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Abstract

Purpose – The purpose of this paper is to investigate the relationships of company characteristics to intellectual capital (IC) reporting in a mandatory management report. Based on the relevant regulation in Germany, IC components of the mandatory management report can be characterised as being partially required, partially recommended and partially voluntary.

Design/methodology/approach – A content analysis of 428 group management reports of listed German companies was conducted for required, recommended and voluntary IC reporting. To investigate the relationship of certain company characteristics to IC reporting, this study conducted a regression analysis considering company returns, size and industry.

Findings – The findings show that structural capital dominates total IC reporting in Germany. This observation is in contrast to prior literature, in which relational capital has been found to be most frequently reported. However within the sub-group of voluntary IC reporting in German companies, relational capital has the highest proportion. The regression results show that company returns show no effect on IC reporting, but size and industry group are significantly related to IC reporting.

Research limitations/implications – The findings indicate that IC reporting requirements and the relatively stringent German regulatory recommendations influence corporate IC reporting behaviour. The findings provide a basis for further discussion by standard setters regarding the extent to which requirements and recommendations on individual IC components seem to encourage IC reporting.

Originality/value – This study utilises the unique research setting in Germany with a mandated management report to distinguish between required, recommended and voluntary IC reporting.

Keywords Regulation, Recommendations, Management report, Mandatory, Requirements, Voluntary reporting

Paper type Research paper

1. Introduction

The aim of this study is to investigate the relationship between intellectual capital (IC) reporting and certain company characteristics in a mandatory management report in Germany, regulated by the German Accounting Standard GAS 15 (GASC, 2010a). This standard is part of the German reporting regulation for listed companies with limited liability and requires additional narrative information on corporate performance. The study analyses what information in GAS 15 can be characterised as IC reporting, how listed German companies report on their IC with regard to required, recommended and voluntary IC components, given certain company characteristics. In a previous German study, a working group on "Accounting and Reporting of Intangible Assets" called for

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IC reporting, particularly in management reports (Arbeitskreis Immaterielle Werte im Rechnungswesen, 2005). However, the IC reporting literature has not investigated IC reporting in Germany, in the context of management reporting regulations.

This study contributes to the IC reporting literature through the unique research setting in Germany with IC reporting requirements and recommendations. The findings of this study may provide a basis for further discussions on approaches to IC reporting guidelines and recommendations. First, the standard GAS 15 is analysed to distinguish required from recommended and voluntary IC components. Second, this study conducts a content analysis and a regression analysis of IC reporting in consolidated management reports of 428 listed German companies, a large sample in comparison with prior studies. The content analysis in this study uses software-aided coding. The characteristics of the German language facilitate software-aided coding because of the structure of German compound words. Consequently, the German context of this study contributes in two ways. The research setting facilitates an analysis of required, recommended and voluntary elements of IC reporting in a large sample. Furthermore, this study adds insights to IC reporting by listed German companies by means of a content analysis and a regression analysis by reporting types, something that has not been previously investigated.

IC is seen to support competitive advantages and represents a main proportion of company value represented in excess market values compared to book values (e.g. Hall, 1993; Brooking, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). This is partly due to the criticised diminishing informativeness of the balance sheet regarding intangible resources (Lev and Zarowin, 1999; Zéghal and Maaloul, 2011), consequently lacking meaningful information on IC. For this important form of capital, IC reporting is a central communication platform (e.g. Mouritsen *et al.*, 2001). Therefore, this study investigates whether reporting regulations can support reporting on corporate IC as a way of informing the market about the degree to which this form of capital represents an important part of company value.

This study is structured as follows. Section 2 reviews the literature on IC, summarising the international development of IC reporting guidelines and outlining country-specific issues for IC reporting in Germany. In Section 3, the German management reporting regulation is described and analysed for IC components. The research design is outlined in Section 4. Section 5 presents the results of the content analysis and the regression analysis for IC reporting by required, recommended and voluntary IC reporting. Section 6 concludes the study.

2. Literature review

2.1 Research on IC reporting

IC reporting has been the subject of research for more than 15 years, as reviewed by Dumay (2014) or Guthrie *et al.* (2012). A remarkable number of IC reporting studies exist, focusing on voluntary IC reporting in various research settings, as discussed by Beattie and Thomson (2007) or Dumay and Cai (2014). However, many exploratory studies approaching IC reporting in content analyses use relatively small samples of the largest companies listed on the respective stock exchanges (e.g. Guthrie and Petty, 2000; Brennan, 2001; Bozzolan *et al.*, 2003; Abeysekera and Guthrie, 2005; Vergauwen *et al.*, 2007; Striukova *et al.*, 2008; Li *et al.*, 2012). Larger samples may provide richer data for IC reporting investigations, as advocated by Lee and Guthrie (2010) with software-aided coding as feasible tool (Bontis, 2003; Lee and Guthrie, 2010).

In the literature, IC has been considered in three main categories: structural capital, relational capital and human capital (e.g. Beattie and Thomson, 2007; Brüggen *et al.*, 2009). One major finding of prior IC reporting literature is that relational capital is most frequently reported on, compared to structural and human capital, even across different countries (Guthrie and Petty, 2000; Vandemaele *et al.*, 2005; Vergauwen and van Alem, 2005). Guthrie *et al.* (2007) compare IC reporting in Australia and Hong Kong. Although in both countries relational capital dominates corporate IC reporting, Hong Kong companies report relatively more on human capital than Australian companies. The findings are compared across the chosen countries, but the results appear to be two separate studies describing general differences without identifying potential reasons or strong patterns, which may be country specific. Other studies that compare IC reporting across countries show similar results describing IC reporting divergence in different countries (Vergauwen and van Alem, 2005; Vandemaele *et al.*, 2005; Vergauwen *et al.*, 2007). One reason may be that country-specific settings may hamper detailed international comparisons of IC reporting.

Curado and Bontis (2007) add another perspective to IC from the knowledge-based view of the firm. They discuss dynamics of IC in the management process and further build on this idea with regard to IC reporting in Curado *et al.* (2011). One of their main conclusions is that a company's IC focus changes with its maturing progress as maturing companies establish a stock of knowledge, representing an important part of IC. Curado *et al.* (2011) argue that companies would then also report on their developed IC. Therefore, corporate IC management and reporting would evolve relative to the maturity of the company. Taking this thought further, more mature companies may enhance their IC reporting with the dynamics of IC.

2.2 IC reporting influences

Some IC reporting studies have empirically investigated the relationships between IC reporting and certain company criteria, such as company size or industry (Bozzolan *et al.*, 2003; Bukh *et al.*, 2005; Brüggen *et al.*, 2009). Brüggen *et al.* (2009) find a significant association between IC reporting and size, but this is not confirmed in other studies (Bozzolan *et al.*, 2003; Bukh *et al.*, 2005). With regards to industry, general associations of IC reporting with industry groups seem to exist. In a comparison of knowledge-intensive and traditional sectors, Bukh *et al.* (2005) and Bozzolan *et al.* (2003) find that high-tech companies report more on IC. Brüggen *et al.* (2009) confirm that the sectors IT and healthcare indicate significant positive relationships with IC reporting.

Based on Raffournier (1995), a company's profitability may influence its reporting behaviour. According to his argument, higher company returns motivate managers to report more extensively in order to convince the market of continued future profitability. This idea of profitability influence has been applied in IC reporting research. Williams (2001) attempted to investigate the relationship between IC performance and IC reporting, accounting for company returns. The results on profitability by Williams (2001) show no significant relationship. Cerbioni and Parbonetti (2007) also consider company returns as a potential influence for IC reporting in their study on corporate governance and IC reporting. They find a significant positive relationship between company returns and voluntary IC reporting, indicating that IC reporting is used to explain corporate performance to the market.

IC reporting practices may also be influenced by national legislation or guidelines to foster IC reporting, traditions and auditor conservatism, as suggested by Bukh *et al.* (2005), Vergauwen and van Alem (2005) and Guthrie *et al.* (2007). In a study on IC reporting in Australian companies, Guthrie and Petty (2000, p. 245) state that their research framework is adjusted for "items likely to be reported by Australian companies". This suggests the need to consider reporting regulations in an IC reporting study.

2.3 International projects on IC reporting

As a response to the development of the IC concept, national and international projects have been undertaken, such as the Danish approach to IC statements (DATI, 2000) and the MERITUM Project (2001) conducted by the European Commission. Between 2000 and 2009, IC guidelines have been implemented in the European Union as a whole and in national approaches in Denmark, Germany and Austria (European Commission, 2001, 2009; DATI, 2000; DMSTI, 2003; GFMEL, 2004; BMWi, 2008; Knowledge Management Austria, 2006). The aims of these IC guidelines are to increase awareness of IC, to support IC management and to encourage IC reporting. In most cases, the institutional standard setters provide guidance as to what information on IC may be relevant for internal purposes and for investors. Due to the complexity of IC, these projects have developed non-binding recommendations on IC reporting instead of passing mandatory regulations. A review of international frameworks for IC reporting by Abhayawansa (2014) also shows that guidelines rather than regulations or stringent recommendations are provided by standard setters and international institutions.

In an international context, non-mandatory guidelines have been developed in two main projects by the International Integrated Reporting Committee (IIRC, 2011, 2013) and the International Accounting Standards Board (IASB, 2010). The approach to integrated reporting by the IIRC pays particular attention to corporate reporting on other forms of capital, including IC (IIRC, 2011, 2013). The guidelines on "the capitals" have been elaborated in the 2013 version, describing "the capitals" as various forms of corporate capital contributing to value creation, including IC with human capital and relationships as separate forms of capital. Their IC reporting approach focuses on stocks and flows of capitals and their value contribution (IIRC, 2013). The IASB has also implemented IC reporting in a non-mandatory practice statement for a management commentary (IASB, 2010). Certain features of IC can further be found in guidelines on other aspects of reporting. For companies reporting under IFRS, intangible assets are recognised on the balance sheet if they fulfil certain criteria, such as being separable or arising from legal rights, as outlined in IAS 38 (IASB, 2009). Therefore, one feature of IC reporting is regulated within IAS 38 to be accounted for in the balance sheet. Additional guidelines also address aspects of voluntary IC reporting, such as the Global Reporting Initiative (GRI, 2013) on sustainable reporting and value reporting.

2.4 Country-specific issues for IC reporting in Germany

An investigation of IC reporting in Germany should consider country-specific issues. Two main issues arise: the national level of technological progress and national reporting regulations. First, different levels of technological progress and national IC have been found by Lin and Edvinsson (2011) in an international comparison. According to Lin and Edvinsson (2011, p. 4), Germany ranks above average in the level

of national IC, particularly high on "renewal capital", covering "efforts to increase its competitive strength" and "encourage future growth". Included in "renewal capital" are investments in R&D, patents, start-up companies and capacity for innovation. Hence, IC plays an important role in Germany. Second, an on-going discussion between academics and practitioners shows an appreciation of IC reporting in Germany (Arbeitskreis Immaterielle Werte im Rechnungswesen, 2005; Edvinsson and Kivikas, 2007; Alwert *et al.*, 2009). As the management report is mandatory in Germany with additional requirements by GAS 15, compared to the IASB's non-mandatory management commentary, this provides an interesting research context.

IC reporting by listed German companies has rarely been investigated. Vergauwen and van Alem (2005) looked at IC reporting in Germany but only for annual reports published in English for the accounting years 2000 and 2001. Günther and Beyer (2003) investigated disclosure on intangible resources in Germany, focusing on technological industry sectors. Since these studies were undertaken, reporting regulations have changed in Germany regarding GAS 15 (GASC, 2010a). IC reporting in a mandatory management report of publicly listed German companies has not been investigated. German companies with limited liability are required to publish a management report where reporting on additional narrative information is regulated and group management reports are additionally regulated by GAS 15 (GASC, 2010a). To analyse what information required and recommended by GAS 15 can be characterised as IC reporting, the standard is further investigated in the following section.

3. Analysis of GAS 15 for IC components

3.1 Development of the German management reporting regulation

In 1978, the European Commission passed the Fourth Council Directive on accounting regulations for European countries (European Commission, 2007). In Germany the guidance was implemented in the German Commercial Code (HGB) in 1985. Since then management reports have been required as a separate part of annual reports with additional disclosure on corporate activities and performance. The regulation applies to all listed and unlisted German companies with limited liability that are headquartered in Germany. When the EU Modernisation Directive demanded additional explanations to present a "fair review" (European Parliament, 2003, sec. 9), the German Accounting Standards Committee (GASC) developed a new standard for management reporting, GAS 15, in 2005 (GASC, 2005). The GASC advises the legislator on financial reporting issues and provides accounting standards for consolidated group reporting with guidance on how to apply reporting regulation (Fink and Keck, 2005). These standards are then passed by the Federal Ministry of Justice and are "presumed to represent German proper principles for consolidated financial reporting" (Fink and Keck, 2005, p. 138).

GAS 15 contains ideas following the concepts of IC reporting (Arbeitskreis Immaterielle Werte im Rechnungswesen, 2005), value reporting (Arbeitskreis Externe Unternehmensrechnung, 2002) and management forecasting (Knauer and Wömpener, 2011). GAS 15 was revised in 2010 in the course of the German Accounting Law Modernisation Act in 2009 (GASC, 2010a). The main objectives and principles remained unchanged in the 2010 revision but some recommendations were added to GAS 15, particularly in the appendix. In a further revision in 2013, the German standards on management reporting, GAS 15 and risk reporting, GAS 5, were combined in a new standard GAS 20 (DRSC, 2013). Table I provides an overview of the development of regulations on German management reports.

Year	Regulation development
1978	Fourth Council Directive passed by the European Commission as guidance on accounting regulation (European Commission, 2007)
1985	Following the European guidance, a mandatory management report is introduced in Germany in the German Commercial Code (HGB); Sections 264, 289, 315 HGB Regular revisions by the legislator between 1985 and 2013
2003	EU Modernisation Directive demanding amendments to the Fourth Council Directive and requiring a presentation of a "fair review" (European Parliament, 2003)
2005	To implement demanded amendments, GAS 15 is introduced in Germany with requirements and recommendations on the management report (DRSC, 2010; GASC, 2010a)
2010	Revision of GAS 15, adding recommendations on IC-related information in the German management report (GASC, 2010a)
2013	Introduction of GAS 20 combining management reporting and risk reporting (DRSC, 2013)

Note: This table shows the chronology of the development of the regulation on the German management report

Table I.
Development of the regulation on the German management report

3.2 Analysis of required and recommended IC components in GAS 15

This study analyses what information required and recommended by GAS 15 can be characterised as IC reporting. For this study, GAS 15 is investigated for IC components, following the IC concept developed in the international literature (e.g. Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997), applying the categories structural, relational and human capital. GAS 15 does not explicitly use the term IC but the concept of reporting on intangible resources is implemented, partly following the ideas of the working group "Accounting and Reporting of Intangible Assets" (Arbeitskreis Immaterielle Werte im Rechnungswesen, 2005). GAS 15 refers to IC-related information on different levels (GASC, 2010a). Different wording implies that some information on IC is required and some is recommended. Applying the IC concept developed in prior IC research to GAS 15, required IC components refer to structural and relational capital, whereas recommended IC components cover aspects of all three IC categories. Table II shows a list of IC components in GAS 15, classified as required or recommended IC reporting in this study.

Many components of IC reporting have been implemented in GAS 15 as recommendations in the main standard, with more specific recommendations in the appendix of GAS 15. Although companies are not obliged to report on recommended IC components, theoretical explanations exist for why they may choose to do so. On the one hand, legitimacy theory suggests that companies follow reporting recommendations due to a certain cultural pressure to show that they comply with social norms and values (Suchman, 1995). On the other hand, companies may try to avoid reputational risks as potential consequences of not following the recommendations provided by the regulators (Bebbington *et al.*, 2008).

The appendix of GAS 15 contains additional explanations for certain requirements, examples of non-financial key performance indicators and specific IC indicators. The recommendations mention the IC illustration suggested by the working group "Accounting and Reporting of Intangible Assets" (Arbeitskreis Immaterielle Werte im Rechnungswesen, 2005). Accordingly, GAS 15 recommends to "distinguish between human capital, customer relationships, supplier relationships, investor and capital market relationships, organisational and process advantages and business location factors" (GASC, 2010a, sec. 170). The recommendations encourage reporting on these

Panel A: required IC components identified in GAS 15	
Structural capital	Section
Organisational structure, management and control functions, internal control system	37-39
Main products, impact of product mix	37, 56
Business processes, development of new processes	37, 83
R&D	40-42
Internal control and risk management for reporting processes, internal audit	100-104
Internally generated intangible items	80
Risk management	91-92
Relational capital	
Primary sales and purchase markets, development of new sales markets	37, 59, 83
Competitive position	37, 44
Panel B: recommended IC components identified in GAS 15	
Structural capital	Section
Development of new products and services	155
Separation of functions, access rules of IT systems, dual control principle, manuals	174
R&D areas of activity and results	155
R&D cost ratio, R&D intensity, research productivity, product pipeline	156
Development of patents, licenses, franchise agreements, computer software, intellectual property rights, industrial rights	53, 146, 155, 166
Restructuring and rationalisation	46, 59
Efficiency of production	59
Capacity utilisation	59
Quality assurance, product quality	59, 146, 173
Corporate culture	146
Throughput times	173
Reject rates per product, warranty expenses	173
Relational capital	
Market share	44, 46, 173
Co-operation agreements, co-operations in R&D	46, 155
Acquisitions of businesses	46
Supply arrangements, specific suppliers and customers, supplier relationships	53, 59, 146
Customer base, portfolio	146
Customer satisfaction	146, 173
Customer retention rates, value added per customer	173
Social reputation	146
Human capital	
Qualified staff	53
Personnel expenses	59
Employee turnover	146, 173
Employees' length of service	146
Remuneration system	146, 173
Vocational training	146
Professional development, employee training	146, 173
Internal incentive measures	146
Employees working in R&D	155

Note: These tables show IC information required (Panel A) and recommended (Panel B) in the German regulation for group management reports GAS 15 (GASC, 2010a)

Table II.
Required and recommended IC components in GAS 15

aspects of IC information. As the categorisation by the German working group diverges from the widely-used approach in the IC literature, this study uses the widely used categorisation as structural, relational and human capital to make IC reporting in Germany more approachable from an international research perspective.

4. Research design

4.1 Sample

Group management reports of 428 companies headquartered in Germany and listed on the German stock exchange on 30 December 2010 are investigated. Due to the revision of GAS 15 in 2010, management reports for the accounting year 2010 are of interest for this study, as additional recommendations may have renewed corporate awareness for IC reporting. However, as the changes in the major objectives and main principles in the 2010 revision are negligible, they are not considered to cause reporting bias due to regulatory changes for IC reporting in the first year after the revision.

Prior literature suggests that IC reporting may be more important in some industries (Bozzolan *et al.*, 2003; Bukh *et al.*, 2005; Brüggen *et al.*, 2009). However, industry classifications differ across previous studies of IC reporting. For this study, the companies are grouped into four industries based on the overall corporate sector according to the Datastream item "Industry Classification Benchmark (ICB)": consumer, finance, pharmaceutical and technology and industrial.

4.2 Content analysis

The underlying concept of content analysis is to draw inferences from narratives by coding text units (Krippendorff, 2004; Weber, 1985). This study counts IC references with repetitions because an approach where the same score is achieved, whether a component is mentioned only once or several times, may be too simplistic, as criticised by Beattie and Thomson (2007). The IC reporting scores are a sum of occurring words that refer to IC, scaled by the number of pages of the management reports to account for reporting length. As a robustness test, the IC reporting scores were also scaled by total words. The IC scores scaled by total words give very similar results and are therefore not replicated here.

To develop an unbiased research framework considering country and language characteristics for the German setting, a pilot study was applied. The pilot study manually looked at ten management reports, selected from different industries and sizes out of the total sample, to cover a wide range of potential IC references in different corporate settings. The ten pilot management reports were scrutinised for an extensive list of IC items applied in prior studies, based on a synopsis of 22 prior IC research frameworks by Goebel (2015). Further IC-related items occurred in the pilot management reports and were included in the research framework. The pilot study findings are arranged in a research framework by IC categories for required and recommended based on the analysis of GAS 15. The remaining components are classified as voluntary reporting. Table III shows the research framework applied in the content analysis of this study.

The narratives are analysed in German as the original language version because all companies in the sample are required to publish their management reports in German. Distinctive features of the German language are compound words where several nouns can be linked together to a single term. For example, the word "training" on its own cannot be allocated to a particular IC category with certainty. "Training" may refer to "software training" as structural capital, "customer training" as relational capital or "employee training" as human capital. In German these terms translate as compound words "Softwareschulung", "Kundenschulung" and "Mitarbeiterschulung". The contraction to compound words adds inherent information about the context of the respective "training". This property of the

	Structural capital	Relational capital	Human capital
Required Components	Intellectual property	Market situation	
	Intangibles	Market launch	
	Process optimisation	Key markets	
	Controlling, monitoring	Competitive position	
	Risk management		
	Planning and control system		
	Management structure		
	Research and development		
	Product performance		
Recommended Components	Restructuring	Costumers	Vocational qualification
	Research projects + results	Network of suppliers	Qualification
	Product development	Supplier relations, loyalty	Training
	Software development	Reputation, social reputation	Development
	IT systems	Business collaborations	Personnel expenses
	Corporate culture	Partnering relations	Employee turnover
	Quality management	Co-operation management	Employee retention rate
	Patents	Strategic acquisition	Employee loyalty
	Trademarks + copyrights	Market share	Remuneration system
	Licences		Internal incentives
	Productivity		Learning objectives
	Capacity utilisation		Performance orientation
	Throughput times		
	Reject rates per product		
	Warranty expenses		
Voluntary Components	Strategic planning	Customer involvement	Education
	Strategic orientation	Customer training	Know-how + knowledge
	Information system	Distribution channels	Competencies
	Reporting	Sales force	Skills, soft skills
	Technological systems	Logistical competencies	Experience, experts
	Corporate policy	Supplier know-how	Team work
	Philosophy	Marketing strategy	Working environment
	Communication	Unique selling point	Work life balance
	Sharing of knowledge	Bestseller, trend setter	Diversity
	Know-how transfer	Brand awareness + image	Employees
	Product competencies	Brand strategy	Motivation, enthusiasm
	Innovation	Public relations	Security of employment
	Creativity	Corporate design	Recruitment policies
	Functionality	Pioneer, specialist	Talent management
	Processes	Investor relations, IR	HR management
		Financial contacts	Attractive employer
		Production partner	Career opportunities

Table III.
Research framework for content analysis of IC reporting

Note: This table shows the IC research framework applied in this study, grouped by categories: structural, relational and human capital. The IC components are separated for required, recommended and voluntary IC reporting. The software-aided codes are written to be mutually exclusive

German language allows the use of words as coding units with a relatively high level of reliability for correct coding within the IC context, where the linked words were searched for and coded as one occurrence.

4.3 Coding process

A computer-aided analysis is conducted, using the software "atlas.ti", because it enables high volumes of narratives to be processed at a high level of consistency, as

argued by Krippendorff (2004). Software-aided coding has been criticised by Weber (1985) or Beattie and Thomson (2007) as it may face problems with synonyms or pronouns. However, the software-aided approach has also been argued by Krippendorff (2004) to have advantages, as it increases the degree of coding reliability and continuity. Furthermore, Dumay and Cai (2014) as well as Lee and Guthrie (2010) refer to software-aided coding as having potential for enhancing IC content analyses, as they can be based on larger samples. This study argues that the issue of context sensitivity of IC for electronic coding on the word level, as highlighted by Beattie and Thomson (2007), is compensated for by the characteristics of German compound words.

To illustrate the coding process, some exemplary coding features are described here. The results of the manual pilot content analysis of ten management reports from different industries and sizes provided the basis for the coding process. Overall, the pilot study findings covered a broad range of IC components which were addressed in the international IC reporting research, as reviewed by Goebel (2015). Although the approaches to IC reporting varied across the pilot management reports, no strong pattern of IC components across industries or sizes became apparent, as the pilot companies referred to most features of IC in different ways. Due to these differences, the range of coding for IC components was enhanced accordingly. For example, the IC component "customers" showed different attributes across industries. While customers were referred to as "customers" in the consumer, industrial and finance groups, the terms "users" or "patients" were also used in the industry group pharmaceutical and technology. The codes were written to cover all these forms of customers for this particular IC component. The cording process was equivalently based on the pilot results for other IC components.

Krippendorff's α is applied in this study to ensure reliability as a measure of the relationship between observed disagreements and expected disagreements for different coding procedures (Krippendorff, 2004). As Krippendorff (2004) argues that values above 0.80 indicate reliability, this study targets Krippendorff's α above 0.80. The software results were compared with manual coding for eight management reports. After the first comparison, reporting scores for relational capital in particular showed differences between electronic and manual coding. Therefore, the codes were gradually changed and double checked, with Krippendorff's α improving from 0.791 to 0.857, considered to be reasonable. The software codes for the search terms are written to be mutually exclusive for the IC components.

4.4 Regression analysis

To investigate the association of certain company characteristics to IC reporting, a regression analysis is conducted with criteria found to have been relevant in prior research. The reporting scores from the content analysis on IC reporting serve as the dependent variable for the different reporting types. The IC reporting scores are scaled by page numbers of the management report to account for reporting length. Return on equity (ROE) in per cent forms an independent variable as measure of company returns. The regression was also conducted with return on assets (ROA) as alternative measure of company returns as robustness test. The results for ROA were similar and are not replicated here. Other company characteristics in the regression analysis are company size and industry group. The variable *size* is measured by the natural logarithm of total assets. The variable *industry* represents dummy variables for the four industry groups: consumer, finance, pharmaceutical and technology and

industrial. The industry consumer serves as base industry group. Equation (1) illustrates the regression. Table IV shows definitions, descriptive statistics and correlations of the regression variables:

$$ICpp_j = \beta_0 + \beta_1 returns_j + \beta_2\, size_j + \sum \alpha_i\, industry_j + \varepsilon_j \quad (1)$$

5. Results

5.1 IC reporting by reporting types

The results of the content analysis for required, recommended and voluntary IC reporting for each IC category are shown in Table V. For total IC, on average 8.87 words per page refer to IC, varying between 0 and 30.96 words per page. The findings show that IC reporting in German companies is mostly voluntary, hence, exceeding the reporting regulation. Although IC information on human capital is only partly recommended and not required, the companies report on human capital to a relatively high extent. In a comparison of the percentages of total required and recommended IC reporting an interesting aspect appears. With 14.3 per cent of total IC reporting the recommended reporting is very close to required reporting with 16.3 per cent. The cultural pressure and reputational risk may have caused the companies to choose reporting on the IC recommendations to nearly the same extent as they report on required IC components.

Regarding the total IC scores for the individual IC categories, the dominance of structural capital is in contrast with the findings of prior literature. Hence, the question arises whether the distinctive proportion of structural capital reporting by German companies may be driven by other factors. This reporting behaviour may be due to the large number of requirements and recommendations in GAS 15, classified as structural capital. Hence, the high proportion of structural capital scores for required and recommended components may be supported by regulatory considerations. However, most structural capital reporting is voluntary. This indicates that companies report on their structural capital voluntarily, but with the regulation in place they feel encouraged to additionally report on required and recommended structural capital components. A potential reason for the additional reporting on structural capital may lie in the idea of IC dynamics within structural capital, as outlined by Curado and Bontis (2007). As feedback and feed forward processes are argued to be an important part of IC development, requirements and recommendations may enhance corporate reflection and reporting on their stocks of knowledge and routines within their structural capital reporting.

Although several components of relational capital are required or recommended, the average and maximum reporting frequencies of these reporting types are low for relational capital. This may be due to data sensitivity for the required and recommended relational capital components, such as information on primary sales markets and customer bases. This interpretation is consistent with the conclusion by Günther and Beyer (2003) on German reporting on intangibles. However, relational capital shows the highest proportion of voluntary reporting, covering less sensitive aspects of relational capital. The dominance of relational capital in voluntary reporting is consistent with prior studies on voluntary IC reporting.

5.2 Regression results for IC reporting

The regression results for total IC reporting by reporting types are shown in Table VI. Based on previous research, company returns, industry and size are expected to be

Panel A: definitions of variables

Variable	Definition	Function
ICpp	Total IC scores per page from content analysis	Dependent variable
IC required	Required IC scores per page from content analysis	Dependent variable
IC recommended	Recommended IC scores per page from content analysis	Dependent variable
IC voluntary	Voluntary IC scores per page from content analysis	Dependent variable
ROE	Return on Equity as measure of company returns	Examine profitability
Size	Natural logarithm of total assets as measure of size	Examine size
Industry	Dummy for industry groups: consumer, finance, pharma and tech, industrial; consumer as base industry	Examine industry

Panel B: descriptive statistics

	n	Mean	SD	Min	Max
ICpp	428	8.87	3.55	0.00	30.96
IC required	428	1.45	0.70	0.00	7.25
IC recommended	428	1.27	0.67	0.00	4.32
IC voluntary	428	6.15	2.74	0.00	25.67
ROE	408	−10.12	241.20	−3965.35	408.48
Size	428	12.65	2.40	6.79	21.36

Panel C: correlations

n = 408		*IC reporting*	*ROE*	*Size*
Total IC	*IC reporting*	1	0.13*	0.03
	ROE	−0.05	1	0.20*
	Size	0.06	0.04	1
Required IC	*IC reporting*	1	0.07	−0.03
	ROE	−0.01	1	0.20*
	Size	0.03	0.04	1
Recommended IC	*IC reporting*	1	0.00	−0.0495
	ROE	−0.13*	1	0.20*
	Size	−0.10*	0.04	1
Voluntary IC	*IC reporting*	1	0.16*	0.06
	ROE	−0.03	1	0.20*
	Size	0.10*	0.04	1

Notes: These tables show definitions (Panel A), descriptive statistics (Panels B) and correlations (Panel C) of variables in the regression analysis of IC reporting. In the correlation table, Pearson correlations are given in the lower left-hand corner for each reporting type and Spearman correlations are shown in the upper right-hand corner. Asterisks indicate a 5 per cent-significance level. The correlation level between the regression variables is low and does not imply multicollinearity

Table IV. Descriptive statistics for regression analysis of IC reporting

$n = 428$	Total	Required	Recommended	Voluntary
Total intellectual capital				
Mean	8.87	1.45	1.27	6.15
% of total IC		16.3	14.3	69.4
SD	3.55	0.70	0.67	2.74
Min	0.00	0.00	0.00	0.00
Max	30.96	7.25	4.32	25.67
Structural capital				
Mean	3.82	1.31	0.61	1.90
% of total IC	43.1	14.8	6.9	21.4
% of total structural		34.3	16.0	49.7
SD	1.65	0.68	0.47	0.93
Min	0.00	0.00	0.00	0.00
Max	12.33	7.11	3.23	7.25
Relational capital				
Mean	3.28	0.14	0.20	2.93
% of total IC	36.9	1.6	2.3	33.0
% of total relational		4.4	6.2	89.4
SD	1.80	0.12	0.16	1.68
Min	0.00	0.00	0.00	0.00
Max	15.98	0.83	0.89	15.27
Human capital				
Mean	1.78		0.45	1.33
% of total IC	20.0		5.0	15.0
% of total human			25.5	74.5
SD	0.81		0.29	0.67
Min	0.00		0.00	0.00
Max	6.06		2.13	4.41

Table V.
Results of IC reporting by reporting types

Notes: This table shows results of the content analysis conducted on 428 German group management reports for the accounting year 2010. The findings represent occurrences per page of IC categories, structural, relational and human capital, for the reporting types total, required, recommended and voluntary IC reporting

associated to voluntary IC reporting. As prior studies investigated voluntary reporting, the findings of this study are particularly interesting for required and recommended IC reporting. The regression results show significant associations for size and industry across nearly all reporting types. Company returns are only significantly associated to IC reporting for recommended reporting, but the coefficients are close to zero and their indicators are opposed to expectations.

The mainly non-significant results on IC reporting for profitability supports the findings by Williams (2001) but are in contrast with the findings by Cerbioni and Parbonetti (2007). However, companies with higher profitability seem to significantly report slightly less on recommended IC components. To investigate which IC category causes the significant association to ROE, the regression analysis was also conducted for the individual IC categories structural, relational and human capital as dependent variables. The regressions on relational and human capital show no significant association to ROE. The only category and IC reporting type with a significant association to ROE is recommended structural capital reporting. As the results and the significant association for structural capital are similar to total IC reporting, they are not replicated here.

	(1) Total IC	(2) Required	(3) Recommended	(4) Voluntary
Constant	4.875***	0.848***	1.156***	2.871***
	(5.28)	(4.32)	(6.51)	(3.95)
Roe	−0.001	−0.000	−0.000**	−0.000
	(−1.06)	(−0.01)	(−2.55)	(−0.72)
Size	0.313***	0.034**	0.006	0.273
	(4.50)	(2.30)	(0.01)	(5.00)
Industry				
Finance	−2.868***	−0.047	−0.460***	−2.361***
	(−5.64)	(−0.43)	(−4.71)	(−5.91)
Pharma and tech	2.595***	0.558***	0.470***	1.567***
	(6.03)	(6.09)	(5.68)	(4.63)
Industrial	−0.633	0.115	−0.010	−0.738**
	(−1.52)	(1.30)	(−0.13)	(−2.25)
Model summary				
R^2	0.227	0.105	0.202	0.201
Adj. R^2	0.217	0.093	0.193	0.191
n	408	408	408	408

Notes: This table shows results for the regression analysis of reporting scores for total IC and the reporting types required, recommended and voluntary IC reporting. IC reporting is measured as occurrences related to IC in German management reports for the accounting year 2010 scaled by the number of pages. Columns (1)-(4) denote different model specifications showing the findings for total IC reporting and the IC reporting types with the scores for each reporting type as respective dependent variable. *t*-Statistics are given in parenthesis underneath values for coefficients. *,**,***Significant at 10, 5 and 1 per cent levels, respectively: $ICpp_j = \beta_0 + \beta_1\, returns_j + \beta_2\, size_j + \sum \alpha_i\, industry_j + \varepsilon_j$

Table VI.
Regression results for total IC reporting

A potential reason for the negligible coefficients for company returns may be that more profitable companies consider their profitability in itself as a sign of efficient internal structures. Therefore, higher company returns indicate structural capital and would support continued profitability. Hence, companies do not see a need to convince the market by increased reporting on structural capital. Another reason why profitability is not associated to IC reporting in Germany may be that all companies have to include IC reporting in the mandatory management report. Therefore, profitability may play a minor role for IC reporting in the German sample because the reporting regulation with requirements and recommendations applies to all companies regardless of their returns.

The results for size for total IC and across the reporting types required and voluntary IC, show significant positive associations to IC reporting. Size shows the strongest significant association for voluntary reporting. This effect is in contrast with the non-significant findings on company size by Bozzolan *et al.* (2003) and Bukh *et al.* (2005) but supports the findings on voluntary IC reporting by Brüggen *et al.* (2009). Due to cultural pressures and reputational risks (Suchman, 1995; Bebbington *et al.*, 2008), size may have no association for recommended and a weaker association for required IC reporting, as all companies are expected to report on their IC in the mandatory management report with its stringent recommendations.

The results on industry groups indicate that significant industry differences exist for mean scores for total IC reporting, except for consumer and industrial required and recommended reporting. The coefficients are highest for pharmaceutical and technology companies for all reporting types. The industry group pharmaceutical and

technology comprises companies relying on intangible rather than tangible assets. Therefore, a higher level of IC reporting compared to other industries may intrinsically be required. This is consistent with the findings in prior literature on voluntary IC reporting (Bozzolan *et al.*, 2003; Bukh *et al.*, 2005; Brüggen *et al.*, 2009). Companies operating in the financial sector report least on IC for every reporting type, being non-significant for required IC reporting. A potential reason is that corporate reporting is highly regulated for the financial sector with particular requirements on risk reporting according to GAS 5-10 and GAS 5-20 (GASC, 2010b, c). This may encourage the financial companies to focus on required reporting on IC and risk rather than recommended or voluntary IC reporting. The findings on IC reporting types strengthen this interpretation, as the proportion of required scores is highest in the content analysis and the coefficients are lowest in the regression analysis in the financial sector compared to other industry groups.

6. Conclusion

This study aims to investigate company characteristics for IC reporting in a mandatory management report. The German mandatory management report, regulated by the standard GAS 15 for consolidated management reports, offers a unique research setting to examine IC reporting given the regulatory status of individual IC components. To achieve the research aim, the concept of IC developed in the international literature, with the categories: structural, relational and human capital, is applied to the German management reporting standard. The analysis of GAS 15 shows that IC components are included in the German regulation as required and recommended reporting. German companies also report on additional IC components beyond the management reporting regulation, classified as voluntary IC reporting.

As prior IC reporting research has focused on voluntary IC reporting, this study cannot conclude whether the management reporting regulation causes German companies to report more on overall IC compared to other countries. However, the findings indicate that the regulation encourages IC reporting. Two main aspects arise from the findings of the content analysis. First, reporting on relational capital is exceeded by structural capital for total IC but not for voluntary IC. Hence, the requirements and recommendations cause more frequent references to structural capital compared to prior international findings. Second, the proportions of required and recommended IC reporting indicate that companies choose to apply the recommendations to a relatively high extent, being equal to required reporting. As the combined proportions of required and recommended IC account for about 30 per cent of total IC reporting, the findings indicate that requirements and recommendations seem to enrich IC reporting. Therefore, the encouragement of recommended IC components seems to be effective within the reporting regulation.

The results of the regression analysis for IC reporting show that an overall association exists for company size and industry across reporting types. Company returns only show a significant result for recommended reporting but have coefficients close to zero. This result on profitability may be due to the regulation, as it applies to all German companies regardless of company returns. The low coefficients for size with non-significant findings for recommended IC reporting may be due to cultural pressures and reputational risks in the regulatory setting as all companies, regardless of their profitability, have to report on their IC. The mainly significant industry differences show two major aspects. On the one hand, the industry findings indicate that total IC reporting is guided by the corporate context as companies with a more

intangible focus in the industry sector pharmaceutical and technology report more on IC in their management reports, supporting the findings of prior studies. On the other hand, regulatory differences become apparent. Companies operating in the financial sector report least on their IC, with a relatively high proportion of required reporting. One reason may be that finance companies focus on other aspects of the management report which are more stringently regulated for that sector, such as risk reporting.

This study is subject to limitations. Certain simplifications and assumptions are needed for this IC reporting study to enable industry groupings. However, as this study does not aim to answer industry-specific questions but attempts to control for industry, relatively simple industry groupings seem plausible. Furthermore, the analysis of the corporate IC reporting practices does not allow drawing conclusions on the regulators' motivations for IC reporting requirements and recommendations. To develop a deeper understanding of the regulations' motivations and their consequences, interviews with regulators may be preferable.

This study contributes to the IC reporting literature by investigating IC reporting in a mandatory management report for a relatively large sample of listed companies in a country where little is known about corporate IC reporting. The software-aided content analysis of a large sample, given the characteristics of the German language, utilises the unique German setting. This study adds to an on-going discussion on the implementation of requirements and recommendations for IC reporting, as the findings show that required and recommended reporting account for a relatively high proportion. The findings of this study also contribute to international considerations for IC reporting policies. The non-mandatory practice statement for a management commentary by the IASB (2010) and the non-binding integrated reporting model (IIRC, 2011, 2013) refer to IC reporting, but they do not provide detailed information on how to approach IC reporting. The findings of this study offer a basis for further discussions as they indicate that further explicit requirements and particularly recommendations on individual IC components may encourage corporate IC reporting.

For future research, the findings of this study suggest an examination of the national setting before an IC reporting study is conducted in order to account for the country-specific influence of reporting regulations. Additionally, future research could investigate the importance placed on IC reporting by regulators and evaluate potential reasons why certain IC components may be required or recommended. Furthermore, the regulatory changes in GAS 20 may offer future opportunities for research investigations of IC reporting in Germany. Modifications in the appreciation of IC information within the management reporting regulation GAS 15 and GAS 20 may cause changes in corporate IC reporting in Germany. As the findings indicate recommendations to be important, the recent alterations in GAS 20 may have effects on future IC reporting behaviour, offering a potentially rich setting for further research.

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