

## Disclosure of R&D activities

Susana Maria Teixeira da Silva ·  
Ana Isabel Abranches Pereira de Carvalho Morais ·  
José Dias Curto

Published online: 4 December 2013  
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**Abstract** The aim of this study is to investigate whether the dissemination of information about Research and Development (R&D) in Sweden and Finland has increased upon the adoption of International Accounting Standard no. 38 (IAS 38) for companies listed on the “Stockholm Stock Exchange” and the “Helsinki Stock Exchange”, and also to identify the determinants of these disclosures. The sample is composed of 36 companies that were analyzed over the period between 2005 and 2008. Results in general show that the companies not only reported the information required by IAS 38, but also made voluntary disclosures about these activities. With regard to the determinants of disclosure the following conclusions were drawn: the variables such as company size, debts, kind of auditor, internationalization, and sector of activity are statistically significant for the “Required Disclosure Index” dependent variable, while the variables such as company size, debts, profitability, sector of activity, and country are statistically significant for the “Index of Voluntary Disclosure” dependent variable.

**Keywords** R&D activities · Disclosure of information ·  
Accounts harmonization · IAS 38 · Sweden · Finland

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S. M. T. da Silva (✉)  
Escola Superior de Ciências Empresariais, Instituto Politécnico de Setúbal, Setúbal, Portugal  
e-mail: susana.silva@esce.ips.pt

A. I. A. P. de Carvalho Morais  
Instituto Superior de Economia e Gestão, Lisbon, Portugal  
e-mail: anamorais@iseg.utl.pt

J. D. Curto  
Instituto Superior de Ciências do Trabalho e da Empresa, Instituto Universitário de Lisboa, Lisbon,  
Portugal  
e-mail: dias.curto@iscte.pt

## Introduction

Financial information must be easily accessible, reliable, and easy to understand in order to respond to the needs of a global business community that requires clarity and efficiency in the finance markets and economy. That is why an effort has been made over the years to harmonize accounting standards so as to obtain common principles that are internationally accepted; several international organizations have been involved in this effort such as the International Accounting Standards Board (IASB); the Organization for Economic Co-operation and Development (OECD); the European Commission; the International Organization of Securities Exchange Commissioners (IOSCO); the International Federation of Accountants (IFAC); and the United Nations Economic and Social Council (ECOSOC).

The convergence of standards that international organizations strive for involves the recognition, measuring, and disclosure of financial information embodied in uniform international accounting standards that meet the users' needs, namely in terms of its comparability. The work of the IASB and the European Commission is particularly important; according to Volcker (2002) the actions of the IASB are globally recognized and it is currently the foremost private organization as regards issuing international accounting standards.

The disclosure of information about R&D activities is particularly relevant to international accounting standard organizations that believe some information should be disclosed on this matter. Aboody and Lev (2000), Archel (1999), Domench (2001), Gomes et al. (2006), Leitão (2006) and other authors report that R&D financial information provided by entities is scarce and of little use to investors, hindering the entities' ability to face up to the economic environment. Although several studies (Domench 2001; Gomes et al. 2006; Gray and Skogsvik 2004; Jones 2007; Leitão 2006; Zeghal et al. 2007; others) analyze the information disclosed (mandatory and voluntary) about R&D activities in national and international companies (listed or unlisted on Stock Exchanges), we believe that it is important to conduct new research projects that extend the scope of previous studies. This paper contributes to the literature on three levels, namely by:

1. Analyzing the information disclosure on R&D activities after the adoption of IAS 38;
2. Analyzing the information disclosure on R&D activities in a country with a high rate of R&D activities;
3. Identifying the determinants on mandatory and voluntary R&D disclosure.

It is important to analyze the level of information disclosed on R&D activities following the adoption of IAS 38 even though all companies should have adopted the standard as of 1st January 2005 i.e., all companies should have the same level of disclosure if they adopted the same standard.

On the other hand, the IAS demands a higher level of disclosure than national standards. Analysis of the information disclosure level in a country with a high rate of R&D reveals that R&D expenses tend to be significant, thus highlighting the importance of disclosing this information. Therefore, companies in countries with a higher level of R&D tend to disclose more information and comply more with the IAS 38 requirements.

This study can also help the identification of the main R&D activities in the companies of the sample. This can be useful, for example, to draw up standards upon which a universally recognized system can be created for companies' information disclosure of their R&D activities. This work can also aid future research that intends to compare R&D information disclosed by stock-market listed companies from other continents.

## Theoretical framework

Due to the importance of R&D to companies, the accounting standards commissions (ASB, FASB, IASB, CNC, and others) have a similar opinion about the disclosure of this information. Most of their guidelines already foresee comprehensive disclosure and establish a set of mandatory information to be disclosed.

However, according to the *Proyecto Meritum*<sup>1</sup> (2002)—supported by the *European Research Arena on Intangibles* project (E\*Know-Net)<sup>2</sup>—information disclosed on intangible assets flowing into and out of the company remains scarce. In other words, although these assets are important to the companies' value, this is not reflected due to the difficulty in complying with the requirements established by the accounting standards.

However, according to other authors (Aboody and Lev 2000; Boone and Raman 2004; Kothari et al. 2002), the information disclosure about R&D activities is related to a larger asymmetry of the information due to the unique and risky nature of these activities, the limited use of information obtained from companies and the absence of markets for this kind of intangible asset, thus highlighting the importance of disclosing information about R&D activities to the investors.

Despite this recognized importance, the samples in some studies are small and cover only limited types of industries. Jones (2007), for example, studied R&D information in 119 US companies working in four types of intensive industries (Chemical and Pharmaceutical Products, Machinery and Hardware, Electrical and Electronic Equipment, and Instruments and Scientific Products). The results obtained report that companies disclose information on R&D activities, especially about ongoing projects; moreover, the lower the costs incurred by the company, the more information they disclose.

Gray and Skogsvik (2004) analyzed the information disclosed in pharmaceutical companies in Sweden and the United Kingdom from 1984 to 1998. Their results

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<sup>1</sup> The *Proyecto Meritum* (Merit Project)—*Measuring Intangibles to Understand and Improve Innovation Management*—was conducted by researchers from several institutions and countries of the EU. The project began in November 1998 and ended in April 2001, and the objective was to propose a set of directives to measure the intangible assets and their subsequent financial disclosure.

<sup>2</sup> The E\*-Know-Net—or “*European Research Arena on Intangibles*”—is a project that took place between 1st September 2001 and 31st August 2003 financed by the European Commission as a Thematic Network of the program “*Concerted Actions and Thematic Networks*”. It was financed by the OECD and the European Investment Bank as well as many other institutions. The research results—which included more than 200 companies in 7 different European countries—about evaluation, management and disclosure of intellectual capital led to the publication of guidelines to support companies when evaluating and disclosing their own intangible assets.

showed that companies in these countries consistently reported voluntary information relevant to the assessment of the competitive advantage, notably on R&D activities.

Other authors studied the importance of financial information on R&D expenses: Aboody and Lev (2000), Barth et al. (2001), Domench (2001), Ferreira et al. (2001), Francis and Schipper (1999), Lev and Zarowin (1999), Sampaio and Pimpão (2003), Leitão (2006).

Aboody and Lev (2000) analyzed 10,013 companies between 1985 and 1997 to determine whether the financial information disclosure of 253,038 transactions of buying and selling shares was relevant to R&D expenses. The authors concluded that the companies with a higher volume of R&D activities had contributed to a disparity in the information between managers and investors. Moreover, the company managers who had privileged information had taken advantage of that information to negotiate the companies' shares.

Francis and Schipper (1999) studied between 400 and 4,800 American companies every year from 1952 to 1994. The goal was to analyze whether the financial information was shown to become less relevant in companies with more intangible assets. As such, the authors formed two sub-samples and used a variable for intangible assets not recognized on the Balance Sheet—the “*market-to-book value*”—and an intangible investment index—R&D expenses (a percentage of assets). They concluded that the financial information in companies with more intangible assets does not lose relevance, given that the results of the two sub-samples and the sample as a whole are similar.

Following the same research principles, Lev and Zarowin (1999) conducted a study that aimed to analyze the use of financial information disclosed to investors. The study was based on between 3,700 and 6,800 American companies a year from 1977 to 1996. They were organized into two indexes—equity and market capitalization—and grouped into ten categories of a similar size. The percentage change was assessed through the magnitude and frequency that the companies changed their category over time. After testing this hypothesis based on variables defined to obtain what the authors termed “*economic rate of change*” (p. 376), they concluded that the percentage change increased over time due to two main factors: the increased investment in R&D and the decrease in the informative content of the results, thus supporting the conclusions of Aboody and Lev (2000).

Barth et al. (2001) conducted a study to analyze the performance of financial analysts in the USA in companies with R&D activities. They concluded that they are more interested in two kinds of companies: those with high R&D investments and those with above average R&D investment for their industrial sector. They used a sample of 2,977 companies and analyzed them from 1983 to 1994. Like Aboody and Lev (2000), the authors concluded that there is more disparity in the information between managers and investors in companies with a high investment in R&D, and also greater uncertainty about the company value and the share prices in the capital markets are underestimated.

The main aim of Domench's study (2001) was to analyze the information disclosure policy for R&D activities. The author used a sample of 100 industrial companies operating in Spain in sectors with high levels of R&D. He reports that most companies disclose little financial information about R&D activities, but that the disclosure has gradually been increasing due to legal requirements to reduce conflicts.

Ferreira et al. (2001) conducted a study to explore the main factors that influence the disclosure of R&D expenses in Financial Statements. The sample was formed by companies listed on the Lisbon and Porto Stocks Market from 1995 to 1999 and which applied the Official Accounting Plan. The accounting of R&D expenses was analyzed and it was concluded that few companies disclosed information on R&D activities. Despite being mandatory, the information is scarce in Tables 8 and 9 in Appendix to the balance sheet; as a result, users of financial information do not have qualitative data about these activities.

The study by Sampaio and Pimpão (2003) aimed to analyze information and disclosure practices on intangible assets, recognized or not in the Balance Sheet, of certain Portuguese companies. The sample comprised 57 companies listed on Euronext Lisbon and the study focused on the analysis of annual reports and accounts of 38 companies on 31st December 2001. The authors concluded that financial information is disclosed on R&D activities in line with the standards of the Official Accounting Plan. Some companies disclose the non-financial information on the annual reports, although only a small percentage of them do so. Leitão (2006) reached similar conclusions in a study analyzing the annual reports of 31 companies—the sample comprised 57 companies listed on Euronext Lisbon—on December 31st 2001 and with notable R&D activities.

As shown by the above-mentioned studies it is not only important to fulfill the requirements of the accounting standards, but also to improve the disclosure of information about R&D activities, as the mandatory information is insufficient and is primarily financial. The standards in each country should be adjusted in line with an international reference so that economic and financial information is comparable. However, although there will always be differences in accounting standards, these must be quantified and disclosed in financial statements so that users can obtain the necessary reliable and comprehensive information.

Although several studies address the disclosure and relevance of financial information about R&D expenses, it is important to know what makes companies disclose information voluntarily. Archambault and Archambault (2003) conducted a study focused on the annual reports of 621 companies from 33 countries between 1992 and 1993. The authors concluded that the concept of financial disclosure is complex and is not only influenced by several political and economic factors inherent to countries, but also by other aspects related to the corporate systems, i.e., the company's understanding of public interest. The authors concluded that disclosure is the result of the influence of several cultural variables, together with national economic policies and the companies' operational and financial systems. However, the study also highlights the influence that the expansion of the businesses to international markets has on the increase in financial disclosure.

Francis et al. (2005) conducted a study on what made companies voluntarily disclose financial information and ascertained to what extent this was related to the need of external funding in countries where investment support is low and the capital markets are financially underdeveloped. The sample included 856 non-American companies from 34 countries and 18 different industries between 1991 and 1993. The study included several variables related to national economic policies, the kind of funding practiced in each country and the companies' market

value. The authors concluded that if a company is dependent on external funding, it tends to voluntarily disclose more financial information.

Oliveira et al. (2006) conducted a study to identify the factors that influence the voluntary disclosure of intangibles in companies listed on the Euronext Lisbon on December 31st 2003, by analyzing their annual reports. They concluded that the size of the company, its auditor, its internationalization, its sector of activity, and the kind of business all influence the voluntary disclosure of intangibles.

A study by Gerpott et al. (2008) focused on 29 international telecommunications companies with the aim of detecting specific patterns in this business sector for the voluntary disclosure of intangible assets in June 2003. They concluded that often only a small amount of information was disclosed, but it was of a qualitative nature. The disclosure depends significantly on the company's country of origin. The level of disclosure in companies from European countries was higher than in American companies. The factors that influenced the information were not strongly related to the financial and performance criteria of the companies under analysis.

Zeghal et al. (2007) studied some of the determinants of the disclosure of voluntary information on R&D activities in Canadian companies. The authors established a set of variables which they considered relevant to the disclosure of this information: company size; debts; internationalization; R&D activities; accounting policies; partnerships in R&D projects; management; and business area. The results show that the company size, R&D activities, and partnerships had a positive impact on the disclosure level. On the other hand, other factors like debts, internationalization, and accounting policies for R&D activities were not significant for the disclosure level. The results corroborate the conclusions of Oliveira et al. (2006) regarding company size.

Although most of the studies on the factors relevant to the disclosure of information tested the importance of size, profitability, internationalization, debts and company auditor in several countries, the results are not significant, i.e., they show that the relation between the company's features and disclosure practices depends on the market.

## Goals and research questions

The various structural and cultural differences between the accounting standards and practices adopted by different international organizations are the biggest barriers to the harmonization of accounting rules and the search for solutions that permit standard accounting in the economic internationalization process. Globalization—a phenomenon caused by the search for cheaper capital in foreign markets and the diversification of the portfolio to raise profitability—has increased the need to set standards for international accounting. According to Graham and Neu (2003), this gives it an increasingly important role in the internationalization process.

Due to globalization and the consequent internationalization of businesses, some studies on accounting standards (Alves and Antunes 2010; Baker and Barbu 2007; Barbu 2004; Giner and Mora 2001; Nobes 1991; Nobes and Parker 2008; Tay and Parker 1990; Van der Tas 1988) have shown that harmonization should not only

address users' and entities' needs, but should also be seen as an essential process to improve the international comparability of financial statements. Choi and Mueller (1992) state that comparability is the only pattern or rule for all similar situations, while Nobes and Parker (2008) suggest that the comparability of accounting practices is due to a set of boundaries that are adjusted to their variation degree; the experience in European countries is the most representative as it is part of the harmonization of law and is strictly linked to the legislation in EU. Tay and Parker (1990, p. 73) say that this is "a movement away from total diversity of practice", i.e., accounting harmonization results from the legislators' and regulators' efforts to reduce accounting diversity when reporting transactions or in financial statements (Aisbitt 2001). However, according to Amaral (2001, p. 54), the harmonization of accounting standards will only be successful if it "provides reliable information based on a clear financial report".

Despite the barriers to accounting harmonization, the EU issued Regulation (CE) no. 1606/2002 of the European Parliament and Council on 19th July 2002. This marked the beginning of the implementation of the European strategy for accounting harmonization. It makes use of the mandatory IASB standard in financial statements as of 1st January 2005 for companies listed on the regulated market of any member state. This regulation corroborates what Alves and Antunes (2010) had reported, i.e., that the EU has significant power in accounting harmonization and aims to remove all economic barriers in its territory through guidelines and regulations.

Thus, according to Qu (2008), most of the approximately 7,000 listed companies in EU countries adopted the *International Financial Reporting Standards* (IFRS) from 1st January 2005. Even the non-listed companies were encouraged to do so and, according to Guerreiro (2008), accounting harmonization has already surpasses the group of listed and multinational companies and extends to the individual financial statements in most companies. According to a list published online by DeloitteToucheTohmatsu,<sup>3</sup> 123 countries from the five continents (Africa, America, Asia, Europe, and Oceania) had already adopted the mandatory or voluntary IFRS in 2011.

A number of studies (Bean and Jarnagin 2001; Gelb 2002; Cazavan-Jeny 2010; Lev 2002; Stolowy and Cazavan-Jeny 2001) addressing the information about R&D activities find great diversity in the treatment of intangible assets not only between the different national standards, but also between these and the content of *International Accounting Standard no. 38* (IAS 38)—*Intangible Assets*. According to Stolowy and Cazavan-Jeny (2001), the lack of homogeneity with regard to intangibles is an evidence of the absence of a generally accepted conceptual structure. As many countries do not have just one rule to treat each type of intangible, it can be said that the lack of international homogeneity is due to the lack of national homogeneity.

This research into the information disclosure about R&D activities in the Information and Communication Technologies (ICT) and Pharmaceutical Industries aims primarily to identify the level of information disclosure by Swedish and Finnish listed companies after adopting the IAS 38.

<sup>3</sup> Retrieved 15 June 2010, from the list published by DeloitteToucheTohmatsu on <http://www.iasplus.com/country/useias.htm>.

This goal can be divided into two specific aims:

1. Analysis of the mandatory and voluntary information disclosed about R&D activities;
2. Analysis of the factors determining the information disclosure about R&D activities.

The following question is central to this research: “To what extent have Information and Communication Technologies and Pharmaceutical companies disclosed information about R&D activities since adopting the IAS 38?” This question can further be divided into:

1. Has the information recommended by the international guidelines about R&D activities in Sweden and Finland been disclosed since the adoption of the IAS 38?
2. What kind of information about R&D activities is disclosed by companies? And in which documents?
3. Which factors determine the information disclosure about R&D activities?

## Research methodology

Our underlying hypotheses, the samples, data collection method, and conclusions are described below.

### Hypotheses

To address the first research goal, two hypotheses were formulated about R&D activities in relation to the mandatory or voluntary information disclosed—after adopting IAS 38:

**Hypothesis 1 (H1)** The ICT and Pharmaceutical companies have disclosed information about R&D activities in line with recommendations in the IAS 38 since adopting this guideline.

**Hypothesis 2 (H2)** The ICT and Pharmaceutical companies have voluntarily disclosed information about R&D activities since adopting the IAS 38.

Given the above hypotheses, the level of information disclosure about R&D following the adoption of the IAS 38 was analyzed. Two grids were made showing: firstly, mandatory information as recommended in the IAS 38, and secondly voluntary information, according to the current literature. The documents in which the information was disclosed were also analyzed.

Companies were expected to comply with the IAS 38, but they had also voluntarily disclosed some information about R&D activities, as the guideline is unclear on this matter.

To address the second research goal, six hypotheses were formulated in order to link the level of disclosure on R&D activities, the dependent variable, to several independent variables which characterize the companies forming the sample, as below.

*Company size* The size of the company is a significant factor related to the extent of disclosure. This association has been analyzed by several empirical studies (Arvidsson 2003; Barako 2007; Bauwhede and Willekens 2008; Bozzolan et al. 2003; Guthrie et al. 2006; Inchausti 1997; Oliveira et al. 2006; Palmer 2008; Percy 2000; Ponnu and Okoth 2009). Big companies influence communities and stakeholders. On the other hand, these companies are under much more pressure to disclose additional information. According to García-Meca et al. (2005), they have greater visibility and consequently are more exposed to political attacks, pressure to be socially responsible, greater regulation, price control, or higher taxes, and are therefore encouraged to disclose information to minimize the political costs.

According to several authors (Adams 2002; Inchausti 1997; Jones and Higgins 2006) the larger companies are more organized than smaller companies, have sophisticated information systems and more internal resources; as a result, they can generate more detailed information at a lower cost. Moreover, these companies can involve a larger number of people in collecting and organizing the information and they are less vulnerable to competitive threats. Larger companies can be expected to disclose more information with better quality because, according to Hossain (2008), the managers of larger companies tend to believe in the benefits of disclosure more than those of smaller companies.

Considering the size of the company, the third research hypothesis is as follows:

**Hypothesis 3 (H3)** The company size has a positive influence on the disclosure of information about R&D activities.

*Debt* Company debt is a significant factor that is often related to the level of disclosure. The link between company debt and the disclosure level has been addressed in several empirical studies (Fernandes 2008; Gerpott et al. 2008; Leuz 2004; Prencipe 2004; among others). However, empirical evidence on how debt influences the disclosure of intangible assets is mixed. Fernandes (2008) and Gerpott et al. (2008) report a significant positive association, i.e., the greater the debt, the higher the level of disclosure. On the other hand, Prencipe (2004) and Leuz (2004) report a significant negative association.

Companies' responsibilities to creditors vary in accordance with the debt level and may involve more than the simple payment of the debt. As the funding has a larger or smaller risk corresponding to the information flow between shareholders and creditors, it is usual for creditors to require the disclosure of diverse information so they can assess the risk of wealth transfer to shareholders.

Managers clearly tend to take more risks than they should, hence creditors impose restrictions on the company's performance (Lopes 2004). As a result, companies with higher debt levels tend not only to disclose more information, but it is also more diversified so that the following goals can be achieved: (i) satisfaction of creditors' requirements; and (ii) removal of any suspicion about the wealth transfer to shareholders.

Considering company debts, the fourth hypothesis is as follows:

**Hypothesis 4 (H4)** Company debts have a positive influence on the level of information disclosed about R&D activities.

*Profitability* Profitability influences the disclosure of information in the companies' annual reports. This association has been addressed in several empirical studies (Aljifri 2008; Barako 2007; Fernández et al. 2006; Hassan et al. 2006; Inchausti 1997; Owusu-Ansah 1998a, b; Palmer 2008). Profitability is an important variable measuring business performance—companies with poor performance may disclose less information to hide this from shareholders—and this information reflects on the shares' value. Companies with a better performance are encouraged to disclose more information to reduce funding costs.

Considering company profitability, the fifth hypothesis is as follows:

**Hypothesis 5 (H5)** The profitability of the company influences the disclosure of information about R&D activities.

*Auditor* The quality of the information disclosed in the companies' annual reports is often influenced by the external auditor, i.e., the better known the auditor, the more information is disclosed. According to Chalmers and Godfrey (2004), the most prestigious audit companies care first and foremost about the markets' assessment of the quality of their services, as well as the possible consequences resulting from audits made to companies that do not disclose all the recommended information. As a result, the auditors often encourage companies to disclose information. Therefore, Jones and Higgins (2006) note that many companies completely rely on the auditors' advice on the accounting practices recommended by the IFRS.

According to Wallace et al. (1994), auditors not only audit the content of the annual reports, but they also influence them. In the case of well-known external auditors, the annual reports may act as an index of reliability. The better the auditor's reputation, the more information will be disclosed by the companies (Barako et al. 2006; Bushman et al. 2004; Daga and Koufopoulos 2010; Palmer 2008).

According to some auditors (Ahmad et al. 2003), the audit firms from the "Big Four"—KPMG, PricewaterhouseCoopers, Deloitte Touche Tohmatsu, and Ernst & Young – do not tend to be associated with clients that have a low level of disclosure. Moreover, according to Lemos et al. (2009), the vast experience of the audit firms is likely to increase the demand for the amount of information disclosed by their clients. Therefore, a positive association can be expected between the auditor's reputation and the disclosure of information about R&D activities, i.e., more information is disclosed in companies with an external auditor from the "Big Four".

Considering the kind of auditor, the sixth hypothesis is as follows:

**Hypothesis 6 (H6)** The level of disclosure about R&D activities is greater in companies audited by one of the "Big Four" audit firms.

*Internationalization* The companies listed on more than one share market or on the best known markets face greater pressure to disclose information as they have more shareholders and the annual reports are their main source of information. Morris and Tronnes (2008), for example, believe that only companies listed on the New York Stock Exchange (NYSE) can be considered "international", because it is the world's most important stock market.

Companies with securities traded in the international stock exchange markets face greater pressure to disclose information than those listed only on the stock

exchange market of their own countries (Meek et al. 1995). According to Archambault and Archambault (2003), the stock market in which the shares are traded tends to influence the company's disclosure policies.

Considering the internationalization of the company, the seventh hypothesis is as follows:

**Hypothesis 7 (H7)** The company's internationalization has a positive influence on the level of disclosure about R&D activities.

Oliveira et al. (2005) and Wallace et al. (1994) note that competition and success in the market, accounting policies, kind of private information and threat of new companies entering the market can encourage companies in the same activity sector to disclose more or less information than companies in other sectors.

Since some of the studies already conducted (Zeghal et al. 2007; Barako 2007) obtained a positive association between the activity sector and the level of information disclosure, while others find no significant association (Wallace et al. 1994; Owusu-Ansah 1998a, b), the eighth research hypothesis is as follows:

**Hypothesis 8 (H8)** The activity sector has a positive influence on the level of disclosure about R&D information.

Table 1 summarizes the hypotheses to be studied, as well as the expected association between independent variables and the dependent variable related to the second goal of this paper.

## Sample

To analyze the level of information about R&D disclosed by Swedish and Finnish companies, as well as the determinants for disclosure, a sample was selected

**Table 1** Summary of the variables, hypotheses, and expected association

Variable	Hypothesis	Expected association
Company size	H3: The company size has a positive influence on the disclosure of information about R&D activities	+
Debt	H4: Company debts have a positive influence on the level of information disclosed about R&D activities.	+
Profitability	H5: The profitability of the company influences the disclosure of information about R&D activities.	+
Auditor	H6: The level of disclosure about R&D activities is higher in companies that use one of the "Big Four" auditors	+
Internationalization	H7: The company's internationalization has a positive influence on the level of disclosure about R&D activities	+
Sector of activity	H8: The activity sector has a positive influence on the level of disclosure about R&D information	+

comprising ICT and Pharmaceutical Industry companies listed on the Stock Exchange after IAS 38 (2005–2008).

According to a Eurostat report (2009), Swedish and Finnish companies' expenditure on R&D (% GDP) is among of the largest in the EU27 (3.63 and 3.47 %, respectively).

ICT and Pharmaceutical companies were chosen as they are recognized as typical examples of highly innovative sectors where intensive research is prevalent, and in which disclosure of information about intangible assets can be extremely relevant due to the central role played by research in the development strategy (Boekestein 2006; SubbaNarasimha et al. 2003).

There are five reasons underlying the decision to use listed companies: (i) it is very easy to access these companies' annual reports as their publication is mandatory; (ii) it is usual to use annual reports to research the disclosure of information about intangibles in companies from different countries (Guthrie et al. 2006; Abeysekera 2007); (iii) these companies have been obliged to adopt the IAS 38 since January 1st 2005; (iv) there is greater control of large-scale listed companies by the regulatory authorities of the respective countries; and (v) larger companies tend to disclose more information because, according to some authors (Guerreiro 2008; Zeghal et al. 2007), unlike smaller companies, their competitiveness is less affected by this information.

Compared to other company activities, R&D involves higher risks and there is greater uncertainty concerning whether it will reap future economic benefits. The inherent risk of innovation makes the information disclosure about R&D activities more useful to investors to assess the profitability of their potential investment. According to Percy (2000), companies with a high level of R&D persistently disclose asymmetrical information and present significant monitoring costs of the disclosure between managers and investors. According to Gelb (2002) and Gu and Li (2003), the companies with a significant level of R&D and advertising costs disclose more voluntary and flexible information about their R&D projects in the annual reports.

This paper therefore analyzes companies from the ICT and Pharmaceutical Industry listed on the Stock Exchange of the two countries.

Through "Worldscope Database", 1062 companies were identified among the listed companies on the Stock Exchange of Sweden (Stockholm Stock Exchange) and Finland (Helsinki Stock Exchange), for the period under review (2005–2008). Initially, we excluded 938 companies that did not belong to the two sectors of activity selected. Of the remaining 124 companies, 49 companies were excluded because they were unquoted in one or more years of the period under review as were two companies that did not undertake R&D activities and a further 37 companies which did not produce an annual report in English. The final sample comprised 36 companies (analyzed in each of the 4 years). Companies that did not produce an annual reports in English on their websites were excluded; after contacting them by email, it was confirmed it would be impossible to obtain the information in English.

## Data collection

The main goal of the research is to analyze the kind and level of information disclosed about R&D activities by ICT and Pharmaceutical companies after adopting the IAS 38. The content analysis method was used for this purpose. According to Silverman (2009), content analysis can be applied to financial studies in which official disclosure documents are analyzed in the light of the research goals and the activities of the companies to which the documents pertain. Moreover, content analysis has become a common method in studies on intangible assets and information disclosure (Abeysekera 2006; Beattie and Thomson 2007; Giampaolo 2008; Gray and Kang 2010; Guthrie et al. 2006; White et al. 2007), since it provides credibility and inference to the analysis in a specific context (Beretta and Bozzolan 2008, *apud* Krippendorff 1990). However, according to Owusu-Ansah (1998a, b), one of the main difficulties in studies on information disclosure is defining the possible information—items—that one expects to find in financial statements. There is often a lack of consensus on the definition of these items as it depends on the focus of the research (Wallace and Naser 1995).

In this paper, the content analysis method will be used for the descriptive analysis of the information disclosed by ICT and Pharmaceutical Industries about R&D activities by encoding the collected information, through the determination of several items. The items were established based on the following hypotheses:

- Mandatory information disclosure as recommended by the IAS 38;
- Voluntary information disclosure.

The resources for data collection were the IAS 38, the annual reports—from 2005 to 2008—and the reviewed literature. Two tables were formulated for this purpose: one to collect the company data and mandatory information disclosed (see Table 8 in Appendix), and another for information disclosed voluntarily (see Table 9 in Appendix).

After establishing the above-mentioned items, an index is used to measure the level of disclosure about R&D activities. The use of a Disclosure Index (DI) is a strategy adopted in the studies of several authors (Aljifri 2008; Arvidsson 2003; Gray and Kang 2010; Hossain 2008; Kang and Gray 2011; Laidroo 2011; Lemos et al. 2009; Lopes and Rodrigues 2007; Tsamenyi et al. 2007). The annual reports of each company were analyzed and a reference was confirmed for each attributed item. The value 1 (one) was attributed for each reference to an item, and the value 0 (zero) was attributed where there was no reference. A scale of 0 and 1 is used i.e., each item is considered only once, regardless of the number of times that it is disclosed by the same company.

The DI calculation is expressed in the following formula:

$$ID = \sum_{i=1}^n d_i/N,$$

where  $d_i = 1$ , if the item is disclosed;  $d_i = 0$ , if the item is not disclosed;  $N =$  the total number of analyzed items.

The second research goal is to identify the determinants in disclosing mandatory and voluntary information on R&D activities. To achieve this goal, a linear regression model was used to link the dependent variable (disclosure index) to the independent variables. In line with the hypotheses, H3 to H8, the independent variables tested were: company size; debts; profitability; kind of auditor; internationalization; sector of activity; and year. The data for all the independent variables were obtained from the “Wordscope Database”. The company size was measured using the business volume; debt was measured through the liabilities/equities; profitability was measured by the profitability of assets (ROA).

Table 2 presents authors that used the same measures (*proxies*) for these variables in their empirical studies.

To measure the kind of auditor, the companies are classified as audited or not audited by one of the “*Big Four*”, creating a dichotomous variable, or dummy variable. The variable assumes only two values: 1 (one) to represent the occurrence of an event and 0 (zero) otherwise. Thus, the variable will have the following parameters:

0 = Audited by one of the “*Big Four*”

1 = Not audited by one of the “*Big Four*”

To measure internationalization, the companies are classified either as listed in only one stock exchange, or in more than one, also creating a dichotomous or dummy variable. Thus, the variable will have the following parameters:

1 = Company listed in more than one stock exchange

0 = Company listed in just one stock exchange

To measure the sector of activity, the companies are classified as belonging to or not belonging to the pharmaceutical industry, creating a dichotomous or dummy variable. The variable has only two values: 1 (one) to represent the occurrence of an event and 0 (zero) otherwise. Thus, the variable will have the following parameters:

1 = Companies that belong to the pharmaceutical industry

0 = Companies that do not belong to the pharmaceutical industry

A nominal variable that represents the year was also considered, using the first year of the IAS 38, 2005, as the reference. Then, a multiple linear regression model was developed in line with the hypotheses, considering the DI as a dependent variable and the above-mentioned independent variables. The model is as follows:

**Table 2** Some empirical studies that used the same measures (*proxies*)

Authors	Variables			
	Company size business volume	Debt liabilities/ equities	Profitability ROA	Expected sign
Ashbaugh et al. (1999)			X	+
Demaria and Dufor (2007)		X		+
Fernández et al. (2006)	X		X	+
Larrán and Giner (2002)	X	X		+
Lopes and Rodrigues (2007)		X		+
Palmer (2008)			X	+

$$ID = \alpha_0 + \beta_1 DIM + \beta_2 END + \beta_3 REN + \beta_4 TAUD + \beta_5 INT + \beta_6 SACT + \beta_7 COUNTRY + \beta_8 ANO + \varepsilon_i(2),$$

where DIM, Company size, measured by the business volume (submitted to logarithmic transformation); END, Debts, measured by the total liabilities/equities\*100; REN, Profitability, measured by the net income/total assets\*100; TAUD, Kind of auditor, dichotomous variable with the value 0 if the company is not audited by one of the “Big Four” and 1 otherwise; INT, Internationalization, dichotomous variable with the value 0 if the company is listed on only one stock exchange and 1 if it is listed on more than one; SACT, Sector of activity, dichotomous variable with the value 0 if the company does not belong to the pharmaceutical industry and 1 otherwise; COUNTRY, Country, dichotomous variable with the value 0 if the company does not belong to Finland and 1 otherwise; YEAR, Years 2006, 2007, and 2008 (reference year = 2005).

Results

Table 3a, b present the descriptive statistics for the dependent variable—mandatory disclosure index (MDI) and voluntary disclosure index (VDI)—from 2005 to 2008.

The minimum and maximum values, the average, the median, and the standard deviation were calculated for both indexes.

As shown in Table 3, the MDI average in 2005 is 58 %, in 2006 and 2007 is 61 % and rises to 64 % in 2008. However, the MDI interval varies between 0 and 86 %.

As for Table 3b, the MDI average is constant, 68 %. However, the MDI interval varies between 14 and 86 %.

The values for the average disclosure are a little lower than those indicated by some authors (Archambault and Archambault 2003; Francis et al. 2005) for the IAS disclosure index: 75.69 and 71.76 %, respectively.

However, as the mandatory information disclosure level (on annual reports) increased between 2005—when IAS 38 was adopted—and 2008, this indicates that implementing an accounting standard involves a learning process and a positive

**Table 3** Descriptive statistics of the mandatory and voluntary disclosure—Sweden and Finland

Years	N	Minimum		Maximum		Average		Median		Standard deviation	
		MDI	VDI	MDI	VDI	MDI	VDI	MDI	VDI	MDI	VDI
(a) Sweden											
2005	23	0	0.06	0.86	0.67	0.58	0.41	0.71	0.40	0.34	0.13
2006	23	0.14	0.06	0.86	0.67	0.61	0.43	0.86	0.40	0.32	0.13
2007	23	0.14	0.06	0.86	0.67	0.61	0.43	0.86	0.40	0.32	0.12
2008	23	0.14	0.13	0.86	0.67	0.64	0.44	0.86	0.40	0.31	0.12
(b) Finland											
2005	13	0.14	0.40	0.86	0.73	0.68	0.55	0.86	0.53	0.31	0.09
2006	13	0.14	0.40	0.86	0.73	0.68	0.56	0.86	0.53	0.31	0.09
2007	13	0.14	0.40	0.86	0.73	0.68	0.56	0.86	0.53	0.31	0.10
2008	13	0.14	0.40	0.86	0.73	0.68	0.57	0.86	0.53	0.31	0.09

change can therefore be expected in the disclosure and quality of information over the years, as highlighted by Hausin et al. (2008).

As for the VDI in Sweden, Table 3a shows that there is a low level of voluntary information disclosure (in the annual and management reports) averaging almost 40 % from 2005 to 2008. However, the VDI interval varies between 6 and 67 % from 2005 to 2007 and between 13 and 67 % in 2008. As for the VDI in Finland, Table 3b shows that there is a low level of voluntary disclosure (in the annual and management reports) averaging 56 % from 2005 to 2008. However, the VDI interval varies between 40 and 73 % from 2005 to 2008. As shown by some authors (Sampaio and Pimpão 2003; Gerpott et al. 2008) voluntary information disclosure is very low.

Turning to the second research goal—the analysis of the factors determining disclosure of information on R&D activities—the results are based on a multiple linear regression model. The model used was obtained directly from the SPSS software (*Statistical Package for the Social Sciences*) and it aims to describe the association between the dependent variables (MDI and VDI) and the independent variables (DIM, END, REN, TAUD, INT, SACT, YEAR, and COUNTRY).

Table 4 presents the summary model and the Durbin–Watson test for the dependent variable MDI. The inclusion of the error in the model is fundamental, as the variations in the independent variables are not expected to fully explain those in the dependent variable. The value of the error (0.278) represents the variation in the dependent variable that is not associated or does not result from variations in the independent variables.

The Durbin–Watson test is commonly used to identify the self-correlation of residuals. In line with Pestana and Gageiro (2005), it can be concluded from Table 4 that there is no self-correlation between the residuals as the test value (2.909) is in the acceptance zone (values near 2).

Table 5 presents the results of the linear regression for the MDI.

In Table 5, the  $R^2$  Adjusted level (21.3 %) represents the MDI variation, which is explained by the independent variables. Although this value shows that the MDI can be explained by other variables through the  $F$  test, the value of which is statistically significant (0.000)—to a level of significance of 0.05 (by default)—the conclusion is that the model is valid.

Based on the individual analysis of each independent variable, the  $t$  test shows the significance level of the model (1, 5 or 10 %), while the estimated coefficient signs demonstrate how they explain the dependent variable MDI.

Table 5 presents the significance level of the explanatory variables. The only variables that are statistically significant are END, TAUD, INT, and SACT—from

**Table 4** Summary model and Durbin–Watson test

Model	$R$	$R^2$	$R^2$ adjusted	Standard error of estimate	Durbin– Watson
Companies listed on the Stockholm Stock Exchange and Helsinki Stock Exchange	0.518 <sup>a</sup>	0.268	0.213	0.278	2.909

<sup>a</sup> Independent variables: (constant), DIM, END, REN, INT, TAUD, SACT, COUNTRY, YEAR06, YEAR07, YEAR08

**Table 5** Linear regression results (MDI)

Variables	Expected sign	Non standard coefficient		<i>t</i>	Significance
		<i>B</i>	Standard error		
Constant	0.000	0.686	0.241	2.846	0.005
DIM	0.000	0.041	0.022	1.916	0.058**
END	0.000	−0.136	0.049	−2.771	0.006***
REN	0.000	0.001	0.004	0.151	0.875
TAUD	0.000	−0.359	0.106	−3.394	0.001***
INT	0.000	0.235	0.090	2.620	0.010***
SACT	0.000	−0.309	0.062	−4.963	0.000***
COUNTRY		−0.059	0.058	−1.014	0.312
YEAR06		0.019	0.066	0.294	0.769
YEAR07		0.025	0.066	0.378	0.706
YEAR08		0.054	0.066	0.820	0.414
<i>N</i>		144			
<i>R</i> <sup>2</sup> adjusted		0.213			
Statistical <i>F</i>		4.870			
<i>F</i> significance		0.000			

\*\*\* Significance level 1 %; \*\* significance level 5 %; \* significance level 10 %

2005 to 2008—with a significance level of 1 %. The signs (positive and negative) of these explanatory variables have several meanings.

The negative sign of the explanatory variable END means that it has significant influence for the mandatory disclosure of information about R&D activities (value of −2.771). Despite being statistically significant (significance of 0.006), this variable presents the opposite sign to the one foreseen in H4.

The negative sign of the explanatory variable TAUD means that it has a significant influence for the mandatory disclosure of information about R&D activities (value of −3.394). Despite being statistically significant (significance of 0.001), this variable presents the opposite sign to the one foreseen in H6.

The positive sign of the explanatory variable INT means that the presence of the company on more than one stock exchange has a positive influence on the disclosure level. This result validates H7, proving that these companies disclose more mandatory information about R&D activities.

For the explanatory variable SACT, the negative sign means that it has a positive significance for the mandatory disclosure of information about R&D activities (value of −4.961). Despite statistical significance (0.000), this variable presents the opposite sign to the one foreseen in the hypothesis H8. The statistical significance of this variable is also similar to that found in the study by Barako (2007).

In addition to the above-mentioned explanatory variables, the DIM variable has some explanatory power for the MDI dependent variable with a significance level of 5 %. The positive sign means that the bigger the company, the higher the level of mandatory information disclosure about R&D activities. It is likely that large companies disclose more information and with better quality. According to Hossain

(2008) large companies' managers tend to believe that they benefit from this disclosure, contrary to small companies' managers. This result validates H3 which proves that larger companies disclose more mandatory information about R&D activities, similar to the study by Palmer (2008) and Ponnu and Okoth (2009).

Table 6 presents a summary model and the Durbin–Watson test for the dependent variable VDI. The error obtained (0.100) represents the variation in the dependent variable that is not linked to or that does not result from variations in the independent variables.

Given that the value of Durbin–Watson (2.175), shown in Table 6, is in the acceptance zone (values of about 2), we can conclude that there is no residual self-correlation.

Table 7 presents the linear regression results for VDI.

In Table 7, the Adjusted  $R^2$  (41.8 %) represents the proportion of the VDI variance that is explained by the independent variables. Although this value shows that the VDI could be explained by other variables using test  $F$ , which has a

**Table 6** Summary model and Durbin–Watson test

Model	$R$	$R^2$	$R^2$ adjusted	Standard error	Durbin–Watson
0.000	0.677 <sup>a</sup>	0.458	0.418	0.100	2.175

<sup>a</sup> Independent variables: (Constant), DIM, END, REN, INT, TAUD, SACT, COUNTRY, YEAR06, YEAR07, YEAR08

**Table 7** Linear regression results (VDI)

Variables	Expected sign	Non standard coefficients		$t$	Significance
		$B$	Standard error		
Constant		0.819	0.087	9.434	0.000
DIM	+	−0.037	0.008	−4.803	0.000***
END	+	0.050	0.018	2.801	0.010***
REN	+	0.004	0.001	3.338	0.001***
TAUD	+	0.059	0.038	1.554	0.123
INT	+	−0.051	0.032	−1.578	0.117
SACT	+	0.094	0.022	4.220	0.000***
COUNTRY		−0.132	0.021	−6.280	0.000***
YEAR06		0.024	0.024	1.007	0.316
YEAR07		0.027	0.024	1.125	0.262
YEAR08		0.032	0.024	1.340	0.183
$N$		144			
Adjusted $R^2$		0.418			
Statistical $F$		11.254			
$F$ significance		0.000			

\*\*\* Significance level 1 %; \*\* significance level 5 %; \* significance level 10 %

significant value (0.000)—to a level of significance of 0.05 (by default)—the conclusion is that the model is in general valid.

An analysis of Table 7 reveals that the statistically significant variables are DIM, END, REN, SACT, and COUNTRY—from 2005 to 2008—to a significance level of 1 %. A number of conclusions can be drawn from the positive and negative signs of these variables.

The negative sign for DIM means that it has a significant influence on the voluntary disclosure about R&D activities (value of  $-4.803$ ). Although significant (0.000), this variable has the opposite sign to the one defined in H3. The studies of Barako (2007) and Zeghal et al. (2007) also presented significant results for this variable.

The positive sign of the explanatory variable END means that it is positively linked to the voluntary disclosure level (2.801). This variable is statistically significant (0.006) validating the sign defined by H4. These results are in line with findings of Fernandes (2008) and Gerpott et al. (2008).

The positive sign of the explanatory variable REN means that the more profitable the company is, the greater its voluntary disclosure level. These results validate hypothesis H5 proving that the most profitable companies disclose more voluntary information about R&D activities.

As for SACT, the positive sign means that the companies' sector of activity has a positive influence on the disclosure level. These results validate hypothesis H8 thus proving that Pharmaceutical companies disclose more information about R&D activities than ICT companies, i.e., in accordance with Álvarez (2001), pharmaceutical companies disclose more information than companies from other sectors. This variable also presents statistically significant results in the studies by Álvarez (2001), Barako (2007) and Kang and Gray (2011). No correlation was found between the explanatory variables (TAUD and INT) and VDI.

Finally, comparative analysis of results obtained in MDI and VDI (Tables 5, 7) shows that there are only two statistically significant variables (significance level of 1 %) for END and SACT. In IDO, the explanatory variables END and IDV yielded a significance level of 0.006 and 0.010, respectively. For the SACT, the significance level obtained for both indices (IDO and IDV) is 0.000.

## Conclusion

Information on R&D activities is important as it helps in the assessment of a company's ability to face up to the technological challenge, which is known to involve change. This information can also allow the results of companies from the same industry to be compared, job requirements to be forecasted, as well as indicating the company's level of technological leadership and its ability to maintain this leadership.

According to Chiucchi (2008), there are several reasons for companies disclosing information about their intangible assets, and it helps reduce the asymmetrical information between managers, shareholders, and investors. However, given that several intangible assets are not found on the Balance Sheet, companies like those of the ICT and Pharmaceutical Industries that use more technology and in which intangible assets play a significant role find it more difficult to appeal to investors

and financial institutions. In these cases, according to RICARDIS (2006), the voluntary disclosure of information about intangible assets may help reduce investors' uncertainties, and simultaneously contribute to easier access to funding.

The IASB established the IAS 38 to harmonize the accounting and disclosure of intangible assets. The standard specifies how intangible assets which are not encompassed in other guidelines should be accounted. In the EU, the adoption of the IAS 38 in or after January 1st 2005 was a turning point for the accounting harmonization of companies listed on the stock exchange. The mandatory and voluntary information on R&D activities disclosed by the ICT and Pharmaceutical Industries was analyzed, as well as the determinant factors of the disclosure, in order to determine whether the IAS 38 increased the disclosure of information.

The results obtained in this study show that between 2005 and 2008 the companies from the sample disclosed information in their annual reports in line with the IAS 38. The mandatory information disclosed increased steadily, confirming the results of several authors (Cascino and Gassen 2009; Chen et al. 2010; Fontes et al. 2005; Gomes et al. 2006; Jesus et al. 2008; Miihkinen 2008; Morais and Curto 2008) which report an increase in the information disclosure level in accounting after the adoption of IFRS.

Relative to voluntary disclosure, the results show that the companies from the sample disclosed information in the annual and management reports from 2005 to 2008 and the disclosure average was 46 %. This average corroborates the results of several authors (Domench 2001; Gomes et al. 2006; Gray and Skogsvik 2004; Jones 2007; Leitão 2006) reporting a low level of voluntary disclosure about R&D activities.

Using the Multiple Linear Regression Model, two linear regressions were performed using MDI and VDI as dependent variables. Relative to the explanatory variables studied, it was shown that the DIM, END, TAUD, INT, and SACT are statistically significant for the dependent variable MDI, while the variables DIM, END, REN, SACT, and COUNTRY are statistically significant for the dependent variable VDI. Thus, we can conclude that: (i) the size of the company, debts, kind of auditor, internationalization, and the activity sector all influence the level of mandatory disclosure on R&D activities; and (ii) the size of the company, debts, profitability, activity sector, and country all influence the level of voluntary disclosure on R&D activities. This study found no evidence of a link between profitability and mandatory disclosure of information, nor between the kind of auditor and internationalization, and the level of voluntary disclosure.

Hereafter, the study will analyze whether similar results are obtained in countries with a higher R&D rate. In addition, new explanatory variables will be introduced, which may allow different conclusions to be obtained and the identification of new determinants regarding the disclosure of information about R&D activities.

The limitations of this paper include the (small) size and specificity of the sample (only Swedish and Finish companies)—thus making it impossible to generalize results to other countries. Another limitation of this study is the insignificance of some of the explained variables selected.

## Appendix

See Tables 8 and 9.

**Table 8** Mandatory information about the R&D disclosed in the years 2005, 2006, 2007, and 2008

Part 1: Company identification												
Name:												
Industry group:												
Part 2: Mandatory information disclosed												
	2005			2006			2007			2008		
	D	NA	Doc									
Undefined or limited useful lives (years of useful lives and amortization rates)												
Amortization methods used for intangible assets with finite useful lives												
Gross value and accumulated amortizations, including accumulated impairment losses in the beginning and at the end of period												
Income statement items where intangible assets amortization are included												
Bases that define if intangible assets have an undefined useful live												
Reconciliation between the book value in the beginning and in the end of the period which evidences the items of \$118												
R&D amount recognized as expense in the period												

*D* disclosed, *NA* not disclosed, *NA* not applicable, *Doc* document

**Table 9** Voluntary information about the R&D disclosed in the years 2005, 2006, 2007, and 2008

Part 1: Company identification												
Name:												
Industry group:												
Part 2: Voluntary information disclosed												
Voluntary information	2005			2006			2007			2008		
	D	ND	Doc									
Product under R&D description												
People or parties involved in R&D												
R&D infrastructures												
Current product results, or associated with it												
Potential results												
R&D projects financing sources												
Scheduled dates												
R&D project future perspectives												
Amount invested in R&D projects												
Spending on staff assigned to R&D projects												
Number of personnel assigned to R&D projects												
Developed products sales volume												
Ratio between net sales and expenditure on R&D												
Key areas for products development												

*D* disclosed, *ND* not disclosed, *Doc* document

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