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THE CAPITALISATION OF INTANGIBLES DEBATE: SOFTWARE DEVELOPMENT COSTS

ACCA AND ADAM SMITH BUSINESS SCHOOL RESEARCH REPORT

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1. Introduction

1.1 Background and objectives

There have been concerns that financial statements do not reflect adequately the underpinning drivers of value in modern business (Bernanke 2011; Haskel and Westlake 2017; Lev and Gu 2016). Additionally, International Accounting Standard (IAS) 38 Intangible Assets, which governs the treatment of intangible assets, has been criticised for reflecting prudence and conservatism that encourages the expensing of internally generated intangible assets (Mazzi et al. 2019b). This implies that the accounting treatment of internally generated intangible assets, as prescribed by the standard, exacerbates the perceived lack of intangible assets in companies' balance sheets.

To shed more light on these conjectures, a study by Mazzi et al. (2019b) has among other things examined the relevant amounts and firm characteristics of a very large sample of firms across the world that capitalise and/or expense research and development (R&D) expenditure, specifically under International Financial Reporting Standards (IFRS). However, in today's economies, companies increasingly invest in software, develop websites as well as other software (eg applications for mobile phones) for use as part of their operations, but that are not necessarily heavily involved in R&D activities. Thus, firms could find themselves spending significant software-related amounts. Such expenditure should be capitalised, subject to meeting the criteria, and shown as a separate category of intangible assets. As such, prior literature that has examined the capitalisation of development costs more broadly has not separately analysed the relevant costs recognised on companies' financial statements.

The present study complements and extends the study by Mazzi et al. (2019b) by focusing particularly on software development costs (SDCs), which are governed by the same accounting standard (ie IAS 38). To the best of the authors' knowledge, research on the frequency and likelihood of SDC capitalisation and relevant amounts capitalised on companies' balance sheets under IFRS is not available. Furthermore, there is an absence of evidence on the characteristics of firms that are more likely to capitalise such expenditure and on the determinants of the amounts of SDC capitalised. The overall objective of the present research is to shed light on these areas.

1.2 Method

By drawing on listed companies from 39 countries (40,241 firm-year observations) that have either converged their national standards to IFRS or adopted IFRS, for the five-year period 2015 to 2019, we have collected and summarised evidence on how many companies capitalise SDCs during the year (capitalisers) and how many report R&D costs in the income statement but do not capitalise SDCs during the year (non-capitalisers). This evidence is provided in aggregate and on a country and industry level. We also provide descriptive statistics of the amounts of SDCs capitalised in a given year relative to market values and the net amounts of SDCs that feature on companies' balance sheets, relative to total assets, at the end of the year. We then provide results from multivariate regression analysis to identify the country- and firm-level determinants influencing the decision of companies to capitalise SDCs and identifying the factors affecting the magnitude of SDCs capitalised in a given year.

In additional analysis with a separate sample, we explored any differences in the determinants influencing the decision of companies to capitalise SDCs and the factors affecting the magnitude of SDCs capitalised for a sample period that covers the same number of years before and after the implementation of IFRS 3 Business Combinations (Revised) in 2009. Finally, for a relatively small number of firms, we collected companies' most recent annual reports and, from those, we manually extracted examples of voluntary disclosure and accounting policy notes about capitalisation or expensing of SDCs.

1.3 Main findings

- The data shows that 62.2% of the firm-year observations in the sample capitalise SDCs. This suggests that companies very frequently recognise and report SDCs separately. Moreover, from the multivariate analysis we conducted, we identified a significant number of non-capitalisers that, given their firm- and country-level characteristics, one would have expected to capitalise SDCs. This would increase the percentage of capitalisers of SDCs even further.
- In Argentina, Brazil, Chile, Colombia, India, Ireland, Japan, Mexico, New Zealand, Peru, Philippines, Portugal, South Africa and Spain, more than 80% of the firm-year observations are of firms that are capitalisers. In fact, all firm-year observations from Colombia and Philippines are capitalisers.

- The constituents of Consumer Discretionary, Financials, Real Estate and Utilities Sectors exhibit the largest proportion of capitalisers (the proportion of capitalisers is greater than 70%).
- The high frequency of SDCs capitalisation identified holds, even though the amounts involved can be considered immaterial relative to companies' total assets and/or market values. Specifically, we note that the mean (median) SDC asset intensity on the balance sheet is 0.6% (0.2%) of capitalisers' total assets. Further, the mean (median) SDC asset capitalised in the year is 0.04% (0.1%) of capitalisers' market values. However, the large proportion of firms from Asia, which exhibit the lowest net SDCs intensity (mean (median) 0.32% (0.11%) of total assets), distorts the picture in relation to the SDC asset intensity of the overall sample.
- Firms from Oceania (represented by firms from New Zealand and Australia) exhibit the highest intensity (mean (median) 2.22% (1.32%) of total assets). European firms and South African firms tend to present the second highest values of SDC assets as a proportion of total assets (mean (median) for Europe: 1.51% (0.73%); mean (median) for South Africa: 1.28% (0.66%)).
- Firms in the Telecommunications industry exhibit the highest net SDC asset intensity (mean (median) 1.26% (0.37%) of total assets), followed by firms in Technology and Consumer Discretionary (mean (median) is 1.06% (0.28%) and 0.80% (0.26%) of total assets, respectively). Although firms in the Financials Sector have the highest proportion of capitalisers, net SDC asset intensity is of intermediate level when compared with other industries.
- In particular, of the firm-year observations that complete material business combinations in a given year (4,076), a large proportion (3,115 firm-year observations – 76.4%) capitalise SDCs during the year (this represents 12.06% of the firms that capitalise SDCs in the entire sample). Additionally, we identify 1,028 firm-year observations that capitalise research and development (R&D) in the year (this represents 13.80% of the firm-year observations that capitalise R&D in the year in the entire sample). Moreover, for the firms that capitalise SDCs during the year, the mean (median) SDC intensity is 1.1% (0.3%) of total assets, while the mean (median) SDC capitalised in the year is 0.5% (0.1%) of market values.
- Compared with those that do not capitalise SDCs, companies that take the decision to capitalise SDCs tend to be larger, riskier, with higher leverage, to have more international sales, to have incentives to capitalise SDCs to meet their earnings targets, to capitalise other development costs and to have concluded material business combinations during the year. They are also more likely to employ one of the Big Four auditors. The same characteristics associate positively with the magnitude of the amounts capitalised.
- Nonetheless, firm size, employing a Big Four auditor, and international sales are not significant factors affecting the decision to capitalise SDCs for the sub-sample of firms that have material business combinations. Further, book to market, firm size, having a Big Four auditor, international sales, and frequency of R&D capitalisation and being headquartered in a civic-law country or a country with highly skilled labour and better health infrastructure are not significant determinants of the amounts of SDCs capitalised in the sub-sample with material business combinations. Hence, these factors are significant determinants of SDC capitalisation only for the sub-sample of firms that do not have material business combinations.
- The results from the separate sample focusing on the years before and after the implementation of IFRS 3 (R) in 2009 suggest that the implementation of the revised standard does not influence a firm's decision about capitalising SDCs or the magnitude of SDC capitalisation, even if it has conducted material business combinations.

1.4 Policy implications and recommendations

The issue of intangible assets has been on the agenda of standard setters and regulators for some time and it is increasingly gaining momentum. For example, in 2015, as a response to the request for views on the Agenda Consultation of the International Accounting Standards Board (IASB), the European Securities and Markets Authority (ESMA) agreed that there is a need for a review of the guidance for intangible assets and R&D.[1] Moreover, in the UK in 2019, the Financial Reporting Council (FRC), following a project it had carried out and a request for feedback from stakeholders, published proposals for business reporting of intangibles (FRC 2019). Additionally, in late 2019, the intangibles research unit within the European Financial Reporting Advisory Group (EFRAG) held discussions on intangibles in relation to the IASB's forthcoming Agenda Consultation and, 'at the meeting, IFRS IC [Interpretations Committee] members noted that a fundamental overhaul of the Standard was necessary' (EFRAG 2019: 2). In response to these voices, the IASB, in its request for information on what its priorities should be over the following five years, included revisiting IAS 38 as one of its potential projects (IASB 2021: Table 5). Further, even though in 2017 the Financial

1 <https://www.esma.europa.eu/sites/default/files/library/2015-1740_-_esma_cl_to_the_iasb_agenda_consultation.pdf>

Accounting Standards Board (FASB) reported that it was undertaking a project aiming to review, among other things, the mandatory disclosures for intangibles (FASB 2018), it has now initiated a project on accounting for and disclosure of intangibles, including internally developed intangibles and R&D (FASB 2021). Against this backdrop, the findings of the present research are very timely and speak directly to these projects. The findings should also be relevant to regulators more broadly, and to companies and auditors. With regard to SDCs in particular, the key recommendations arising from our findings are summarised as follows.

i. Our findings of high frequency of capitalisation of SDCs, even though the amounts involved can be considered relatively small, are in direct contrast to the prior evidence of relative lack of capitalisation of development costs of new products and processes (ie R&D-related costs) under IAS 38. We conjecture that such costs can be more reliably estimated at the time when the related projects are undertaken. Further, the SDCs' duration of development can also be estimated with relative reliability over a shorter time period. These two features allow companies to establish their internal use, rather than applying an external market condition for product development, with greater relative reliability and this enables capitalisation of such costs. Along these lines, a relevant method of amortisation or monitoring for impairment can be established. Nonetheless, the stringent criteria for the recognition of development costs deter companies from capitalising other development costs equally frequently. Thus, if the IASB proceeds by revising/replacing IAS 38, reconsideration of the conditions of capitalising developments costs is pertinent. This would improve the accounting treatment and comparability of other intangible assets.

ii. Our findings on the frequency of SDCs' capitalisation and magnitude of related amounts capitalised for the periods before and after IFRS 3 (R) reveal that the IASB's expectation for 'an increase in the intangible assets recognised as a result of business combinations' (IASB, 2014: 13) following the implementation of IFRS 3 (R) did not materialise. This holds for all firms conducting business combinations and for those for which the combinations were material. Further, our findings for the companies that have conducted material business combinations in the most recent sample period suggest that the majority of these firms do recognise SDCs (and even other development assets) separately. In fact, the corresponding amounts appear to be higher than those from all SDC capitalisers in the sample. This suggests that companies do follow IFRS 3 and recognise separately such assets upon material business combinations. The finding also reinforces views regarding the differential treatment and resultant influence in the frequency of recognition of intangible assets on companies' balance sheets (see in IASB 2021). In combination, this suggests that the generally perceived lack of recognition of intangible assets more broadly lies with IAS 38.

iii. Our findings indicate significant differences between the percentage of SDC-capitalising firms and SDC asset intensity on companies' balance sheets across countries/regions. While firms from Asia demonstrate a clear tendency to recognise SDCs separately on the balance sheet, the SDC asset intensity is far smaller than for firms in those regions, such as Oceania and Europe, where capitalisation is less frequent. Given this, users of financial statements, preparers, auditors and/or enforcers of financial information should be alerted of the differential reporting incentives and contextual, or cultural, influential factors across different countries, which result in significant variations in reporting practices. The concept of materiality for triggering separate disclosure of SDC assets and the perceived importance of SDCs evidently have different weight across different jurisdictions. On the other hand, SDC intensity across different sectors appears less variable and percentage of capitalisers is more explicable/less unexpected.

iv. Finally, in contrast to the evidence about lack of disclosures in relation to R&D, our findings from reviewing the disclosures in companies' annual reports indicate some good disclosure practice for SDCs. Given the lack of mandatory disclosures for either topic in IAS 38, the good practice we have observed rests on companies' voluntary disclosure behaviour. Arguably, the higher frequency of recognition of SDCs 'forces' companies to 'talk' about the amounts recognised, despite the relative lack of materiality. Even so, in the cases where business combinations are not present, we have observed that companies do not explicitly explain how much of the cost capitalised relates to in-house development or externally acquired software. Arguably, IAS 38, enforcing bodies and auditors could be encouraged to support more transparent disclosures by assisting firms to distinguish how much of the capitalised amounts relates to externally acquired or internally developed software.

1.5 Report outline

The next chapter describes the accounting for SDCs and an overview of the relevant accounting standards and literature. The research design is outlined in Chapter 3. We then present and discuss our results in Chapter 4. Conclusions are set out in Chapter 5.

2. **Accounting for Software Development Costs** – overview of relevant accounting standards and literature

2.1 Overview of relevant accounting standards

Under an IFRS reporting regime, accounting for SDCs and associated capitalisation of relevant expenditure is governed primarily by IAS 38 Intangible Assets and less so by IFRS 3 Business Combinations.

IAS 38 prescribes (paragraph 21) that an intangible asset shall be recognised if, and only if:

a. it is probable that the expected future economic benefits that are attributable to the asset will flow to the entity; and

b. the cost of the asset can be measured reliably.

Second, paragraphs 25 and 26 explain, 'the probability recognition criterion in paragraph 21(a) is always considered to be satisfied for separately acquired intangible assets' and 'the cost of a separately acquired intangible asset can usually be measured reliably'.

IAS 38 further covers the accounting for internally generated intangible assets, including R&D costs, of which SDCs form a constituent element. All research costs are expensed. Development costs must be capitalised on meeting the six conditions specified in paragraph 57 of the standard; all other costs are expensed. The six conditions can be applied to cover those costs incurred in relation to the internal development and use of software or its development for sale, as set out below.

"An intangible asset arising from development (or from the development phase of an internal project) shall be recognised if, and only if, an entity can demonstrate all of the following:

a. the technical feasibility of completing the intangible asset so that it will be available for use or sale;

b. its intention to complete the intangible asset and use or sell it;

c. its ability to use or sell the intangible asset;

d. how the intangible asset will generate probable future economic benefits. Among other things, the entity can demonstrate the existence of a market for the output of the intangible asset or the intangible asset itself or, if it is to be used internally, the usefulness of the intangible asset;

e. the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset;

f. its ability to measure reliably the expenditure attributable to the intangible asset during its development".

Within IAS 38, specific guidance is also provided in relation to software (including that developed internally) that is integral to the use of property, plant and equipment. Specifically, 'computer software for a computer-controlled machine tool that cannot operate without that specific software is an integral part of the related hardware and it is treated as property, plant and equipment. The same applies to the operating system of a computer. When the software is not an integral part of the related hardware, computer software is treated as an intangible asset' (IAS 38, para 4).

Recognising the growing importance of website development for internal use and as a sales platform, SIC-32 Intangible Assets – Web Site Costs was issued in March 2002. This confirms that a website developed by an entity using internal expenditure, whether for internal or external access, is an internally generated intangible asset that is subject to the requirements of IAS 38, and specifically those conditions specified in para 57 for capitalisation. SIC-32 identifies four stages of

website development. Firstly, 'planning application and infrastructure development', which is akin to the research phase, so all costs are expensed. Secondly, 'graphical design development' is akin to the development stage and costs are to be capitalised if they meet the conditions specified in IAS 38. Owing to websites' susceptibility to technological obsolescence, SIC 32 specifies that where costs are capitalised, the expected amortisation period should be short, consistent with that set out in IAS 38 para 92. Finally, for 'content development' that is developed to advertise and promote an enterprise's own products and services and costs in the 'operating phase' are expensed.

In addition to these considerations, as part of a business combination, as of the acquisition date, the acquirer must, among other things, recognise, separately from goodwill, the identifiable assets acquired (IFRS 3, para 10). Specifically, the acquirer's application of this recognition principle and conditions may result in recognising some assets (including software) that the acquiree had not previously recognised as assets in its financial statements because it developed them internally and charged the related costs to expense (IFRS 3, para 13). As a result, while consolidating subsidiaries, SDCs' value on a company's balance sheet would increase, not only because of recognising SDCs already on the balance sheet of the acquiree but also because of the newly recognised SDCs on consolidation.

In this study, we shed light to all relevant costs recognised on companies' balance sheets.

2.2 Related literature

Despite the plethora of literature about general R&D costs and associated capitalisation (see in Mazzi et al. (2019a; 2019b) and Dargenidou et al. (2021) for relevant references), there is a sparsity of literature on accounting for SDCs under IAS 38. This is despite the growth in importance of automated systems and production planning, the development of apps, cybersecurity challenges and risks, artificial intelligence and big data analytics (Morgan Stanley 2017). Indeed, the body of literature relevant to SDCs has been confined to US-based studies (Aboody and Lev 1998; Ciftci 2010; Dinh et al. 2019; Givoly and Shi, 2008; Krishnan and Wang 2014; Mohd 2005).

This is motivated by the different accounting treatments, under US Generally Accepted Accounting Principles (GAAP), for R&D and SDCs. Statement of Financial Accounting Standard (SFAS) No. 2 requires immediate expensing of R&D costs. Significantly, in contrast to this, capitalisation (and subsequent amortisation) of development costs of software intended for sale is mandated by SFAS No. 86 (effective from 31 December 1985), once technological feasibility has been established for a computer software product. Further to this, SOP 98-1 (effective from 15 December 1998) similarly requires capitalisation of SDCs related to software for internal use during the application development stage (Para 21), where it is 'probable that the project will be completed and the software will be used to perform the function intended' (Para 27b). All other costs are expensed. The different accounting treatments of SDCs and R&D have been attributed to the strength of lobbying from the software industry to recognise assets rather than expensing all costs (Kaplan and Sandino, 2001). As noted earlier, under IAS 38 the accounting for SDCs is the same whether the software is developed for internal use or for sale.

Within the extant literature, the focus of the majority of the US-based studies, in the post SFAS 86 era, has been to examine the value relevance of SDC capitalisation. Aboody and Lev (1998: 162–3) find that 'annually capitalized development costs are positively associated with stock returns and the cumulative software asset reported on the balance sheet is associated with stock prices'. Further, they find no support for the view that the judgement involved in software capitalisation decreases the quality of reported earnings. Mohd (2005) finds that within the software industry information asymmetry is significantly lower for capitalisers than for those that expense SDCs and capitalisers have a resultant lower cost of capital. Indeed, he argues that expensing leads to ambiguity about the value of R&D and hence greater information asymmetry for investors. Consistent with this reasoning, Givoly and Shi (2008) similarly report that capitalising SDCs reduces information asymmetry and the under-pricing of IPOs and consequently lowers cost of capital. These findings are in stark contrast to Ciftci, who reports that 'capitalization of software costs does not improve earnings quality' and that the findings 'suggest that investors' perception of earnings quality is higher for firms that make a conservative reporting choice' (Ciftci 2010: 429). He concludes that the earnings quality of the firms that expense all R&D is greater than that of those that capitalise, recognising the possibility of earnings management.

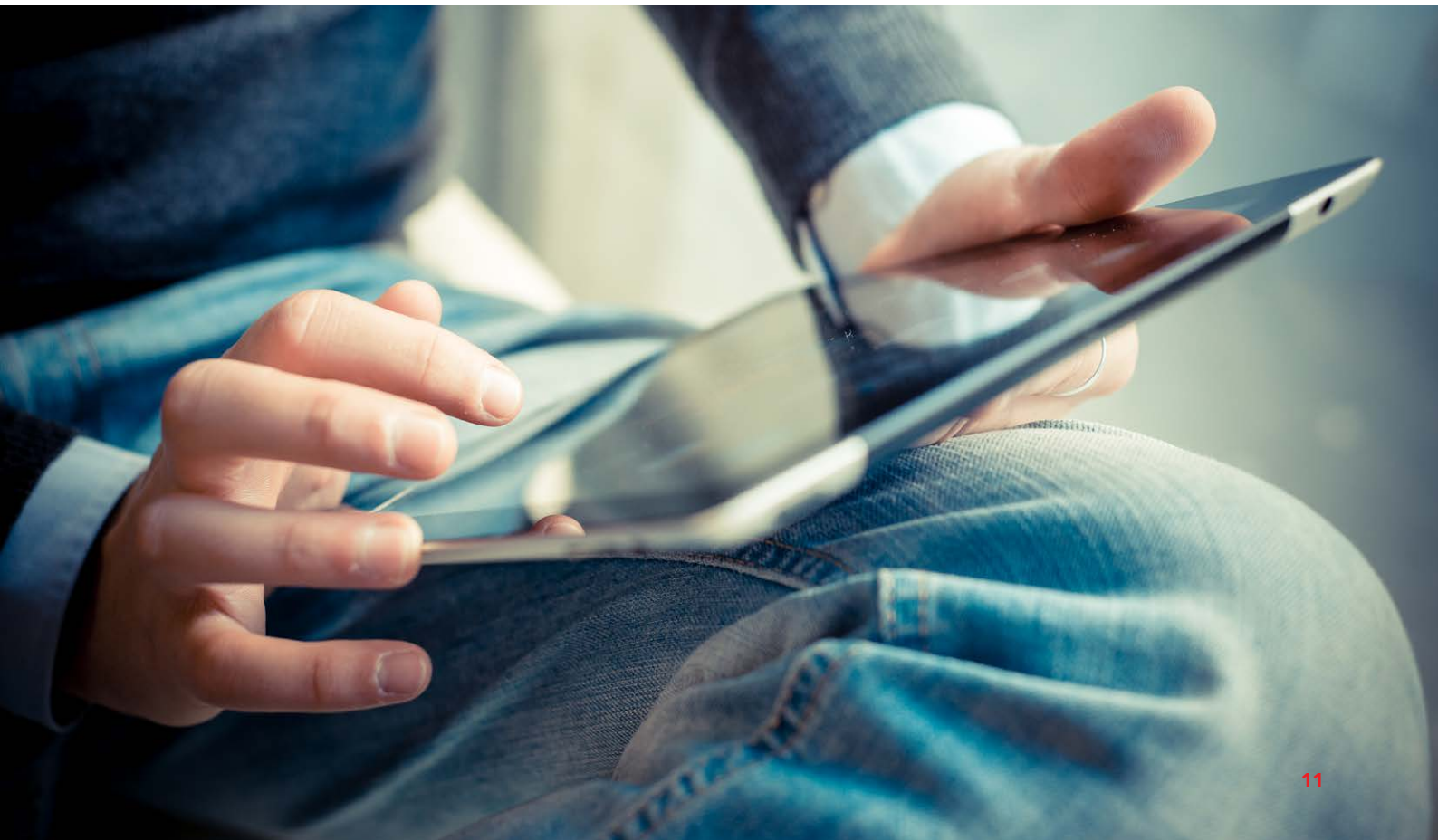
In another study, revealing more positive evidence of SDC capitalisation, Krishnan and Wang (2014) find that SDC capitalisation sends a positive signal of a reduction of business risk to auditors, with a consequent decrease in audit fee. Nonetheless, this is where such capitalisation is inconsequential for beating analysts' forecasts and also for firms with a low level of following by analysts. Finally, Dinh et al. (2019) contrasting the accounting for SDCs versus R&D in other industries found that capitalisation mitigated the likelihood of under-investment and similarly mitigated the likelihood of a cut in discretionary spend.

Overall, these studies highlight the generally positive evidence of the value relevance and signalling of SDC capitalisation. While there is some contrary evidence, and the possibility that capitalisation will be used as an earnings management tool, nonetheless the literature generally supports the asset recognition of appropriate SDCs.

In a non-US context, to our knowledge the only study of accounting for SDCs in other jurisdictions is that of Walker and Oliver (2005). Their research examined the differences and inconsistencies in capitalisation and asset recognition between US, UK, Australian and IAS accounting treatments of development costs of software intended for internal use, before the adoption of IAS 38. IAS 38 and the US accounting treatment have already been covered in this review: both mandate capitalisation on meeting specified, although different, conditions. In contrast, the UK accounting standard SSAP 13 Accounting for Research and Development (1989) allowed, but did not require, this treatment on meeting conditions for asset recognition. Similarly, Australian Accounting Standard AAS 13 Accounting for Research and Development Costs (1983), and the identically titled AASB 1011 (1987) permitted capitalisation of expenditure on the development of a 'new product', to the extent that such costs 'are expected beyond reasonable doubt to be recoverable', given future (uncertain) projections. To remove these inconsistencies in accounting treatments, Walker and Oliver (2005: 67) argue for 'clarity in accounting rules governing the treatment of software expenditure'.

Further to this divergence of treatments, they argue more widely that the application of capitalisation through the relevant accounting standards is reliant on a series of subjective judgements, such as those about technological feasibility, commercial viability and economic life. This in turn may be susceptible to earnings management owing to pressures on earnings performance or internal bonus incentive structures. In conclusion, Walker and Oliver (2005: 88) advocate '(a) the immediate expensing of internally developed software; (b) reporting of this expense as a line item where software expenditure is material; and (c) disclosing, in notes to the financial statements, information about major software development projects'. Such a conclusion is counter to IAS 38, the focus of this research, and widely adopted after 2005 outside the US, where capitalisation of SDCs remains mandated where the specified conditions are met.

As a summary, no research exists on the capitalisation of SDCs under IFRS or outside the US. Therefore, this is the first study to examine the frequency and magnitude of SDC capitalisation of IFRS reporting firms, the factors associated with such practices and the amounts involved.



3. Research approach

3.1 Sample selection

Given that we are interested in exploring companies' relatively recent practices in relation to the objectives of the study and that we wanted to involve as many countries as possible that have adopted IFRS or converged their accounting standards to IFRS or permit listed companies to report under IFRS, the sample selection started by identifying all countries that met these conditions as of 2015, and we then included all periods between 2015 and 2019 in our analysis. To identify these countries, we relied on the relevant guide published by the IFRS Foundation on the use of IFRS by jurisdiction.[2] For each of those countries, we obtained the research lists constructed by Worldscope containing all active and dead firms for the years 2015 to 2019. From these lists, we eliminated instruments not classified as equity.[3] As far as cross-listed firms were concerned, we retained only those firms based on the country of primary listing. Subsequently, we eliminated 33,402 firm-year observations of firms not reporting under IFRS (or local GAAP, for those countries that had converged their accounting standards with IFRS).[4] To avoid the influence of potential transition effects on our findings (Mazzi et al. 2019b), we eliminated any observations of firms that appeared to have adopted IFRS for the first time in a given year (mostly 2015 (31%) and 2016 (28%): 4,141 firm-year observations). Further, we eliminated 949 firm-year observations because the reporting period of the firms concerned was more than 380 or less than 350 days (García Lara, García Osma and Mora 2005; Dargenidou et al. 2021). Then, we eliminated 6,960 firm-year observations because either the firms' industry classification information was missing or they were in the Energy industry.[5]

Subsequently, given the objectives of the study (ie to focus on firms that have recognised SDCs on the balance sheet in a given year), we considered the following aspects. According to IAS 38, and assuming that the firm considers the relevant amounts to be sufficiently material, such expenditure that is capitalised should be shown as a separate category of intangible assets. Further, SDCs could be part of what a company could define as R&D and thus the SDC-related amount expensed in the income statement might be 'badged' as R&D expenses. Hence, in a given year, we required our sample firms to have either an SDC asset recognised on the balance sheet and/or an R&D expense in the income statement. Because of this requirement, we eliminated 67,378 firm-year observations that did not report R&D expense or recognise an SDC asset in a given year. Additionally, we eliminated 12,872 firm-year observations with missing firm-specific data and/or negative book value of equity, and 2,739 for which we could not identify whether the company had concluded business combinations in a given year. Finally, we deleted 1,041 firm-year observations because of missing country-specific data. The final sample consists of 40,241 firm-year observations, corresponding to 12,239 firms across 39 countries. The sample selection process is summarised in Table 3.1.

Before discussing the sample distribution by country and year, we note the following. Appendix A presents tabulated information and discussion about the firm-year observations with no R&D expense or SDC asset recognised in a given year that we have excluded, after we have eliminated firm-year observations with missing firm or country-specific data (ie 37,438 firm-year observations). This information indicates that among all the firm-year observations with available data (ie 77,679 – calculated as the sum of total excluded (ie 37,438 firm-year observations) and total included (ie 40,241 firm-year observations) in the analysis) and thus we could have analysed, approximately 52% report an R&D expense in the income statement and/or recognise an SDC asset in a given year and hence are included in the study. This 52%

2 See <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>, accessed 16 April 2021

3 We require the Datastream item TYPE to be equal EQ, indicating an equity instrument.

4 As in Schleicher et al. (2010) and Daske et al. (2013) and Mazzi et al. (2019a), we rely on the Worldscope item 'accounting standards followed (WC07536) to identify the accounting standards that a company reports.

5 As explained by Mazzi et al. (2019a), exploration and evaluation expenses could be recorded as research and development expenses in the database for companies in this industry. It is noted that in previous ICB Industry namings (and hence earlier literature which used those) this industry was titled 'Oil and Gas'.

TABLE 3.1: Sample selection

	FIRM-YEAR OBSERVATIONS
We focus on the countries that, as of 2015, had adopted IFRS or had converged their accounting standards to IFRS, or permitted listed companies to report under IFRS. Our sample begins in 2015 and ends in 2019.	169,723
Excluding companies that do not report under IFRS (or local standards that have converged with IFRS)	(33,402)
Excluding firm-year observations that relate to a firm that adopted IFRS for the first time in a given year	(4,141)
Excluding firm-year observations of firms that changed their reporting period	(949)
Excluding firms in the energy sector or that have missing industry classification information	(6,960)
Excluding firm-year observations of firms with no R&D expense or SDC asset recognised in a given year	(67,378)
Excluding firm-year observations of firms with negative book value of equity and/or missing firm-specific data	(12,872)
Excluding firm-year observations of firms with missing information on whether they had concluded business combinations	(2,739)
Excluding firm-year observations of firms with missing country-specific data	(1,041)
FINAL SAMPLE [t=2015, 2019][12,239 firms]	**40,241**

or 'retention rate' indicates that, overall, we include in our sample a large number of firms from a large number of IFRS reporting countries. Even so, we note that for 11 (5) countries the retention rate is below 30% (20%). On the other hand, for China and Japan (Korea and Taiwan) the retention rate is above 90% (80%). This suggests that, compared with other countries, a significant majority of firms in these countries report an R&D expense in the income statement and/or recognise an SDC asset in the year. Further, from descriptive statistics for key firm-level variables, we observe that, on average, firms excluded from the analysis (ie firms that do not report R&D expense in the income statement and did not recognise an SDC asset on the balance sheet) are smaller in size and more leveraged, have significantly lower levels of international sales, and invest more in capital expenditure; a lower percentage of them are audited by a Big Four auditor.

Tables 3.2 and 3.3 show the sample distribution by country and year, and industry and year, respectively. The latter classification is based on the 10 industries specified by the Industry Classification Benchmark. These tables indicate that our sample is heavily populated by Asian firms (63.89%) and in particular firms from China (11,058 firm-year observations), Taiwan (6,481 firm-year observations), Korea (4,986 firm-year observations) and India (3,184 firm-year observations). The high 'retention rate' for China, Korea and Taiwan (see earlier discussion) and the fact that there are a very large number of firms listed in China, Korea and Taiwan, explains why our sample heavily represents firms in the Asian region. The next country with a large representation in the sample which is not in Asia is the UK, with 2,094 firm-year observations.[6] The remaining countries all have fewer than 2,000 firm-year observations and the weight of some countries is much smaller, reflecting the comparable sizes of equity markets.

As regards industry representation, the sample consists primarily of firms in the in the Industrials (9,056 firm-year observations), Consumer Discretionary (7,449 firm-year observations), Technology (6,401 firm-year observations), Basic Materials (5,101 firm-year observations) and Health Care (3,808 firm-year observations). The remaining industries are also well represented in our sample. The exceptions are Real Estate and Utilities, which have the lowest number of firm-year observations in our sample (915 and 991 firm-year observations, respectively).

6 49% retention rate as per Appendix A (Table A1).

We note that, in Appendix A (Table A2), our sample includes the majority of potential firms (ie high retention rate) in the Health Care (76%), Technology (74%) and Telecommunications (69%) industries from the countries we analyse. Hence, it is not surprising these are the most represented in our overall sample.

The firm-year observations across years range from the lowest of 6,528 in 2015 to the highest of 9,021 in 2018. The lower numbers for 2015 and 2016 can be explained by the fact that we have excluded many firms for which this was the first year of IFRS adoption (see earlier discussion and in Table 3.1).

TABLE 3.2: Sample distribution by country and year

COUNTRY	REGION	2015	2016	2017	2018	2019	TOTAL
Argentina	America	15	15	18	20	16	**84**
Australia	Oceania	216	253	264	285	308	**1,326**
Austria	Europe	24	25	22	21	21	**113**
Belgium	Europe	39	44	40	40	41	**204**
Brazil	America	93	93	90	98	107	**481**
Canada	America	223	201	201	190	215	**1,030**
Chile	America	46	57	60	71	73	**307**
China	Asia	1,868	2,117	2,392	2,601	2,080	**11,058**
Colombia	America	0	5	4	5	4	**18**
Denmark	Europe	25	31	39	38	35	**168**
Finland	Europe	47	51	48	59	52	**257**
France	Europe	167	182	184	203	166	**902**
Germany	Europe	171	182	193	209	205	**960**
Greece	Europe	51	57	57	56	26	**247**
Hong Kong	Asia	247	260	311	367	306	**1,491**
India	Asia	398	569	631	697	889	**3,184**
Indonesia	Asia	64	68	80	93	78	**383**
Ireland	Europe	17	19	11	16	16	**79**
Israel	Asia	96	100	96	103	100	**495**
Italy	Europe	47	60	58	70	65	**300**
Japan	Asia	23	55	79	117	140	**414**
Jordan	Asia	20	22	14	11	7	**74**
Korea	Asia	561	1,046	1,073	1,156	1,150	**4,986**
Malaysia	Asia	72	69	66	69	49	**325**
Mexico	America	21	27	18	20	3	**89**
Netherlands	Europe	39	49	51	49	48	**236**
New Zealand	Oceania	41	46	50	49	42	**228**
Norway	Europe	36	41	40	46	41	**204**
Peru	America	17	12	16	14	1	**60**
Philippines	Asia	2	2	2	3	3	**12**

COUNTRY	REGION	2015	2016	2017	2018	2019	TOTAL
Portugal	Europe	10	11	16	15	8	**60**
Singapore	Asia	11	11	10	10	51	**93**
South Africa	Africa	78	84	88	89	91	**430**
Spain	Europe	45	59	56	60	61	**281**
Sweden	Europe	90	100	105	127	125	**547**
Switzerland	Europe	1	2	3	4	2	**12**
Taiwan	Asia	1,132	1,262	1,317	1,371	1,399	**6,481**
Turkey	Europe	93	99	107	105	124	**528**
United Kingdom	Europe	382	419	435	464	394	**2,094**
TOTAL		**6,528**	**7,805**	**8,345**	**9,021**	**8,542**	**40,241**

TABLE 3.3: Sample distribution by industry and year

INDUSTRY	2015	2016	2,017	2,018	2,019	TOTAL
Basic Materials	881	988	1,026	1,111	1,095	**5,101**
Consumer Discretionary	1,202	1,456	1,568	1,687	1,536	**7,449**
Consumer Staples	440	525	576	605	564	**2,710**
Financials	284	403	449	478	486	**2,100**
Health Care	632	731	769	842	834	**3,808**
Industrials	1,459	1,750	1,898	2,048	1,901	**9,056**
Real Estate	146	186	194	197	192	**915**
Technology	1,046	1,245	1,301	1,438	1,371	**6,401**
Telecommunications	271	327	364	393	355	**1,710**
Utilities	167	194	200	222	208	**991**
TOTAL	**6,528**	**7,805**	**8,345**	**9,021**	**8,542**	**40,241**

Industry classification is based on the 10 industries specified by the Industry Classification Benchmark (FTSE Russell 2020).

3.2 Econometric analysis

3.2.1 Determinants of the decision to capitalise SDCs, and amounts of SDC capitalised

One of the primary aims of this project is to identify the factors that affect a firm's decision to capitalise SDCs and the magnitude of SDCs capitalised in a given year. For the former, we used multivariate Probit analysis with the dependent variable being an indicator variable (*SDCAPD*). This is equal to one (1) when a company capitalises SDCs during the year and zero (0) otherwise. For the latter, we used multivariate Tobit models (left censored) with the dependent variable being the amount of SDCs capitalised during the year, scaled by the market value of the firm (*SDAsset*). Given the absence of previous research in this area under IFRS, we followed existing literature that examines the capitalisation of R&D-related assets in choosing firm-level factors that may affect the decision or magnitude of SDCs' capitalisation (see Dargenidou et al. 2021 and Mazzi et al. 2019b).

Following that literature, the factors that we considered for capturing a firm's life cycle and risk were: book to market (*BM*), size (*SIZE*), beta (*BETA*), leverage (*LEV*) and age (*AGE*). We also included a binary variable that is equal

to one (1) if the financial statements are audited by a Big Four firm (*Big4*) and zero (0) otherwise. We also included the level of investment in tangible fixed assets (*CAPEX*). Additionally, we controlled for a firm's international exposure by including the percentage of international sales (*INTSALES*). Moreover, we included the magnitude of total R&D expenditure relative to total assets (*RDInt*) and the market value of the firm generated in relation to R&D (*RDValue*). We also included variables that capture a firm's incentives for manipulating earnings to meet or beat the previous year's earnings (*PAST_BEAT*) or a zero-earnings threshold benchmark (*ZERO_BEAT*). We also included an indicator variable that is equal to one (1) if a company capitalises other development costs during the year (*CAP*) and zero (0) otherwise, and an indicator variable that is equal to one (1) if the company concluded material combinations (individually or collectively) during the year (*BC*)[7] and zero (0) otherwise.

We also controlled for institutional influences in the country of domicile with the following variables: anti-self-dealing index (*ANTISELF*), control of corruption (*CORR*) and an indicator variable that is equal to one (1) if a country is classified as having a civil law system and zero (0) if it has a common law system (*CIV_COM*). Additionally, we considered the following potential factors that may affect the overall levels and productivity of R&D in the economy: health infrastructure (*Healthinfrastructure*), skilled labour (*Skilledlabour*), scientific research legislation (*Scientificresearchlegislation*) and GDP growth (*GDPGrowth*). Finally, all our multivariate tests included industry and year fixed effects, and standard errors are clustered at the firm level. Detailed variable definitions are presented in Appendix B[8] and a generic representation of the models we applied is expressed in Equation 3.1.

3.2.2 Expected vs unexpected treatment of SDCs

Subsequently, in the spirit of the analysis in Mazzi et al. (2019b) and Kreß et al. (2019), we investigated whether firms follow the expected accounting treatment of capitalising or not SDCs. This analysis involved two stages.

In the first stage, we identified as 'mandatory non-capitalisers' firms that do not have SDC capitalised and we would anticipate that they would not have capitalised such costs in the following circumstances.

a. The firm does not capitalise SDCs or other development costs and all other firms in the same industry and in the same year do the same. This provides a signal that firms in this industry-year cluster would not capitalise SDCs.

b. The firm's *RDValue* is negative; this is a signal that R&D and SDC expenditure are perceived by the market (and the companies themselves) as having no future economic benefit and thus should not be capitalised.[9]

c. The *RDValue* of a non-capitaliser is lower than the minimum *RDValue* of a capitaliser[10] in the same industry-year. This criterion ensures that the remaining non-capitalisers are at least as successful in R&D and SDC expenditure as the least successful capitaliser.

In the second stage, we examined whether the remaining firms (ie capitalisers and non-capitalisers, excluding 'mandatory non-capitalisers') could be classified in the alternative category. To address this, we relied on Equation (3.1), used earlier to examine the determinants of each firm's decision about capitalising SDCs. Subsequently, we measured the probability that a firm would be a capitaliser, given the control variables in place, by obtaining the fitted values from this regression. If the predicted probability is higher than 50% then the firm is considered to be following the expected method.

EQUATION 3.1

$$SDCAPD \text{ or } SDAsset = f(BM, SIZE, BETA, LEV, BIG4, CAPEX, INTSALES, RDValue, RDInt, PAST\_BEAT, ZERO\_BEAT, CAP, BC, AGE, ANTISELF, CIV\_COM, CORR, Healthinfrastructure, Skilledlabour, Scientificresearchlegislation, GDPGrowth)$$

7 The consideration accounts for 5% of the previous year's book value of equity.

8 All continuous variables in all descriptive statistics presented and in the regressions are winzorised in the ±1 percentile.

9 It is noted that *RDvalue* is measured as the difference between the market value of equity and book value of equity less the amount of R&D and SDC capitalised during the year, divided by the sum of current and lagged annual R&D expenditure.

10 As also explained in the next section, for firm-year observations that capitalise SDCs during the year, the firms are classified as 'capitalisers' and the remaining firms are classified as 'non-capitalisers'.

4. Findings and discussion

4.1 Capitalisers of software development costs

Our sample comprises 40,241 firm-year observations across 39 countries (see section 3.1). For firm-year observations that capitalise SDCs during the year, the firms are classified as 'capitalisers' and the remaining firms are classified as 'non-capitalisers'. In total, we have 14,422 non-capitalisers (36%) and 25,819 (64%) capitalisers. Within the capitalisers, 10,818 recognise only an SDC asset on the balance sheet and no R&D expense in the income statement in a given year. This information is shown in Table 4.1.

The significantly large number of SDC capitalisers is striking when compared with previous literature examining the capitalisation of R&D under IFRS among large international samples. More specifically, from their international sample with almost 21,000 firm-year observations, Mazzi et al. (2019b) identify approximately 38% of their sample as capitalising R&D costs. Similarly, Kreß et al. (2019) identify about 33% of their international sample of firm-year observations as being capitalisers of R&D costs. This initial finding indicates that companies do capitalise SDCs relatively frequently. In fact, they are more likely to report an SDC asset and less likely to report other types of development assets on the balance sheet. Consistent with this, we have identified only 7,449 of the 40,241 firm-year observations as recognising an R&D asset in the year.

The data reveals the frequency with which companies capitalise such costs across the five-year sample period. Specifically, Table 4.2 shows that 20.96% of the capitalisers capitalise SDCs every year, while 17.70% of the capitalisers capitalise such costs in four of the five-year sample periods. The observations in our sample of firms that capitalise SDCs in only one year is only a very small proportion of the total sample (4.89%).

TABLE 4.2: Firm-year observations of firms capitalising SDCs by year

CAPITALISERS	25,819 (64.1%*)
Capitalisers in **one year** of the sample period only	1,966 (4.89%*)
Capitalisers in **two years** of the sample period only	3,338 (8.30%*)
Capitalisers in **three years** of the sample period only	4,956 (12.32%*)
Capitalisers in **four years** of the sample period	7,124 (17.70%*)
Capitalisers in **all five years** of the sample period	8,435 (20.96%*)

*of the full sample of 40,241 (100.00%) firm-year observations

TABLE 4.1: Sample composition of capitalisers and non-capitalisers

FINAL SAMPLE [T=2015, 2019][12,239 FIRMS]	40,241 (100.00%)
1. Reporting expensed R&D in the income statement and no SDC capitalised in the balance sheet in a given year (non-capitalisers)	14,422 (35.84%)
2. Reporting SDC capitalised in the year (capitalisers)	25,819 (64.16%)
2.1 Capitalising SDC in the balance sheet and recognising no R&D expense in the income statement in a given year	10,818 (26.88%)
2.2 Reporting both SDC capitalised in the balance sheet and R&D expense in the income statement in the year	15,001 (37.28%)
3. Capitalising R&D in the year	7,449 (18.51% of full sample)
3.1 Capitalising SDC and R&D in the balance sheet in the year	4,963 (12.33% of full sample)

Figure 4.1 plots the percentage of firm-year observations capitalising SDCs by country. We note that in Argentina, Brazil, Chile, Colombia, India, Ireland, Japan, Mexico, New Zealand, Peru, Philippines, Portugal, South Africa and Spain more than 80% of the firm-year observations are capitalisers. In fact, all firms from Colombia and Philippines are capitalisers. This indicates a significantly large proportion of SDC capitalisers for IFRS reporters in these countries in a given year. At the other end of the spectrum, in Austria, Finland, Jordan, Switzerland and Turkey, fewer than 40% of the firm-year observations in our sample capitalise SDCs. Switzerland has the lowest percentage of capitalisers (17%). Canada, Germany, Hong Kong, Jordan, Korea, Sweden, Taiwan and China exhibit intermediate proportions of capitalisers but they generally have higher proportions of non-capitalisers (ranging between 40% and 50%). On reviewing the 'retention rates' shown in Appendix A (Table A1), we note that the sample 'retention rate' for China and (Korea and Taiwan) is above 90% (80%). This and the data shown in Figure 4.1 allow us to say with confidence that about half of the listed companies in China recognise an SDC asset across the sample period, while this percentage is much lower for Korea and Taiwan.

Figure 4.2 plots the percentage of firm-year observations capitalising SDCs by industry. We note that all industries exhibit more capitalisers than non-capitalisers. The constituents of Consumer Discretionary, Financials, Real Estate and Utilities exhibit the largest proportion of capitalisers (the proportion of capitalisers in these is greater than 70%). Firms in the Technology, Health Care and Basic Materials industries have the lowest proportion of capitalisers (56%, 52% and 51%, respectively). Nevertheless, these percentages can be considered relatively high if one considers the data in Appendix A (Table A2), where we show that our sample includes the majority of potential firms in the Health Care (76%) and Technology (74%) industries.

In order to delve further into the proportion of capitalisers across industries, we have also relied on the Industry Classification Benchmark (ICB) Sectors (ie more refined sub-categories of industries) in which the companies operate. Figure 4.3 shows that in those Sectors the proportion of capitalisers exceeds 70%. Notably, all firms in Banks, Insurance (Life & Non-life) and Real Estate Investment Trusts (REITS) capitalise SDCs. The Sectors with the next highest proportions of capitalisers are Finance & Credit Services (98%), Travel & Leisure (93%), Real Estate, Investment & Services (93%) and Investment Banking & Broker (91%). In untabulated descriptive statistics, we see that Sectors with the lowest proportion of capitalisers include: Medical Equipment Services (47%), Pharmaceutical & Biotech (50%) and Leisure Goods (50%). The remaining Sectors have a higher proportion of non-capitalisers relative to capitalisers. Overall, these results confirm the earlier findings shown in Figure 4.2 that firms in Financials exhibit the highest proportion of capitalisers.

As part of IFRS 3 requirements, when companies complete a business combination they should recognise other intangible assets acquired (including SDCs) separately from goodwill. To explore the influence of business combinations on companies' SDC intensity levels and frequency of annual capitalisation, we explore the 4,076 firm-year observations that conclude material business combinations during the year and present relevant information in Table 4.3.

Of these firm-year observations, a large proportion (3,115 firm-year observations – 76.4%) capitalise SDCs during the year (this represents 12.06% of the firms that capitalise SDCs during the year in the entire sample). Of these, 1,347 fully capitalise SDCs and do not expense any R&D (this represents 12.45% of such companies in the entire sample). Additionally, we note that 1,028 firm-year observations exhibit material business combinations and capitalise R&D in the year (this represents 13.80% of the firm-year observations that capitalise R&D in the year in the entire sample). Of these, 741 firm-year observations capitalise both R&D and SDCs (this represents 14.93% of the firms in the entire sample that recognise both types of intangibles during the year). Overall, these results indicate that the majority of companies that conclude material business combinations do recognise software and other development assets.

FIGURE 4.1: Proportion of capitalisers and non-capitalisers across countries

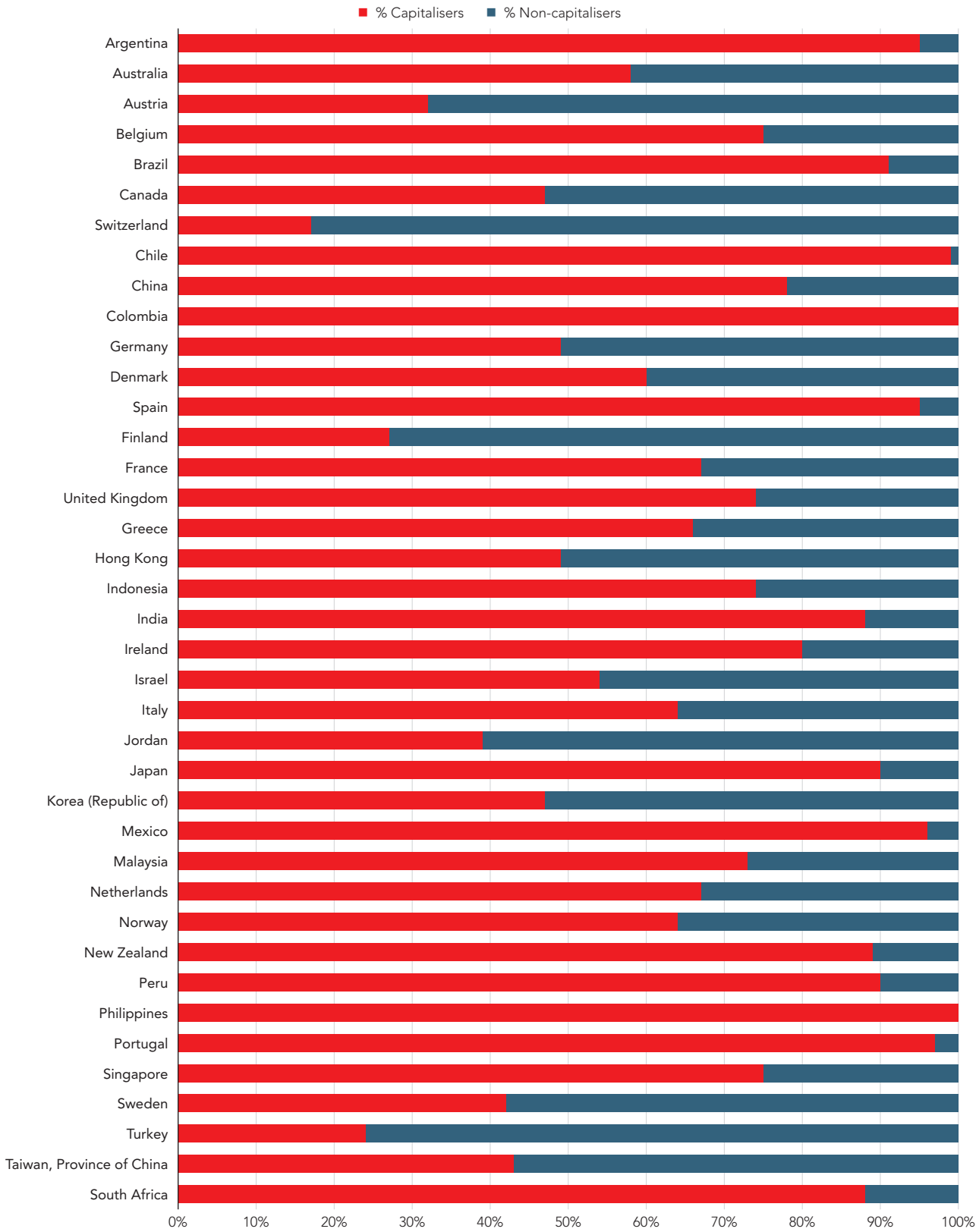


FIGURE 4.2: Proportion of capitalisers and non-capitalisers across industries

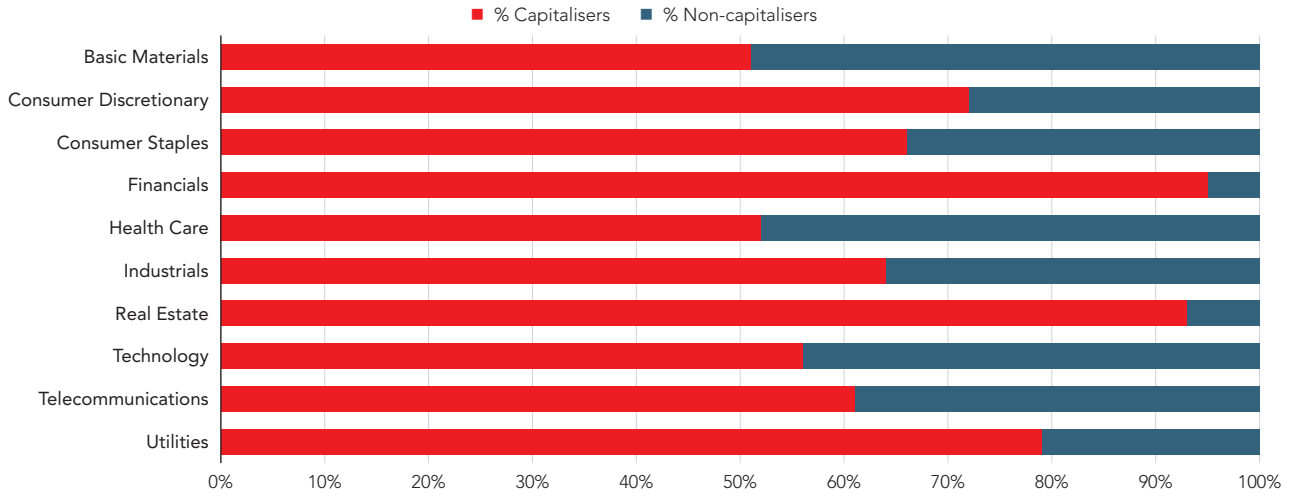


FIGURE 4.3: Proportion of capitalisers and non-capitalisers for Sectors with a high proportion of capitalisers

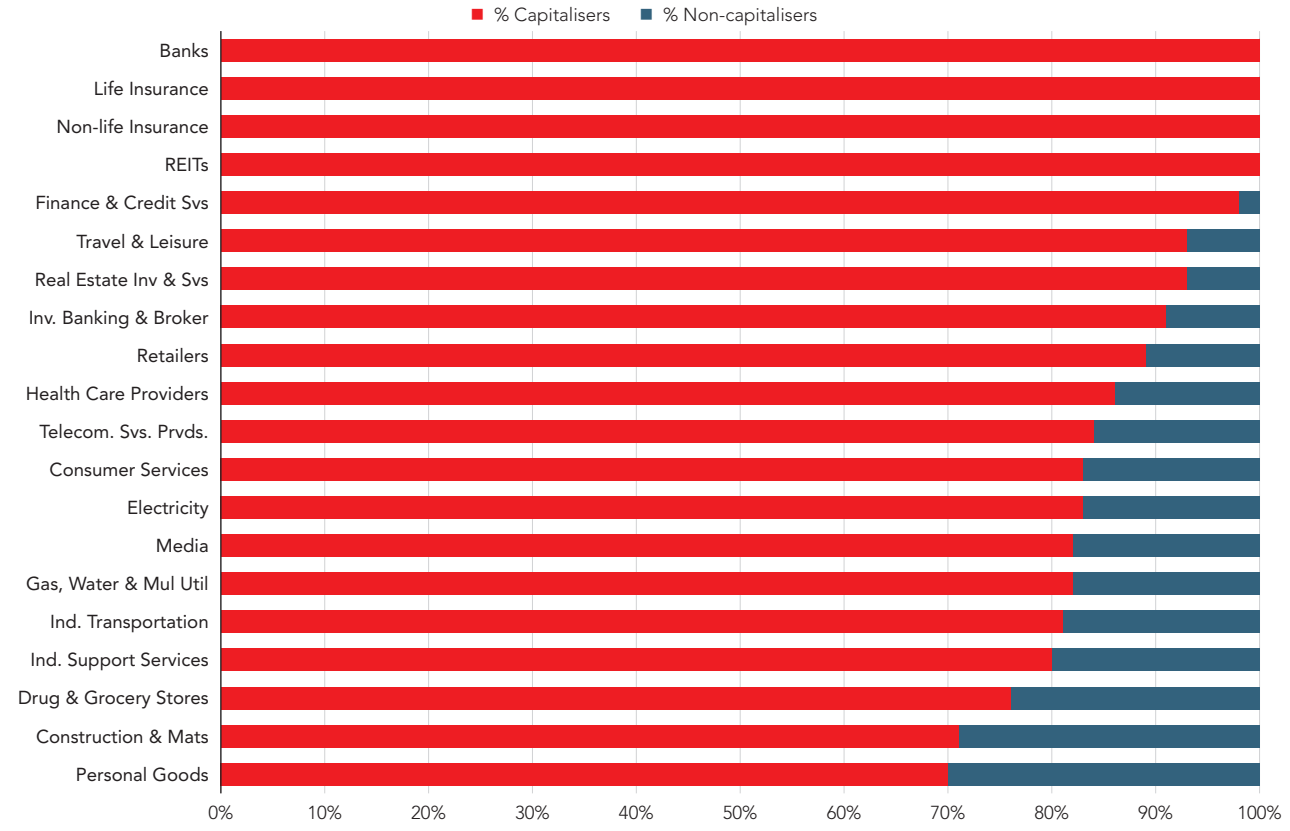


TABLE 4.3: Firm-year observations of firms with material business combinations

REPORTING MATERIAL BUSINESS COMBINATIONS (The consideration accounts for 5% of the previous year's book value of equity)	4,076 (100.00%)
1. Reporting expensed R&D in the income statement and no SDC capitalised in the balance sheet in a given year (non-capitalisers)	961 (6.66% of full sample non-capitalisers)
2. Reporting SDC capitalised in the year (capitalisers)	3,115 (12.06% of full sample capitalisers)
2.1 Capitalising SDC in the balance sheet and recognising no R&D expense in the income statement in a given year	1,347 (12.45% of such companies in the full sample)
3. Capitalising R&D in the year	1,028 (13.80% of those capitalising R&D in the year)
3.1 Capitalising R&D and SDC in the year	741 (14.93% of those capitalising SDC and R&D in the year)

4.2 SDC capitalisation intensity

To give more insights into the importance of SDCs on companies' financial statements, this section reflects on the net SDCs on the balance sheet, scaled by total assets. First, we note that the mean (median) SDC asset intensity on the balance sheet is 0.6% (0.2%) of capitalisers' total assets (see *sdnetasset* in Table 4.4). Further, the mean (median) SDC asset capitalised in the year is 0.04% (0.10%) of capitalisers' market values (see *SDAsset* in Table 4.4). Delving further in the data, from untabulated information, we see that for the 6,222 firm-year observations in the top quartile of SDC asset intensity, the mean (median) SDC intensity is 2.1% (1.3%) of total assets while the mean (median) SDC asset capitalised in the year is 1% (0.5%) of market values. Interestingly, 71% of the firms from Oceania that report a net SDC asset on the balance sheet are in this top quartile. Firm-year observations from Europe and Africa follow, with 58% and 56%, respectively. Only 13% of the firm-year observations from Asia that show a net SDC asset on the balance sheet are in the top quartile. This information suggests that the large proportion of firms from Asia distorts the picture of the amounts recognised across the overall sample. In fact, for non-Asian firms, the amounts of SDCs recognised on the balance sheet are far from negligible.

Among the subset of firm-year observations that conclude a material business combination (see also in Table 4.3), from untabulated information, we note the following. For the firms that capitalise SDCs during the year, the mean (median) SDC intensity is 1.1% (0.3%) of total assets, while the mean (median) SDC capitalised in the year is 0.5% (0.1%) of market values. Further, for the firms that fully capitalise SDCs and do not expense any R&D, the mean (median) SDC intensity is 1.4% (0.6%) of total assets, while the mean (median) SDC capitalised in the year is 0.8% (0.3%) of market values. For the firms that capitalise R&D in the year, the mean (median) SDC intensity is 0.8% (0.1%) of total assets, while the mean (median) SDC capitalised in the year is 0.4% (0.1%) of market values. Finally, for the firms that capitalise both R&D and SDCs, the mean (median) SDC intensity is 1.2% (0.4%) of total assets, while the mean (median) SDC capitalised in the year is 0.5% (0.1%) of market values. This suggests not only that companies that conclude material business combinations recognise software and other development assets but also that the amounts involved are not negligible and, in fact, these amounts appear to be higher than those from all capitalisers in the sample (see Table 4.4).

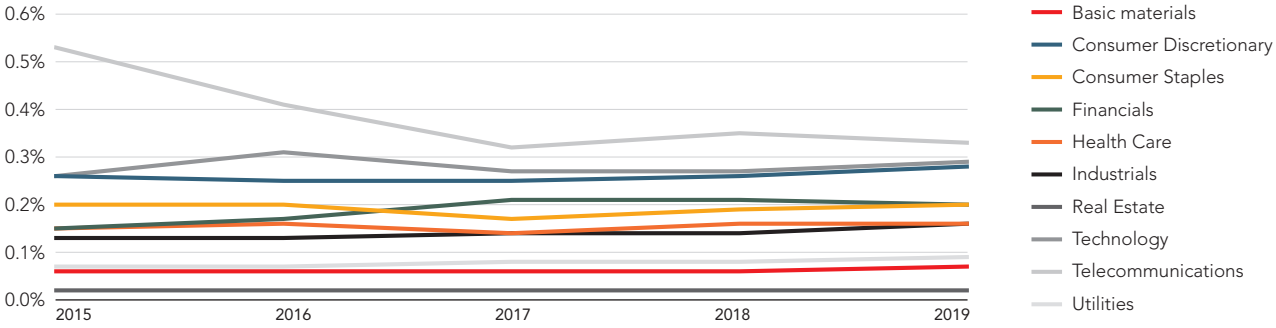
Figure 4.4 shows the yearly median value of net SDC intensity across each industry in our sample. Perhaps not surprisingly, given the nature of their operations, firms in Telecommunications exhibit the highest net SDC intensity (mean (median) 1.26% (0.37%) of total assets), followed by Technology and Consumer Discretionary (mean (median) is 1.06% (0.28%) and 0.80% (0.26%) respectively of total assets). Nonetheless, we note that the median value for firms in the Telecommunications industry has been decreasing over the last five years. Real Estate firms have the lowest median values of net SDC intensity (mean (median) 0.22% (0.02%) of total assets), although Real Estate firms include a relatively large proportion of capitalisers (see Figure 4.2). The remaining industries exhibit intermediate levels of net SDC intensity. Although firms in the Financials Sector have the highest proportion of capitalisers (see Figure 4.2), net SDCs intensity is intermediate when compared with other industries.

Figure 4.5 plots the yearly median values of net SDC intensity for each of the geographic areas/regions to which the countries included in our sample belong.[11] Firms from Oceania (ie firms from New Zealand and Australia) exhibit the highest intensity (mean (median) 2.22% (1.32%) of total assets). European and South African firms tend to present the second- and third-highest values of SDC assets in proportion to total assets (mean (median) for Europe: 1.51% (0.73%); mean (median) for Africa: 1.28% (0.66%) of total assets). Firms from Asia, exhibit the lowest net SDC intensity (mean (median) 0.32% (0.11%) of total assets). This, and the fact that firms from this region represent the largest proportion of our sample (63.89%, see Table 3.2), explains the relatively low SDC intensity levels across the full sample and brings to light an interesting feature of the firms in Asia. Although many of them report separately an SDC asset capitalised or an R&D expense, the amounts capitalised on the balance sheet are far smaller than corresponding amounts in other regions.

At a broader level, the information in these graphs demonstrates that, on average, companies appear to have a relatively stable investment in software as reflected on their balance sheets, with no increasing trend relative to total assets over the last five years.

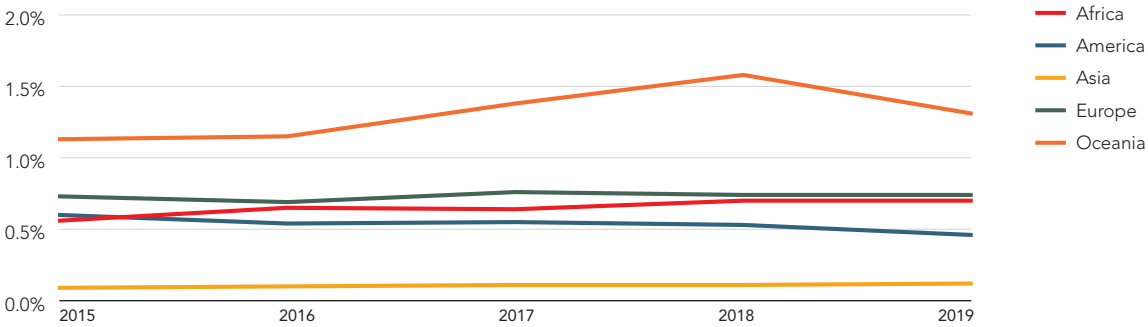
Further, to demonstrate the variation in the way companies describe the reasons behind their investment in SDCs, along with the relevant disclosures provided within their financial statements, we drew on the annual reports of 100 random firms from our sample that have high SDC asset intensity and come from different sectors and different countries and regions. Appendix C presents extracts from the financial statements of 15 such firms that we have selected from this analysis and that could be considered examples of good disclosure practice, including mentions of SDC capitalisation as a key audit matter in auditors' reports.

FIGURE 4.4: Net software asset intensity across industries



Yearly median net SDC asset on the balance sheet, scaled by total assets.

FIGURE 4.5: Net software asset intensity across regions



Yearly median net SDC asset on the balance sheet, scaled by total assets.

11 Drawing on Table 3.2, Africa includes firms from South Africa while America includes firms from Argentina, Brazil, Canada, Chile, Colombia, Mexico and Peru. Asia includes firms from China, Hong Kong, India, Indonesia, Israel, Japan, Jordan, Korea, Malaysia, Philippines, Singapore, and Taiwan. Finally, Europe includes firms from Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

4.3 Univariate analysis

Table 4.4 shows the descriptive statistics of the variables included in Equation 3.1, shown separately for capitalisers and non-capitalisers. We also compare the mean (median) values of each variable across the two groups through a T-test (Mann-Whitney test). Before we outline the key observations from these descriptive statistics, it is noted that these descriptive statistics are taken in isolation of one another. Hence, some findings may seem contradictory if viewed as interdependent.

The results indicate that, when compared with non-capitalisers, capitalisers tend to:

- ✓ document lower amounts of R&D expense in the income statement (mean *RDExp* = 0.014 for capitalisers vs. mean *RDEXp* = 0.037 for non-capitalisers; p<0.01)
- ✓ document lower amounts of R&D intensity (mean *RDInt* = 0.023 for capitalisers vs. mean *RDInt* = 0.043 for non-capitalisers; p<0.01)
- ✓ document lower amounts of capital expenditure (mean *CAPEX* = 0.055 for capitalisers vs. mean *CAPEX* = 0.061 for non-capitalisers; p<0.01)
- ✓ document lower incentives to capitalise software development costs for meeting earnings benchmarks (eg mean *BENCH_BEAT* = 0.190 for capitalisers vs. mean *BENCH_BEAT* = 0.224 for non-capitalisers; p<0.01)
- ✓ be marginally larger in size (mean *SIZE* = 18.576 for capitalisers vs. mean *SIZE* = 18.111 for non-capitalisers; p<0.01)
- ✓ be riskier (mean *BETA* = 1.003 for capitalisers vs. mean *BETA* = 0.924 for non-capitalisers; p<0.01)
- ✓ be more leveraged (mean *Leverage* = 0.827 for capitalisers vs. mean *Leverage* = 0.591 for non-capitalisers; p<0.01).
- ✓ have concluded almost twice as many material business combinations (mean *BC* = 0.121 for capitalisers vs. mean *BC* = 0.067 for non-capitalisers; p<0.01)
- ✓ report materially higher R&D value (mean *RDValue* = 420.781 for capitalisers vs. mean *RDValue* = 117.959 for non-capitalisers; p<0.01)
- ✓ be audited less frequently by Big Four audit firms (mean *BIG4* = 0.369 for capitalisers vs. mean *BIG4* = 0.461 for non-capitalisers; p<0.01)
- ✓ document lower amounts of R&D development asset on the balance sheet (mean *rdnetasset* = 0.001 for capitalisers vs. mean *rdnetasset* = 0.001 for non-capitalisers; p<0.01).

With respect to country-level characteristics, T-test and Mann-Whitney tests indicate that, compared with non-capitalisers, capitalisers tend to operate in countries with:

- ✓ higher levels of investor protection (mean *ANTISELF* = 0.650 for capitalisers vs. mean *ANTISELF* = 0.599 for non-capitalisers; p<0.01)
- ✓ higher levels of corruption (mean *CORR* = -65.333 for capitalisers vs. mean *CORR* = -74.226 for non-capitalisers; p<0.01)
- ✓ higher levels of GDP growth (mean *GDPGrowth* = 3.352 for capitalisers vs. mean *GDPGrowth* = 2.204 for non-capitalisers; p<0.01)
- ✓ marginally lower levels of skilled labour (mean *Skilledlabour* = 5.710 for capitalisers vs. mean *Skilledlabour* = 5.792 for non-capitalisers; p<0.01)
- ✓ marginally lower levels of scientific research legislation (mean *Scientificresearchlegislation* = 5.941 for capitalisers vs. mean *Scientificresearchlegislation* = 6.052 for non-capitalisers; p<0.01)
- ✓ lower levels of health infrastructure (mean *Healthinfrastructure* = 6.002 for capitalisers vs. mean *Healthinfrastructure* = 6.956 for non-capitalisers; p<0.01).

TABLE 4.4: Descriptive statistics across capitalisers and non-capitalisers

	CAPITALISERS (25,819 firm-year observations)					NON-CAPITALISERS (14,422 firm-year observations)					COMPARISON	
VARIABLES	Mean	St. Dev.	Min	Median	Max	Mean	St. Dev.	Min	Median	Max	T-Test	Mann-Whitney Test
rdnetasset	0.001	0.006	0.000	0.000	0.050	0.002	0.007	0.000	0.000	0.050	-0.001***	0.000***
sdnetasset	0.006	0.013	0.000	0.002	0.082	0.000	0.001	0.000	0.000	0.069	0.006***	0.002***
SDAsset	0.004	0.008	0.000	0.001	0.057	0.000	0.000	0.000	0.000	0.000	0.004***	0.001***
SDCAPD	1.000	0.000	1.000	1.000	1.000	0.000	0.000	0.000	0.000	0.000	1	1
RDExp	0.014	0.032	0.000	0.002	0.280	0.037	0.053	0.000	0.017	0.280	-0.023***	-0.015***
RDAsset	0.001	0.006	0.000	0.000	0.058	0.002	0.008	0.000	0.000	0.058	-0.001***	0.000***
CAP	0.192	0.394	0.000	0.000	1.000	0.172	0.378	0.000	0.000	1.000	0.020***	0.000***
BM	0.637	0.568	0.035	0.468	3.926	0.774	0.658	0.035	0.593	3.926	-0.137***	-0.125***
SIZE	18.576	4.186	8.699	18.072	30.873	18.111	4.901	8.699	17.584	30.873	0.465***	0.488***
BETA	1.003	0.693	-1.435	0.980	6.764	0.924	0.665	-1.435	0.906	6.764	0.079***	0.074***
LEV	0.827	1.281	0.000	0.412	8.107	0.591	0.956	0.000	0.298	8.107	0.236***	0.114***
BIG4	0.369	0.482	0.000	0.000	1.000	0.461	0.498	0.000	0.000	1.000	-0.092***	0.000***
CAPEX	0.055	0.088	0.000	0.024	0.606	0.061	0.096	0.000	0.025	0.606	-0.006***	-0.001**
INTSALES	25.667	33.194	0.000	6.200	100.000	27.933	36.121	0.000	3.315	100.000	-2.266***	2.885***
RDValue	420.781	2122.403	-5900.000	26.080	27000.000	117.959	906.082	-5900.000	7.224	27000.000	302.822***	18.856***
RDInt	0.023	0.044	0.000	0.008	0.395	0.043	0.073	0.000	0.017	0.395	-0.020***	-0.009***
PAST_BEAT	0.168	0.374	0.000	0.000	1.000	0.190	0.392	0.000	0.000	1.000	-0.022***	0.000***
ZERO_BEAT	0.037	0.189	0.000	0.000	1.000	0.057	0.232	0.000	0.000	1.000	-0.020***	0.000***
BENCH_BEAT	0.190	0.392	0.000	0.000	1.000	0.224	0.417	0.000	0.000	1.000	-0.034***	0.000***
AGE	16.300	9.327	3.000	16.000	46.000	16.316	8.722	3.000	16.000	46.000	-0.016	0
BC	0.121	0.326	0.000	0.000	1.000	0.067	0.249	0.000	0.000	1.000	0.054***	0.000***
ANTISELF	0.650	0.183	0.165	0.725	1.000	0.599	0.183	0.165	0.565	1.000	0.051***	0.160***
CIV_COM	0.708	0.455	0.000	1.000	1.000	0.777	0.417	0.000	1.000	1.000	-0.069***	0.000***
CORR	-65.323	20.214	-99.519	-57.692	-36.058	-74.226	17.727	-99.519	-79.327	-36.058	8.903***	21.635***
Healthinfrastructure	6.002	1.618	1.510	5.940	8.746	6.956	1.297	1.510	7.388	8.746	-0.954***	-1.448***
Skilledlabour	5.710	0.601	3.077	5.702	7.532	5.792	0.543	3.077	5.685	7.532	-0.082***	0.017***
Scientificresearchlegislation	5.941	0.977	3.028	5.895	8.064	6.052	0.876	3.028	5.904	8.064	-0.111***	-0.009***
GDPGrowth	3.352	6.273	-36.279	4.171	15.154	2.204	5.976	-36.279	2.861	15.154	1.148***	1.310***

Definitions and source of all the variables are reported in Appendix B.

4.4 Multivariate analysis

4.4.1. Full sample

As the univariate analysis provided earlier does not necessarily identify influential factors associated with the decision to capitalise SDCs or the amounts of SDCs capitalised, Table 4.5 provides four models of multivariate analysis, presenting the empirical implementation of Equation 3.1 for the entire sample. The dependent variables are the decision to capitalise (Models 1 and 2) and the amount of SDCs capitalised in a given year (Models 3 and 4). The models differ only in the use of alternative measures to proxy for incentives to manipulate earnings by SDCs. Specifically, Models 1 and 3 employ *PAST_BEAT* and *ZERO_BEAT* while Models 2 and 4 use *BENCH_BEAT*. The latter effectively combines *PAST_BEAT* and *ZERO_BEAT* as it is also a binary variable and indicates if *PAST_BEAT* or *ZERO_BEAT* is one (1).

For firm-level determinants of the decision to capitalise SDCs, *SIZE, BETA, LEV, BIG4, INTSALES, PAST_BEAT, ZERO_BEAT, CAP* and *BC* report a positive and statistically significant coefficient. This suggests that companies more likely to decide to capitalise SDCs are larger, riskier, have higher leverage, employ one of the Big Four auditors, have more international sales, have incentives to capitalise SDCs to meet their earnings targets and capitalise other development costs, and have concluded material business combinations during the year. Conversely, firms with greater growth opportunities (high book-to-market ratio) and higher R&D intensity are less likely to capitalise SDCs (coefficients of *BM* and *RDInt* are negative and statistically significant).

Looking at the coefficients of the country-level variables, we infer that firms likely to decide to capitalise SDCs are headquartered in countries with more skilled labour and better scientific research legislation (Skilledlabour and Scientificresearchlegislation have positive and statistically significant coefficients). Instead, non-capitalisers are more likely to operate in countries with better health infrastructure (Healthinfrastructure has a negative and statistically significant coefficient).

The coefficients reported in Models 3 and 4 indicate that almost all factors associated with the decision to capitalise SDCs are also associated with the amounts of SDCs capitalised and in the same direction. The only exception/additional factor is being headquartered in countries with higher investor protection. This is positively associated with higher amounts of SDCs capitalised.

TABLE 4.5: Multivariate analysis (decision and magnitude of SDCs capitalisation)

	DECISION TO CAPITALISE SDCs				MAGNITUDE OF SDCs CAPITALISATION			
VARIABLES	Model 1		Model 2		Model 3		Model 4	
BM	-0.192***	(-8.59)	-0.191***	(-8.55)	-0.109***	(-9.23)	-0.108***	(-9.17)
SIZE	0.019***	(5.12)	0.019***	(5.12)	0.009***	(4.89)	0.009***	(4.89)
BETA	0.048***	(3.08)	0.048***	(3.09)	0.022***	(2.93)	0.022***	(2.94)
LEV	0.045***	(3.86)	0.045***	(3.89)	0.015***	(3.41)	0.015***	(3.45)
BIG4	0.133***	(4.56)	0.133***	(4.56)	0.054***	(3.61)	0.054***	(3.61)
CAPEX	-0.021	(-0.15)	-0.019	(-0.13)	0.048	(0.66)	0.049	(0.68)
INTSALES	0.002***	(6.19)	0.002***	(6.19)	0.001***	(7.09)	0.001***	(7.09)
RDValue	0.000***	(4.18)	0.000***	(4.19)	0.000***	(3.85)	0.000***	(3.87)
RDInt	-2.789***	(-11.04)	-2.737***	(-10.95)	-1.788***	(-11.34)	-1.756***	(-11.24)
PAST_BEAT	0.100***	(4.85)			0.052***	(4.91)		
ZERO_BEAT	0.095**	(2.31)			0.054**	(2.34)		
BENCH_BEAT			0.101***	(5.08)			0.052***	(5.12)
CAP	0.192***	(6.06)	0.192***	(6.06)	0.118***	(7.52)	0.118***	(7.52)
BC	0.319***	(10.05)	0.319***	(10.07)	0.152***	(11.60)	0.153***	(11.63)
AGE	-0.032	(-1.56)	-0.032	(-1.55)	-0.015	(-1.47)	-0.014	(-1.46)
ANTISELF	0.105	(0.96)	0.105	(0.97)	0.141***	(2.70)	0.141***	(2.70)
CIV_COM	-0.020	(-0.45)	-0.020	(-0.45)	0.021	(1.14)	0.021	(1.14)
CORR	0.001	(0.62)	0.001	(0.61)	0.000	(0.81)	0.000	(0.79)
Healthinfrastructure	-0.285***	(-16.70)	-0.285***	(-16.69)	-0.135***	(-16.85)	-0.135***	(-16.85)
Skilledlabour	0.064**	(2.34)	0.063**	(2.33)	0.046***	(3.77)	0.046***	(3.76)
Scientificresearchlegislation	0.057**	(2.40)	0.056**	(2.38)	0.030**	(2.50)	0.030**	(2.48)
GDPGrowth	-0.002	(-0.93)	-0.002	(-0.91)	-0.001	(-1.08)	-0.001	(-1.06)
Constant	0.523**	(2.27)	0.522**	(2.27)	0.340***	(3.42)	0.340***	(3.42)
Observations	40,241		40,241		40,241		40,241	
r2_p	0.155		0.155		0.0941		0.0940	
chi2/F	2217***		2215***		83.63**8		86.13***	
MeanVIF	6.04		6.03		6.04		6.03	

Robust z-statistics (t-statistics for regressions on magnitude) in parentheses. We include industry and year fixed effects and standard errors are clustered at the firm level.

*** p<0.01, ** p<0.05, * p<0.1. Definitions and sources of all the variables are reported in Appendix B.

4.4.2 Expected and unexpected accounting treatment of SDCs' capitalisation

Following the procedure described in section 3.2.2, from the 14,422 firm-year observations of non-capitalisers in our sample, we identified 6,484 firm-year observations as 'mandatory non-capitalisers'. Thus, arguably, the remaining non-capitalisers in our sample (7,938 firm-year observations) could potentially capitalise SDCs. From these, we find that the vast majority (6,058) follow the unexpected method (not capitalising) and thus could capitalise SDCs. Further, from the firm-year observations that actually capitalise SDCs, a small (large) proportion follow the unexpected (expected) method, ie 1,341 (24,485). Table 4.6 summarises this information.

Figure 4.6 shows the percentage of firm-year observations following the unexpected method for each country in our sample. All firms from Argentina, Brazil, Greece, India, Indonesia, Ireland, Mexico, Peru, Portugal and South Africa that do not capitalise SDCs and are not classified as 'mandatory non-capitalisers' could have capitalised such expenditure at least partially. It is noted that, most of these are countries with low 'retention rates' in our sample (see Appendix A – Table A1). Hence, in combination, this suggests that these countries have a very small proportion of firms with an indication of some R&D expense in the income statement and even smaller proportion capitalising SDC assets in a given year. Other countries with high proportions of unexpected non-capitalisers include China, Jordan, Italy and Hong Kong. Firms from Germany, Belgium, Netherlands, France and Spain have the highest percentage of unexpected capitalisers. On the other side of the spectrum, firms from Argentina, Brazil, Chile, Colombia, Greece, India, Indonesia, Ireland, Jordan, Mexico, Peru, Philippines, South Africa and Switzerland, do not have any unexpected capitalisers.

Figure 4.7 plots the percentage of firm-year observations following the unexpected method by industry. We note that all industries have a higher proportion of unexpected non-capitalisers (excluding 'mandatory non-capitalisers') than of unexpected capitalisers. Firms operating in Real Estate and Financials present the highest percentages of unexpected non-capitalisers. Further, firms in these industries have no unexpected capitalisers. Interestingly, firms in these industries also exhibit the highest (lower) percentage of capitalisers (non-capitalisers) (see Figure 4.2).

Overall, these results suggest that firms that capitalise SDCs are mostly those that would be expected to do so. Further, some non-capitalisers would be expected to capitalise some amounts of such expenditure, given their firm-level and country-level characteristics. Moreover, firms in specific industries, such as Real Estate and Financials, where we observe large proportions of capitalisers, appear to have even more companies that could have capitalised SDCs than other sectors.

TABLE 4.6: Companies following the 'expected' and 'unexpected' accounting treatment

	NON-CAPITALISERS		CAPITALISERS
	Mandatory non-capitalisers	Potential capitalisers	
Full sample [40,241 observations]	6,484	7,938	25,819
Expected method	–	1,880 (hence expected to be non-capitalisers)	24,478 (hence expected to be capitalisers)
Unexpected method	–	6,058 (ie they are expected to be capitalisers)	1,341 (ie they are expected to be non-capitalisers)

FIGURE 4.6: Percentage of unexpected non-capitalisers and capitalisers by country

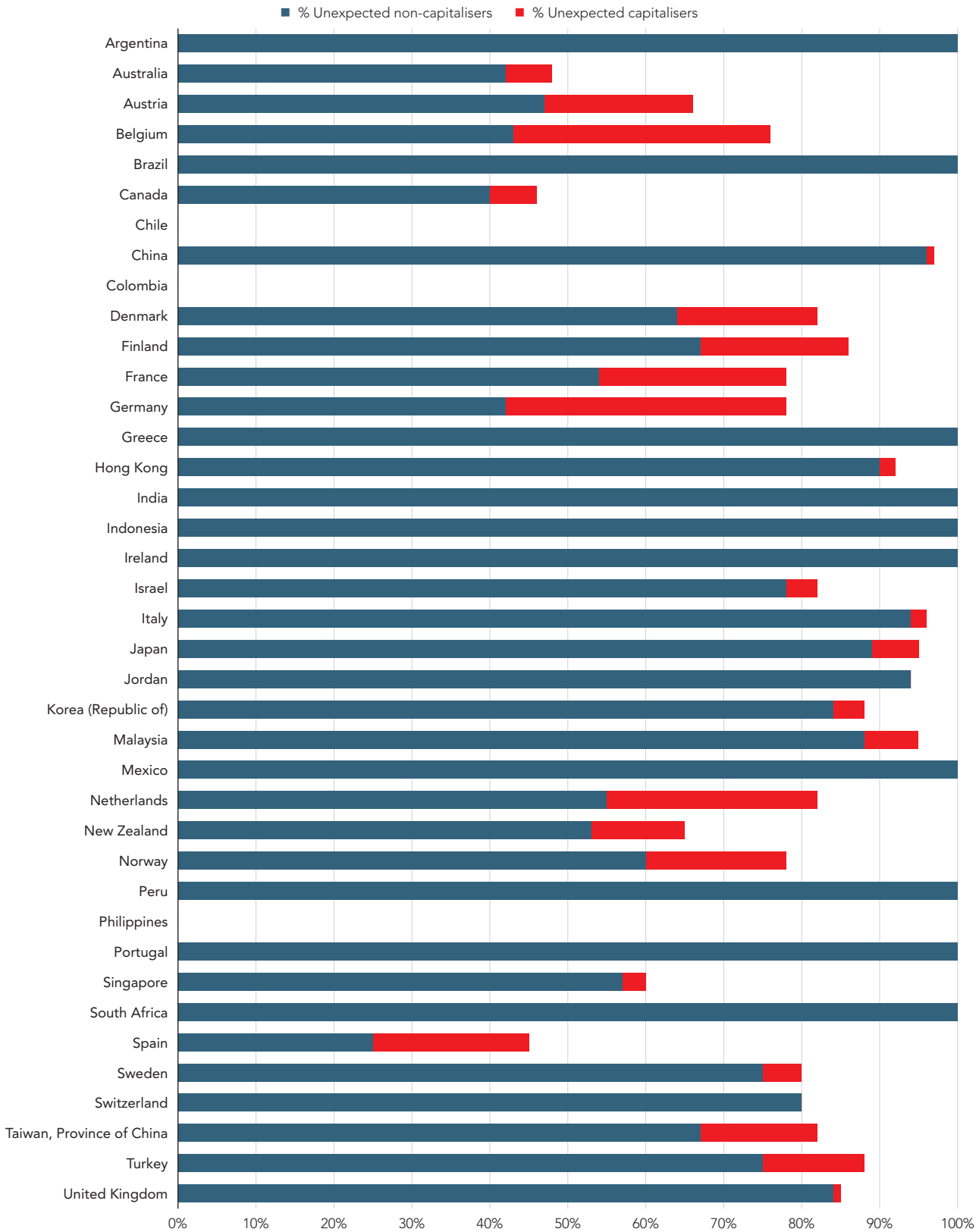
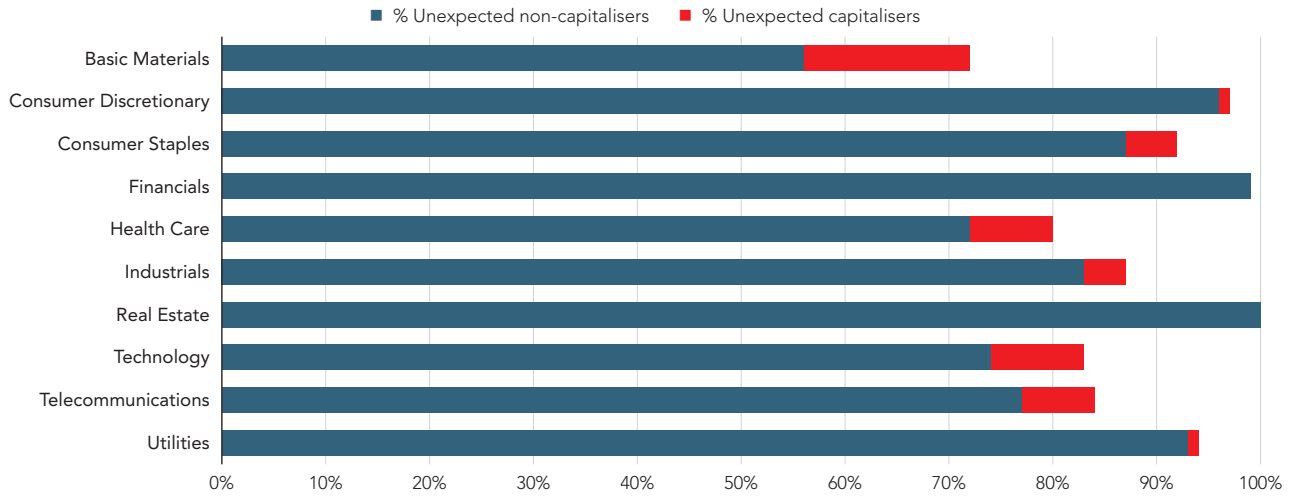


FIGURE 4.7: Percentage of unexpected non-capitalisers and capitalisers by industry



4.4.3 SDC capitalisation and material business combinations

As indicated in Table 4.4, firms that are capitalisers of SDCs have concluded significantly more material business combinations than non-capitalisers. We also see from the results in Table 4.5 that having concluded a material business combination in a given year is indeed positively associated with the likelihood of being a capitaliser and the amounts of SDCs capitalised in the year. Given these results and the expectation that firms with material business combinations in a given year are probably different from firms that do not conclude such a combination,[12] in this section the sample is split across these two sub-samples. We explore whether the two samples have different determinants for the decision to capitalise SDCs and the amounts they capitalise in a given year. Table 4.7 presents the results of our multivariate analysis in four models for each sub-sample. Similar to the main regression results, the first two models examine the decision to capitalise SDCs and the latter two examine the determinants of the magnitude of the amounts capitalised.

Some of the results on the decision to capitalise SDCs are similar to the main findings: ie, whether firms have concluded a material business combination or not, the likelihood of deciding to capitalise SDCs is higher when firms have higher betas and leverage and when companies have incentives to capitalise SDCs to meet earnings targets and have capitalised R&D costs. Further, firms headquartered in countries with more skilled labour and better scientific research legislation are more likely to capitalise SDCs. At the same time, firms with higher R&D intensity and those that operate in a country with lower health infrastructure are less likely to capitalise their software costs, irrespective of conducting material business combinations. Having greater growth opportunities (ie higher book to market), being larger in size, employing a Big Four auditor, and/or having more international sales are not significant for the sub-sample of firms that have material business combinations. Hence, these factors are significant determinants of SDC capitalisation for the sub-sample of firms that do not have material business combinations. Moreover, we find that firms headquartered in countries with common law and higher corruption levels are more likely to capitalise SDCs when they have concluded material business combinations in a given year, although these are not significant determinants for the full sample.

The coefficients reported in Models 3 and 4 indicate that, whether a company has a material business combination or not, factors associated with higher amounts of SDCs capitalised are: being riskier (ie having higher beta), being more leveraged, having lower R&D intensity, having incentives to capitalise larger amounts of SDCs for meeting earnings targets or benchmarks, and being headquartered in countries with higher investor protection. Nonetheless, book to market, firm size, having a Big Four auditor, having more international sales, having more frequent R&D capitalisation and being headquartered in a civic-law country or a country with highly skilled labour and better health infrastructure are

12 In untabulated descriptive statistics, indeed, we identify significant differences in most of the firm-level and country-level characteristics of firms with and without material business combinations.

not significant determinants of the amounts of SDCs capitalised in the sub-sample of firms with material business combinations. Hence, these characteristics are related to the levels of SDCs capitalisation only for firms without material business combinations. In fact, health infrastructure environment has a statistically significant coefficient, albeit with the opposite sign across the two sub-samples. Overall, these findings suggest that firms with a material business combination in a given year have different determinants for the decision to capitalise software costs and the amounts they capitalise in a given year than those firms that do not do this.

TABLE 4.7: Multivariate analysis across firms with and without material business combinations

	DECISION TO CAPITALISE				MAGNITUDE OF CAPITALISATION			
VARIABLES	Model 1		Model 2		Model 1		Model 2	
	BC = 0	BC = 1	BC = 0	BC = 1	BC = 0	BC = 1	BC = 0	BC = 1
BM	-0.194***	-0.133*	-0.194***	-0.117	-0.111***	-0.061*	-0.111***	-0.054
	(-8.53)	(-1.67)	(-8.52)	(-1.46)	(-9.09)	(-1.85)	(-9.08)	(-1.64)
SIZE	0.024***	-0.012	0.024***	-0.013	0.012***	-0.006	0.012***	-0.006
	(6.29)	(-0.94)	(6.29)	(-1.03)	(6.03)	(-1.20)	(6.03)	(-1.29)
BETA	0.046***	0.093**	0.047***	0.092**	0.022***	0.027*	0.022***	0.027*
	(2.90)	(2.02)	(2.90)	(1.99)	(2.79)	(1.75)	(2.80)	(1.72)
LEV	0.041***	0.078**	0.041***	0.084***	0.013***	0.023***	0.013***	0.025***
	(3.39)	(2.52)	(3.39)	(2.70)	(2.91)	(2.73)	(2.91)	(3.02)
BIG4	0.143***	0.086	0.143***	0.084	0.061***	0.030	0.061***	0.027
	(4.79)	(1.16)	(4.80)	(1.12)	(3.88)	(0.99)	(3.89)	(0.91)
CAPEX	-0.004	-0.317	-0.003	-0.363	0.051	-0.051	0.051	-0.063
	(-0.03)	(-0.65)	(-0.02)	(-0.75)	(0.68)	(-0.29)	(0.69)	(-0.35)
INTSALES	0.003***	-0.000	0.003***	-0.000	0.002***	-0.000	0.002***	-0.000
	(6.84)	(-0.27)	(6.85)	(-0.32)	(7.73)	(-0.21)	(7.73)	(-0.23)
RDValue	0.000***	0.000	0.000***	0.000*	0.000***	0.000**	0.000***	0.000**
	(4.01)	(1.64)	(4.01)	(1.73)	(3.44)	(2.04)	(3.44)	(2.21)
RDInt	-2.722***	-3.408***	-2.701***	-2.734***	-1.780***	-1.548***	-1.766***	-1.281***
	(-10.31)	(-5.13)	(-10.31)	(-4.21)	(-10.58)	(-4.77)	(-10.57)	(-3.94)
PAST_BEAT	0.080***	0.267***			0.044***	0.097***		
	(3.66)	(4.11)			(3.77)	(4.32)		
ZERO_BEAT	0.048	0.737***			0.028	0.258***		
	(1.11)	(4.83)			(1.10)	(6.14)		
BENCH_BEAT			0.076***	0.327***			0.042***	0.122***
			(3.64)	(5.11)			(3.73)	(5.51)
CAP	0.227***	-0.048	0.227***	-0.057	0.141***	-0.017	0.141***	-0.019
	(6.97)	(-0.69)	(6.98)	(-0.82)	(8.44)	(-0.61)	(8.44)	(-0.70)
AGE	-0.029	-0.016	-0.029	-0.019	-0.013	-0.005	-0.013	-0.007
	(-1.36)	(-0.33)	(-1.35)	(-0.39)	(-1.27)	(-0.29)	(-1.26)	(-0.39)
ANTISELF	0.084	0.239	0.085	0.243	0.134**	0.203**	0.135**	0.207**
	(0.75)	(0.92)	(0.76)	(0.94)	(2.44)	(2.14)	(2.45)	(2.17)
CIV_COM	0.028	-0.213*	0.028	-0.218*	0.044**	-0.064	0.045**	-0.067
	(0.61)	(-1.74)	(0.62)	(-1.79)	(2.36)	(-1.57)	(2.37)	(-1.63)

	DECISION TO CAPITALISE				MAGNITUDE OF CAPITALISATION			
VARIABLES	Model 1		Model 2		Model 1		Model 2	
	BC = 0	BC = 1	BC = 0	BC = 1	BC = 0	BC = 1	BC = 0	BC = 1
CORR	-0.000	0.008**	-0.000	0.007**	-0.000	0.003**	-0.000	0.003**
	(-0.37)	(2.05)	(-0.36)	(2.02)	(-0.11)	(2.40)	(-0.11)	(2.31)
Healthinfrastructure	-0.316***	-0.084*	-0.316***	-0.086**	-0.153***	-0.018	-0.153***	-0.019
	(-18.05)	(-1.94)	(-18.04)	(-1.98)	(-18.05)	(-1.11)	(-18.05)	(-1.16)
Skilledlabour	0.092***	-0.107*	0.092***	-0.108*	0.058***	-0.030	0.058***	-0.031
	(3.29)	(-1.68)	(3.29)	(-1.70)	(4.53)	(-1.29)	(4.53)	(-1.31)
Scientificresearchlegislation	0.079***	-0.076	0.079***	-0.074	0.042***	-0.034*	0.042***	-0.034*
	(3.17)	(-1.49)	(3.17)	(-1.45)	(3.25)	(-1.66)	(3.24)	(-1.66)
GDPGrowth	-0.001	-0.008	-0.001	-0.008	-0.000	-0.002	-0.000	-0.002
	(-0.29)	(-1.56)	(-0.27)	(-1.52)	(-0.51)	(-1.18)	(-0.50)	(-1.10)
Constant	0.208	2.467***	0.206	2.469***	0.188*	1.219***	0.187*	1.225***
	(0.89)	(4.44)	(0.88)	(4.45)	(1.81)	(6.29)	(1.80)	(6.30)
Observations	36,165	4,076	36,165	4,076	36,165	4,076	36,165	4,076
r2_p	0.161	0.0904	0.161	0.0852	0.0969	0.0570	0.0968	0.0536
chi2/F	2085***	255.8***	2084***	240.2***	83.68***	7.470***	86.29***	7.219***
Mean VIF	1.98	2.21	2.01	2.24	1.98	2.21	2.01	2.24

Robust z-statistics (t-statistics for regressions on magnitude) in parentheses. We include industry and year fixed effects and standard errors are clustered at the firm level.

*** p<0.01, ** p<0.05, * p<0.1 Definitions and sources of all the variables are reported in Appendix B.

4.4.4 Additional analysis: implementation of IFRS 3 (Revised) and capitalisation of SDCs

The revised IFRS 3, which was effective for financial periods starting on or after 1 July 2009, and resultant changes in IAS 38 for recognition of intangible assets arising from business combinations, raised the expectation for 'an increase in the intangible assets recognised as a result of business combinations' (IASB 2014:13). To address this conjecture with particular regard to the recognition of SDCs, we focus on all countries that had adopted IFRS or had converged their accounting standards with IFRS by 2008. Subsequently, we followed the same sample selection approach discussed in Section 3.1. This time, however, we limited the sample period so that we considered the same number of years before and after the implementation of IFRS 3(R) (ie the earliest is 2006 and the latest is 2013) and we maintain only the firm-year observations for firms that made at least one business combination in the period before or after the implementation of IFRS 3(R). This yields a sample of c.6500 firm-year observations. We note that, in untabulated descriptive statistics, although the number of capitalisers increases slightly, the magnitude of capitalised SDCs and the net SDCs shown on the balance sheets is not different in the post IFRS 3R adoption period.

In order to examine the effect of IFRS 3(R) adoption, we extended Model (1), discussed in Section 3.2, and included an indicator variable (POST), which is equal to one (1) for reporting periods ending after 1 July 2010 and zero (0) otherwise. We present the results of the multivariate analysis in Table 4.8. Our results show that the coefficients of POST are negative but insignificant (coefficients: -0.079, -0.079, -0.042 and -0.043, respectively; p-values >10%). These results suggest that the adoption of IFRS 3(R) does not have an influence on a firm's decision to capitalise SDCs or the magnitude of SDC capitalisation.

We expanded this analysis and repeated the same test for the sub-sample of firm-year observations only for those firms that had conducted a material business combination in any given year before and after the implementation of IFRS 3(R). We present the results of this multivariate analysis in Table 4.9. Our results show that the coefficients of POST are again negative but insignificant (coefficients: -0.079, -0.077, -0.035 and -0.034, respectively; p-values>10%). These results suggest that the implementation of IFRS 3(R) does not influence a firm's decision to capitalise SDCs or the magnitude of SDC capitalisation, even if it has conducted a material business combination.

TABLE 4.8: Multivariate analysis: the adoption of IFRS 3 (revised)

	DECISION TO CAPITALISE SDCs		MAGNITUDE OF SDCs CAPITALISATION	
VARIABLES	Model 1	Model 2	Model 1	Model 2
POST	-0.079	-0.079	-0.042	-0.043
	(-0.76)	(-0.76)	(-0.69)	(-0.69)
BM	-0.169***	-0.166***	-0.105***	-0.103***
	(-2.76)	(-2.73)	(-2.69)	(-2.66)
SIZE	-0.011	-0.011	-0.007	-0.007
	(-0.68)	(-0.68)	(-0.71)	(-0.72)
BETA	0.166**	0.165**	0.109**	0.109**
	(2.27)	(2.26)	(2.41)	(2.40)
LEV	0.149***	0.149***	0.073***	0.073***
	(3.55)	(3.56)	(3.91)	(3.93)
BIG4	0.167**	0.166**	0.096*	0.095*
	(2.14)	(2.13)	(1.88)	(1.87)
CAPEX	-0.066	-0.065	-0.026	-0.025
	(-0.20)	(-0.20)	(-0.14)	(-0.13)
INTSALES	-0.002	-0.002	-0.001	-0.001
	(-1.36)	(-1.35)	(-1.13)	(-1.12)
RDValue	-0.000	-0.000	-0.000	-0.000
	(-0.46)	(-0.44)	(-0.34)	(-0.33)
RDInt	-3.663***	-3.583***	-2.586***	-2.529***
	(-3.94)	(-3.88)	(-3.81)	(-3.75)
PAST_BEAT	0.150***		0.101***	
	(2.77)		(2.90)	
ZERO_BEAT	0.149		0.102	
	(1.38)		(1.44)	
BENCH_BEAT		0.163***		0.108***
		(3.09)		(3.22)
CAP	-0.277***	-0.278***	-0.179***	-0.180***
	(-3.07)	(-3.08)	(-2.85)	(-2.88)
BC	0.170***	0.169***	0.104***	0.104***
	(3.54)	(3.54)	(3.50)	(3.50)
AGE	0.036	0.036	0.021	0.021
	(0.52)	(0.51)	(0.50)	(0.50)
ANTISELF	-0.457	-0.462	-0.302	-0.305
	(-1.04)	(-1.05)	(-1.08)	(-1.09)
CIV_COM	-0.585**	-0.588**	-0.389**	-0.392**
	(-2.10)	(-2.11)	(-2.16)	(-2.17)
CORR	0.001	0.001	0.001	0.001
	(0.24)	(0.25)	(0.34)	(0.35)
Healthinfrastructure	-0.034	-0.034	-0.016	-0.016
	(-0.68)	(-0.67)	(-0.50)	(-0.48)

	DECISION TO CAPITALISE SDCs		MAGNITUDE OF SDCs CAPITALISATION	
VARIABLES	Model 1	Model 2	Model 1	Model 2
Skilledlabour	-0.032	-0.032	-0.018	-0.018
	(-0.69)	(-0.69)	(-0.66)	(-0.67)
Scientificresearchlegislation	-0.097*	-0.097*	-0.072**	-0.072**
	(-1.90)	(-1.90)	(-2.29)	(-2.29)
GDPGrowth	-0.010***	-0.010***	-0.005***	-0.005***
	(-3.08)	(-3.07)	(-2.80)	(-2.80)
Constant	1.281**	1.287**	1.071**	1.075***
	(2.03)	(2.04)	(2.57)	(2.58)
Observations	6,505	6,505	6,505	6,505
r2_p	0.103	0.103	0.0661	0.0660
chi2/F	202.6***	202.0***	6.168***	6.317***
Mean VIF	3.4	2.71	3.4	3.46

Robust z-statistics (t-statistics for regressions on magnitude) in parentheses. We include industry and year fixed effects, and standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1 Definitions and sources of all the variables are reported in Appendix B.

TABLE 4.9: Multivariate analysis: the adoption of IFRS 3 (revised)

	DECISION TO CAPITALISE SDCs		MAGNITUDE OF SDCs CAPITALISATION	
VARIABLES	Model 1	Model 2	Model 1	Model 2
POST	-0.079	-0.077	-0.035	-0.034
	(-0.47)	(-0.46)	(-0.39)	(-0.39)
BM	-0.059	-0.055	-0.040	-0.037
	(-0.54)	(-0.51)	(-0.65)	(-0.61)
SIZE	0.037	0.037	0.017	0.017
	(1.31)	(1.31)	(1.09)	(1.09)
BETA	-0.002	-0.001	0.009	0.009
	(-0.01)	(-0.01)	(0.14)	(0.14)
LEV	0.260***	0.261***	0.103***	0.104***
	(3.71)	(3.72)	(4.54)	(4.56)
BIG4	0.256**	0.252**	0.126*	0.124*
	(2.05)	(2.03)	(1.69)	(1.65)
CAPEX	-0.757	-0.748	-0.351	-0.343
	(-1.33)	(-1.31)	(-1.20)	(-1.18)
INTSALES	-0.002	-0.002	-0.001	-0.001
	(-1.16)	(-1.14)	(-0.91)	(-0.89)
RDValue	-0.000*	-0.000*	-0.000	-0.000
	(-1.78)	(-1.76)	(-1.64)	(-1.62)
RDInt	-4.451***	-4.351***	-2.760***	-2.685***
	(-3.34)	(-3.31)	(-3.13)	(-3.08)
PAST_BEAT	0.160**		0.094**	
	(2.13)		(2.20)	

	DECISION TO CAPITALISE SDCs		MAGNITUDE OF SDCs CAPITALISATION	
VARIABLES	Model 1	Model 2	Model 1	Model 2
ZERO_BEAT	0.209		0.137	
	(1.18)		(1.35)	
BENCH_BEAT		0.192**		0.113***
		(2.56)		(2.67)
CAP	-0.327**	-0.330**	-0.199**	-0.201**
	(-2.47)	(-2.50)	(-2.35)	(-2.39)
BC	0.177***	0.175***	0.109***	0.108***
	(3.45)	(3.42)	(3.64)	(3.61)
AGE	-0.016	-0.016	-0.008	-0.008
	(-0.15)	(-0.15)	(-0.14)	(-0.14)
ANTISELF	-0.982	-0.986	-0.629	-0.631
	(-1.34)	(-1.35)	(-1.49)	(-1.50)
CIV_COM	-1.417***	-1.419***	-0.869***	-0.870***
	(-2.97)	(-2.97)	(-3.21)	(-3.22)
CORR	0.005	0.005	0.004	0.004
	(0.56)	(0.54)	(0.82)	(0.81)
Healthinfrastructure	0.109	0.109	0.068	0.068
	(1.33)	(1.33)	(1.47)	(1.47)
Skilledlabour	0.052	0.051	0.031	0.030
	(0.70)	(0.69)	(0.81)	(0.79)
Scientificresearchlegislation	-0.240***	-0.241***	-0.146***	-0.147***
	(-2.77)	(-2.80)	(-3.23)	(-3.24)
GDPGrowth	-0.003	-0.003	-0.001	-0.001
	(-0.58)	(-0.61)	(-0.32)	(-0.35)
Constant	1.233	1.235	1.162*	1.163*
	(1.20)	(1.20)	(1.85)	(1.85)
Observations	2,957	2,957	3,000	3,000
r2_p	0.142	0.142	0.0947	0.0946
chi2/F	123.5***	123.7***	5.741***	5.886***
Mean VIF	3.73	3.02	3.73	3.8

Robust z-statistics (t-statistics for regressions on magnitude) in parentheses. We include industry and year fixed effects, and standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1 Definitions and sources of all the variables are reported in Appendix B.

5. Conclusion

5.1 Conclusions and recommendations

While the wider topic of intangible assets and their accounting treatment has been on the agenda of standard setters and regulators for some time, there is no evidence on the frequency with which SDCs are capitalised or of the amounts concerned on the balance sheets of IFRS-reporting firms. Further to the recent request in the IASB Agenda Consultation and various initiatives of other international, and standard-setting, bodies (FRC 2019; EFRAG 2019 and FASB 2021), in this study we address this lacuna. Specifically, by drawing on listed companies from 39 countries (40,241 firm-year observations) that have converged their national standards to IFRS or adopted IFRS, for the five-year period 2015 to 2019, we collected and summarised evidence on how many companies capitalise SDC during the year (capitalisers) and how many report R&D costs in the income statement but do not capitalise SDC during the year (non-capitalisers). This evidence is provided in aggregate and also at a country and industry level.

Key findings include the following. The data shows that almost two-thirds of the firm-year observations in the sample capitalise SDCs. This suggests that companies very frequently recognise and report SDCs separately. This contrasts with Mazzi et al.'s report (2019b) on general R&D costs, in which 62% of the sample are shown to expense such costs. The high frequency of SDC capitalisation we identify holds even though the amounts involved can be considered immaterial relative to the companies' total assets and/or market values. At a country/regional level, however, we find significant differences in the percentage of capitalising firms and the SDC asset intensity on companies' balance sheets. While firms from Asia show a greater tendency to recognise SDCs separately on the balance sheet than do firms in Oceania and Europe, the SDC asset intensity is far smaller than for firms in these other regions. At a sector level, firms in the Consumer Discretionary, Financials, Real Estate and Utilities Sectors exhibit the largest proportion of capitalisers (it is greater than 70%). Firms in the Telecommunications industry exhibit the highest net SDC asset intensity, followed by firms in Technology and Consumer Discretionary.

Of the firms that complete material business combinations in a given year, a large proportion capitalise both SDCs and R&D in the year. When compared with firms that do not capitalise SDCs, firms that do so are more likely to be larger, riskier, have higher leverage, employ one of the Big Four auditors, have more international sales, have incentives to capitalise SDCs to meet their earnings targets, capitalise other development costs and have concluded material business combinations during the year. These same characteristics associate positively with the magnitude of amounts capitalised. Even so, firm size, employing a Big Four auditor, and making international sales are not significant factors affecting the decision to capitalise SDCs for the sub-sample of firms that have material business combinations. Further, book to market, firm size, having a Big Four auditor, international sales, frequency of R&D capitalisation and being headquartered in a civic-law country or a country with highly skilled labour and better health infrastructure are not significant determinants of the amounts of SDCs capitalised in the sub-sample with material business combinations. Hence, these characteristics are related to the levels of SDC capitalisation only for firms without material business combinations. The results from the separate sample focusing on the years before and after the implementation of IFRS 3 (R) in 2009 suggest that the implementation of the revised standard does not influence a firm's decision to capitalise SDCs or the magnitude of SDC capitalisation, even if it has conducted material business combinations.

The key recommendations from these findings are as follows. The high frequency of capitalisation of SDCs, in direct contrast to the prior evidence of relative lack of capitalisation of development costs of new products and processes (ie R&D-related costs) under IAS 38, reinforces the call for revision to the criteria of capitalisation of other development costs in IAS 38. The fact that having material business combinations is associated with a larger number of capitalisers and higher amounts of capitalised SDCs suggests that IFRS 3 does achieve its objectives for the separate recognition of SDCs. Nonetheless, the implementation of IFRS 3(R) does not seem to have had an effect (and hence has not improved financial reporting quality) in this respect, relative to the previous standard.

No further revision of IFRS 3 appears pertinent, at least as far as the recognition of SDCs is concerned. The significant differences in the percentage of capitalising firms and SDC asset intensity on companies' balance sheets across countries/regions should alert users of financial statements, preparers, auditors and/or enforcers of financial information to the differential reporting incentives and contextual influential factors across different countries, which result in significant variations in reporting practices. Finally, although we observe relatively good disclosure practices on the issue of SDCs, IAS 38 and auditors and enforcing bodies could encourage more refined disclosures in assisting firms to distinguish how much of the capitalised amounts of SDC relate to externally acquired or internally developed software.

5.2 Limitations and directions for future research

As in every research study, the results reported above are subject to a number of common limitations and caveats. First, the firm-level data we used is provided by commercial databases. These may contain errors and misclassifications. Second, certain firms may engage in R&D but may not separately report any R&D expense in the income statement or any SDC asset on the balance sheet. These companies are not included in the sample. In practice, their inclusion is unlikely to affect our results because these firms have low R&D intensity, and presumably low materiality. Third, certain firms may capitalise SDC costs but may not report these as a separate category of intangible assets; some companies may have (mis)classified such amounts as part of general development costs capitalised. Hence, we cannot classify them as capitalisers in our sample. Similarly, it is likely that some companies may develop software internally and part of this expenditure is treated as an expense in the income statement. The databases that we rely on for the data collection do not capture such amounts separately. It is likely that companies merge these expensed costs with other R&D-related expenses. The implications from these potential (mis)classifications would be negligible for the tests on and conclusions about the amounts capitalised, because it is presumed that the non-separate reporting of such amounts is due to their small, non-material, magnitude. Fourth, we rely on econometric techniques to identify the expected practice of SDC capitalisation. While we have made every effort to develop a model that accurately predicts the expected accounting treatment of SDCs, we recognise that this may misclassify some companies.

Future research could examine any consequences of the decision to capitalise SDCs and of the amounts capitalised on various equity and debt market outcomes. Further, insights about the decision to capitalise SDCs and about the amounts capitalised, while comparing IFRS and US GAAP reporters would be pertinent. Additionally, future research could consider the views of preparers on their respective accounting treatments of R&D costs compared with those costs associated with SDCs. This could shed useful light on the differences, in practice, between internally generated and externally purchased intangibles and their treatment under IAS 38.

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Appendix A:

Information for the firm-year observations excluded from our analysis

Table A1 shows the distribution, by country and year, for the firm-year observations that do not report R&D expense in the income statement and do not recognise an SDC asset on the balance sheet, which were hence excluded from our analysis. For comparative purposes, Table A1 also shows the number of firm-year observations included in our analysis, along with the resultant 'retention rate'. This latter column indicates that, on average, the percentage of firm-year observations that report an R&D expense in the income statement and/or recognise an SDC asset in the year is about 52%. Thus, overall, we include a large number of firms from a large number of IFRS reporting countries in our sample.

We note, however, that for 11 (5) countries the retention rate is below 30% (20%). On the one other hand, for China and Japan (Korea and Taiwan) the retention rate is above 90% (80%). This suggests that a significant majority of firms in these countries report an R&D expense in the income statement and/or recognise an SDC asset in the year. Further, this, and the fact that a very large number of firms are listed in each of China, Korea and Taiwan, explains why our sample heavily represents firms in the Asian region.

Like Table A1, Table A2 reports the distribution of firm-year observations excluded from and included in our analysis, across industries. Overall, with the exception of firms in the Real Estate industry, we included a very large number of firm-year observations from each industry in our analysis.

Looking at more details, the data in Table A2 indicates that, probably as expected because of their operations, our sample includes the majority of firms in the Health Care (76%), Technology (74%) and Telecommunications (69%) industries.

TABLE A1: Distribution of firm-year observations excluded from and included in our analysis, by country

COUNTRY	2015	2016	2017	2018	2019	TOTAL excluded	TOTAL included	Retention rate
Argentina	35	37	34	33	39	178	84	**32.06%**
Australia	690	603	620	631	631	3,175	1,326	**29.46%**
Austria	29	24	24	24	19	120	113	**48.50%**
Belgium	54	52	56	50	50	262	204	**43.78%**
Brazil	85	80	78	74	63	380	481	**55.87%**
Canada	633	520	502	495	481	2,631	1,030	**28.13%**
Chile	109	88	81	76	75	429	307	**41.71%**
China	257	216	188	174	180	1,015	11,058	**91.59%**
Colombia	0	14	13	11	11	49	18	**26.87%**
Denmark	71	57	55	59	56	298	168	**36.05%**
Finland	47	51	55	50	51	254	257	**50.29%**
France	234	234	225	207	171	1,071	902	**45.72%**
Germany	152	144	140	143	121	700	960	**57.83%**
Greece	87	76	69	65	21	318	247	**43.72%**
Hong Kong	760	814	864	946	860	4,244	1,491	**26.00%**
India	1,407	1,267	1,259	1,239	1,060	6,232	3,184	**33.81%**
Indonesia	343	337	338	352	254	1,624	383	**19.08%**
Ireland	14	14	14	13	12	67	79	**54.11%**
Israel	191	171	174	181	177	894	495	**35.64%**

COUNTRY	2015	2016	2017	2018	2019	TOTAL excluded	TOTAL included	Retention rate
Italy	161	150	154	158	146	769	300	**28.06%**
Japan	2	3	1	3	6	15	414	**96.50%**
Jordan	145	123	113	116	48	545	74	**11.95%**
Korea	210	162	165	140	161	838	4,986	**85.61%**
Malaysia	462	524	534	532	612	2,664	325	**10.87%**
Mexico	73	69	75	81	89	387	89	**18.70%**
Netherlands	37	33	35	32	24	161	236	**59.45%**
New Zealand	58	56	53	52	52	271	228	**45.69%**
Norway	83	88	93	91	91	446	204	**31.38%**
Peru	46	41	43	45	50	225	60	**21.05%**
Philippines	4	7	9	11	5	36	12	**25.00%**
Portugal	25	18	20	15	16	94	60	**38.96%**
Singapore	48	46	43	44	298	479	93	**16.26%**
South Africa	150	142	143	144	132	711	430	**37.69%**
Spain	54	56	53	53	42	258	281	**52.13%**
Sweden	191	199	212	234	241	1,077	547	**33.68%**
Switzerland	1	2	2	1	1	7	12	**63.16%**
Taiwan	296	292	303	283	313	1,487	6,481	**81.34%**
Turkey	188	172	165	169	145	839	528	**38.62%**
United Kingdom	505	467	444	423	339	2,178	2,094	**49.02%**
Venezuela	3	2	2	2	1	10	0	**0.00%**
Total	**7,940**	**7,451**	**7,451**	**7,452**	**7,144**	**37,438**	**40,241**	**51.80%**

TABLE A2: Distribution of firm-year observations excluded from and included in our analysis, by industry

INDUSTRY	2015	2016	2017	2018	2019	TOTAL excluded	TOTAL included	Retention rate
Basic Materials	1,455	1,274	1,253	1,232	1,174	6,388	5,101	**44.40%**
Consumer Discretionary	1,456	1,388	1,411	1,364	1,300	6,919	7,449	**51.84%**
Consumer Staples	551	533	536	534	517	2,671	2,710	**50.36%**
Financials	955	866	850	873	840	4,384	2,100	**32.39%**
Health Care	219	236	248	252	261	1,216	3,808	**75.80%**
Industrials	1,590	1,523	1,534	1,529	1,463	7,639	9,056	**54.24%**
Real Estate	845	811	823	846	809	4,134	915	**18.12%**
Technology	474	443	441	444	434	2,236	6,401	**74.11%**
Telecommunications	159	165	150	165	143	782	1,710	**68.62%**
Utilities	236	212	205	213	203	1,069	991	**48.11%**
Total	**7,940**	**7,451**	**7,451**	**7,452**	**7,144**	**37,438**	**40,241**	**51.80%**

Table A3 (Panel A) presents the descriptive statistics for key firm-level variables for the firm-year observations that are excluded from our analysis. Panel B of Table A3 contrasts this information with the corresponding characteristics of the firm-year observations we analyse in this report.

The data reveals that, on average, firms excluded from the analysis (ie firms that do not report R&D expense in the income statement and do not recognise an SDC asset on the balance sheet) are smaller in size and more leveraged, have significantly lower levels of international sales, and invest more in tangible fixed assets. and a lower percentage of them are audited by a Big Four auditor.

TABLE A3: Descriptive statistics for firm-year observations excluded from our analysis

PANEL A: FIRM-YEAR OBSERVATIONS EXCLUDED FROM OUR ANALYSIS						
VARIABLE	**N**	**MEAN**	**SD**	**MIN**	**MEDIAN**	**MAX**
BM	37,438	1.174	1.124	0.031	0.849	7.259
SIZE	37,438	15.826	4.924	7.709	15.322	31.749
Beta	37,438	0.782	0.733	–1.462	0.725	4.48
Lev	37,438	0.894	1.547	0	0.387	9.861
BIG4	37,438	0.333	0.471	0	0	1
CAPEX	37,438	0.082	0.143	0	0.027	1.004
INTSALES	37,438	13.229	28.383	0	0	100
AGE	37,438	17.261	8.985	3	17	46
PANEL B: FIRM-YEAR OBSERVATIONS INCLUDED IN OUR ANALYSIS						
VARIABLE	**N**	**MEAN**	**SD**	**MIN**	**MEDIAN**	**MAX**
BM	40,241	0.686	0.605	0.035	0.508	3.926
SIZE	40,241	18.409	4.461	8.699	17.892	30.873
Beta	40,241	0.975	0.684	–1.435	0.957	6.764
Lev	40,241	0.743	1.18	0	0.368	8.107
BIG4	40,241	0.402	0.49	0	0	1
CAPEX	40,241	0.057	0.091	0	0.024	0.606
INTSALES	40,241	26.479	34.289	0	5.3	100
AGE	40,241	16.306	9.115	3	16	46

Appendix B:

Variable definition

VARIABLE	DEFINITION	DATASTREAM CODE OR OTHER SOURCE
rdnetasset	is the net R&D asset on the balance sheet, scaled by total assets	Net development costs: WC02504 Total assets: WC02999
sdnetasset	is the net SDC asset on the balance sheet, scaled by total assets	Net software development costs: WC18299 Total assets: WC02999
SDAsset	is the capitalised amount of SDC in the year, measured as the change in net SDC asset (sdnetasset) plus amortisation of software, scaled by the market value of equity	Net software development costs: WC18299 Amortisation of software: WC01157 Market Capitalisation: WC08001
SDCAPD	is an indicator variable equal to one (1) if a company capitalises SDC during the year (ie when SDAsset is greater than zero (0))	
RDExp	is the research and development expense recognised in the income statement, scaled by the market value of equity	R&D expense: WC01201 Market Capitalisation: WC08001
RDAsset	is the capitalised amount of R&D in the year, measured as the change in net R&D asset (rdnetasset) plus amortisation of R&D scaled, by the market value of equity	Net development costs: WC02504 Amortisation of R&D: WC01153 Market Capitalisation: WC08001
CAP	is an indicator variable equal to one (1) if a company capitalises R&D during the year (ie when RDAsset is greater than zero (0))	Net development costs: WC02504
BM	is the book-to-market value of equity ratio	Common equity: WC03501 Market Capitalisation: WC08001
SIZE	is the natural logarithm of market value of equity, measured at the fiscal year end	Market Capitalisation: WC08001
BETA	is the firm beta estimated using 12 months of returns over each firm's local market index	Datastream regression formula
LEV	is the total debt-to-book value of equity	Total debt: WC03255 Common equity: WC03501
BIG4	is an indicator variable equal to one (1) if the company's financial statements are audited by one of the Big Four auditors and zero (0) otherwise	TR.BSAuditorCode
CAPEX	is the level of investment in tangible fixed assets for the year, scaled by the market value of equity	Capital Expenditure: WC04601 Market Capitalization: WC08001
INTSALES	is international sales as a percentage of total sales	IntSalesPerc: WC07101
RDValue	is R&D value, measured as the difference between the market value of equity and book value of equity, less the amount of R&D and SDC capitalised during the year divided by the sum of current and lagged annual R&D expenditure	Common equity: WC03501 Market Capitalisation: WC08001 R&D expenditure: RDExp+SDAsset+RDAsset

VARIABLE	DEFINITION	DATASTREAM CODE OR OTHER SOURCE
RDInt	is the R&D intensity measured as R&D expenditure (see above), divided by total assets less the amount of R&D or SDC capitalised during the year	R&D expenditure: RDExp+SDAsset+RDAsset Total assets: WC02999
PAST_BEAT	is equal to one (1) if prior year earnings are higher than current earnings, assuming full expensing of SDC capitalised in the year and prior year earnings are lower than current earnings, assuming full capitalisation of R&D expense and 0 otherwise (see also Dinh et al. 2016). Earnings refer to income before extra items/preferred dividends	Net income before extra items/preferred dividends: WC01551
ZERO_BEAT	is equal to one (1) if earnings, assuming full expensing of SDC capitalised in the year, are negative, and earnings assuming full capitalisation of R&D expense are positive and zero (0) otherwise (see also Dinh et al. 2016). 'Earnings' refer to income before extra items/preferred dividends	Net income before extra items/preferred dividends: WC01551
BENCH_BEAT	is equal to one (1) if PAST_BEAT and/or ZERO_ BEAT are equal to one (1) and zero (0) otherwise	
AGE	Firm age in years. In multivariate analysis we use its natural logarithm	Base date
BC	is equal to one (1) if there is a material business combination and zero (0) otherwise. Material business combination is considered if the consideration accounts for 5% to previous year's book value of equity.	Compustat: Acquisition expense: ACQ Common equity: CEQ
ANTISELF	(anti self-dealing index) is a measure of legal protection of minority shareholders against expropriation by corporate insiders	La Porta et al. (2008)
CIV_COM	is an indicator variable that takes the value of zero (0) if the company is headquartered in a common law country and one (1) in a civil law country	La Porta et al. (1998)
CORR	Corruption is the percentile rank of control of corruption multiplied by –1. The higher the value, the higher is the corruption in a country	World Bank (2010). Worldwide Governance Indicators (WGI) Project
Healthinfrastructure	is the country-level health infrastructure	IMD World Competitiveness Yearbook 2021
Skilledlabour	is the country-level skilled labour that is readily available	IMD World Competitiveness Yearbook 2021
Scientificresearch-legislation	is the country-level scientific research legislation measuring whether laws relating to scientific research encourage innovation	IMD World Competitiveness Yearbook 2021
GDPGrowth	is the annual growth rate of gross domestic product (GDP)	IMD World Competitiveness Yearbook 2021

Appendix C:

Examples of companies' disclosures

This Appendix provides extracts from the financial statements of 15 firms, as indicative examples of good disclosure practice, including mentions of SDC capitalisation as a key audit matter in auditors' reports. These firms have very high SDC asset intensity in the year 2019. Thus, for these firms, SDCs would be considered an important aspect and detailed and clear disclosures would be pertinent.

HOME24, Retailers, UK, Year-end: 31 December 2019

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2.3. Research and Development

The Group develops core elements of its internal software in-house. Thereby the Group wants to ensure that the software as best as possible satisfies rapid growth and scaling requirements, and the individual challenges posed by the online furniture sector. If the criteria for capitalization were met, all development costs were capitalized in the financial year ended. Accordingly, investments in internally generated intangible assets totaled EUR 8.0m (2018: EUR 7.6m). Amortization of internally generated intangible assets totaled EUR 4.7m (2018: EUR 4.9m).

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INTANGIBLE ASSETS

The Group's intangible assets comprise acquired brands and customer lists, internally generated and acquired software and other licenses as well as goodwill.

Trademark rights and customer lists obtained through acquisitions are recognized at their fair value as of the acquisition date and are subsequently measured at cost less any accumulated amortization and impairment losses. The goodwill is recognized initially as a positive difference between the purchase costs and the fair value of identifiable net assets. After initial recognition it is measured at cost adjusted for impairments.

Acquired software and other licenses are recognized at the costs incurred to acquire them and bring them to use.

Internally generated software directly attributable to the design and testing of identifiable and unique software products controlled by the Group is recognized as an intangible asset if the following criteria are met:

- It is technically feasible to complete the software enabling internal use or the sale of the software product,
- The Group intends to complete the software product and is able and willing to use or sell it,
- It can be demonstrated how the software product will generate probable future economic benefits,
- Adequate technical, financial and other resources are available to complete development of the software product, and
- The expenditure attributable to the software product during its development can be reliably measured.

Directly attributable costs that are capitalized as part of the software product mainly include the software development employee cost. Other development costs that do not meet these criteria are recognized as an expense as incurred. Development costs previously recognized as an expense will not be recognized as an asset in a subsequent period.

Intangible assets, with the exception of goodwill and domain rights which are included in acquired software and other licenses, have finite useful lives and are amortized on a straight-line basis over their respective economic lives:

	Useful life in years
Internally developed software	1 – 7
Customer lists	4
Acquired software and other licenses	3 – 7
Brand	4

Amortization of internally developed and acquired software begins when the software is in the condition necessary for it to be capable of operating in the manner intended by management.

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5.11. Intangible Assets and Goodwill

Intangible assets and goodwill changed as follows:

In EURm	Goodwill	Customer lists	Brand	Internally developed software	Software and other licenses	Advance payments made for intangible assets	Total
Cost							
As of January 1, 2018	**3.1**	**4.1**	**15.0**	**29.2**	**9.5**	**8.2**	**69.1**
Additions	0.0	0.0	0.0	7.6	5.3	1.6	14.5
Reclassifications	0.0	0.0	0.0	0.0	9.8	–9.8	0.0
Currency translation	0.0	0.0	0.0	–0.3	–0.2	0.0	–0.5
As of December 31, 2018	**3.1**	**4.1**	**15.0**	**36.5**	**24.4**	**0.0**	**83.1**
Additions	0.0	0.0	0.0	8.0	0.5	0.0	8.5
Disposals	0.0	0.0	0.0	–10.8	0.0	0.0	–10.8
Currency translation	0.0	0.0	0.0	–0.1	0.0	0.0	–0.1
As of December 31, 2019	**3.1**	**4.1**	**15.0**	**33.6**	**24.9**	**0.0**	**80.7**
Accumulated amortization							
As of January 1, 2018	**0.0**	**–2.4**	**–3.2**	**–15.2**	**–4.8**	**0.0**	**–25.6**
Additions	0.0	–0.8	–2.1	–4.9	–1.1	0.0	–8.9
Currency translation	0.0	0.0	0.0	0.2	0.1	0.0	0.3
As of December 31, 2018	**0.0**	**–3.2**	**–5.3**	**–19.9**	**–5.8**	**0.0**	**–34.2**
Additions	0.0	–0.9	–9.7	–4.7	–3.1	0.0	–18.4
Disposals	0.0	0.0	0.0	10.8	0.0	0.0	10.8
As of December 31, 2019	**0.0**	**–4.1**	**–15.0**	**–13.8**	**–8.9**	**0.0**	**–41.8**
Carrying amount							
As of December 31, 2018	**3.1**	**0.9**	**9.7**	**16.6**	**18.6**	**0.0**	**48.9**
As of December 31, 2019	**3.1**	**0.0**	**0.0**	**19.8**	**16.0**	**0.0**	**38.9**

Internally developed software contains software in development in the amount of EUR 5.1m (2018: EUR 2.9m).

The brand, which was fully written down as of 31 December 2019, was pledged as collateral to third parties as of the December 31, 2019 reporting date for liabilities of EUR 2.4m (2018: EUR 5.4m).

Amortization of intangible assets is shown under selling and distribution costs at EUR 10.6m (2018: EUR 3.0m) and under administrative expenses at EUR 7.8m (2018: EUR 5.9m).

Myer Holdings, Retailers, Australia, Year-end: 27 July 2019

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C2 INTANGIBLE ASSETS

	Goodwill $'000	Brand names and trademarks $'000	Software $'000	Lease rights $'000	Total $'000
At 29 July 2017					
Cost	492,131	437,358	268,445	25,786	1,223,720
Accumulated amortisation and impairment	(27,097)	(15,405)	(169,775)	(25,786)	(238,063)
Net book amount	465,034	421,953	98,670	-	985,657
Period ended 28 July 2018					
Carrying amount at beginning of period	465,034	421,953	98,670	-	985,657
Additions	-	-	37,899	-	37,899
Transfer between classes	-	-	10,637	-	10,637
Assets written off – cost	-	-	(7,200)	-	(7,200)
Assets written off – accumulated amortisation	-	-	7,108	-	7,108
Impairment[1]	(465,034)	(50,315)	(4,322)	-	(519,671)
Amortisation charge[2]	-	-	(29,318)	-	(29,318)
Exchange differences	-	-	39	-	39
Carrying amount at end of period	-	371,638	113,513	-	485,151
At 28 July 2018					
Cost	492,131	437,358	309,820	25,786	1,265,095
Accumulated amortisation and impairment	(492,131)	(65,720)	(196,307)	(25,786)	(779,944)
Net book amount	-	371,638	113,513	-	485,151
Period ended 27 July 2019					
Carrying amount at beginning of period	-	371,638	113,513	-	485,151
Additions	-	-	16,223	-	16,223
Transfer between classes	-	-	993	-	993
Assets written off – cost	-	-	(19)	(7,535)	(7,554)
Assets written off – accumulated amortisation	-	-	9	7,535	7,544
Amortisation charge[2]	-	-	(34,775)	-	(34,775)
Exchange differences	-	-	22	-	22
Carrying amount at end of period	-	371,638	95,966	-	467,604
At 27 July 2019					
Cost	492,131	437,358	327,039	18,251	1,274,779
Accumulated amortisation and impairment	(492,131)	(65,720)	(231,073)	(18,251)	(807,175)
Net book amount	-	371,638	95,966	-	467,604

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(iv) Computer software

All costs directly incurred in the purchase or development of major computer software or subsequent upgrades and material enhancements, which can be reliably measured and are not integral to a related asset, are capitalised as intangible assets. Direct costs may include internal payroll and on-costs for employees directly associated with the project. Costs incurred on computer software maintenance or during the planning phase are expensed as incurred. Computer software is amortised over the period of time during which the benefits are expected to arise, initially being up to 10 years. The assets' residual values and useful lives are reviewed annually and adjusted if appropriate, which may result in a useful life outside of this period.

Warehouse Group, Retailers, New Zealand, Year-end: 28 July 2019

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2.2 Capital expenditure, depreciation and amortisation		CAPITAL EXPENDITURE		DEPRECIATION AND AMORTISATION	
	NOTE	2019	2018	2019	2018
		$000	$000	$000	$000
The Warehouse Segment		47,753	42,889	46,310	46,477
Noel Leeming Segment		10,276	14,165	11,364	11,685
Digital Retail		3,641	4,363	1,200	-
Other Group operations		433	10,238	1,739	1,468
Continuing Retail Group		62,103	71,655	60,613	59,630
Discontinued operations		-	335	-	-
Total Group		62,103	71,990	60,613	59,630
Comprising					
Property, plant and equipment	9.1	34,676	51,185	50,371	52,368
Computer software	9.2	27,427	20,805	10,242	7,262
Total Group		62,103	71,990	60,613	59,630

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9.2 Intangible assets		GOODWILL		BRAND NAMES		COMPUTER SOFTWARE		TOTAL	
	NOTE	2019	2018	2019	2018	2019	2018	2019	2018
		$000	$000	$000	$000	$000	$000	$000	$000
Cost		94,380	117,094	23,523	23,523	126,689	133,178	244,592	273,795
Impairment and accumulated amortisation		(36,924)	(34,016)	-	-	(92,300)	(105,033)	(129,224)	(139,049)
Opening carrying amount		57,456	83,078	23,523	23,523	34,389	28,145	115,368	134,746
Additions	2.2	-	-	-	-	27,427	20,805	27,427	20,805
Disposals		-	-	-	-	(1,563)	(7,299)	(1,563)	(7,299)
Impairment		-	(25,622)	(5,478)	-	-	-	(5,478)	(25,622)
Amortisation	2.2	-	-	-	-	(10,242)	(7,262)	(10,242)	(7,262)
Closing carrying amount		57,456	57,456	18,045	23,523	50,011	34,389	125,512	115,368
Cost		94,380	94,380	23,523	23,523	149,035	126,689	266,938	244,592
Impairment and accumulated amortisation		(36,924)	(36,924)	(5,478)	-	(99,024)	(92,300)	(141,426)	(129,224)
Closing carrying amount		57,456	57,456	18,045	23,523	50,011	34,389	125,512	115,368
Less: Assets held for sale	15.2	-	-	-	-	-	(37)	-	(37)
Intangible assets		57,456	57,456	18,045	23,523	50,011	34,352	125,512	115,331

Computer software

All costs directly incurred in the purchase or development of computer software or subsequent upgrades and enhancements, which can be reliably measured and are not integral to a related asset, are capitalised as intangible assets. Computer software is amortised on a straight line basis over a period of between two to fifteen years. Costs incurred on computer software maintenance are expensed to the income statement as they are incurred.

N Brown Group plc, Retailers, UK, Year-end: 2 March 2019

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Capitalisation of software development costs

The Group's software development and implementation programme is ongoing, and the Committee has continued to review the treatment of the significant software and project costs in order to satisfy itself that the Group's approach to capitalisation of these costs remains appropriate. In this regard, the Committee has been assisted by internal audit.

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Independent Auditor's Report to the members of N Brown Group PLC

Risks of material misstatement	vs 2018
Recurring risks	
Allowance for doubtful debts	▲
Taxation provisions	▲
Regulatory provision	◆
Capitalised software and development costs	▲
Carrying value of inventories	▼
Parent company – carrying value of investments	▲

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	The risk
Carrying value of software and development costs under the course of construction Refer to page 24 (principal risks), page 53 (viability statement), page 59 (Audit Committee Report), page 98 (accounting policy) and page 110 (financial disclosures).	**Accounting treatment:** The Group has incurred significant software and development project costs in the current and prior year in respect of a significant systems infrastructure programme. The Group capitalises both internal and external eligible costs to the extent that future economic benefits are expected to be generated by the project. This requires judgement as to whether the costs incurred are directly attributable and that the development relates to technically feasible systems and websites. Judgements are involved in determining the classification of software and development costs between revenue and capital expenditure.

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Intangible assets
Computer software development costs that generate economic benefits beyond one year are capitalised as intangible assets and amortised on a straight-line basis over a range of five to ten years. Assets under construction are not amortised but instead tested for impairment annually.

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Software development costs

Included within intangible assets are significant software and development project costs in respect of the Group's technological development programme. Costs are capitalised to the extent that future economic benefits are expected to be generated by the project, which requires judgement to be made as to whether the project will be completed successfully, will be technically feasible and whether sufficient revenue and profitability will be generated to recover the costs capitalised. If these criteria are not subsequently met, the asset would be subject to a future impairment charge which would impact the Group's results. This is consequently a source of estimation uncertainty.

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12 Intangible assets

	Brands £m	Software £m	Customer Database £m	Total £m
Cost				
At 4 March 2017	16.9	294.4	1.9	313.2
Additions	–	36.5	–	36.5
At 3 March 2018	16.9	330.9	1.9	349.7
Additions	–	32.9	–	32.9
Disposals	–	(2.4)	–	(2.4)
At 2 March 2019	**16.9**	**361.4**	**1.9**	**380.2**
Accumulated amortisation and impairment				
At 4 March 2017	8.0	161.4	1.9	171.3
Charge for the period	–	22.4	–	22.4
At 3 March 2018	8.0	183.8	1.9	193.7
Charge for the period	–	25.2	–	25.2
Impairment	7.1	10.7	–	17.8
Disposals	–	(1.7)	–	(1.7)
At 2 March 2019	**15.1**	**218.0**	**1.9**	**235.0**
Carrying amount				
At 2 March 2019	**1.8**	**143.4**	**–**	**145.2**
At 3 March 2018	8.9	147.1	–	156.0
At 4 March 2017	8.9	133.0	–	141.9

Assets in the course of construction included in intangible assets at the year end total £35.4m (2018: £14.6m). No amortisation is charged on these assets. Borrowing costs of £nil (2018: £0.1m) have been capitalised in the period using the weighted average bank loan interest rate applied to the capitalised spend on technological developments included within software.

As at 2 March 2019, the Group had entered into contractual commitments for the further development of intangible assets of £4.7m (2018: £2.0m) of which £1.5m (2018: £1.0m) is due to be paid within one year.

Impairment testing of software intangible assets
The Group is undertaking a systems transformation project. Some elements of the project are not yet available for use and are not therefore being amortised. Where intangible assets are not being amortised management have tested for impairment with the recoverable amount being determined from value in use calculations.

The value in use calculations use cash flows based on budgets prepared by management covering a three-year period. These budgets have regard to historic performance and knowledge of the current market, together with management's views on the future achievable growth and impact of technological developments. Cash flows beyond this three-year period are extrapolated using a long term growt rate to five years at which point a terminal value has been calculated based upon the long-term growth rate and the Group's risk adjusted pre-tax discount rate.

The Group's three-year cash flow projections are based upon the Group's approved three-year plan. The detailed forecast assumes continued growth during the course of the next three years, driven by new media campaigns, exploitation of the Group's data assets and further investments in the core technology underpinning the Group's key channels to market.

Other than the detailed budgets, the key assumptions in the value in use calculations are the long-term growth rate and the risk adjusted pre-tax discount rate. The long-term growth rate has been determined with reference to forecast GDP growth which management believe is the most appropriate indicator of long-term growth rates that is available. The long-term growth rate used is purely for the impairment testing of intangible assets and brands under IAS 36 'Impairment of Assets' and does not reflect long-term planning assumptions used by the Group for investment proposals or for any other assessments. The pre-tax discount rate is based on the Group's weighted average cost of capital, taking into account the cost of capital and borrowings, to which specific market-related premium adjustments are made.

The assumptions are as follows:

- Long-term growth rate: 1.5% (2018: 2.0%)
- Pre tax discount rate: 10.7% (2018: 13.9%)

The analysis performed indicates that no impairment is required other than the specific impairment of the Welcom asset spend (see note 6). A sensitivity analysis has been performed on each of these key assumptions with other variables held constant. Management have concluded that there are no reasonably possible changes in these key assumptions that would cause the carrying value to exceed the value in use.

Van de Velde, Personal Goods, Belgium, Year-end: 31 December 2019

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Intangible assets

(1) Research and development
The nature of the development costs within the Van de Velde Group is such that they do not meet the criteria set out in IAS 38 for recognition as intangible assets. They are therefore expensed when incurred.

(3) Other intangible assets
Other intangible assets (software and online platform) acquired by Van de Velde are recognized at cost (purchase price plus all directly attributable costs) less accumulated amortization and accumulated impairment losses. Expenses for the registration of trade names and designs are recorded as brands with finite useful life to the extent that this relates to new registrations in the country of registration. Other expenditure on internally generated goodwill and brands are recognized in the income statement when incurred. The useful life of intangible assets other than acquired brands and key money is considered to be finite. Amortization begins when the intangible asset is available using the straight-line method. The useful life of intangible assets with a finite life is generally estimated at three to five years. Other intangible assets include acquired distribution rights and similar rights, which are amortized over a period of five years. The rules of IAS38 are met at the moment of activation of other intangible assets.

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4. Intangible assets

000 euro	Total	Brands with finite useful life	Brands with indefinite useful life	Distribution rights and similar rights	Software	Key money
Intangible assets, gross						
At 01/01/2018	42,165	3,948	25,518	3,734	8,648	317
Investments	10,596	208	0	0	10,388	0
Disposals	0	0	0	0	0	0
Other adjustments	0	0	0	0	0	0
Exchange adjustments	0	0	0	0	0	0
At 31/12/2018	52,761	4,156	25,518	3,734	19,036	317
Amortization and impairment						
At 01/01/2018	28,257	3,662	13,315	3,676	7,411	193
Amortization	797	189	0	58	526	24
Impairment	600	0	0	0	600	0
Disposals	0	0	0	0	0	0
Exchange adjustments	-6	-3	0	0	-3	0
At 31/12/2018	29,648	3,848	13,315	3,734	8,534	217
Intangible assets, net 31/12/2018	23,113	308	12,203	0	10,502	100
Intangible assets, gross						
At 01/01/2019	52,761	4,156	25,518	3,734	19,036	317
Investments	1,168	333	0	0	835	0
Disposals	0	0	0	0	0	0
Other adjustments	3,252	0	0	0	3,252	0
Exchange adjustments	27	27	0	0	0	0
At 31/12/2019	57,208	4,516	25,518	3,374	23,123	317
Amortization and impairment						
At 01/01/2019	29,648	3,848	13,315	3,734	8,534	217
Amortization	3,620	617	0	0	2,988	15
Impairment	0	0	0	0	0	0
Disposals	0	0	0	0	0	0
Exchange adjustments	0	0	0	0	0	0
At 31/12/2019	33,268	4,465	13,315	3,734	11,522	232
Intangible assets, net 31/12/2019	23,940	51	12,203	0	11,601	85

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The investment in software in 2019 concerns the upgrade of our ERP system to a more recent version. At the same time, we also took this opportunity to standardize and optimize our processes. A new digital B2B platform was also developed and successfully launched.

Safilo Group, Personal Goods, Italy, Year-end: 31 December 2019

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Software

All software licenses purchased are capitalized on the basis of the costs incurred for their acquisition and in bringing them to their current condition. Amortization is calculated on a straight-line basis over their estimated useful lifetime (from 3 to 5 years).

The costs associated with the development and maintenance of software programs are posted to the income statement of the period in which they were incurred. The costs directly associated with the production of unique and identifiable software products controlled by the Group are recorded as intangible fixed assets on the balance sheet only if the following conditions are respected: the costs can be reliably calculated, the Group has the technical and financial resources to complete the products and intends to conclude such activities, the technical feasibility of the products is guaranteed and the use of the products will generate probable future economic benefits for more than one year. Direct costs include costs relating to employees developing the software as well as any appropriate share of general costs.

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4.7 Intangible assets

The following table shows changes in intangible assets:

(thousands of Euro)	Balance at January 1, 2019	Increase	Decrease	Reclass.	Changes in the scope of consoli-dation	Transl. diff.	Balance at December 31, 2019
Gross value							
Software	81,884	146	(2,439)	10,299	(2,659)	260	87,490
Trademarks and licenses	56,117	-	-	209	(478)	22	55,870
Other intangible assets	7,413	35	(3,627)	665	-	73	4,558
Intangible assets in progress	5,504	8,397	(64)	(11,173)	-	(12)	2,652
Total	**150,917**	**8,578**	**(6,131)**	**-**	**(3,137)**	**343**	**150,570**
Accumulated depreciation							
Software	58,309	14,226	(2,439)	-	(1,857)	223	68,462
Trademarks and licenses	29,253	2,364	-	-	(478)	22	31,161
Other intangible assets	4,869	662	(3,627)	-	-	66	1,970
Total	**92,431**	**17,253**	**(6,066)**	**-**	**(2,335)**	**311**	**101,394**
Net value	**58,486**	**(8,675)**	**(64)**	**-**	**(803)**	**32**	**48,976**

(thousands of Euro)	Balance at January 1, 2018	Increase	Decrease	Reclass.	Transl. diff.	Balance at December 31, 2018
Gross value						
Software	74,430	280	(144)	6,861	457	81,884
Trademarks and licenses	55,558	-	(6)	552	13	56,117
Other intangible assets	6,817	19	-	496	80	7,413
Intangible assets in progress	5,910	7,584	(7)	(7,909)	(73)	5,504
Total	**142,714**	**7,883**	**(158)**	**-**	**477**	**150,917**
Accumulated amortization						
Software	46,961	11,100	(144)	2	390	58,309
Trademarks and licenses	26,928	2,320	(6)	(2)	13	29,253
Other intangible assets	4,257	525	-	-	88	4,869
Total	**78,146**	**13,944**	**(150)**	**-**	**491**	**92,431**
Net value	**64,569**	**(6,061)**	**(8)**	**-**	**(14)**	**58,486**

Investments in intangible fixed assets made during the year amount to 8,578 thousand Euro (7,883 thousand Euro in the previous year). The increase in investments reported under "construction in progress" is mainly due to the continuing investments to implement the new integrated information system (ERP) of the Group.

The reclassification from intangible assets in progress to software is mainly referred to the portion of investments related to the modules of the new integrated information system (ERP) that have been completed and went live during the year.

The decrease of the items "Software" and "Other intangible assets" respectively for 2,439 thousand Euro and 3,627 thousand Euro in both the gross and the accumulated depreciation value, is related to the accounting offset and write-off of assets already fully depreciated and no longer in use booked mainly in the Italian and US companies.

The balance of "Changes in the scope of consolidation" is related to the discontinued Retail business disposed in July 2019 (for more details see the note 5.9).

doValue, Investment Banking and Broker, Italy, Year-end: 31 December 2019

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Effects of first-time adoption of IFRS 16 - Leases

Additionally, on the basis of the IFRS 16 standard requirements and the clarifications of the IFRIC ("Cloud Computing Arrangements" document September 2018), software is not included in the range of application of IFRS 16; software is therefore accounted for by following the standard IAS 38 and related requirements.

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NOTE 1 - INTANGIBLE ASSETS

(€/000)

	Software	Brands	Assets under development and payments on account	Other intangible assets	Goodwill	Total
Gross opening balances	**16,284**	**76**	**1,335**	**412**	-	**18,106**
Initial reduction in value	(10,919)	(9)	-	(332)	-	(11,260)
Net opening balances	**5,365**	**67**	**1,335**	**80**	-	**6,847**
Initial adjustments	*1*	-	-	*(1)*	-	-
Increases	**20,098**	**40,075**	**958**	**167,582**	**137,969**	**366,680**
Purchases	4,632	8	1,975	313	-	6,928
Business combination	14,457	40,067	-	167,269	137,969	359,762
Others changes	1,009	-	(1,017)	-	-	(8)
Decreases	**(6,923)**	**(1,783)**	-	**(23,944)**	-	**(32,650)**
Amortisation	(6,923)	(1,783)	-	(23,944)	-	(32,650)
GROSS CLOSING BALANCES	**36,383**	**40,151**	**2,293**	**167,993**	**137,969**	**384,789**
Final reduction in value	(17,842)	(1,792)	-	(24,276)	-	(43,910)
NET CLOSING BALANCES	**18,541**	**38,359**	**2,293**	**143,717**	**137,969**	**340,879**

With the acquisition of Altamira Asset Management, the value of intangible assets increased substantially, from €6.8 million to €340.9 million.
The value that could be allocated to the following intangible assets was established when making the provisional calculation of the Purchase Price Allocation (PPA):

- €14.5 million for software
- €40.1 million for the Altamira brand
- €167.3 million for the other intangible assets, with €157.9 million of this relating to the measurement of the long-term servicing contracts with big banks and companies, including the Santander bank and the real estate company Sareb, and €9.3 million relating to the backlog & database component.

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Administrative expenses increased by +54% compared with the previous period, while, excluding Altamira, the increase in costs amounted to 11% due mainly to the increase in the one-off external consulting costs connected with the acquisition of Altamira and IT costs to develop software applications.

Brewin Dolphin, Investment Banking and Broker, UK, Year-end: 31 September 2019

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Investments in technology

Last year we indicated that we would begin to make significant investments in our technology infrastructure, including the replacement of our core custody and settlement system, and our client management system. That development is now well under way and will provide a platform to support our future growth.

Our new client management system, Client Engage, will be delivered in Spring 2020. This has been a complex project which has required considerable investment over the last two years. The new platform will enable our advisers to become more effective and efficient in their handling of client relationships and client information.

In April 2019, we announced that we had appointed Avaloq to replace our core custody and settlement system. Avaloq is a pre-eminent provider of core software and digital technology to banks and wealth managers. Its robust and scalable software is used by over 150 wealth managers and banks globally. We expect the system to go live towards the end of 2020.

These two systems are key components of the strategic investment the Group is making to develop its services and client proposition. They will enable us to enhance the experience we provide for our clients and our own people and improve the efficiency of our business.

As part of these large programmes we have put in place governance to monitor and manage the delivery. This also ensures best practice procedures are used from top to bottom, with full control over risk management and spending.

During the year we made improvements to our MyBrewin client portal, with the release of MyBrewin apps for phones and tablets, enhancing our clients' experience. We recognise that people increasingly want to use a range of communication channels for different aspects of their relationship with us. Our clients see technology and a physical office network as complementary parts of an integrated client experience.

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The Group has incurred £16.7 million of capital expenditure in 2019, significantly higher than the £8.3 million in 2018. This is in line with the strategy to invest in growth initiatives, infrastructure and client facing systems. Included within capital expenditure are £4.0 million of costs for 8 Waterloo Place and the increased office network in the south of England. The replacement of our core custody and settlement system is on track and making good progress. We expect to invest a further £30.0 million in 2020 on this infrastructure upgrade. Two-thirds of this is expected be in the custody and settlement system, in addition to the £5.6 million in the current year, and is expected to be capitalised as a software intangible asset on the balance sheet. The remainder will be in both property and the client management system.

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Computer software

Computer software which is not an integral part of the related hardware is classified as an intangible asset. Costs of acquiring and developing computer software are treated as an intangible asset and amortised over three to ten years, dependent upon the assessment of the expected useful life of the software, on a straight-line basis from the date the software is operating as management intended.

The assessment of the expected useful life of computer software is performed annually and based on the contractual terms or where appropriate past experience of the life of similar assets, with the effect of any changes in estimates being accounted for on a prospective basis.

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13. Intangible assets

Group

	Goodwill £'000	Client relationships £'000	Brand £'000	Software costs £'000	Total £'000
Cost					
At 30 September 2017	48,637	133,613	–	19,085	201,335
Additions	–	325	–	1,076	1,401
Exchange differences	–	3	–	–	3
Disposals	–	–	–	(968)	(968)
At 30 September 2018	48,637	133,941	–	19,193	201,771
Additions	**4,096**	**22,716**	**1,388**	**11,290**	**39,490**
Exchange differences	**–**	**(1)**	**–**	**–**	**(1)**
At 30 September 2019	**52,733**	**156,656**	**1,388**	**30,483**	**241,260**
Accumulated amortisation and impairment losses					
At 30 September 2017	–	91,757	–	13,787	105,544
Amortisation charge for the year	–	7,619	–	3,855	11,474
Exchange differences	–	2	–	–	2
Disposals	–	–	–	(968)	(968)
At 30 September 2018	–	99,378	–	16,674	116,052
Amortisation charge for the year	**–**	**6,789**	**69**	**1,105**	**7,963**
Exchange differences	**–**	**(1)**	**–**	**–**	**(1)**
At 30 September 2019	**–**	**106,166**	**69**	**17,779**	**124,014**
Net book value					
At 30 September 2019	**52,733**	**50,490**	**1,319**	**12,704**	**117,246**
At 30 September 2018	48,637	34,563	–	2,519	85,719
At 30 September 2017	48,637	41,856	–	5,298	95,791

McMillan Shakespeare Limited, Investment Banking and Broker, Australia, Year-end: 30 June 2019

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6 Intangible Assets

(a) Carrying values	Consolidated Group 2019 $'000	2018 $'000
Goodwill		
Cost	197,748	197,616
Impairment loss	(60,321)	(42,336)
Net carrying value	137,427	155,280
Brands		
Brands at cost - indefinite life	22,443	22,443
Impairment loss and disposal	(13,171)	(13,171)
Net carrying value of brands with an indefinite life	9,272	9,272
Brands at cost - finite life	6,598	6,598
Impairment loss and disposal	(5,720)	(4,319)
Net carrying value	10,150	11,551
Dealer relationships		
Cost	28,602	28,566
Accumulated amortisation	(12,216)	(9,640)
Impairment loss and disposal	(5,298)	(5,029)
Net carrying value	11,088	13,897
Software development costs		
Cost [1]	60,673	47,994
Accumulated amortisation and disposal	(30,286)	(25,852)
Net carrying value	30,387	22,142
Contract rights		
Cost	13,070	13,070
Accumulated amortisation	(13,070)	(12,985)
Net carrying value	-	85
Customer list and relationships		
Cost	6,657	6,634
Accumulated amortisation	(4,381)	(3,650)
Net carrying value	2,276	2,984
Total Intangibles	**191,328**	**205,939**

1 Software includes capitalised internal costs.

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Intangible assets in software development costs and contract costs, which are not acquired from business combination, are initially measured at cost and subsequently remeasured at cost less amortisation and impairment.

(iii) Capitalised software development costs

Software development costs are capitalised when it is probable that future economic benefits attributable to the software will flow to the entity through revenue generation and / or cost reduction. Development costs include external direct costs for services, materials and licences and internal labour related costs directly involved in the development of the software. Capitalised software development costs are amortised from the date of commissioning on a straight line basis over three to five years, during which the benefits are expected to be realised.

(c) Reconciliation of written down values

Consolidated Group 2019	Goodwill $'000	Brands $'000	Dealer relationships $'000	Customer lists and relationships $'000	Software development costs $'000	Contract rights $'000	Total $'000
Net book amount							
Balance beginning of year	155,280	11,551	13,897	2,984	22,142	85	205,939
Additions	-	-	-	-	15,197	-	15,197
Transfer to Property, Plant and Equipment	-	-	-	-	(518)	-	(518)
Impairment[1]	(17,985)	-	(269)	-	-	-	(18,254)
Amortisation	-	(1,401)	(2,705)	(725)	(6,434)	(85)	(11,350)
Changes in foreign currency	132	-	165	17	-	-	314
Closing balance	137,427	10,150	11,088	2,276	30,387	-	191,328

1 Impairment of intangible assets relate to RFS Retail

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Key audit matter

Impairment of goodwill and intangible asset balance (Note 6)

At 30 June 2019 the Group has $137,427,000 of goodwill and $23,514,000 in other intangible assets contained within separate cash generating units (CGUs).

During the year the group recognised an impairment against goodwill and other intangible assets totalling $18,254,000 relating to the Retail Financial Services Retail business CGU.

Management is required to perform an impairment test on goodwill, other infinite life intangibles, and capitalised software development costs at least annually, and is also required to perform an impairment test on other intangible assets with finite lives if indicators of impairment are identified.

We consider this a key audit matter due to the nature of the balances and the judgments required in preparing the value-in-use models and due to the judgement in determining CGUs, impairment indicators and triggers. This involves consideration of the future results of the business, growth and the discount rates applied.

Amadeus Fire, Industrial Support Services, Germany, Year-end: 31 December 2019

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Investments of EUR 4.2m in the reporting year were up in comparison to the prior year (EUR 2.7m). After partial implementation in prior years, a new sales software program was fully rolled out in the personnel services segment at all branches and at a corporate level in the fiscal year. At year-end, Amadeus FiRe exercised the option of acquiring the full application.

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Software is amortized on a straight-line basis over useful lives of 3 to 10 years.

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Non-current assets

14. Intangible assets

Amounts stated in EUR k	31.12.2019	31.12.2018
Software under development	805	2,893
Software	6,914	1,707
Goodwill	171,706	6,935
Other intangible assets	33,701	0
	213,126	11,535

Goodwill of EUR 171,706k (prior year: EUR 6,935k) mainly relates to the acquisition of the Comcave Group (EUR 164,771k) in fiscal year 2019. Effective 19 December 2019, Amadeus FiRe AG acquired all of the shares in Comcave Holding GmbH. In the preliminary purchase price allocation, purchased intangible assets were identified as of 31 December 2019. These include trademark rights, the order book, technologies, certifications and an instructor pool. These intangible assets were separable from goodwill and were recognized as assets as they meet the recognition criteria for intangible assets in IAS 38. After deducting deferred tax liabilities on fair value step-ups, the remaining difference compared to the purchase price was recognized as goodwill. The following intangible assets were acquired as of 19 December 2019:

Amounts stated in EUR k	19 December 2019
Intangible assets at fair value	**34,450**
thereof trademark rights (Comcave brand) revalued in the purchase price allocation	19,030
thereof order book revalued in the purchase price allocation	7,647
thereof technologies (GECS "live" and "in development") revalued in the purchase price allocation	5,471
thereof certifications revalued in the purchase price allocation	1,480
thereof instructor pool revalued in the purchase price allocation	822
Goodwill	**164,771**

The purchased trademark rights (EUR 19,030k) relate to the right to use the "COMCAVE" brand, which has a useful life of 10 years.

No impairment losses had to be recognized as of 31 December 2019 as a result of the impairment testing of the purchased trademark rights and goodwill.

The recognized order book (EUR 7,647k) will be amortized over a period of two years.

Purchased technologies (EUR 5,471k) relate to Comcave's proprietary Global Educational Collaboration System (GECS) required for its customer business. GECS allows for the digitalization of Comcave's complete value chain.

Identified GECS technology has a useful life of seven years.

Other intangible assets revalued in the purchase price allocation include certifications (EUR 1,480k) and Comcave's instructor pool (EUR 822k).

The Comcave Group had to acquire education provider certification to be able to offer publicly funded occupational retraining, advanced vocational training and skills development training. In accordance with the applicable AZAV ["Akkreditierungs- und Zulassungsverordnung Arbeitsförderung": German Accreditation and Licensing Ordinance for the Promotion of Employment], a competent government agency issues an education provider certification, which is valid for three years, if the relevant requirements are met.

While the instructor pool was assigned a useful life of four years, certifications are amortized over two years based on their date of issue and their total useful life.

Software under development of EUR 805k (prior year: EUR 2,893k) mainly includes payments for the acquisition of the software.

Internally generated intangible assets of EUR 570k (prior year: EUR 0k) were recognized in the fiscal year. Amortization of software of EUR 825k (prior year: EUR 500k) is recognized in cost of sales, selling and administrative expenses.

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16. Consolidated statement of changes in non-current assets for fiscal year 2019

Amounts stated in EUR k	Cost					
	01.01.2019	Acquisition of subsidiaries	Additions	Disposals	Reclassifications	31.12.2019
Intangible assets						
Software	6,735	803	451	346	5,046	12,689
Software under development	2,893	326	2,568	0	-4,982	805
Goodwill	14,254	164,771	0	0	0	179,025
Other intangible assets	0	33,701	0	0	0	33,701
	23,882	**199,601**	**3,019**	**346**	**64**	**226,220**

Amounts stated in EUR k	Accumulated amortization, depreciation and impairment				Carrying amounts	
	01.01.2019	Additions	Disposals	31.12.2019	31.12.2019	31.12.2018
Intangible assets						
Software	5,027	825	77	5,775	6,914	1,708
Software under development	0	0	0	0	805	2,893
Goodwill	7,319	0	0	7,319	171,706	6,935
Other intangible assets	0	0	0	0	33,701	0
	12,346	**825**	**77**	**13,094**	**213,126**	**11,536**

Workforce Holdings, Industrial Support Services, South Africa, Year-end: 31 December 2019

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3.10 Intangible assets

Intangible assets acquired separately

Intangible assets are initially measured at cost. Intangible assets acquired separately are reported at cost less accumulated amortisation and accumulated impairment losses. Amortisation is charged on a straight-line basis over their estimated useful lives. The estimated useful life and amortisation method are reviewed at the end of each annual reporting period, with the effect of any changes in estimate being accounted for on a prospective basis.

Internally-generated computer software – research and development expenditure

Expenditure on research activities is recognised as an expense in the period in which it is incurred.

Internally-generated computer software arising from development (or from the development phase of an internal project) is recognised if, and only if, all of the following have been demonstrated:

- The technical feasibility of completing the computer software so that it will be available for use or sale;
- the intention to complete the computer software and use or sell it;
- the ability to use or sell the computer software;
- how the computer software will generate probable future economic benefits;
- the availability of adequate technical, financial and other resources to complete the development and to use or sell the computer software; and
- the ability to measure reliably the expenditure attributable to the computer software during its development.

The amount initially recognised for internally-generated computer software is the sum of the expenditure incurred from the date when the intangible asset first meets the recognition criteria listed above. Where no internally-generated intangible asset can be recognised, development expenditure is charged to profit or loss in the period in which it is incurred. Subsequent to initial recognition, internally-generated computer software is reported at cost less accumulated amortisation and accumulated impairment losses, on the same basis as intangible assets acquired separately.

The following useful lives are used in the calculation of amortisation:

	Years
Computer software	2 to 5
Client relationships	3
Brand names	3
Training course accreditation	3

Intangible assets with a finite life are assumed to have a residual value of nil.

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Internally developed software

Significant judgement is required in determining the development phase of internally developed computer software. Development costs are recognised as an asset when all the criteria are met, whereas any other expenses not directly related to the development, are expensed as incurred. In determining the development phase, it is the group's accounting policy to also require a detailed forecast of cost savings expected to be generated by the intangible asset. The forecast is incorporated into the group's overall budget forecast as the capitalisation of development costs commences. This ensures that managerial accounting, impairment testing procedures and accounting for internally-generated intangible assets is based on the same data. The group's management also monitors whether the recognition requirements for development costs continue to be met. This is necessary as the economic success of any product development is uncertain and may be subject to future technical problems after recognition. Details of intangible assets are provided in note 4 of the notes to the group annual financial statements.

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4. Intangible assets

	2019 Cost R'000	2019 Accumulated Amortisation R'000	2019 Carrying value R'000	2018 Cost R'000	2018 Accumulated Amortisation R'000	2018 Carrying value R'000	2017 Cost R'000	2017 Accumulated Amortisation R'000	2017 Carrying value R'000
Brands	**119**	**(5)**	**114**	82	(6)	76	3 209	(3 209)	–
Client relationships	**42 194**	**(36 465)**	**5 729**	42 194	(27 842)	14 352	31 522	(15 260)	16 262
Computer software	**99 487**	**(45 140)**	**54 347**	74 733	(45 096)	29 664	62 146	(45 081)	17 065
Training course accreditations	**20 620**	**(6 530)**	**14 090**	20 620	(2 406)	18 214	–	–	–
Development costs	**22**	**–**	**22**	11 822	–	11 822	10 920	–	10 920
	162 441	**(88 140)**	**74 302**	149 451	(75 323)	74 128	107 797	(63 550)	44 247

The carrying amounts of intangible assets can be reconciled as follows:

	Brands R'000	Client relationships R'000	Computer software R'000	Training course accreditations R'000	Development costs R'000	Total R'000
Carrying value at 1 January 2017	756	14 067	15 755	–	8 552	39 130
Additions	–	–	1 677	–	2 368	4 045
Disposals	–	–	(39)	–	–	(39)
Acquired through business combinations	–	12 012	2 761	–	–	14 773
Additions from internal development	–	–	3 600	–	–	3 600
Amortisation	(756)	(9 817)	(6 689)	–	–	(17 262)
Carrying value at 1 January 2018	–	16 262	17 065	–	10 920	44 247
Additions	82	–	1 355	–	12 233	13 670
Disposals	–	–	–	–	–	–
Acquired through business combinations	–	10 672	3	20 620	–	31 295
Additions from internal development	–	–	11 331	–	(11 331)	–
Amortisation	(6)	(12 582)	(90)	(2 406)	–	(15 084)

Intangible assets *(continued)*

	Brands R'000	Client relationships R'000	Computer software R'000	Training course accreditations R'000	Development costs R'000	Total R'000
Carrying value at 31 December 2018	76	14 352	29 664	18 214	11 822	74 128
Additions	75	–	13 436	–	(122)	13 388
Disposal at carrying value	–	–	–	–	–	–
Additions from internal development	–	–	11 678	–	(11 678)	–
Amortisation	(37)	(8 623)	(431)	(4 124)	–	(13 215)
Carrying value at 31 December 2019	**114**	**5 729**	**54 347**	**14 090**	**22**	**74 302**

The above amortisation expense is included in "Depreciation and amortisation of intangible assets" in the statement of comprehensive income. No intangible assets have been impaired during the year (2018: Nil). Computer software is mostly internally generated. The value of research and development expenditure recognised as an expense during the period was R378 221 (2018: R200 761).

The group has no further contractual commitments to acquire intangible assets at reporting date. No restrictions exist over intangible assets.

Downer Edi, Construction & Materials, Australia, Year-end: 30 June 2019

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Intangible assets increased by $80.0 million arising from $128.4 million additional goodwill and other acquired intangible assets recognised from acquisitions made during the period and $45.3 million additional investment in software; offset by $100.0 million amortisation mainly related to Spotless' acquired intangible assets.

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C6. Intangible assets

2019 $'m	Goodwill	Customer contracts and relationships	Brand names on acquisition	Intellectual property on acquisition	Software and system development	Total
Carrying amount as at 1 July 2018	2,351.5	381.1	74.7	2.2	241.2	3,050.7
Additions	–	–	–	–	45.3	45.3
Disposals at net book value	–	–	–	–	(0.3)	(0.3)
Acquisition of businesses(i)	98.2	30.2	–	–	–	128.4
Reclassifications at net book value(ii)	–	–	–	–	0.8	0.8
Amortisation expense	–	(66.3)	(3.9)	(0.2)	(29.6)	(100.0)
Net foreign currency exchange differences at net book value	4.8	–	0.5	–	0.5	5.8
Closing net book value as at 30 June 2019	2,454.5	345.0	71.3	2.0	257.9	3,130.7
Cost	2,606.9	494.1	79.4	2.4	419.3	3,602.1
Accumulated amortisation and impairment	(152.4)	(149.1)	(8.1)	(0.4)	(161.4)	(471.4)
2018						
Carrying amount as at 1 July 2017 (restated)(iii)	2,341.1	409.1	56.9	3.5	220.6	3,031.2
Additions	–	–	–	–	46.4	46.4
Disposals at net book value	–	–	–	–	(0.2)	(0.2)
Acquisition of businesses	105.0	34.5	21.7	(1.1)	–	160.1
Disposal of business at net book value	(14.2)	–	–	–	–	(14.2)
Reclassifications at net book value(ii)	–	–	–	–	0.3	0.3
Amortisation expense	–	(62.6)	(3.9)	(0.2)	(25.2)	(91.9)
Impairment of goodwill	(76.4)	–	–	–	–	(76.4)
Net foreign currency exchange differences at net book value	(4.0)	0.1	–	–	(0.7)	(4.6)
Closing net book value as at 30 June 2018	2,351.5	381.1	74.7	2.2	241.2	3,050.7
Cost	2,503.9	463.8	78.7	2.4	394.9	3,443.7
Accumulated amortisation and impairment	(152.4)	(82.7)	(4.0)	(0.2)	(153.7)	(393.0)

(i) The values recognised are based on the fair value of assets acquired from the business acquisitions made during the year ended 30 June 2019, for which the accounting on certain transactions remains provisional. Refer to Note F2.
(ii) Refers to the reclassification of software from Capital work in progress to Intangible assets.
(iii) June 2017 balances were restated to reflect the impact of acquisition accounting adjustments made during the previous period on opening balances.

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Intellectual property, software and system development

Intangible assets acquired by the Group, including intellectual property (purchased patents, trademarks and licences) and software are initially recognised at cost, and subsequently measured at cost less accumulated amortisation and any impairment losses. Internally developed systems are capitalised once the project is assessed to be feasible. The costs capitalised include consulting, licensing and direct labour costs. Costs incurred in determining project feasibility are expensed as incurred.

Amortisation

Intangible assets with finite useful lives are amortised on a straight-line basis over their useful lives. The estimated useful lives are generally:

Item	Useful Life
Software and system development	5-15 years
Brand names	20 years
Customer contracts and relationships	1-20 years
Intellectual property acquired	15-20 years
Other intangible assets (other than indefinite useful life intangible assets)	20 years

The estimated useful life and amortisation method are reviewed at the end of each annual reporting period.

Arcadis, Construction & Materials, Netherlands, Year-end: 31 December 2019

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13 Intangible assets and goodwill

Software

Software is measured at cost less accumulated amortization and impairment losses. Software has a finite life and is amortized on a straight-line basis over the estimated useful life. The amortization methods and useful lives, as well as residual values, are reassessed annually. Subsequent costs are recognized in the carrying amount of Software only when it increases the future economic benefits. All other expenditures are recognized in profit or loss as incurred.

Estimated useful lives

The estimated useful lives of Goodwill and Intangible assets varies according to their respective categories, as shown below.

Category	Years
Goodwill	Not amortized
Software	0.5 – 10
Other intangible assets	3 – 10
Intangibles under development	Not amortized (yet)

In € thousands	Goodwill	Other intangible assets	Software	Intangibles under development	Total
Cost	914,748	268,269	79,517	45,139	1,307,672
Accumulated amortization	–	(197,937)	(55,490)	–	(253,427)
At 1 January 2019	**914,748**	**70,332**	**24,026**	**45,139**	**1,054,245**
Additions	–	311	2,497	10,995	13,803
Acquisitions of subsidiaries	695	39	1,859	–	2,593
Disposals	–	–	(489)	(513)	(1,002)
Amortization charges	–	(16,609)	(12,922)	–	(29,531)
Impairment charges	–	–	–	–	–
Reclassifications	–	–	28,581	(24,575)	4,006
Exchange rate differences	33,025	2,293	360	(1)	35,677
Movement 2019	**33,720**	**(13,966)**	**19,886**	**(14,094)**	**25,547**
Cost	948,468	270,911	112,325	31,046	1,362,750
Accumulated amortization	–	(214,546)	(68,411)	–	(282,957)
At 31 December 2019	**948,468**	**56,366**	**43,914**	**31,045**	**1,079,793**
Additions	–	–	5,095	9,207	14,302
Acquisitions of subsidiaries	7,894	1,655	(65)	–	9,484
Disposals	–	–	(183)	(813)	(996)
Amortization charges	–	(21,889)	(19,775)	–	(41,664)
Impairment charges	(118,881)	–	–	–	(118,881)
Reclassifications	–	95	9,214	(6,210)	3,099
Exchange rate differences	(55,865)	(2,017)	(764)	(43)	(58,689)
Movement 2020	**(166,852)**	**(22,156)**	**(6,478)**	**2,141**	**(193,345)**
Cost	781,616	270,645	125,623	33,186	1,211,070
Accumulated amortization	–	(236,435)	(88,187)	–	(324,622)
At 31 December 2020	**781,616**	**34,210**	**37,436**	**33,186**	**886,448**

Software and Intangibles under development

Investments in Software mainly relate to the implementation of harmonized systems, which is part of the implementation of the Arcadis Way. An amount of €14.3 million was invested in Software and Intangibles under development in 2020 (2019: €13.5 million). The Intangibles under development of €33.2 million are related to the development of software not yet in use and are not yet amortized (2019: €31.0 million).

Attica Bank, Banks, Greece, Year-end: 31 December 2019

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3.6. Informatics Committee

The Informatics Committee is the official body of the Bank whose purpose is to determine, prioritize, evalu- ate, approve the implementation of IT projects, supervise them based on the Bank's strategy and objectives, central coordination of the execution of IT projects, as well as and the supervision of the smooth and efficient operation of the Bank's infrastructure and systems and the management of the operational risk arising from the information systems. In addition, in the context of its responsibilities regarding approval, it is responsible for approving the costs relating to implementing IT projects or forwarding them to a higher approval level.

During 2019, 3 meetings were held in which the following issues were examined:

- Services of protection of the Bank's Information Systems from DDos (denial of service) type attacks.
- Supply of HID SMS adapter software development services, for the needs of PSD2.
- Presentation of BIA (Business Impact Analysis) in the framework of the IT Risk Assessment project.
- Supply of software development services in the context of the implementation of the new N. 4605/2019 (protection of the 1st house).
- Supply of services for the integration into e-banking of the new transaction authentication functionality, according to the requirements of the framework of the revised Directive 2015/2366 / EU (PSD2).
- Software supply (TEMENOS software module) for T24, which covers new SWIFT requirements.
- Procurement of a system of "automation of tasks" performed in the computer center of the Bank (Data Center Job Automation).
- Digital Services Division Support Project in the design and development of digital systems.
- Compliance project with the regulatory framework L.924 / 2009, regarding the harmonized imposition of a fee on ATM withdrawals with foreign issuance cards (International Access Fee).
- 3DS Issuing and Contactless POS Acquiring compliance projects with the new PSD2 configuration framework.
- Operation of Informatics and Organization Units and Digital Services on a project basis.
- Integration of all Informatics, Organization and Digital Services projects in Master plan with uniform prioritization and allocation of resources by the Informatics Committee.
- Services of protection of the Bank's Information Systems from DDos (denial of service) type attacks.
- Supply of HID SMS adapter software development services, for the needs of PSD2.
- Supply of services for the integration into e-banking of the new transaction authentication functionality, according to the requirements of the framework of the revised Directive 2015/2366 / EU (PSD2).
- Supply of a system of "automation of tasks" performed in the computer center of the Bank (Data Center Job Automation).
- Digital Services Division Support Project in the design and development of digital systems.
- Purchase of services for the development of a new Investment Product Guaranteed Capital & Deadline Deposit in the central banking system T24.
- Business Plan 2020-2022 of the Divisions of Informatics and Organization and Digital Services.
- 2020 Budget of the Divisions of Informatics and Organization and Digital Services.
- Control report - Evaluate the adequacy and effectiveness of the security valves of the U-Switchware application.
- Management of accounting records from a Branch network.
- Customer Account Management.
- Update on Investment Accounting and Processing Solution.
- Results of BIA working group for the ownership of information systems.
- Regular Report of Attica Bank Information Systems Security Incidents.
- Information on cooperation with TEMENOS.
- Renewal of licenses for the use of the back-up system of administration buildings.

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(2.10) Intangible Assets

"Intangible assets" include computer software. Computer software which is acquired and can be clearly identified is capitalized at the cost of acquisition. Expenses that improve or extend the performance of the software beyond the initial technical specifications are incorporated in the acquisition cost of intangible assets. The acquisition cost of intangible assets is increased by any direct cost required for its creation, development and sound operation. Such direct costs are:

- Employee fees which are directly related to the particular intangible asset and can be reliably estimated
- The fees of free lancers related to the creation and development of intangible assets
- Administration expenses that are directly related and can be reliably estimated at the stage of creating and developing the intangible assets.

Subsequently, intangible assets are carried at cost less any accumulated amortization and any impairment losses. Software is amortized over its useful life which cannot exceed 20 years. Group's management reviews the fair value of intangible assets on an annual basis so as to assess whether an indication of impairment exists or whether the useful life should be amended. In cases where the carrying value of an intangible asset exceeds its recoverable value, an impairment loss of an equal amount is charged to the income statement.

25. Intangible Assets

(Amounts in thousand €)

Software and other intangible assets	Group	Bank
Cost	85,769	84,905
Accumulated Amortization and Impairment Losses	(39,101)	(38,270)
Net Book Value as at 01.01.2018	**46,668**	**46,635**
Plus:		
Acquisitions	8,824	8,824
Less:		
Amortization charge for the year	(5,079)	(5,069)
Net book value as at 31.12.2018	**50,413**	**50,390**
Cost	94,593	93,729
Accumulated Amortization and Impairment Losses	(44,180)	(43,339)
Net book value 01.01.2019	**50,413**	**50,390**
Plus:		
Acquisitions	8,358	8,357
Less:		
Amortization charge for the year	(5,878)	(5,870)
Net book value as at 31.12.2019	**52,893**	**52,877**
Cost	102,951	102,086
Accumulated Amortization and Impairment Losses	(50,058)	(49,209)
Net book value as at 31.12.2019	**52,893**	**52,877**

Intangible assets of the Group consist mainly of software programs, which as at 31.12.2019 amounted to € 52,893 thousand compared to € 50,413 thousand as at 31.12.2018,while for the Bank, the respective amounts are € 50,390 thousand as at 31.12.2018 and € 52,877 thousand as at 31.12.2019.

BNK, Banks, Australia, Year-end: 30 June 2019

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Liquidity investments and other assets
The Group's cash and liquidity investments predominantly comprise physical cash, at call deposits, negotiable certificates of deposits, government (including semi-government) bonds, and floating rate notes. ATM bailment facilities still comprise $8.0m of liquid asset investments, and whilst reducing still provide a source of diversified revenues for the Group. The remainder of liquidity management falls under the remit of ALCO, which ensures the Groups operates within its policy settings.

Investment in the T24 platform, including an upgrade to the most recent version (R18), as well as upgrades to the aggregation business software platform LoanKit (re-launched as Infynity) ensure that the Group is best positioned to deliver on its growth aspirations. Investments into the bank's digital strategy (mainly T24) and Infynity were $1.2m (WIP balance $1.5m) and $1.3m (WIP balance $2.0m), respectively, and were capitalised according to the Group's software capitalisation policy. Expenditure included in the development of these assets include costs of the systems themselves, as well as contractor and employee costs.

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7.2 Goodwill and other intangible assets

	Consolidated		Bank	
In thousands of AUD	**2019**	**2018**	**2019**	**2018**
	$	**$**	**$**	**$**
Goodwill – at cost	19,172	-	-	-
Brandnames, trademarks and domain names	16,572	-	132	-
Software	10,646	2,070	3,274	2,070
Accumulated amortisation	(1,832)	(121)	(302)	(121)
	8,814	1,949	2,972	1,949
Broker relationships	4,075	-	-	-
Accumulated amortisation	(1,415)	-	-	-
	2,660	-	-	-
Total goodwill and other intangibles	47,218	1,949	3,104	1,949

Reconciliation of intangible assets

	Consolidated				
In thousands of AUD	**Goodwill**	**Brand names & trademarks**	**Software**	**Broker relationships**	**Total**
		$	**$**	**$**	**$**
Opening balance at 1 July 2018	-	-	1,949	-	1,949
Additions	-	132	2,606	-	2,738
Additions through acquisitions	19,172	16,440	4,738	2,988	43,338
Depreciation	-	-	(478)	(329)	(807)
Closing balance at 30 June 2019	19,172	16,572	8,814	2,660	47,218

Reconciliation of intangible assets

	Bank				
In thousands of AUD	**Goodwill**	**Brand names & trademarks**	**Software**	**Broker relationships**	**Total**
		$	**$**	**$**	**$**
Opening balance at 1 July 2018	-	-	1,949	-	1,949
Additions	-	132	1,203	-	1,335
Depreciation	-	-	(180)	-	(180)
Closing balance at 30 June 2019	-	132	2,972	-	3,104

Accounting policy - recognition and measurement

Goodwill and other intangible assets with a finite life recognised upon acquisition of subsidiaries are measured at cost less accumulated impairment losses.

Costs incurred in acquiring software and licenses that will contribute to future period financial benefits through revenue generation and/or cost reduction are capitalised to computer software. Costs capitalised include external direct costs of materials, service, consultants spent on the project and internal costs of employees directly engaged in delivering the project. For software in the course of development, amortisation commences once development is complete and the software is in use.

Other intangible assets are recognised at cost less accumulated amortisation and impairment losses.

Subsequent expenditure is recognised only when it increases the future economic benefits embodied in the specific asset to which it relates. All other expenditure, including expenditure on internally generated goodwill and brands is recognised in profit or loss.

Amortisation

Amortisation is calculated to write-off the asset less its estimated residual value using the straight-line method over their estimated useful lives, and is generally recognised in profit or loss. Goodwill is not amortised, but tested annually for impairment.

The estimate useful lives of intangible assets with a finite useful life are as follows:

- Software	3-10 years
- Broker relationships	6 years

Amortisation methods, useful lives and residual values are reviewed at each reporting date and adjusted as appropriate.

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The key audit matter

During the year, the Group acquired Finsure Holding Pty Ltd and its controlled entities through the issue of 40,750,000 of its own shares for a total consideration of $52.98million.

Acquisition accounting was considered a key audit matter due to the:

- Size of the acquisition having a pervasive impact on the financial statements including the recognition of Identified Intangible Assets (IIAs) relating to Brand names, Software and Broker relationships of $24.2million and resulting goodwill of $19.2million; and
- Significant judgement required to assess the Group's purchase price allocation (PPA) acquisition accounting to:
  - value the Identified Intangible Assets using assumptions such as royalty rates and the cost to recreate method, and discount rates used; and
  - recognise deferred tax assets relating to carry forward losses and assess their recoverability.

The Group engaged external experts to assist with these assessments.

We involved our specialists to supplement our senior audit team members in assessing this key audit matter.

PI-INTANGIBLES-SOFTWARE

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