relevant than it used to be to explain the rise or decrease of a stock price. These companies usually have a lot of hidden value inside their company, that need triggers to unlock them.

De Leus argues that the difficulty of intangibles assets and their assessment also comes from the fact that there is no market to buy or sell them. He explains that if a company successfully uses its assets, then it can become extremely profitable. However, while in traditional sectors, it is easy to resell a machine or factory, this is made very difficult in the technology sector, due to the lack of market for these types of assets. Therefore, in the event that this asset is not successful, the company may incur significant losses. This also explains the continued growth of companies such as Amazon, which have sufficient funds to absorb losses generated by a failed asset, and which then allows the company to reinvest money in other products or services (Galloway, 2017). Moreover, both De Leus and De Groodt insist on the importance of the scalability of such assets, and how, once the asset is developed and the firm is well established in the market, no more investments are generally needed, and earnings will only increase.

De Leus explains that once the firm is established, it is very difficult for the competitors to gain market shares, while De Groodt states that in this sector, it is relatively easy for a small company with a new innovative product to take over large companies. This phenomenon is called disruptive innovation ("Disruptive Innovations", n.d.), and forces these larger firms to continuously invest in research and development in order to remain the leader in the market.

All respondents agree that some intangible assets are very difficult to value, such as staff training, or types of structures that make work more efficient. These items can be measured in terms of their numerical effect on the operating margin, rather than by putting a specific amount on the asset. This information can be found or guessed using clues given by the company. The analyst must then use his or her expertise and knowledge of the sector to deduce the conclusions necessary for its valuation. Due to the shift in strategy and assets used by companies, these analysts will, therefore, have more and more added value for investors as their broad knowledge of the sector, their meetings with management and their in-depth research will allow them to have a much more informed view of these companies than a simple investor relying only on publicly shared information. De Leus adds that the world is slowly shifting to a world where investors will absolutely need to meet a firm's management in order to have the necessary information about the company. Soon, the main way to be able to invest in listed companies will be to use analysts to access their expertise in the field of technology companies. However, this raises the question of if the need to rely on analysts is a

good thing for investors. This raises many questions about information asymmetry (Investopedia, n.d.), an economic concept presented earlier in this research.

According to De Leus and his knowledge of the literature about intangible assets and the disclosure on their subject, there is a demand from investors for a higher disclosure surrounding intangible assets. However, he believes it is getting more and more difficult for analysts to value these assets, and for companies to know what information they should disclose. De Leus argues that increased information about intangibles assets will give increased visibility and certainty about the future cash flows of the company. De Groodt says that an increased disclosure would be beneficial, and more information about the margins generated by a certain product or algorithm would be very welcome, but he also understands that this probably will never happen as it would be risky due to competition. An increased disclosure could show how attractive a sector is, or highlight a gap in the market, that could be exploited by competitors. In addition, if they don't reach the target announced, investors can be very severe to companies with disappointing results. This could explain why companies tend to disclose less than investors would want to see. However, according to De Groodt and De Leus, companies tend to underestimate their targets, and then it's the analyst's job to work with these targets and decide whether they would increase them or not.

According to Alberto, the main risk of this lack of disclosure on intangible assets would be the overvaluation of a firm. De Groodt argues that disclosing less information would create difficulties for potential bidders to set a number on the company. In the tech sector more specifically, the management's goal is often not to sell out their company but to add value.

Finally, De Leus adds that the accounting rules should evolve to measure this value, but this is at the opposite of today's rules. This includes amortization and depreciation, that, according to him, should not occur with intangible assets such as databases or the value of engineers in a company, as they probably will only bring more value in the future. Alberto points out that these amortizations and depreciation are included in the calculation of the DCF.

In conclusion, the interviewees pointed out the differences in the structure of the technology sector compared to others. They comment on the difficulty of measuring intangible assets, due to the lack of a market to exchange them. They also emphasize that, in the near future, analysts will become essential to informed investment in the technology sector, highlighting

the problem of information asymmetry (Investopedia, n.d.). They also indicate that companies do not always know what information to share and that they, therefore keep to the strict minimum for competitive reasons.

3.4 ANALYSIS AND HYPOTHESIS ANSWERS

3.4.1 HYPOTHESIS 1: THE DIFFERENCE BETWEEN THE BOOK VALUE AND THE MARKET VALUE CAN BE EXPLAINED BY INTANGIBLE ASSETS.

As explained by most of the people interviewed, the gap between the book value and the market value can partially be explained by the intangible assets.

The innovative capacity of a company in the pharmaceutical sector is a firm's main value driver (Branigan, 2019). This innovation generated internally can't be recorded on the balance sheet (IAS, n.d.), and yet generates value, therefore, increasing the gap between the market and book value. In this sector, the ratio between the intangible assets recorded in the balance sheet and the market capitalization could be as low as 1% and rise to 40%. Many other assets presented on the firms' website, such as clinical trials or researchers in companies, are not represented in this percentage (PwC, 2013). It is very likely that these intangible assets explain the difference between the book value and the market value.

In the technological sector, where accounting rules have become obsolete (OECD, 2012), the main source of value creation comes from databases, talented employees, and algorithms (Monga, 2016). The large majority of the intangible assets used to generate value are not recorded on the balance sheet of tech companies. The ratio between the intangible assets recorded in the balance sheet and the market capitalisation varies between 2.5% and 7%. These figures are much lower than in the pharmaceutical sector. De Groodt argues that this gap is indeed explained partially by intangible assets.

In both these sectors, other macro-economic and competitive factors have a major impact on the share price of a company, without having anything to do with the assets used by the firm. These external factors cannot be underestimated, as they play, for most sectors, a major role in the valuation of a company. That being said, according to Warren Buffett, intangible assets can serve as a safety net, for instance, in times of economic stress. This would give the investor an incentive to pay a higher share price for companies with a higher percentage of these intangibles (Kennon, 2019).

3.4.2 HYPHOTHESIS 2: COMPANIES DO NOT DISCLOSE INFORMATION ABOUT INTANGIBLE ASSETS NOT RECORDED ON THE BALANCE SHEET.

The comparative tables give different results for each sector. The pharmaceutical sector disclosed more information about the innovation within the firm, because of public health reasons (Branigan, 2019). The firms in this sector disclose more about their human capital than the technological sector. However, human capital is extremely important for tech companies too (Monga, 2016).

In the pharmaceutical sector, which is a very particular case, a company's annual reports and their websites include a lot of information on the different phases of the clinical trials (Johnson, 2015). However, due to competition reasons, no numerical information such as the expected margins on those products can be given. Little information is given about the employees of these companies, and their expertise.

The technological sector also relies mainly on internally generated assets to generate value. In opposition to the pharmaceutical sector, there is no public health issue linked to the companies in this sector. Therefore, mostly for competition reasons, and as the accounting rules do not require the disclosure of this information, companies in the technological sector do not share information they are not legally required to. The strong competition in this sector, in which a new product can be created with little capital needed, makes companies more careful regarding the information they disclose. In this sector, the most valuable, yet unmeasurable asset is the data collected about users (Barnett, 2011). This data is sold to developers and advertisers and the advertisement revenues make up for most of these firms' turnovers (The Economist, 2017). However, no information was found on this data or the way it is used, neither on the annual reports or on the websites of these companies.

To conclude, it can be said that companies do not disclose information about intangible assets not recorded in the balance sheet. The pharmaceutical sector is an exception. For public health reasons, companies in this sector are required to disclose certain information to the public (Branigan, 2019). The technology sector, however, is not bound by this kind of obligation. In this sector, information about intangible assets used by the company but not recorded on the balance sheet, such as data, is only very rarely shared by the company. The information that can be obtained is not quantified, and does not allow the value of these intangible assets to be

measured with certainty. This does not allow investors to compare this information with another, and leaves a lot of room for interpretation.

3.4.3 HYPOTHESIS 3: AN INCREASED DISCLOSURE ON INTANGIBLE ASSETS NOT RECORDED IN THE BALANCE SHEET WOULD BE BENEFICIAL FOR ANALYSTS AND INVESTORS.

In the pharmaceutical sector, the valuation of companies is mostly carried via a Sum of the Parts. The most relevant information for analysts and specialists is the long-term guidance given by the company regarding future sales. Evans, Vandersmissen, and Cespedes agreed that an increased disclosure in this sector wouldn't be very material, however, they would be interested in further information about the sales and earnings potentials of the different drugs in development.

In the technological sector, it is difficult for analysts to use a classic DCF as the earnings of these firms are usually negative during the first years of activity. Therefore, analysts, similarly to the pharmaceutical sector, use the Sum of the Parts of the different segment of a company. To do so, they have to make assumptions based on the information given by the companies. However, as said by De Groodt and De Leus, this information is not always available. Most of the time, companies do not disclose much information about their hidden jewels. De Groodt and De Leus highlighted the fact that an increased disclosure would be beneficial for them, although it could hurt the company competition-wise. In addition, the growing importance of using analysts specialized skills to enable educated investment in this type of sector is highlighted. This highlights the problem of information asymmetry that arises when assets whose accounting and disclosure rules are poorly regulated (Investopedia, n.d.).

Therefore, an increased disclosure of intangible assets not recorded in the balance sheet would be useful for the investors and would allow them to be less reliant on the analysts to have the relevant information about companies, thereby reducing the information asymmetry.

4. Conclusion and limits

4.1 CONCLUSION

Overly strict accounting rules and limited information allowed on the balance sheet lead some companies to have a considerable gap between their book value and their market value. This research is divided into two parts and will discuss the involvement of intangibles in this gap, and the subsequent disclosure about these assets. The first part reviews and summarises the literature on intangible assets. The second part, the practical one, covers two more specific sectors, through in-depth analysis of websites, annual reports, and interviews with analysts.

The first observation is that intangible assets are a major factor explaining the gap between the book and the market value. Throughout the sectorial analysis, very high price-to-book ratios were identified, while having very low percentages of intangible assets recorded on the balance sheet. Both sectors mainly generate value from internally generated intangible assets, whether through algorithms and databases for the technology sector (Monga, 2016), or innovation for the pharmaceutical sector (Branigan, 2019). Based on these findings, it is clear that the assets mentioned above, that cannot be recorded on the balance sheet, explain most of the gap between the book value and the market value.

The second observation made is that companies do not provide sufficient information on intangible assets, making financial statements unrepresentative of the economic reality of a company. Companies are legally required by the International Accounting Rules to publish certain financial information (IAS, n.d.). This research highlights the fact that unregulated financial and non-financial information is generally not published by companies. The only information available is related to ESG criteria, however, this information does not impact significantly the market capitalization (Hoff & Wood, 2008). The non-legally required information is not shared for two main reasons. First, competition is high and based mainly on intangible assets held by companies. As a result, firms do not disclose sensitive information in order not to say too much, or too little, to their competitors and investors. Secondly, there is no global framework for sharing information about intangible assets. It is now essential that sector-by-sector frameworks are implemented, with clear methods of measuring intangibles, for investors to be able to understand the information, to ensure that it is reliable, and comparable with other companies in the same sector.

The last observation made is that there is a demand from investors and analysts for more information about these unrecorded intangible assets. Companies, for the reasons mentioned above, are not willing to share this information, and accounting rules still do not allow for the measurement and recognition of most intangible assets in the financial statements. This financial information is, therefore, becoming obsolete (OECD, 2012). This is where the problem of information asymmetry arises (Investopedia, n.d.), since, through meetings with management and greater expertise in the sectors, analysts have access to more information than an individual investor. Both sectors reviewed in this research have become extremely complex to understand, and it is now difficult to assess the real value drivers of companies in these sectors without external assistance. Accounting rules must evolve to allow investors and analysts to have access to the same reliable and understandable information in order to make informed investment decisions.

From an investor perspective, the main risk related to the poor disclosure about intangible assets is the misunderstanding of the company's activities (Blumenthal, 2018), which can lead to mistrust towards the company (Miller, 2016). From a management perspective, the main risk of not providing information on intangible assets is that it is more difficult for companies to manage assets of which they are not fully aware (Skroupa, 2017). This can lead to the undervaluation or overvaluation of a company during IPOs or acquisitions.

In conclusion, accounting rules must evolve to include more intangible assets, as they are important value drivers for companies, and allow financial statements to share this essential information with investors. More transparent disclosure needs to be implemented in order to allow a better management of intangible assets, and allow investors to have a broader understanding of a firm's activity. With no evolution of the accounting rules, risks associated with a lack of disclosure will only increase, as companies highly relying intangible assets are constantly growing (Salinas, 2018).

4.2 LIMITS OF THIS PAPER

This research focused on two very particular sectors, both with very different expectations from the stakeholders, in term of disclosure. Therefore, sector-by-sector research including a broader range of industry could be interesting.

In addition, the new GDPR regulation might have an impact on the disclosure as the right of users to know what data the firms own about them and how they use it could lead the companies to have to increase their disclosure regarding this data.

Interesting research topics for future students could be:

- The difference in disclosure between a profit or loss-making company, such as Celyad or Uber. Is an increase in disclosure a way to reassure investors about the future of the company?
- What are the advantages and disadvantages of being a leader/the first to publish this information about intangible assets?

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