
# POLICY PAPER

## What impact will the digital economy have on accounting? The challenge of intangible assets' recognition.

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**Summary**

The digital revolution and the dematerialisation of the economy are under way, but what impact will this have on accounting? I aim to shed light on this issue by studying the possible accounting implications of the digital economy and, in particular, their impact on the role of intangible assets. This paper focuses first on identifying the accounting issues raised by new digital transaction methods and, based on examples drawn from companies in the new economy, raises the issue of the increased accounting recognition of intangible assets. I then present a literature review on the contribution of intangible items to the value relevance of financial statements and their impact on the decisions made by users of financial information. I attempt to resolve the issue of the recognition of intangible assets in the balance sheet. The intangible assets examined are R&D, advertising expenses and patents. Two main findings stand out: intangible assets appear to be firmly linked to companies' stock market performance measures; however, the results of the studies examined are highly dependent on the institutional sector and the market conditions in which the companies in question find themselves.

**Key words**: intangible assets – value relevance – R&D – digital – accounting

## Introduction

Our society is on the verge of a digital revolution, made possible not only by digital technology and economic changes, but also by the way people communicate through computers, smartphones and the Internet. The widespread access to telecommunications and computer technology is creating new ways of working and socialising. The growing role of the digital economy in everyday life has increased the supply and demand of new data. This revolution has paved the way for a new era of information, sparking a fourth industrial revolution, or "Industry 4.0" as it is also known (Schwab, 2017). It is mainly characterised by the processing of very large volumes of data thanks to the development of algorithms and mathematical models to support innovative technological solutions. This fourth industrial revolution also bodes well for an overhaul of the entire traditional production system beyond the mere optimisation of production resources.

This transformation is beginning to integrate business practices via the so-called platform economy and the emergence of global digital giants such as Google, Amazon, Facebook and Apple, as well as Uber, Airbnb, Alibaba and many others. Many start-ups also offer a vast range of services thanks to new technologies. But the accounting treatment of the transactions generated by these new players is stymied by the existing accounting frameworks. What are the limits of these frameworks? Do they take into account all of the characteristics of these digital transactions or do they need to be revised?

The rise of big data, the digital revolution and social media are also radically changing decision-making processes (Brown, Chui and Manyika, 2011). These new technologies make it possible to directly link supply and demand and thus modify traditional value creation processes. New types of transactions are emerging with the rise of platforms (like Uber) and the sharing economy (e.g., Blablacar), where the consumer is part of the value creation process. Customer experience is the core focus. This new digital context is therefore likely to change financial management and accounting. Petty and Guthrie (2000) explain that the bridge between this new digital context and firm value lies in knowledge management (or "KM") and is reflected in intellectual capital, a concept translated as intangible assets in financial accounting. The two authors argue that the emergence of an information economy has created a potential competitive advantage in the form of so-called knowledge-based intangible assets. The areas of knowledge management and intellectual capital are linked to the identification and effective management of knowledge to achieve this competitive advantage. However, traditional accounting practices do not allow for the identification and measurement of these "new" intangible assets, hence the importance of managing, measuring and disclosing such forms of intangible assets from a research perspective.

Over the past few decades, companies have thus gradually entered a knowledge and information-based economy characterised by rapid technological change. The production of physical goods no longer appears to be the main source of value creation, having been replaced by the creation and management of intangible assets (Goldfinger, 1997; Lev and Zarowin, 1999).

In light of this situation, companies increasingly need to invest in intangible assets. However, in most cases, these investments are not reflected in the balance sheet due to very restrictive criteria for the recognition and valuation of these assets. It is therefore possible that financial statements have become less informative about companies' current and future financial position; indeed, they increasingly provide reliable but irrelevant information about the value of such companies. Does the traditional accounting model–initially developed for companies whose primary activity was of an industrial or manufacturing nature–need to be modified or at least expanded to reflect intangible assets and to improve the relevance of accounting information? Digital transformation is the result of major technological and IT developments, and the issue of capitalising R&D is therefore becoming even more pronounced. These digital developments and the emergence of a new knowledge-based economy create value that can take the form of intangible assets (e.g., R&D, trademarks, patents, customer lists, etc.). However, these assets are scarcely or poorly recognised by existing accounting frameworks. The question is, does this transformation exacerbate the existing problem of the recognition of intangible assets?

Academic work has focused on the issue of the recognition of intangible assets since the late 1990s, which proved a turning point as a result of the development of the Internet. But empirical evidence mainly comes from listed companies where the new economy is under-represented. This policy paper therefore aims:

- to take stock of the possible accounting impact of new transactions arising as a result of the digital economy, new intangible assets that generate value, and new risks specific to digital transactions; and

- to provide a literature review of the main empirical works on the role of intangible assets in the relevance of accounting data and investors' understanding of these data. By intangible items, we mean all expenses incurred by the company that are of an intangible nature, whether they are considered as expenses, investments or intangible assets. These refer to R&D, patents and advertising expenditure. We do not deal with intangible expenses such as consumer satisfaction or human resources for which empirical results are still very rare and contradictory.

This first part of this paper focuses on identifying the accounting issues raised by the new digital transaction methods (1.1.) and, based on examples drawn from companies in the new economy, raises the issue of the increased recognition of intangible assets (1.2.). The second part of this paper is dedicated to presenting the empirical results of numerous studies that have sought to test the relevance of intangible expenses such as R&D and advertising expenditure (section 2.1), in addition to the capitalisation of certain intangible items such as patents and R&D (section 2.2). Lastly, we present the findings of articles that have focused on studying investor behaviour: do they understand the information provided by recognised intangible assets, what is the impact of the recognition of intangible assets on the quality of accounting results, etc. (section 2.3). The conclusion recalls the accounting issues raised by the digital transition, summarises the findings of the literature review and presents future areas for research.

# 1. Digital transformation and intangible assets

## 1.1. Accounting issues related to the digital transformation

All sectors are impacted by the new intermediary mechanisms resulting from the digital transformation, the arrival of the Internet and the emergence of what Rochet and Tirole (2006) refer to as "two-sided markets". Cloud-computing, big data, blockchain technology, among others, have reshuffled the deck where business transactions are concerned.

In Table 1 below, we have tried to benchmark these new forms of transactions and identify their potential impact on accounting.

**Table 1 - Potential impact of the digital transition on accounting**

| **New types of transactions** | **Taken into consideration in current accounting standards** | **Recognition method to be provided?** |
|---|---|---|
| Domain names | No specific regulation | Is it of the same nature as trademarks and intellectual property rights? **Should it be recognised as a new type of intangible asset**? How can we assess its value? |
| Development and creation of algorithms | No specific regulation | Is it a **new kind of intangible asset**, similar to R&D, that can be capitalised?<br>Are the current R&D recognition criteria still relevant? Should they be modified? |
| EDI (Electronic Data Interchange) and dematerialisation of transaction media (invoices, purchase orders, etc.) | No impact on the recognition of the transaction itself. Only the transaction medium is digital in nature | NS |
| E-commerce (online sales/purchases), dematerialised loyalty programmes and online payment | Yes – same as traditional transaction | Only the transaction medium is different. But new risks may emerge in relation to cybercrime.<br>Are new measures required regarding impairment or provisions? |
| Platform economy: reservation on dedicated websites, which are in theory not e-commerce websites for the buyer (e.g., Booking, eBay, Le Bon Coin)<br>• For the seller<br>• For the buyer<br>• For the intermediary | For buyers and sellers, the transaction would appear to be a classic relationship and does not pose any particular problems. However, the flows generated by the intermediary must be analysed. | The question of how the intermediary is remunerated is key and could raise accounting issues. The value of the platform itself may also arise, i.e., does it constitute a new intangible asset? |
| Crowdfunding via online platforms<br>• For the beneficiary<br>• For the donor | This transaction could be treated as a loan or donation, as the case may be. | It is crucial to analyse the nature of the funding in order to determine the applicable accounting method. There are currently no recommendations for this type of transaction, but they could prove useful. |

| **New types of transactions** | **Taken into consideration in current accounting standards** | **Recognition method to be provided?** |
|---|---|---|
| Acquisition of data:<br>• in exchange for access<br>• via transactions<br>for example, consultation of free websites, MOOC, online newspapers, online advertising | Do these new data fall within the scope of Article 627-1 of the French general accounting plan (PCG): exchange activities as part of online transactions?<br>How should these transactions be classified? | Creation of potential customer files, consumption habits, potentially resalable data?<br>**New category of intangible assets?** |
| Blockchain: technology enabling the storage and transmission of data. It is transparent, secure and operates without any supervisory body.<br>The most notable application of this technology is in cryptocurrencies such as bitcoin. | No, not for any of the players in the sector (at the initiative of the blockchain, data validators, buyers), nor for blockchain transactions themselves, such as the purchase of tokens, ICOs etc. | Services developed using blockchain technology.<br>Classification of cryptocurrencies?<br>Management of transactions?<br>Exposure to new risks, how to account for them, new types of provisions? |
| Cloud-computing: outsourcing the hosting of all of a company's data. | Yes | Software development costs that can be capitalised already fall within the current recognition criteria.<br>Exposure to new risks, how to account for them, new types of provisions? |
| Big data: data sets that meet the "3Vs" (volume, variety and velocity), large volume of data to be processed, wide variety of information, fast processing of data collected, data storage and use. | Capitalised development costs | The ability to exploit these databases represents a source of economic value. **Should recognition as an intangible asset be considered?** And if so, on what basis should it be valued?<br>But this opens the door to a new type of risk regarding the hacking of personal data. Should it be taken into consideration by the accounting framework? |

It is interesting to note that, in July 2017, the Quebec-based accounting firm Raymond Chabot Grant Thornton announced the establishment of a blockchain technology expertise centre in Montreal to work on the research, development, training and marketing of this technology. This initiative aims to provide companies with the expertise necessary to make the shift towards this new digital platform. In France, the financial markets authority (*Autorité des Marchés Financiers*, or "AMF") published a discussion paper on 26 October 2017, in which it stated: "In view of the absence of specific regulations governing all new fundraising activity based on cryptocurrencies and Blockchain technology, the French Autorité des Marchés Financiers (AMF) wishes to gather the views of stakeholders on the different means of supervision and launches a programme involving the support and analysis of these transactions, called UNICORN[i]."

At the same time, the French accounting standards authority (*Autorité des Normes Comptables* or "ANC") will also launch a working group on the accounting issues related to these transactions.

The French accounting standards deal with exchange activities in the context of online transactions (see Art. 627-1 of the PCG and CNC opinion no. 2003-06 relating to the accounting treatment of exchange activities in the context of online transactions). They govern the accounting treatment of transactions in which at least one of the items exchanged concerns an advertising service carried out online, the commodity or service received in the exchange is then valued at the most reliable market value of the two items. However, this standard does not seem to cover online transactions carried out via free exchange platforms (MOOC, online newspapers, etc.). Indeed, the link between the service provided and the advertising service is unclear and is difficult to trace to two parties. It is important that accounting standards address the issue of the recognition of these new types of transactions.

From a global point of view, the sharing economy calls into question the principle of property rights and thus the worth of the balance sheet. This new type of economy means that you no longer need to own an asset in order to use it. The provision of a right of use or its use are in theory not recognised. Changes in the accounting treatment of financial leases may provide an interesting area for consideration regarding the evolution of the current accounting framework.

At the heart of all these digital innovations lies the development of algorithms and mathematical models. One thing all of the entities in this business sector have in common is the competence of their development and engineering teams. This human capital, which is not recognised from an accounting perspective, can be embodied in intangible assets such as capitalised development costs, software, copyrights and trademarks. However, the question we need to ask is whether the criteria used to capitalise development costs are relevant. It would be interesting for researchers to study the key success factors of these elements and their levers for value creation in order to propose new criteria for the recognition as intangible assets.

The issue of security must also be addressed in accounting, one of the roles of which is to secure market exchanges. Must we create new types of provisions for risks and expenses? What valuation method should be used for the impairment of these new assets?

In the following part of this policy paper we will focus on the question of the recognition of intangible assets, which are fast becoming essential in this digital age.

### 1.2. New value creation processes

Value creation processes have undergone significant change over the past few years. For example, let's compare Google–a flagship of the new economy–and General Motors, a traditional industrial company. Google's success can be seen in its market capitalisation, which reached USD 413.8 billion for 72,053 employees at end-2016. General Motors, on the other hand, has a lower market capitalisation of USD 44.1 billion for a headcount of over 225,000. This gap shows a profound upheaval in the value creation process. Moreover, Google's book value–i.e., the company's value based on its financial statements–only amounts to USD 139,036 million, in other words, nowhere near its market capitalisation. For General Motors, there is no doubt also a difference between these two values, but to a lesser extent.

A clear distinction must therefore be made between book value and market value. Book value shows the company's history, reflected in cash inflows and outflows, and its income. Market value, on the other hand, represents the present value of the company's expected future value creation (free cash flow forecasts). It is therefore normal that the market value be different from the book value. However, when this difference becomes considerable, this disconnection may indicate a flaw in the monitoring (accounting) tool with regard to capturing the value present in the company. Financial value traceability tools no longer allow for the transmission of a company value that is close to its market value.

Investors and financial analysts base their cash flow forecasts on financial and accounting information. Let's look at how the stock market reacted after Twitter went public on 7 November 2013. The initial share issue price was set at USD 26. However, its value had increased by roughly 73% by the close of its first trading day. This is a considerable upward revision, especially since the social network had announced that it would not be profitable until 2015. Does this mean we should be prepared for another tech bubble? Not necessarily. Twitter is likely to experience very strong growth and reach break-even. On top of that, there is no sign here of the very common phenomenon of underpricing, whereby, after the initial public offering, the share price grows in the early stages, but falls rapidly below its offering price. This would appear to prove that Twitter has an intangible value that cannot be translated or conveyed using traditional tools.

*Why the valuation and recognition of intangible assets is important*

The disconnection between book value and market value has an impact on companies' financial statements. Skype provides an excellent illustration of this. In September 2005, Niklas Zennström sold his company Skype to eBay for USD 2.6 billion. But how much was Skype worth from an accounting perspective? Its assets were recognised as having a book value of USD 20 million. For accounting purposes, the first time a newly acquired company is consolidated in the accounts of the buyer, the latter revalues a certain number of assets and recognises new assets, a large share of which are intangible (brand name, ongoing R&D costs, processes, etc.). If the buyer is able to do so, it is because he/she bases him-/herself on a market value: the transaction cost. Indeed, the accounting system recognises that a value is attached to these items and allows them to be recognised in the balance sheet.

During the purchase price allocation process, eBay was only able to recognise USD 280 million. It revalued patents, the capitalisation of client lists, the brand, etc. Nevertheless, eBay's accounts showed goodwill of USD 2.3 billion out of an acquisition cost of USD 2.6 billion. Usually this goodwill is only a residual value. In the case of companies such as Skype, goodwill represents three quarters of the purchase value. So how can Skype's valuation of USD 2.6 billion be explained. The company was created in 2002. In September 2005, it had 54 million users and global coverage. eBay planned to bill communications between buyers and sellers on its auction platform. The acquisition of Skype therefore made sense from the point of view of its business model. eBay's offer of USD 2.6 billion was based on strong growth prospects: while Skype's 2004 revenue amounted to just USD 7 million–the company being as yet unprofitable–, its revenue was estimated at USD 60 million in 2005 and USD 200 million in 2006. In November 2011, eBay sold 70% of its interest in Skype for a value of USD 2.75 billion.

Five years after its acquisition, eBay therefore sold Skype for a capital gain. Lastly, in May 2011, Microsoft bought Skype for USD 8.5 billion. The company's purchase price of USD 2.6 billion was therefore not absurd after all, although the issue of the value of goodwill recorded in Microsoft's financial statements remains.

*Issues surrounding intangible assets*

The examples of Google, Skype and Twitter demonstrate that intangible capital has become a major financial and management issue. The valuation and recognition of intangible assets has been a source of controversy and debate for many years and the emergence of digital activities only exacerbates this situation by creating new types of intangible assets as described in Part 1. Indeed, it has become even more difficult to objectively define and value future economic profits. Although the concept has been clarified since the introduction of international accounting standards (IAS 38 and IFRS 3), it is still relatively vague. IAS 38 provides the following definition of intangible assets: "Intangible asset: an identifiable non-monetary asset without physical substance." The standard sets out the following identification criteria: "an intangible asset is identifiable when it [...] is separable (capable of being separated and sold, transferred, licensed, rented [...])" or where it "arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity".

So how can a brand be objectively valued? Especially if it has been developed in-house rather than purchased at a fixed price. The accounting system considers that valuation based on the future economic profits of intangible items is far too subjective, and that consequently this value cannot be recorded in a company's balance sheet.

Today, the digital economy is largely based on intangible assets. These new assets must therefore be recognised in the financial statements to provide shareholders and investors with a fair image of company value. This task should be carried out by the accounting system; however, the latter only partially fulfils its responsibility in this area (capitalisation of R&D costs, trademarks or patent filing fees). That's why accountants and financial analysts are in the process of re-examining their positions and are opening up to the recognition of intangible assets.

Big Data is one of the most representative paradigms of the complexity and turbulence of today's knowledge economy (Secundo et al., 2017). Although there is no consensus on its definition (Chen et al., 2014), Big Data can be defined as a large volume of complex data (structured and unstructured) from a variety of sources (internal and external) that require storage, programmes and tools, management, and highly-skilled personnel to obtain information that is useful for sustainable value creation, performance measurement and gaining a competitive advantage (Fredriksson, 2015). According to Andreou et al. (2007), data and information have the potential to be integrated into assets such as competitive intelligence, business intelligence and decision-making efficiency. The increase in the network dimension of our society and the rapid growth of analytical technological tools have shown that intangible assets of potential interest can be found both inside and outside organisations (Borin and Donato, 2015), such as cultural ecosystems and territories.

From a financial and accounting perspective, the main questions regarding intangible assets therefore concern their definition, recognition (balance sheet value, treatment of changes in their value over time) and the impact of their recognition on the financial statements.

## 2. The role of intangible assets in the decline of relevance of accounting information against the backdrop of the digital revolution

In this section, we attempt to resolve the issue of the recognition of intangible assets as assets or a category of assets in company balance sheets. The issue here is the definition of assets. An asset is an identifiable item that has a positive economic value for the entity, i.e., an item that generates a resource that the entity controls as a result of past events and from which it expects future economic benefits. Under current accounting standards, intangible assets can be recognised as assets once they have the economic nature of an investment. The question is therefore to determine whether they will generate future income. Value relevance[ii] research has attempted to provide an answer by studying the link between intangible expenditure and the market value of companies. The rise in value relevance research is due to the implementation of the relevance and reliability criteria defined by the FASB (SFAC 2). According to Barth (1994), the reliability of an accounting measure refers to its ability to represent what it is purported to represent, whereas relevance refers to the ability of an item to impact the decisions of financial statement users. An accounting value will therefore be relevant if it reflects relevant information for investors in their valuation of the company and if it is measured with sufficient reliability to be reflected in the share price. This approach is particularly suited to studying the relevance of intangible assets for at least two reasons. First of all, and unlike event studies that focus on the market reaction to accounting publications over short periods of time, association studies analyse the relationship between stock returns and accounting data over long periods of time. Intangible expenditure (such as R&D) is therefore assumed to have a long-term effect on the company's performance. Secondly, the IASB (and the FASB) include in their conceptual framework the relevance and reliability criteria that value relevance research seeks to measure.

Much of the literature on intangible assets and the financial markets is based on the observation that the usefulness of financial information has deteriorated (e.g., Lev and Zarowin, 1999; Amir and Lev, 1996). In general, this research attempts to establish a link between changes in the stock market value of companies and their commitment to intangible expenditure (limited to R&D, patent applications, trademarks and advertising expenditure).

Researchers have tried to demonstrate that investments in R&D and advertising lead to higher earnings, and consequently are positively associated with company value. Studies have shown a positive association between future profitability and investments in advertising (Chauvin and Hirshey, 1993; Chan, Lakonishok and Sougiannis, 2001) and in R&D (e.g., Lev & Sougiannis, 1999). Other studies have focused on patents (Deng, Lev and Narin, 1999) while some have examined the relevance of the capitalisation of R&D in the light of its recognition by the financial markets (Aboody and Lev, 1998; Zhao, 2002; Callimaci and Landry, 2004; Cazavan-Jeny and Jeanjean, 2005, 2006). This literature review seeks to shed light on the recognition of intangible expenses as assets. We have therefore chosen to present the results of previous research according to the place allocated to intangible assets (expenses or assets) as an explanatory variable of company market value.

## 2.1. The relevance of intangible expenses

### 2.1.1. Empirical evidence on R&D costs

Research indicates that the financial markets consider R&D investment (whether capitalised or not) to be a significant value-creation activity. Can this behaviour also be extrapolated in the context of the digital economy, against the backdrop of a high start-up disappearance rate?

The relationship between stock returns and R&D investment has been studied in a large number of articles, using models similar to those of Fama and French (1992). These models make it possible to test the relevance of intangible assets by analysing flows. Hirschey (1982) demonstrated that, on average, R&D and advertising expenditure had a positive and significant impact on market value. More recently, Lev and Sougiannis (1999) highlighted a significant association between companies' estimated R&D capital and future stock returns. The results of these studies suggest that the shares of R&D-intensive companies are systematically subject to mispricing, or that there is compensation for an "out of market" risk factor associated with R&D. The findings of Chan, Lakonishok and Sougiannis (2001) are generally consistent with this proposition. They show that companies that invest heavily in R&D relative to their market value, tend to have poor past returns and show signs of mispricing, which would apparently made it difficult for the markets to value their R&D investment.

These studies generally show a positive share price reaction to the announcement of an increase in R&D spending, even if the company's results are lower. Companies operating in the high-tech environment also appear to have higher stock returns and their R&D investment is positively associated with return volatility. According to Chan, Lakonishok and Sougiannis (2001), there is a need for more financial communication on intangible items.

Connolly and Hirshey (1984) study the relationship between R&D spending, profits and companies' market value. They use R&D expenditure, marketing expenditure and an over-valuation indicator, calculated as the difference between the company's market value and the book value of its tangible assets, as the main indicators. The results of their study show that there is a correlation between high R&D expenditure and high market value. The same also applies for advertising expenditure and increased market value.

Empirical studies have also sought to develop estimators of R&D capital[iii] to explain the difference between the book value and market value of companies (measured by the market-to-book ratio[iv]). R&D capital has generally been estimated by a regression of operating profit (Sougiannis, 1994; Lev and Sougiannis, 1999) or market-to-book ratios (Cockburn and Griliches, 1988; Hirshey, 1982; Hall, 1993) on R&D expenses. This methodology assumes that R&D growth, the probability of success and amortisation rates are constant for all companies in the economy or for all companies in a given sector at a certain period. To overcome this limitation, Zarowin (1999) and Ballester, Garcia-Ayuso, and Livnat (2003) adopt an alternative approach, estimating R&D capital on the basis of time-series. These two studies find significant differences in capitalisation and amortisation rates for R&D between companies, implying that cross-sectional studies could be affected by a significant bias problem. Using the time-series approach to estimate capitalised R&D, meanwhile, implies that the parameters for capitalisation and amortisation are constant over time for each company.

These results are interesting, but have limitations, as they are based on estimates rather than the figures actually reported to investors.

All of this research suggests that R&D investment, recognised as an expense, is regularly associated with companies' market value, and could therefore be capitalised and amortised over their economic life, which probably differs depending on the sector of activity and the company. Nevertheless, several limitations may affect the validity of these results on the relevance of R&D expenditure. First, they give little consideration to the existence of other factors that explain stock prices and returns. The specific explanatory power of R&D should be examined in relation to these factors. Moreover, these empirical studies consider that the relationship between R&D and market value is linear, whereas the impact of R&D expenditure on company performance has every chance of being non-linear (Ittner and Larcker, 1998) and may depend on environmental factors such as the concentration of R&D and other intangible activities in certain sectors, or the speed at which R&D is disseminated. In conclusion, empirical research on R&D spending in U.S. capital markets shows that (1) the contribution of R&D to productivity and shareholder value is substantial and (2) that the financial markets reflect such contributions in the market price. But while investors show a willingness to take long-term R&D into account, there is also some evidence of the undervaluation of R&D-intensive companies.

More recent articles have examined the appropriateness of valuing R&D spending, including some business-specific characteristics. Franzen and Radhakrishnan (2009) examine the valuation relevance of R&D documented for loss-making companies extend to profitable companies. They use the residual-income valuation model and show that the valuation multiplier on R&D expenses is likely to be negative (positive) for profitable (loss-making) companies. An important implication of their findings is that understanding the role of the R&D expense line item in valuation across companies depends on whether the linear information dynamics assumption of the residual-income model is applicable for the sample of firms under investigation.

### 2.1.2. Advertising expenses

Some empirical studies have examined the relationship between advertising expenses and future results to provide an opinion on the position of the FASB, which requires that they be recognised under expenses. Bublitz and Ettredge (1989), Ravenscaft and Scherer (1982) and Hall (1993) showed that advertising had no long-term impact, but rather had a limited average duration of two years. Therefore, there does not appear to be a strong case for capitalising advertising expenses. While some studies (Abdel-Khalik, 1975) claim to have found a long-term impact of advertising expenditure on future results, which would be consistent with the capitalisation of such expenses, Landes and Rosenfield (1994) suggest that these results are mainly due to the existence of factors specific to the companies studied. However, Chauvin and Hirshey (1993) show that advertising investment has a positive and strong influence on the value of companies. Interestingly, their analysis shows that the stock returns associated with this expenditure are higher for larger companies than for smaller ones. Therefore, the results of this study could be a consequence of the positive association between company size and the robustness of results, rather than the result of a real association between advertising spending and market values. The empirical results of Chan, Lakonishok and Sougiannis (2001) point to a positive link between advertising spending and stock returns.

On the other hand, Han and Manry's (2004) study shows that advertising expenditure has a negative association with stock prices and that the degree of this negative association is similar to the association between other operating expenses and stock prices.

More recently, Gu and Li (2010) studied the value relevance of advertising expenditure in the pharmaceutical industry. Their results indicate that stock market investors view advertising as a source of future economic benefits, consistent with the value-enhancing role of pharmaceutical advertising. They also show that advertising expenditure is not significantly related to future earnings variability and uncertainty, which suggests their reliability. As a result of this empirical research on advertising spending, other studies have examined the relevance of brand value. Barth, Clement, Foster and Kasznik (1998) have provided evidence in the U.S. market that estimates of brand value are positively correlated with stock market prices and returns. Brand value estimates are positively associated with advertising expenditure, operating margin and market share.

However, the empirical evidence from these studies on advertising expenditure and brand value is still limited, contradictory and inconclusive.

## 2.2. Intangible assets recognised in the balance sheet

In section 2.1., we have presented the results of research on intangible expenses. However, in certain countries (e.g., France) and/or under international standards, it is possible, if not compulsory, to capitalise certain intangible expenses (such as R&D). This section therefore focuses on presenting the results of research that has been carried out on the basis of intangible assets recognised in the balance sheet.

### 2.2.1. Patent-related measures

Although R&D investment is the most widely used indicator for measuring innovation, it does have some serious drawbacks. The R&D variable is not primarily a measure of output, but rather a measure of input, and cannot therefore capture changes in the efficiency of the innovation process. R&D can also be a long process, and investors are likely to attribute a different value to the firm depending on the level of progress in the innovation process (Pinches, Narayanan and Kelm, 1996). Pakes (1985) studied the relationship between research investment (R&D expenditure, number of patents filed) and the company's financial performance as measured by its market valuation. His research shows that the evolution of R&D expenditure is significantly correlated with the evolution of a company's patent applications, and that it is positively and strongly associated with the value of the company. Patents and patent citations would therefore appear to be a suitable alternative to R&D for measuring innovation. They capture the success of companies' innovation activities, but do not fully capture their efforts in the area. These two measures were used to study the effect of investment in innovation on the companies' future performance.

Patent relevance studies (Griliches, Pakes and Hall, 1987) have shown that although they do not have more explanatory power than R&D investment, they convey more information than R&D measures, which suggests that patents and patent citations are indeed linked to the market value of companies. However, R&D expenditure is more strongly correlated with market value than patents or patent quotations (Hall, Jaffe and Trajtenberg, 2005).

According to a study published by Cockburn and Griliches (1988), there is a strong sector-specific impact on the market valuation of intangible capital. Their work questions the informative content of patent applications (in numbers) in relation to R&D expenditure (in amount).

Deng, Lev and Narin (1999) examined the ability of various measures derived from patent citations to predict future returns and market-to-book ratios in several R&D-intensive sectors. The underlying assumption of this study is that companies whose patents are frequently cited will tend to be more innovative and better recognised by the financial markets than those whose patents are less frequently cited. Their results indicate that most patent measures are significantly associated with future stock returns and market-to-book ratios. This study also shows that the association between patent measures and future returns is weaker than the association with market-to-book ratios. The explanation provided for this is based on the difference between these two variables: while the market-to-book ratio indicates growth forecasts regardless of when the underlying information reaches the market, stock returns only reflect new information, information that is not available to investors at the beginning of the yield accumulation period. Their results suggest that the information contained in these measures is not fully reflected in market prices. This is not surprising, as patent measures are rarely used in the analysis of investments and securities. As a result, these analyses indicate that patent attributes can contribute significantly to stock market analysis.

### 2.2.2. Capitalised R&D

A wave of academic accounting literature assesses the relevance of capitalising R&D costs in relation to its recognition by the financial markets. Capitalisation[v] of internally developed intangible assets has often been perceived as risky and a source of error with respect to financial analysis. However, some research suggests that the capitalisation of intangible assets may in fact provide investors with useful information. A first study of simulated data (Healy, Myers and Howe, 2002) shows that it is better to capitalise intangible assets than to recognise them under expenses in order to provide investors with interesting accounting information. The model alternately simulates pharmaceutical companies' performance measures when they recognise R&D costs under expenses and when they capitalise them. Their results show that performance measures based on capitalisation are twice as explanatory as those based on recognition under expenses. Aboody and Lev (1998) studied capitalised software development costs across a sample of IT companies in the U.S. The results indicate that capitalised software development costs are positively and significantly associated with stock returns; that the balance sheet value of capitalised software is correlated with market prices; and that capitalised data on software improve predictions of future results. A particularly intriguing result of this study is that companies, which still expense their software development costs, show abnormal positive returns over a period of three years after the costs were expensed, unlike the companies that capitalised these development costs. This result is consistent with the assumption that the securities of companies that expense all of their development costs are undervalued.

This undervaluation may be attributed to a lack of information on software development programmes (information that could be partially communicated through capitalisation). These results suggest that, despite the inherent subjectivity of capitalising software development costs, this treatment provides investors with useful information.

Empirical research therefore tends to agree on the appropriateness of capitalising R&D expenses. Callimaci and Landry (2004) confirm as such. Based on a sample of 191 listed Canadian companies, they found that the amount of R&D expenses capitalised is associated with higher stock returns. Similarly, according to Han and Manry (2004), who studied a sample of Korean firms, the association between R&D expenses and market prices is higher for capitalised R&D expenses. Zhao (2002) compared the relevance of capitalising R&D costs in France, Great Britain, Germany and the United States. His research shows that in countries where it is not possible to capitalise R&D (Germany, the United States), the amount of total R&D costs disclosed improves the association of market prices with earnings and book values. But it also shows that the allocation of R&D costs between expenses and assets provides more information than simply disclosing total R&D costs. The scope of these results is, however, limited by the bias inherent in international comparisons, as the quality of financial reporting is linked to specific country factors other than legal systems (Pope and Walker, 1999; Ali and Hwang, 2000). Following Zhao's (2002) study of actual R&D capitalisation, using French data Cazavan-Jeny and Jeanjean (2006) tested the relevance of capitalizing R&D expenses, which remained an optional accounting treatment in France. Their results show that, contrary to previous research, R&D capitalisation is negatively associated with stock prices and returns. R&D capitalisation would therefore appear to send a negative signal to investors, despite the fact that high-tech companies clearly choose to capitalize R&D expenditure on the French market.

Two articles also examined the UK context in which the capitalisation of R&D was allowed. Anagnostopoulou and Levis (2008) examine the impact of R&D investment on continued operational growth and market performance. They document a positive relationship between R&D intensity and the persistence of growth in sales, gross revenue (but only among companies that engage in R&D as a result of the sector in which they operate), and stock returns. Oswald (2008) examines the determinants and economic consequences of the choice of accounting for R&D expenditure in the United Kingdom. The decision to expense or capitalise R&D is influenced by factors such as earnings variability, earnings sign (i.e., whether the company recorded a profit or loss), company size, R&D intensity, leverage, stability of the R&D investment programme and the success of the R&D programme. There is no significant difference in the relevance of the R&D amounts reported or corrected by companies that expense or capitalise R&D. These results suggest that managers choose the accounting method for R&D in order to best communicate the private information they hold.

The Italian case has also been studied. Markarian, Pozza and Prencipe (2008) examine whether the decision by companies to capitalise R&D costs is influenced by incentives linked to earnings management. Their analysis shows that Italian companies tend to use cost capitalisation for earnings smoothing purposes. But the assumption that companies capitalise R&D costs to reduce the risk of breaching contractual terms is not supported.

In the French context, Cazavan-Jeny, Jeanjean and Joos (2011) study whether the decision by management to capitalise or expense R&D costs convey information on the future performance of the company. They show that the decision to capitalise R&D costs is generally associated with a negative or neutral impact on future performance, even after controlling for the self-selection. Their results suggest that management is unable to convey information about future performance through its decision to capitalise R&D.

## 2.3. Recognition by investors

### 2.3.1. Do investors understand information communicated on intangible assets?

Recognition of identified intangible assets is also related to valuation issues. The current accounting model does not recognise many knowledge-based intangible assets. This raises concerns about the ability of investors to value intangible capital-intensive companies whose core values are largely dependent on knowledge and technology, making it difficult for these companies to raise capital. Chan, Martin and Kensinger (1990) carried out a study of the responses to 95 announcements of increases in R&D spending. They show that high-tech companies that announce an increase in R&D spending experience abnormal positive returns. They also note that a higher R&D intensity than the industry average only leads to an increase in stock market prices for high-tech companies. Boone and Raman (2001) point out that R&D-intensive companies face a relatively low risk-adjusted bid-ask spread. Kimbrough (2007) studies the consequences of FAS 141 on the informativeness of purchase price allocation (PPA). He examines the relationship between the relative price paid to acquire the target (consideration paid divided by the acquirer's market value), and cumulative abnormal returns upon disclosure of the PPA. He finds a greater positive association between the relative price paid and the absolute value of the cumulative abnormal returns following the adoption of FAS 141. Kimbrough (2007) finds that investors react positively when the PPA results in high levels of separately identified intangibles, and negatively when high levels of goodwill are recognised. He argues that goodwill is a composite asset with several components that are hard to disentangle, and is relatively less informative to market participants than specific intangible assets.

Three other articles contribute to the debate on whether the requirement under U.S. accounting standards to expense R&D costs as incurred leads investors to underestimate the benefits of R&D. Boone and Raman (2004) argue that FAS 2 may distort the income statement in that good news (such as an increase in R&D spending) could translate into reported bad news and vice versa. The results suggest that R&D spending information has an effect on trading activity. Ali, Ciftci and Cready (2012) confirm these results regarding the market's underestimation of the implications of R&D increases for future earnings. They show that future abnormal returns related to R&D increases are concentrated around subsequent earnings announcements. They also document that market expectations, implied by stock prices, underestimate the future earnings benefits of R&D increases. Lastly, they show that financial analysts also underestimate the effect of increases in R&D spending in their forecasts of future earnings. While previous studies attribute future excess returns of R&D-intensive companies to increased risk compensation or mispricing, Donelson and Resutek (2012) suggest a third explanation and show that neither the level of R&D investment nor the change in R&D investment explain future returns.

The future positive returns that previous studies attribute to R&D investment are in fact due to the component of the R&D company's realised return that is unrelated to R&D investment, but present in R&D-intensive companies. Their results suggest that the excess returns of R&D firms are an anomaly. In addition, they show that while future profits are positively associated with current R&D, errors in investors' and analysts' earnings forecasts are not related to R&D investment.

### 2.3.2. Impact of recognised intangible assets on the quality of accounting data

Lev, Sarath and Sougiannis (2005) examine whether R&D reporting biases have an impact on earnings conservatism. Using a profitability bias model, they show that companies with high R&D growth rates relative to profitability adopt a prudent approach to their financial communication. Their empirical analysis, which covers the period from 1972 to 2003, detects an undervaluation of "prudent" companies and an over-valuation of companies deemed to be "aggressive" in their financial communication. These incorrect assessments appear to be corrected when the reporting bias is reversed, ranging from conservative to aggressive and vice versa. Givoly and Shi (2008), in the context of IPOs in the software sector, assess the value of the information contained in the accounting treatment of software development costs (SDCs). They hypothesise that by sharing information about the probability of recoverability of SDCs and the amortisation period, the capitalisation of these development costs reduces information asymmetry and therefore undervaluation. The results, based on a sample of 390 IPOs in the software industry, are consistent with the hypothesis. The findings suggest that the option to capitalise, through its information impact, lowers the cost of capital.

A number of studies show that R&D expenditure is also a means of managing earnings. Some companies tend to use R&D capitalisation for earnings smoothing purposes (see Markarian et al., 2008, for Italy and Oswald and Zarowin, 2007, for the UK). More specifically, Oswald and Zarowin (2007) find that in the United Kingdom, capitalisers manage R&D expenses in order to meet profitability criteria by manipulating accruals.

At the time of the IPO, information asymmetry between managers and investors is at its most significant, which, in theory, explains the market undervaluation and underperformance in the long term. Guo, Lev and Shi (2006) investigate whether R&D expenditure as a source of information asymmetry explains these phenomena. By examining a sample of US IPOs between 1980 and 1995, they find that pre-IPO R&D expenditure scaled by total sales (and expected market value) is positively related to first-day IPO return, meaning that R&D activities contribute significantly to information asymmetry around the IPO. Extensive disclosure about R&D, however, mitigates this relationship – biotech firms which tend to disclose more R&D information compared to R&D-intensive firms in other industries show lower underpricing. Their analyses also reveal that R&D-intensive issuers "leave money on the table" at the time of the IPO, but are able to collect more post-IPO revenue once the results of their R&D have been achieved. Pre-IPO R&D expenditure is positively related to long-term stock market performance suggesting that in the long-run the market incorporates the success of the R&D activities. This performance of long-term returns comes after investors' optimism is mitigated by the uncertainty and risk of R&D-intensive activities at the time of the IPO.

Finally, Ritter & Wells (2006) position their study in the pre-IFRS Australian specific context where companies could take advantage of a loophole in the accounting standards to voluntarily recognise identifiable internally-generated intangible assets (Wyatt, Matolcsy and Stokes, 2001). These identifiable intangible assets were not directly specified in the standards, but rather indirectly and were understood to include brand names, copyrights, franchises, intellectual property, licenses, patents and trademarks developed internally (Wyatt et al., 2001). They provide evidence of a positive association between stock prices and voluntarily recognized and disclosed identifiable intangible assets, and of the existence of a positive association between identifiable intangible assets and future income for the period.

## Conclusion

This policy paper first sought to highlight the accounting issues related to transactions specific to the digital transition of the economy. We have drawn up a non-exhaustive list of these transactions: domain names, algorithm development, EDI, e-commerce, platform economy, participatory financing, data acquisition, blockchain, cloud-computing, and big data. These new types of transactions call into question property rights, which form the basis of accrual-based accounting; they question the recording of transactions on a purely monetary basis (e. g. making available free content); they call into question the criteria for capitalising research and development costs; and they also pave the way for new types of risk (cybercrime, exploitation of personal data, etc.) which must be taken into account by accounting in the form of new measures regarding amortisation and provisions.

These transactions include elements that are often described as intangible (competence of developers, engineering teams), are based on processes and intellectual property rights, which are their source of value creation. However, current accounting standards provide little or no recognition of these intangible items. It seems to us then that one of the major challenges is the recognition of new identifiable intangible assets, whether they are the result of an acquisition, the result of a business combination or simply developed in-house.

The amount of goodwill recognised as a result of mergers and acquisitions has become very, if not too, significant in relation to the total price of the deal. Since very few identifiable intangible assets can be recognised in the purchase price allocation process, goodwill values are no longer residual. These balance sheet values are very difficult to follow over time, both for the companies themselves and for the auditors. How can asset impairment tests be carried out on these items five years after the transaction has been completed?

Similarly, for SMEs, very small businesses and start-ups whose business models are based on technological, digital and service innovation, it is very difficult–if not impossible–to translate their investments and wealth creation in accounting terms. Consequently, their access to bank financing is affected since their balance sheets are meaningless.

In the second part of this policy paper, we therefore set out to propose a review of the accounting academic literature dealing with the issue of the value relevance of intangible items. An important field of empirical research has sought to demonstrate the relevance (usefulness) of intangible items in valuing shares. Accordingly, this research stresses the need to take these elements into account in investment and credit decisions. A review of the most significant contributions in this area shows that, in general, current investments in intangible assets are associated with higher future results and stock returns. This is consistent with the recognition of intangible as assets.

This literature review has enabled us to highlight two keys points of accounting research on the value relevance of intangible elements.

On the one hand, it would appear that intangible assets are indeed related to the market value of companies. However, this is clearly demonstrated for R&D costs and patents, mainly in the U.S. capital markets and often based on a sample of companies in the same sector. The conclusions are much more debatable when it comes to capitalised R&D costs, advertising

expenditure and brands. Lastly, the results are still quite contradictory on the relevance of publishing voluntary information on intangible items. This implies the need for greater recognition of intangible assets in the financial statements.

On the other hand, the results of empirical studies on intangible assets are highly dependent on market conditions: speculative bubble, period of rising or falling stock prices (Penman, 2003), institutional context and national accounting methods for intangible assets. Indeed, the results of the various studies are rarely convergent. The institutional environment must therefore be taken into account when assessing the relevance of accounting standards, as already pointed out by Cormier, Magnan and Zeghal (2001), Leuz, Nanda and Wysocki (2003).

However, this literature review was conducted as part of current research on the value relevance of accounting data. However, one aspect in which value relevance research can be criticised in particular is that it assumes accounting only has one role to play, that of providing information to the financial markets. The results of this empirical work show that with respect to accounting information, intangible items result in numerous interpretations of the theoretical accounting framework and can provide another purpose for accounting. Recognition of assets has always been a key accounting issue. R&D costs and brands are two of the most striking examples of this issue at present. Indeed, intangible assets are at the heart of this accounting dilemma.

Ultimately, several research paths can be proposed:

- The application of IFRS makes it mandatory to capitalise R&D costs when the project is profitable (IAS 38). It would therefore be interesting to study, for European listed companies based on their published financial statements for 2005, the relevance of this capitalisation.

- Until now, empirical research has mainly focused on the impact of intangible assets on investors' perceptions through the study of associations with stock market performance measures. It would be interesting and important to study the impact of these intangible items on accounting performance measures, such as revenue growth or profitability.

- In order to define new criteria for the recognition of algorithm development costs, it would be necessary to understand the key success factors of these algorithms, or to replicate the studies carried out on R&D spending on social network development and research algorithms in the digital economy.

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[i] http://www.amf-france.org/en_US/Actualites/Communiques-de-presse/AMF/annee-2017?docId=workspace%3A%2F%2FSpacesStore%2F5097c770-e3f7-40bb-81ce-db2c95e7bdae&langSwitch=true

[ii] Value relevance refers to relevance or usefulness of accounting information for its users. The usefulness of accounting information is assessed based on whether or not it is reflected in the market value of a company.

[iii] These studies were carried out in a U.S. environment, where capitalisation of R&D expenses is prohibited.

[iv] The market-to-book ratio, which is defined as the ratio between the market value and book value of a share, will be discussed in the following chapter.

[v] Capitalisation involves the recording of a cost as an asset, rather than an expense.