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How Integrated Thinking can be detected in management disclosures in Annual Reports: Insights from a large-scale text-analysis approach

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ABSTRACT

Integrated Thinking has been promoted as a way of revolutionizing decision-making to create sustainable value. Our study shows how disclosures made by managers in annual reports can reveal aspects of Integrated Thinking within organizations. We develop a new dictionary-based measure of Integrated Thinking and apply our measure to two samples: 685 reports over a 9-year period from South Africa, where Integrated Reporting is mandatory, and a matched sample of European firms where such reporting is voluntary. We provide evidence that our Integrated Thinking measure is distinct from overall reporting quality and generic ESG and CSR disclosures and is more nuanced and variable over time than Integrated Thinking proxies used in the prior literature. Our new measure is positively and significantly associated with improved return on assets (influenced by real decisions made by managers rather than capital market participants). Our findings will be of interest to reporting bodies, practitioners and academics.

Keywords: Integrated Thinking; Text Analysis; Management Disclosure

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I. INTRODUCTION

‘Integrated Thinking Principles’ are promoted by several reporting bodies as central to sustainable value creation by enabling the link between external reporting of sustainability-related information and internal management practices (VRF 2021a; IFRS 2022). Although Integrated Thinking (IT) is strongly associated with Integrated Reporting (IR), IT has also been promoted by the Value Reporting Foundation (VRF) and, more recently, by the International Sustainability Standards Board (ISSB) (IFRS 2022). Within organizations, management accounting practices reflect a growing recognition of combining financial and non-financial information for optimal decision-making (Esch, Schnellbacher, and Wald 2019; Hansen and Schaltegger 2016). Business leaders have expressed interest in IT as a potential solution for embedding sustainable practices and have asked for more guidance on the topic (IIRC, 2017b). While managers recognize the growing need to incorporate sustainability into their strategy (Hansen and Schaltegger 2016; Gond, Grubnic, Herzig, and Moon 2012), they often remain unclear on how to facilitate organizational change to support this (KPMG 2021; Joshi and Li 2016). Gaining a deeper understanding of IT is topical and vital in this context. As current research on IT is mainly limited to individual case studies, we consider how IT may be detected and analyzed in larger datasets through computer-aided text analysis.

IT is the management philosophy that theoretically underpins IR, a recent development in corporate reporting (Eccles 2014; De Villiers, Hsiao, and Maroun 2020). IR integrates financial and non-financial information into a single report, aiming to communicate how an organization creates long-term sustainable value by focusing on using six financial and non-financial ‘capitals’ (De Villiers, Venter, and Hsiao 2017). The International Integrated Reporting Council (IIRC), the leading promoter of IR, coined the term IT, defining it as “the active consideration by an organization of the relationships between its various operating and functional units and the capitals that the organization uses or affects” (IIRC 2021, 3). The IIRC

intends for ‘reporting’ and ‘thinking’ to operate as a virtuous cycle (IIRC 2017a), with IR acting as the visible representation of an organization’s underlying IT (Busco, Malafronte, Pereira, and Starita 2019; Adams 2015).

There is mixed evidence to support the IIRC’s claim that adopting IR and IT brings a virtuous cycle of benefits. Several case studies find that IR adoption is associated with internal benefits (Oliver, Vesty and Brooks 2016; Feng, Cummings and Tweedie 2017). A quantitative study by Barth, Cahan, Chen, and Venter (2017) also finds an association between high-quality IR and Tobin’s Q, potentially through the real effects channel associated with IT. However, another body of evidence shows that IR can be adopted purely as a reporting exercise without the changes to business decision-making associated with IT (Raemaekers, Maroun and Padia 2016; Stubbs and Higgins 2014). There is also some evidence that the principles of IT are independent of IR (Adams 2017; Al-Htaybat and Von Alberti-Alhtaybat 2018; Dimes and De Villiers 2020; Caruana and Grech 2019). These mixed findings are consistent with findings in the sustainability reporting literature indicating that external reporting alone is unlikely to achieve change within organizations without supporting formal and informal management controls, including a focus on organizational culture (Journeault 2016; Bui and De Villiers 2018).

Beyond case study settings, empirical evidence to support the economic benefits of adopting IT independently from IR is limited, mainly due to measurement challenges (Malafronte and Pereira 2020). To date, attempts to measure IT have been based either on measures of ‘connectivity’ evident within corporate reports (Grassmann, Fuhrmann and Guenther 2019; Zhou, Simnett and Green 2017) or database or index measures (Serafeim 2015; Malafronte and Pereira 2020; Baboukardos, Mangena and Ishola 2021; Reimsbach and Braam 2022). While these approaches have the potential to measure IT in large datasets, a construct

as nuanced as IT is unlikely to be fully captured with such relatively simplistic measures. In addition, these measures may be biased due to their construction from binary components or may be incomplete due to companies reporting selectively or being excluded from certain databases (De Villiers et al. 2017).

Narrative disclosures are a rich and widely available source of information within corporate reports, yet these have not been used extensively to better understand IT. Analyzing narrative disclosures on a large scale may give unique insights into IT if viewed as a form of management. In management research, narrative disclosures have been used to measure similarly unobservable constructs such as entrepreneurship (Short, Broberg, Cogliser, and Brigham 2010; Krippendorff 2018), strategy (Gamache, Neville, Bundy, and Short 2020), market dynamics (Verma, Malhotra, and Singh 2020) and Corporate Social Responsibility (CSR) (Azhar, Pan, Seoq, Koh, And Tay 2019).

This paper develops a novel measure for IT based on four hallmarks of successful IT adoption identified in prior research. The new measure is tested on two datasets. The first is a panel data set of 685 reports from the unique reporting environment of South Africa, where IR compliance by listed companies with local corporate governance codes effectively makes IR mandatory (this has been the case since 2011). IT is, therefore, more likely to be better developed and understood, with less self-selection bias in this setting. In addition, the EY Excellence in IR Awards in South Africa provide an independent measure of IR quality to allow us to separate IT from general reporting quality. The second data set is a sample of European companies comprising a set of IT companies (selected by the VRF as demonstrating excellence in IT) matched with control companies.

Our study provides evidence that IT is revealed in management disclosures. Our measure of IT is distinct from reporting quality, generic CSR disclosure measures, and self-

reported database measures. Our measure provides insights into how IT has developed over time and how it links to reporting quality. Regression analysis shows our measure to be associated with greater return on assets, specifically through greater asset turnover (efficiency). Our matched sample analysis indicates that firms independently identified as Integrated Thinkers score highly on our measure and demonstrate stronger financial performance than the control group.

This study makes several contributions. First, we provide a new measure of IT that allows for a far more nuanced understanding than other proposed measures for large dataset analysis. We demonstrate the potential for narrative disclosures to reveal insights into internal organizational management, building on evidence from the management field (Payne, Brigham, Broberg, Moss, and Short 2011; Krippendorff 2018). Evidence in our paper indicates that narrative disclosures directly reference IT and that rich narrative data is superior to binary database measures. Second, this study finds that although disclosures that reveal IT are weakly correlated with reporting quality, Environmental, Social and Governance (ESG) scores, and other CSR disclosures, IT disclosures remain distinct from them in key areas. This suggests that our measure has the potential to capture and measure IT rather than any other construct. This inference is reinforced by statistically significant findings in regression analyses in two different samples showing that IT levels are positively associated with economic benefits. Our paper also provides evidence of IT developing over time, which supports construct validity.

The expert-generated domain-specific dictionary measure of IT developed as part of this study could be helpful for subsequent research. We provide comprehensive information regarding the dictionary development process and subsequent analysis, responding to calls for transparency in the field of content analysis in accounting (El-Haj, Rayson, Walker, Young, and Simaki 2019) and replicability of management accounting studies more generally (Shields

2018). Our study addresses calls for studies that consider measurement challenges with IR and IT (De Villiers et al. 2017).

The remainder of this paper is structured as follows: Section 2 provides background on IT and IR. Section 3 reviews the literature on IT measurement. Section 4 describes the text analysis methodology and the sample selection. Section 5 presents and discusses the findings. Section 6 concludes, highlighting the contribution of this study and avenues for future research. Sections 7 and 8 contain references and appendices, respectively.

II. BACKGROUND AND DEFINITIONS

IR seeks to integrate financial and non-financial information into a single report to communicate how an organization creates long-term value, focusing on the use of six ‘capitals’ (financial, natural, intellectual, social, human and manufactured). IR has effectively been mandatory for listed companies in South Africa since 2011, as listed companies need to comply with the corporate governance King Codes, which require an Integrated Report and make direct reference to IT (IODSA 2016). Outside of South Africa, approximately 2,000 listed companies in over seventy countries voluntarily use IR for their reporting (IIRC 2020). Interest in IR has developed following growing awareness of the weaknesses of traditional profit-focused annual corporate reporting (Rowbottom and Locke 2016; Adams 2015) and increasing interest in other ESG information provided by organizations (Deegan and Blomquist 2006). IR has recently been promoted by reporting bodies, such as the ISSB, as a way of connecting financial and non-financial information and embedding sustainable business practices, thereby fostering IT (IFRS 2022).

Definitions of IT vary. The IIRC definition of IT is “the active consideration by an organization of the relationships between its various operating and functional units and the capitals that the organization uses or affects” (IIRC 2021, 3). However, this definition is poorly

understood by practitioners, who have raised concerns about what IT looks like in practice (IIRC 2017b), and by academics, who consider IT to lack a common conceptualization and theoretical base (Feng et al. 2017; La Torre, Bernardi, Guthrie, and Dumay 2018).

IT is fundamentally a form of management. Knauer and Serafeim (2014, 59) describe IT as “the systematic management of all the forms of corporate capital....with the goal of delivering sustainable profitability” and Oliver et al. (2016, 229) describe IT as the “attribute or capacity for senior management to constructively face the tensions between corporate efficiency and a model that considers broader societal health and well-being”. Studies have argued that as IT requires understanding how different capitals connect across an organization, it has many parallels with systems thinking (Oliver et al. 2016; Hurth 2017). IT can also be viewed as a means of organizational development (Massingham, Massingham, and Dumay 2019). The multitude of interpretations may help to explain why IT is so hard to define and conceptualize. The diversity of conceptualizations also suggests that studies of IT need to allow for different interpretations of IT and that use of binary database measures is unlikely to capture its inherent subtlety.

The definition of IT used in this paper is based on a comprehensive literature review on IT in practice conducted by Dimes and De Villiers (2023). Based on a thematic analysis of the findings, the authors develop a framework of four success factors (IT “Hallmarks”) necessary for IT to thrive within organizations, shown in Figure 1.

Figure 1: Hallmarks of Integrated Thinking (Dimes and De Villiers, 2023)

<Insert Figure 1 here >

The first hallmark considers the top of an organization, where the board and CEO need to fully understand IT and deliberately encourage an organizational focus on IT. Without this hallmark, IT is unlikely to eventuate, as support from top management is crucial to its success. The second hallmark is an Integrated Strategy, developed through engagement with a broad set of stakeholders and well understood and communicated throughout the organization. The third hallmark is development of an organizational culture of trust. A supportive culture is essential for employee engagement, since IT can bring tension and difficulty to decision-making. The fourth hallmark is investment in Integrated Intelligence, described as a combination of underlying performance management systems and how these systems are used in decision-making processes within organizations.

III. LITERATURE REVIEW

If IT can exist in the absence of IR and can potentially bring economic benefits to organizations independently of IR, then measuring an organization's level of IT and its development over time is essential. Previous attempts to measure IT fall into two main camps: those considering the 'connectivity' of information provided in Integrated Reports to proxy for IT and those using measures from external databases, indices, or awards. Consultants have also attempted to measure IT, but their measures are usually proprietary and are of limited use for academic research (Maroun, Ecim and Cerbone 2022).

3.1. 'Connectivity' measures

IT requires the 'connectivity' of information to improve organizational decision-making (IIRC 2017a). Some studies have considered the connectivity of capitals mentioned in Integrated Reports (Grassmann et al. 2019) or direct mentions of connectivity elements of the IR Framework (Zhou et al. 2017; Ahmed Haji and Anifowose 2016; Ruiz-Lozano and Tirado-

Valencia 2016) to proxy for this internal connectivity. Other papers have considered ‘connectivity’ to mean the ease of reading the provided information in reports, focusing, for example, on the ability to drill down for additional data (Rivera-Arrubla and Zorio-Grima, 2016). These papers are helpful in their attempts to show how external information in Integrated Reports might proxy for internal IT capability and organizational connectivity. However, IR aims to consider the capitals together, suggesting that any analysis of IT would miss the point if it considered the six capitals independently. Measuring IT by considering the external sophistication of Integrated Reports also fails to consider management accounting practices and ‘softer’ IT approaches such as organizational culture (Oliver et al. 2016), despite extensive research evidence strongly supporting the importance of these softer factors in the successful adoption of IT (Dimes and De Villiers 2023).

3.2 External databases, indices and award data

Another body of research employs scores such as Thomson Reuters Asset 4 Corporate Governance Scores (CGVS) to proxy for integrated decision-making, since these scores are frequently used in academic studies on sustainability (De Villiers, Jia and Li 2022). These scores have been used to consider whether or not IR affects investor clientele (Serafeim 2015) and to consider the relationship between IT and the transparency of tax disclosures (Venter, Stiglingh, and Smit 2017). More recently, there have been calls for a coordinated approach to measuring IT using such measures, with Malafronte and Pereira (2020) proposing four CGVS measures as particularly suitable (see Table 10). Although measures such as CGVS scores may indicate a commitment to IR, they are likely too simplistic to truly represent IT. Many of the measures used are binary, and data provided by organizations voluntarily may be subject to bias that is difficult to correct. Using self-reported data also limits research to companies providing the required information (De Villiers et al. 2017). As we show later in this paper, not all companies provide information in certain key categories (less than half of the companies in

our sample had scores for the category of ‘Integrated Strategy’, for example – see Table 11). Binary measures also tend to remain static over time, giving less insight into the development of IT practices. A box-ticking approach could also achieve a high CGVS score, undermining the entire ethos of IT (Atkins and Maroun 2015).

Other studies, such as Barth et al. (2017), have used awards data to proxy for IT. However, the ‘black box’ characteristics of the awards criteria limit replicability and a deeper understanding of IT as a concept (Velte and Stawinoga 2017). Consultants are keen to develop a measure for IT yet their measures are often proprietary and require detailed knowledge of the organizations studied (Maroun et al. 2022).

IV. METHOD

4.1 A new measure for Integrated Thinking

This study proposes a new approach to measuring IT by using narrative disclosures by management in annual reports. Integrated Reports rely heavily on narrative disclosures to communicate messages around the six capitals and performance (IIRC 2013), so analysis of narrative disclosures within Integrated Reports may help reveal qualitative factors associated with IT (Oliver et al. 2016). Churet and Eccles (2014) suggest that IT can be measured in terms of managerial attention to ESG matters.

Developing a new measure based on narrative disclosures has numerous advantages. Firstly, such a measure is scalable to large datasets through computer-aided text analysis techniques. The technique proposed in this study can be replicated and adjusted as the field develops. A narrative-based measure allows for deeper analysis of the softer, more nuanced aspects of IT that cannot be captured through binary database measures. Using text analysis of firm narrative disclosures also provides the potential to measure an organization’s IT regardless of IR adoption. This is useful as companies increasingly integrate financial and non-financial

measures of performance, even if they do not formally call their approach IR (KPMG 2017). Our approach can therefore help to identify companies with high levels of IT even if they are not self-declared IR adopters.

4.2 Text analysis approach

4.2.1 Background

A growing body of research considers management characteristics as revealed in text. Research into obfuscation in conference calls (Bushee, Gow, and Taylor 2018) and CEO personality traits (Gow, Kaplan, Larcker, and Zakolyukina 2016; Harrison, Thurgood, Boivie, and Pfarrer 2019) show the potential usefulness of text analysis in detecting managerial characteristics of individuals. Notably, such analysis can reveal characteristics that managers themselves may be unaware of (Krippendorff 2018). Research in the management field has also used similar approaches (Hannigan et al. 2019), for example reviewing communications from the board chair (De Groot, Korzilius, Ickerson, and Gerritsen 2006) or letters from the CEO (Conaway and Wardrope 2010). Narrative disclosures have also been used to study more general organizational characteristics such as entrepreneurship (Short et al. 2010), consumer behavior (Chi-Hsien and Nagasawa 2019), strategy (Gamache et al. 2020) market dynamics (Verma, Malhotra, and Singh 2020), CSR (Azhar et al. 2019), climate risk (Berkman, Jona, and Soderstrom 2022) and cybersecurity (Berkman, Jona, Lee, and Soderstrom 2018). Although Arul, De Villiers, and Dimes (2020) consider the potential for narrative disclosures to reveal IT in a small sample of reports from Japan, no previous study has attempted to consider IT using large sample text analysis of narrative disclosures. Quarchioni, Ruggiero, and Damiano (2020) consider vocabulary flows as indicative of IT. Their approach combines text analysis with network text analysis to consider text structures for a sample of 34 reports, considering both the occurrence of words and their linkages to one another as indicative of IT. While this is an interesting approach, it is still limited to small samples.

Analyzing narrative disclosures using computer-aided techniques has several advantages. Natural language processing (NLP) techniques are generally faster and cheaper than manual techniques, reducing some of the potential for error associated with human coding (Neuendorf 2017). As these techniques can be used on large bodies of text, they can identify statistical patterns and enable researchers to capture latent concepts more objectively (Kang, Cai, Tan, Huang, and Liu 2020; Lewis and Young 2019). Using this approach can provide new insights by studying problems that are hard to address using purely quantitative or purely qualitative data. In particular, content analysis techniques may help if multiple different measures are currently used across the research stream (Short et al. 2010), as in the case of IT.

4.2.2 Deductive approach

Our study uses a deductive approach, developing expert dictionaries of words and phrases relating to IT and searching annual reports for their existence using manual and NLP techniques. A deductive approach is essential for our study for two key reasons. Firstly, as IT is unobservable, it is impossible to contrast a sample of ‘IT’ firms with a sample of ‘non-IT’ firms (a design choice that works well for an inductive approach). Although we perform a matched sample analysis later in this paper, this is for a small and unique data set of European firms identified specifically as Integrated Thinkers, and the approach could not currently be applied more broadly. An organization’s level of IT is likely to exist on a spectrum, as it is presumably impossible for an organization to have no IT or to fully realize 100% of its potential for IT. Using a deductive approach also allows for the possibility of separating IT from IR quality, which would not be possible using an inductive approach based on narrative disclosures in annual reports. We use a pre-selected dictionary based on prior literature, detailed manual analysis of a subsample of the dataset, and expert peer review. We follow the approach to dictionary-based studies of multi-dimensional managerial constructs outlined in Short et al. (2010) and used to develop a dictionary for CSR by Pencle and Mălăescu (2016).

Our approach aims to avoid researcher subjectivity, allow for subsequent study replication and enable scaling to large samples (Loughran and McDonald 2016).¹

4.3 Dictionary development

4.3.1 Construct definition

We choose the Dimes and De Villiers (2023) conceptualization of IT as it is the only one based on a significant body of primary academic research evidence. We employ the definitions of IT underpinning their study (shown in Table 1) to develop our new measure.

4.3.2 Construct validity

For text analysis to be useful, the construct of interest needs to be plausibly measured by the word and phrase lists created by the researcher. Short et al. (2010) consider four types of construct validity (content, external, discriminant, and predicative) and outline key steps to be undertaken for deductive content validity approaches to NLP for management research. Using their approach for this study helps to overcome the many criticisms of the use of NLP in accounting research, in particular, the lack of clarity on the research process and problems with transparency and replicability when converting qualitative data into quantitative data for the use in statistical models (also highlighted by Loughran and McDonald (2016)). Our approach combines *a priori* theory, a detailed review of a subsample, and expert review to construct an original dictionary for IT. This approach follows recommended steps for generating deductive word lists in Short et al. (2010). The complete dictionary construction and validation process is outlined in Appendix 1, with the final dictionary presented in Appendix 2.

¹ We considered other machine-learning techniques such as topic modelling less suitable for our study as themes identified by models may be harder to interpret, and results harder to replicate.

4.4 Sample selection

South Africa provides a unique source of data for studying IT. All companies listed on the Johannesburg Stock Exchange (JSE) in South Africa have been required to produce an Integrated Report since 2011 (on an ‘apply or explain’ basis) to comply with local corporate governance codes. Using a mandatory IR environment has several advantages for our study. Although it might seem that voluntary adopters of IR would be more likely to be interested in the potential benefits of IT than mandatory adopters who are ‘forced’ into IR, there is little research evidence to support this notion. Evidence shows that legitimacy, institutional, and agency theories are more viable explanations for voluntary IR adoption than a genuine desire for internal change (De Villiers et al. 2020).

Using data from a mandatory environment reduces the potential for self-selection bias and allows observation of a broad spectrum of IT adoption. This spectrum ranges from firms who are complying with the bare minimum regulatory requirements of IR (some firms do this as they are dual listed and the JSE is their secondary listing) through to those who are IR enthusiasts and promoters of its internal benefits (for example, several of the firms included in our sample were members of the IIRC’s IR Pilot Programme for early adopters). As IR has been mandatory in South Africa since 2011, South African listed firms should be familiar with the notion of IT, and firms committed to it would be more likely to have made efforts to develop IT over the sampling timeframe. An additional benefit of using South African data is the existence of an independent measure of IR quality. EY rank the reports of the JSE top 100 companies each year into five categories, and we use this ranking (*reporting_quality*) in later tests to represent reporting quality. Without this measure, it would be difficult to separate IT from generic reporting quality, particularly as our new measure relies on narrative disclosures.

By their nature, Integrated Reports contain integrated information and are not easy to separate into financial and non-financial sections for further analysis. Although relevant

disclosures were often located in the CEO and Chairman's reports and the strategy sections, all of the Integrated Report content was converted from PDF to text format for analysis using Adobe Acrobat Pro DC's OCR function for completeness. Some files showed errors with text conversion, reducing the overall sample to the 685 reports shown in Table 2.

The 685 Integrated Reports were searched for mentions of the dictionary words and phrases for each hallmark using Python. The word count for each hallmark was then divided by the total word count in each report to give a word count percentage for each hallmark. This gave both absolute and relative measures of IT for further analysis. The absolute measure has the benefit of assuming that a 'critical mass' of IT disclosures might be necessary for an organisation to exhibit IT, whereas the relative measure acknowledges the variety of report lengths in the sample.

Table 3 shows the results of pairwise correlations between each of the individual hallmarks (*IT_1*, *IT_2*, *IT_3* and *IT_4*) and the total *IT_All*. The positive correlations between hallmarks is a feature of linguistic analysis of this type, as dictionaries for multi-dimensional constructs contain constructs that are distinct but closely related. Following Edwards (2001, 146-147) we treat IT as an aggregate construct where "the dimensions of an aggregate construct are themselves constructs perceived as specific components of the construct they collectively constitute" and are operationalized by aggregating the scores for each dimension. While we recognise that analysis of the individual hallmark categories can bring interesting insights (and we perform some analysis at this level), following Pencle and Mălăescu (2016) the primary measure we use is the combined measure *IT_All*. While Dimes and De Villiers (2023) note that there is evidence which suggests an overlap between the hallmarks, they find that strength in some hallmarks may compensate for weakness in others. It is therefore important to consider not just whether or not certain hallmarks drive the overall findings, but also whether or not a critical mass of IT is necessary to drive results.

4.5 Validity testing

If IT is associated with economic benefits, as its supporters claim, and our new measure successfully captures IT, we would expect to see a relation between our measure and economic benefits. As the real effects hypothesis states that performance measurement can impact the decisions made by managers (Kanodia and Sapra 2016), we consider the real effects measure of return on assets (ROA). ROA is calculated as net income scaled by net assets, and further disaggregated using DuPont analysis into asset turnover (turnover/net assets) and profitability (net income/turnover). Such testing also helps to distinguish between our IT measure and more generic reporting quality measures which are reliant on external information.

We use the following regression model. As the impact of IT may not be contemporaneous, the dependent variable is tested for each firm i at time t , $t+1$ and $t+2$.

$$(1) Econ_{it} = \beta_0 + \beta_1 IT_All_{it} + \sum \beta Controls_{it} + \varepsilon$$

The variable of interest is IT_All . The dependent variable $Econ$ is ROA or its DuPont components. Controls relate to other factors that could be correlated with the IT measures or associated with any of the dependent variables (Dhaliwal, Li, Tsang, and Yang 2011). Control variables are consistent with other studies in the accounting literature, notably Barth et al. (2017) on the association between IR and economic benefits. All regressions employ industry and year fixed effects with standard errors clustered by industry and year. Continuous variables are winsorized at the 1% level. Data were collected from Compustat, Capital IQ Pro, Sharedata online, and Datastream, combined with hand collection.

V. FINDINGS AND DISCUSSION

Panel A of Table 4 reports the sample statistics for the key dependent variables, the variable of interest (IT_All), the individual hallmarks and the control variables. Panel A reveals that the mean word count for the overall IT (IT_All) is 144 with a standard deviation of 90,

suggesting a considerable amount of variation. The mean word counts for the first three individual hallmarks are relatively consistent, ranging between 39 and 49, whereas *IT_4_Systems* has the lowest word count in the sample (8). Regarding control variables, the mean ROA is 0.17 and the median is 0.14, showing an average return on assets for the JSE firms that aligns with global averages. The means for *Profitability* and *Asset_Turnover* are relatively high compared to the medians (even though they are winsorized at the 1% level), showing some skewness.

Panel B of Table 4 presents the industry composition of the total sample, revealing a concentration of firms in the Industrials and retail, Financial services, and Materials and chemicals industries.

In the sample, mentions of words and phrases relating to IT increase over time as a proportion of total word count (untabed), with significantly positive increases over time for both *IT_All* and the individual hallmark measures. This is consistent with the notion that IT develops as IR becomes more embedded and better understood. These results hold for both absolute and relative *IT_All* measures (total, and as a % of total word count). Table 5 reports pairwise correlations between *IT_All*, the dependent variables and the control variables. *IT_All* is positively correlated with *firm_size*, *firm_maturity*, *gearing*, *readability* and *prime*. This suggests that larger, more mature firms with a primary listing on the JSE may be more committed to IT. There is a negative and significant correlation between *IT_All* and *accruals*. As *accruals* are related to poor accounting quality, this suggests that IT is less likely in firms with low accounting quality.

5.1. Economic benefits

Table 6 reports results of estimations of equation (1) for three time periods. All models indicate a positive and significant association between *IT_All* and *ROA*.² *ROA* is negatively associated with *firm_size*, *firm_growth*, *firm_maturity*, and *complexity*. The disaggregation of *ROA* into the DuPont elements of profitability and asset turnover, reported in Table 7, reveals positive and significant results for asset turnover (columns 1-3) but insignificant results for profitability (columns 4-6). These findings support the notion that IT may be more strongly associated with efficiency than profitability. This is linked to findings in the literature that suggest that IT may not lead to cost reductions but may lead to better decision-making through improved resource allocation. These results are supported by the regression findings for the individual hallmarks indicating the board and corporate culture to be key drivers of results (both of which may require investment that reduces profitability).

5.2 Matched sample analysis

Despite the difficulty of objectively identifying firms that have adopted IT for comparison purposes, the VRF published a report in 2021 identifying twelve firms as examples of best practice in IT (VRF 2021b). We matched these firms with similar firms (by year, industry, geography, and total assets) and derived their IT according to our measure. Table 8 shows the matched sample consisting of 12 IT firms and 12 control firms. All firms were based in Europe and matched by reporting year over the five years from 2016-2020 (assuming that IT would develop over preceding years if firms were highlighted as Integrated Thinkers in 2021). There were 60 potential matched firm-year pairs (12 firms over 5 years). However, 21 firm-year pairs were eliminated due to data unavailability, leaving 39 matched firm-year pairs.

² In untabled results, further breakdowns reveal positive and significant results for both financial and non-financial firms at the 5% level. Growth firms (growth above the median) show positive and significant results, whereas complex firms (complexity above the median) do not. Regressions of the individual hallmarks indicate that the Table 6 results are driven by *IT_1_Board* and *IT_3_Culture*, both showing significance at the 1% level. *IT_2_Strategy* is significant at the 10% level, but *IT_4_Systems* is only significant at time t (at the 10% level).

Table 9 shows the results from a t-test of the difference in means of *IT_All* between the IT firms (*IT_Select*) and the matched peer group (*IT_Control*).

The IT sample is small but unique. It is the only sample of firms whose classification as ‘Integrated Thinkers’ is based on detailed internal knowledge of the organizations rather than on secondary data. The matches obtained were close and included some Integrated Reporters (and presumably Integrated Thinkers). On average, the IT firms have a significantly higher score for *IT_All* than the matched sample (t -statistic=2.595, one-tailed p -value=0.007). Untabulated results of t -tests of the difference in ROA between the two groups reveal that ROA for the IT firms is significantly greater than that of the control firms (difference in mean=0.059, one-tailed p -value=0.040). This provides further evidence that higher levels of IT are associated with higher economic benefits, consistent with the multivariate regression results in Table 6.

5.3 Robustness tests

5.3.1 Alternative Integrated Thinking measures

Malafronte and Pereira (2020) propose four key measurements from Thomson Reuters Asset 4 data to capture IT. The measures all comprise subsets of the CGVS corporate governance category, which is frequently used in accounting and CSR research (De Villiers et al. 2022). The CGVS codes have changed since Malafronte and Pereira (2020), as per Table 10. The ESG Reporting Scope is scored out of 100, and the other three measures are binary.

Table 11 shows the results of pairwise correlations between *IT_All* and the four CGVS-based variables. The number of observations indicates how limited the CGVS data is in certain categories, such as Integrated Strategy. There is sometimes no correlation reported as the binary variables (ESG report, CSR report, and GRI report, for example) have a constant relationship. No categories have strong correlations and none are significantly correlated with *IT_All*. In the bottom portion of Table 11, we present additional CGVS categories that have the

potential to measure IT but are not included in the four in Table 10. Some of these show a stronger correlation with our measure, particularly the existence of a CSR committee and a CSR report. Both of these might indicate the importance of non-financial matters to an organization, and the CSR committee, in particular, may be connected to IT. Our findings provide evidence that while CGVS measures may be readily available, they are not highly correlated with a broader measure of IT. The choice of the four measures proposed by Malafronte and Pereira (2020) potentially requires more justification.

5.3.2 *Other constructs*

Disclosures related to IT could be related to other types of corporate disclosure, such as CSR disclosure. Therefore, it is essential to ensure that the dictionaries in this study capture IT rather than CSR more broadly. We use three established dictionaries from prior studies (all available at <http://www.catscanner.net/dictionaries>) to measure CSR (Pencle and Mălăescu 2016), organizational virtue orientation (which considers six organizational virtue dimensions: integrity, empathy, warmth, courage, conscientiousness, and zeal) (Payne et al. 2011), and economic value orientation (Moss, Renko, Block, and Meyskens 2018). The aim of this test is to illustrate how our measure is distinct from other measures of organizational purpose that might be revealed subconsciously by managers. Table 12 indicates positive but weak correlations between the IT hallmarks and the dictionaries for CSR at 0.2004 (*CSR*) and organizational virtue orientation at 0.4841 (*Virtue*).³ This is to be expected with the overlap of concepts such as purpose-led organizations and consideration of a broader stakeholder base. The weaker correlation between IT hallmarks and economic value orientation at 0.0543 (*EV*) is also expected, as this shows that IT considers broader outcomes than Economic Value.

³ Although *Virtue* has some commonality with *IT_3_Culture*, it is distinct from *IT_All* as it does not encompass strategy, stakeholder engagement or performance management systems.

5.3.3 Reporting quality

As the *IT_All* measure is derived from narrative information in annual reports, there may be concerns that the results are driven by reporting quality rather than IT. We use the EY ‘Excellence in Reporting’ rankings as a proxy for reporting quality (*reporting_quality*) in a further test. The EY ‘Excellence in Reporting’ rankings show a positive and significant (at the 1% level) correlation of 0.3846 with our *IT_All* measure (untabulated). This positive correlation might be expected as our measure derives from narrative disclosures, but it is not particularly strong, suggesting there is a distinction between our measure and generic reporting quality. As the aim is for our measure to capture underlying management decision-making, we would expect there to be some difference. Table 13 shows that the strong and significant association between *IT_All* and *ROA* remains when we include the reporting quality as a control, suggesting that the effect of IT on *ROA* is incremental to any effect of IR reporting quality. This result provides strong evidence that our measure of IT is distinct from reporting quality more generally.⁴

VI. CONCLUSION

IT has been promoted as having the potential to enhance organizational decision-making in the pursuit of sustainable value creation, providing a crucial link between external reporting and internal management action. Although interest in IT has been growing, it remains poorly understood, difficult to conceptualize, and challenging to measure. Based on early research findings in this newly emerging field, our paper finds that narrative disclosures by management in annual reports may yield unique insights into IT.

Our study provides a novel measure for IT based on narrative disclosures, responding both to calls for more critical analysis of the language and discourse of Integrated Reports

⁴ In another additional test, we also control for alternative IT measures based on *CGVS* discussed in section 5.3.1 and find our main results remain significant.

(Higgins, Stubbs and Love, 2014) and more studies addressing measurement issues with IR and IT (De Villiers et al. 2017). We develop a dictionary-based measure of IT based on a detailed literature review, a detailed review of a sub-sample of Integrated Reports, and independent expert review. We test our measure on a sample of reports from South Africa, finding evidence of IT in the narrative disclosures in Integrated Reports that is distinct from reporting quality, generic CSR disclosures, and self-reported database measures. A matched sample analysis indicates that firms independently identified as Integrated Thinkers score significantly higher on our measure.

We also find evidence that high levels of IT are positively and significantly associated with a higher return on assets, which is driven by efficiency rather than profitability. These results hold while controlling for reporting quality using an independent measure. Robustness tests indicate that the new IT measure is distinct from other existing measures of IT.

Our findings suggest several avenues for further research. Our approach could be extended outside a mandatory reporting environment, investigating the potential for organizations to develop IT independently of IR, or to develop IT through other types of reporting such as sustainability reporting. The potential for our IT measure to reveal shortcomings in board and senior management decision-making related to a lack of IT could also be explored further using examples of corporate failures or scandals.

In addition, the new IT dictionaries provided as part of this paper can be used to analyze data sets other than annual reports. Although accounting analysis often uses traditional print media produced by companies (such as annual reports), analysis using the IT dictionaries could be applied to social media releases (Rivera-Arrubla and Zorio-Grima 2016), firm website information, or conference call transcripts. As text analysis is an emerging field in accounting, it would also be interesting to research managerial awareness of large-scale linguistic analysis

and whether (and how) managers might ‘game’ such analysis through the deliberate inclusion of certain words and phrases in their disclosures.

In common with most studies in this field, this study has some inherent limitations. The literature on IT is at an early stage yet forms a substantial part of the measurement that underpins the findings of the paper. The IT hallmarks and related dictionaries are based on a thematic interpretation of literature, and we acknowledge the possibility that others could have made different choices in the subsample selection process. Nonetheless, we provide evidence that the constructs have validity through expert review, and therefore the dictionaries can be considered a good representation of the current state of knowledge on IT. Critics of NLP procedures in accounting research comment on a lack of transparency in the dictionary development process and consequent problems with replicability (El-Haj, Alves, Rayson, Walker and Young 2020; Loughran and McDonald 2016). We outline in detail each stage of the process, providing dictionaries for other researchers to use and detailed construct validity checks. Our code is available from the lead author upon request.

In addition, while our choice of South Africa is important to develop our measure, the sample chosen does limit the conclusions we can draw on the development of IT. However, our matched sample from EU firms provides strong evidence in support of our construct.

VII. REFERENCES

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Table 1. Working definitions of Integrated Thinking hallmarks

Hallmarks	Description
Hallmark 1: Board and CEO drive Integrated Thinking adoption	The Board, supported by the CEO, drives the principles of Integrated Thinking throughout the organization. The board defines the organizational purpose, sets the ethical tone and demonstrates clear leadership and accountability.
Hallmark 2: Integrated Strategy	There is active engagement with a broad set of external stakeholders to develop a strategy that creates mutual long-term value. This integrated strategy balances financial and non-financial capitals, with an understanding of materiality and the need for trade-offs. Performance incentives are linked to the integrated strategy.
Hallmark 3: Culture of trust and collaboration	An organizational culture of trust, collaboration and teamwork is promoted, which encourages knowledge sharing and knowledge building. Employees are motivated and engaged and take collective ownership of value creation.
Hallmark 4: Integrated Intelligence	There is an investment in enhanced management information systems that provide the data necessary for decision-making. There is a deliberate attempt to promote a cross-functional approach to decision-making and improve information flow across the organization.

Table 2. South African dataset

100 JSE listed companies from 2011 to 2019:	900
Removed from sample for dictionary development	(90)
Integrated Reports not found	(33)
Integrated Reports with text conversion problems	(92)
Remaining dataset	685

Table 3. Pairwise correlation between total and individual IT hallmarks

Variables	(1)	(2)	(3)	(4)	(5)
(1) <i>IT_All</i>	1				
(2) <i>IT_1_Board</i>	0.865*	1			
(3) <i>IT_2_Strategy</i>	0.884*	0.653*	1		
(4) <i>IT_3_Culture</i>	0.854*	0.666*	0.600*	1	
(5) <i>IT_4_Systems</i>	0.680*	0.468*	0.600*	0.546*	1

Note. * $p < 0.05$. See Appendix 3 for variable definitions.

Table 4. Sample statistics

Panel A: Variable Statistics						
	Obs	Mean	Median	Std. Dev	Q1	Q3
Independent variables						
<i>IT_All</i>	685	144	135	90	73	203
<i>IT_1_Board</i>	685	48	43	29	28	65
<i>IT_2_Strategy</i>	685	49	42	37	20	70
<i>IT_3_Culture</i>	685	39	33	30	16	55
<i>IT_4_Systems</i>	685	8	6	9	2	11
Dependent variables						
<i>ROA</i>	685	0.17	0.14	0.19	0.08	0.21
<i>Profitability</i>	685	0.24	0.10	0.53	0.04	0.21
<i>Asset_turnover</i>	685	2.20	1.28	3.08	0.55	2.53
Control variables						
<i>Firm_size</i>	685	4.67	4.57	0.63	4.24	4.95
<i>Complexity</i>	685	0.60	0.60	0.19	0.48	0.70
<i>Firm_growth</i>	678	0.17	0.11	0.41	0.03	0.20
<i>Firm_maturity</i>	685	1.54	1.62	0.44	1.26	1.88
<i>Gearing</i>	685	0.40	0.36	0.28	0.21	0.55
<i>Accruals</i>	685	-0.01	-0.01	0.96	-0.06	0.03
<i>Readability</i>	685	4.69	4.75	0.34	4.60	4.88
<i>Prime</i>	685	0.85	1.00	0.36	1.00	1.00
Panel B: Industry composition						
GICS Sector	Firms	Firms %	Observations	Observation %		
Industrials and retail	31	22.3%	144	21.0%		
Financial services	24	17.3%	132	19.3%		
Materials and chemicals	24	17.3%	114	16.6%		
Metals and mining	19	13.7%	102	14.9%		
Real estate	23	16.5%	102	14.9%		
Telecoms and IT	8	5.8%	37	5.4%		
Construction and materials	4	2.9%	23	3.4%		
Health care	6	4.3%	31	4.5%		
Total	139	100.0%	685	100.0%		

Note. Panel A reports descriptive statistics for variables used in the analyses. See Appendix 3 for variable definitions. Panel B reports sample distribution by industry.

Table 5. Pairwise correlation of IT_All with dependent variables and control variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>(1) IT_All</i>	1											
<i>(2) ROA</i>	0.089*	1										
<i>(3) Profitability</i>	-0.046	1	1									
<i>(4) Asset_t/o</i>	-0.012	-0.228*	1	1								
<i>(5) Firm_size</i>	0.307*	-0.03	-0.213*	-0.147*	1							
<i>(6) Complexity</i>	0.037	-0.156*	-0.100*	-0.019	0.257*	1						
<i>(7) Firm_growth</i>	-0.068	0.06	-0.047	0.334*	-0.006	0.009	1					
<i>(8) Firm_maturity</i>	0.112*	-0.169*	0.119*	0.038	-0.076*	-0.012	-0.041*	1				
<i>(9) Gearing</i>	0.233*	-0.014	-0.034	-0.086*	0.424*	0.029	-0.009	0.006	1			
<i>(10) Accruals</i>	-0.077*	0.489*	-0.154*	-0.190*	-0.037	-0.131*	0.227*	-0.075*	-0.121*	1		
<i>(11) Readability</i>	0.618*	-0.032	-0.068	-0.217*	0.200*	0.020	-0.004	-0.063	0.093*	0.055	1	
<i>(12) Prime</i>	0.018	-0.169*	0.144*	0.008	-0.352*	-0.033	-0.080*	0.264*	0.014	0.001	-0.156*	1

Note. *p<0.05. See Appendix 3 for variable definitions.

Table 6. Regression of ROA on IT_All for all firms

Variables	DV = ROA		
	(1) t	(2) t+1	(3) t+2
<i>IT_ALL</i>	0.000***	0.001***	0.001***
	0.000	0.000	0.000
<i>Firm_size</i>	-0.143***	-0.066**	-0.079***
	-0.027	-0.026	-0.026
<i>Firm_growth</i>	-0.058**	-0.065	0.031
	-0.025	-0.040	-0.051
<i>Firm_maturity</i>	-0.041**	-0.040**	-0.024
	-0.019	-0.017	-0.019
<i>Gearing</i>	0.337***	0.007***	0.003*
	-0.066	-0.001	-0.001
<i>Complexity</i>	-0.099**	-0.100*	-0.103*
	-0.046	-0.054	-0.055
<i>Accruals</i>	0.728***	1.171***	1.140***
	-0.165	-0.172	-0.171
<i>Readability</i>	-0.058**	-0.068*	-0.053*
	-0.027	-0.036	-0.032
<i>Prime</i>	-0.096***	0.03	0.017
	-0.030	-0.032	-0.034
Constant	1.132***	0.824***	0.775***
	-0.166	-0.188	-0.183
Observations	677	677	634
Adj R-squared	0.298	0.302	0.381
Industry and Year FE	YES	YES	YES

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. See Appendix 3 for variable definitions.

Table 7. Regression of Asset turnover and Profitability on IT_All for all firms

Variables	DV = <i>Asset turnover</i>			DV = <i>Profitability</i>		
	(1) t	(2) t+1	(3) t+2	(4) t	(5) t+1	(6) t+2
<i>IT_All</i>	0.003**	0.003*	0.004**	0.000	0.000	-0.000
	-0.001	-0.001	-0.002	0.000	0.000	0.000
<i>Firm_size</i>	-0.514*	-0.299	-0.388	-0.308***	-0.306***	-0.265***
	-0.310	-0.288	-0.300	-0.080	-0.072	-0.070
<i>Firm_growth</i>	-0.395*	0.151	-0.398	-0.146*	-0.297**	-0.282*
	-0.216	-0.170	-0.394	-0.087	-0.123	-0.156
<i>Firm_maturity</i>	-0.445**	-0.345**	-0.427**	0.054	0.012	-0.101
	-0.183	-0.173	-0.199	-0.053	-0.069	-0.078
<i>Gearing</i>	1.829***	-0.015**	-0.026	0.017	-0.007**	0.005*
	-0.492	-0.007	-0.040	-0.201	-0.003	-0.003
<i>Complexity</i>	-1.064***	-1.076***	-0.762*	-0.044	-0.029	-0.237
	-0.354	-0.406	-0.454	-0.158	-0.158	-0.187
<i>Accruals</i>	-0.799	-4.333***	-2.372**	2.360***	3.306***	2.847***
	-0.878	-1.401	-1.128	-0.747	-0.773	-0.710
<i>Readability</i>	-0.651*	-0.761*	-0.818	-0.066	-0.056	-0.012
	-0.362	-0.445	-0.510	-0.091	-0.116	-0.118
<i>Prime</i>	-0.211	-0.021	0.116	-0.429***	-0.328**	-0.216
	-0.303	-0.278	-0.280	-0.092	-0.145	-0.137
Constant	8.103***	7.875***	8.461***	2.328***	2.299***	2.138***
	-2.462	-2.608	-2.916	-0.564	-0.687	-0.690
Observations	677	677	634	677	677	633
Adj R-squared	0.130	0.102	0.067	0.268	0.320	0.229
Industry and Year FE	YES	YES	YES	YES	YES	YES

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. See Appendix 3 for variable definitions.

Table 8. IT and control firms matched sample

Industry	Integrated Thinking firm	Total Assets (2020 €m)	Control firm	Total Assets (2020 €m)
Aerospace	Leonardo	25,495	BAE Systems	33,169
Energy	Snam	24,066	Italgas*	9,129
Financial services	NN Group	263,768	KBC Group	320,743
Financial services	ABN Amro	395,623	Aegon NV *	444,868
Financial services	ING Group	937,275	Rabobank	632,258
Materials and chemicals	Solvay	16,792	OCI NV	7,437
Pharmaceuticals	Novo Nordisk	19,474	AstraZeneca	59,579
Energy	Enel	163,453	ENGIE	153,182
Automotive	BMW Motor Group	216,658	Mercedes Group	285,737
Aviation	Royal Schipol Group	9,280	FraPort	14,081
Utilities	Yorkshire Water	12,077	Southern Water	8,942
Aviation	Munich Airport	5,529	Zurich Airport	4,858

Note: *self-declared Integrated Reporters

Table 9. T-test of difference in means of *IT_All* between IT firms and control group.

Sample	Obs	Mean <i>IT_All</i>	Std. Err	Std. Dev	95% Confidence Interval	
IT_Select	39	0.021	0.001	0.006	0.019	0.023
IT_Control	39	0.018	0.001	0.004	0.017	0.019
diff	39	0.002	0.001	0.006	0.001	0.004
mean(diff) = mean (IT_Select - IT_Control)					t = 2.595	
Ho: mean (diff) = 0				degrees of freedom = 38		
Ha: mean (diff) < 0		Ha: mean (diff) = 0		Ha: mean(diff) > 0		
Pr(T<t) = 0.993		Pr(T<t) = 0.013		Pr(T<t) = 0.007		

Table 10. CGVS measures for Integrated Thinking

Category	Malafrente and Pereira (2020) variables	Revised variables (latest categories)
Policy	Policy for maintaining an overarching vision and strategy that integrates financial and extra financial aspects of the business (CGVSD01S)	ESG Reporting Scope (CGVSDP041)
Monitoring	Monitoring the integrated strategy through belonging to a specific sustainability index and through conducting external audits on reporting (CGVSD03S)	CSR sustainability external audit (CGVSDP030)
Improvement	Specific objectives to be achieved on the integrated strategy (CGVSD04S)	Integrated strategy in MD&A (CGVSDP018)
GC Signatory	Signatory of the global compact (CGVSO03S)	Signatory of the global compact (CGVSDP020)

Table 11. Pairwise correlations between hallmarks and CGVS Integrated Thinking categories

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CGVS Integrated Thinking categories	(1) <i>IT All</i>	1 685							
	(2) <i>ESG report</i>	-0.026 355	1 355						
	(3) <i>External audit</i>	-0.034 284	-0.112 282	1 284					
	(4) <i>Global compact</i>	-0.002 381	0.070 355	0.247* 284	1 381				
	(5) <i>Integrated strategy</i>	-0.034 153	0.163* 146	0.252* 122	-0.066 153	1 153			
Other CGVS categories	(6) <i>CSR report</i>	0.138* 381	+ 355	0.158* 284	0.145* 381	0.226* 153	1 381		
	(7) <i>CSR committee</i>	0.126* 381	0.053 355	0.157* 284	0.132* 381	-0.056 153	0.363* 381	1 381	
	(8) <i>GRI report</i>	0.078 294	-0.020 293	0.132* 251	0.046 294	-0.071 128	+ 294	0.329* 294	1 294
	(9) <i>UNPRI signatory</i>	0.084 381	0.026 355	0.045 284	0.112* 381	-0.129 153	0.019 381	0.018 381	0.005 294

Note. *p<0.05, + data for these binary variables is constant in the sample observations

Table 12. Pairwise correlations between IT_All and alternative dictionary measures

	<i>IT_All</i>	<i>CSR</i>	<i>Virtue</i>	<i>EV</i>
<i>IT_All</i>	1 685			
<i>CSR</i>	0.2004* 685	1 685		
<i>Virtue</i>	0.4841* 685	0.0977* 685	1 685	
<i>EV</i>	0.0543 685	-0.3018* 685	0.4176* 685	1 685

Note. *p<0.05

Table 13. Regression of IT_All on ROA controlling for reporting quality

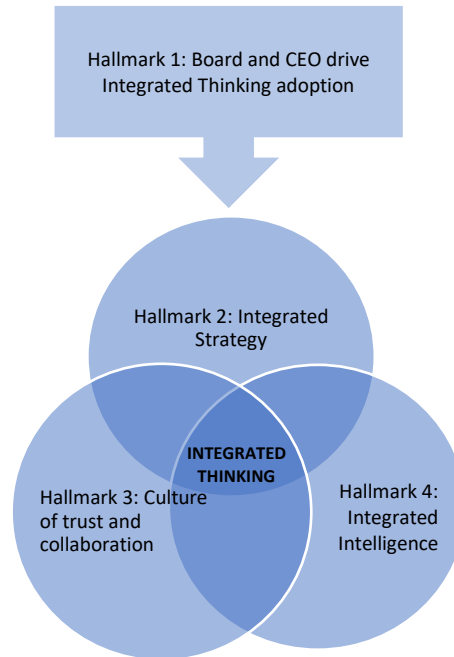
Variables	DV = ROA		
	(1) t	(2) t+1	(3) t+2
<i>IT_All</i>	0.001*** 0.000	0.000*** 0.000	0.001*** 0.000
<i>Reporting_quality</i>	-0.007 -0.008	0.005 -0.009	0.002 -0.010
<i>Firm_size</i>	-0.139*** -0.019	-0.066*** -0.021	-0.080*** -0.021
<i>Firm_growth</i>	-0.059** -0.025	-0.064** -0.030	0.031 -0.050
<i>Firm_maturity</i>	-0.039* -0.022	-0.042* -0.024	-0.024 -0.024
<i>Gearing</i>	0.337*** -0.041	0.007*** -0.002	0.003 -0.005
<i>Complexity</i>	-0.102** -0.045	-0.097** -0.049	-0.102** -0.050
<i>Accruals</i>	0.720*** -0.100	1.184*** -0.109	1.144*** -0.091
<i>Readability</i>	-0.067** -0.032	-0.063* -0.036	-0.049 -0.037
<i>Prime</i>	-0.093*** -0.027	0.032 -0.029	0.016 -0.030
Constant	1.165*** -0.170	0.791*** -0.189	0.763*** -0.193
Observations	677	676	633
Adj R-squared	0.299	0.303	0.381
Industry and Year FE	YES	YES	YES

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. See Appendix 3 for variable definitions.

Table 14. Word list generation

	Hallmark 1	Hallmark 2	Hallmark 3	Hallmark 4	TOTAL
Seed words from NVivo analysis	100	164	163	155	582
Words added from subset review	89	99	115	80	383
Words removed during consolidation process	(117)	(147)	(164)	(152)	(580)
Words provided to experts	72	116	114	83	385
Words added	16	14	4	9	43
Words removed	(3)	(10)	(7)	(5)	(25)
FINAL LIST	85	120	111	87	403

Figure 1: Hallmarks of Integrated Thinking



VIII. APPENDICES

Appendix 1 – Dictionary development process

8.1 Construct definition based on a priori theory

We use working definitions for each hallmark of IT taken from the literature review by Dimes and De Villiers (2023), as shown in Table 1. This study considers IT to be a multi-dimensional construct, consisting of these four main hallmarks. For multi-dimensional constructs, each dimension needs to be distinct from but related to the others (Edwards 2001). The construction of comprehensive dictionaries with limited overlap between the hallmarks is a challenge faced by several text analysis studies. A phrase like ‘long-term value creation’, for example, could easily fit into either Hallmark 1 (Board) or Hallmark 2 (Strategy). A phrase like this could be further complicated by its particular use in certain industries such as asset management. The key to overcoming this challenge is the creation of distinct word lists per hallmark, and subsequent validation by experts, as discussed in later sections. Therefore, we follow the approach to dictionary-based studies of multi-dimensional managerial constructs outlined in Short et al. (2010), which was also followed by Pencle and Mălăescu (2016) who develop a dictionary for CSR.

8.2 Seed word generation

Seed nouns, noun phrases and adjectives were extracted from the original NVivo codes that underpin the definitions in Table 1 from Dimes and De Villiers (2023). The content from each NVivo code was downloaded into an Excel file, with all nouns, noun phrases and adjectives highlighted. Duplicates were eliminated, and the seed words were then grouped into hallmarks (as per the NVivo categorization in Table 1). Nouns, noun phrases and adjectives were chosen for the dictionaries for two specific reasons. Firstly, choosing nouns and adjectives makes it unnecessary to parse sentences into their grammatical components, reducing the level of coding complexity. Secondly, avoiding verb forms wherever possible eliminates the issues

surrounding the timing of statements made by management. Timing is captured instead by the use of a 9-year panel data set for the study.

8.3 Sub-sample analysis

A manual review of 10% of the dataset (90 reports out of the 900) was conducted in order to expand the seed dictionaries by considering alternative ways in which the hallmarks might be expressed by management. This step was taken to ensure that the documents analyzed were appropriate to study the construct of interest for the findings to have external validity. A detailed manual review of a sub-sample of the dataset is common in linguistic analysis (El-Haj et al. 2019; Huang, Zang, and Zheng 2014) as it helps to understand the nuances of the text and to calibrate them to address the research question, reducing semantic inaccuracy (Loughran and McDonald 2016). Manual analysis also helps to address the question of whether or not management would reveal IT hallmarks in their narrative disclosures. Following recommendations for accounting researchers to show detailed examples of relevant text in studies of this type (Firk, Hennig, and Wolff 2020), Appendix 4 lists some direct quotes from our subset, showing how clearly managers express some of the hallmarks. The manual review added many more words and phrases to the seed dictionary, demonstrating the importance of this step (see Table 14). Increasingly fewer words were added as the review progressed, indicating data saturation. Our approach to generating additional words using a sub-sample was chosen over generic synonym-generating algorithms for its ability to keep the dictionaries closely related to the source data. For example, a generic synonym for ‘materiality’ is ‘aptness’ which is very unlikely to occur in this dataset and has quite a different meaning in this context. The process we use is referred to as ‘contextual synonym substitution’ in the linguistics literature, where human assessment is widely used to ensure the naturalness of the chosen words for their context (Chang and Clark 2014).

8.4 Consolidation

The expanded dictionaries were then consolidated by the researchers. The consolidation process was used to ensure that the final dictionary related as closely as possible to the construct of interest and did not allow for misinterpretation of findings. The following rules were used to reduce the dictionaries: Rule 1: Words and phrases need to relate closely to the construct of interest; Rule 2: Word lists per hallmark should be discrete; Rule 3: Words and phrases should not be polysemic; and Rule 4 – Words and phrases are unlikely to be negated. The primary researcher checked this list with a secondary researcher on the project before sending the list to external experts for review. The primary and secondary researchers agreed on 92.5% of the words in total. The reduced list was then sent for expert review.

8.5 Expert review

To review the accuracy of the final dictionaries, the consolidated lists of words and phrases were provided to three independent experts. One expert was an academic with strong research knowledge in IR, the second was a director at the VRF and the third was a CFO in the manufacturing industry. The experts were each independently provided with a file containing the four hallmark definitions and the dictionaries and instructed to use the construct definitions as a guide for including or excluding each word in the related dictionary. If they deemed a word unsuitable, they could either recommend its deletion or alternatively its inclusion under another hallmark. Experts could also suggest additional words for inclusion. The evaluated wordlists were then returned to the researchers. Only words that two or more experts agreed on were included in each category. Newly suggested words by the experts were reviewed by both researchers and only included if both researchers agreed that they represented suitable additions. The independent judging of the wordlists helped with objectivity, while the suggestion of additional words by the experts showed both engagement and knowledge of the

subject. We used Holsti, Gerbner, Paisley, Krippendorff, and Stone's (1969) model to calculate inter-rater reliability, calculating this to be 0.92 (anything higher than 0.9 is an indication of high inter-rater reliability (Allen 2017)). The raw agreement percentage (100% agreement across all words) was 80%. Table 14 shows the total number of words added and removed at each stage of our process from each category (detailed word lists for each stage are available from the authors on request). Appendix 2 lists the final dictionaries for each hallmark of IT.

8.6 Dictionary expansion

The list provided to the experts only included single derivations of each word, for example 'collaboration', but not 'collaborator', 'collaborative' etc. This was to avoid the word lists becoming too long for the reviewers. Expansion of the dictionaries was done by generating derivations of the words and phrases. Python NLTK's PorterStemmer allows for the expansion of individual words into their stems ('collaborat-' as a stem for all derivations of the word for example). This process did not work well on phrases though (for example, the dictionary for Hallmark 1 includes the phrase 'board skills', but not 'skills of the board', even though these have the same meaning) meaning that additional expansion work was done manually.

Appendix 2– Integrated Thinking Dictionaries

<p>Hallmark 1: Board and CEO The Board, supported by the CEO, drives the principles of Integrated Thinking throughout the organisation. The board defines the organisational purpose, sets the ethical tone and demonstrates clear leadership and accountability.</p>	accountability, adding value, authentic, balanced board, benchmarking, best practice, board appraisal , board diversity, board engagement, board skills , champion of change, commitment to change, constant drive, constructive , corporate citizenship, corporate conduct, corporate responsibility, corporate social investment, critical thinking, custodians, debate, director assessment, discussion, doing good, doing the right thing, ESG, ethical values, ethics, executive remuneration, future-fit organization, good governance, governance practices, healthy tension, independent oversight, influence, integrated governance, integrated reporting, integrated thinking , integrity, lasting change, lasting contribution, lead by example, leadership ability, leadership capability, leadership development, leadership skills, legacy, long-term, management and governance practices, mission statement, moral compass, passion, pioneer, policy, positive impact, principles, prioritisation, prosperity, purpose, purpose-driven , reporting boundary, reputation, resilience, respectful, responsible , safeguard, self-evaluation, shared values, skills matrix, social good, social licence to operate, society-centric, stewardship, succession plan, sustainable development, the right thing, the right way, tone at the top, transparent, trusted, values, values-driven, vision, whistleblowing
<p>Hallmark 2: Strategy There is active engagement with a broad set of external stakeholders to develop a strategy that creates mutual long-term value. This integrated strategy balances financial and non-financial capitals, with an understanding of materiality and the need for trade-offs. Performance incentives are linked to the integrated strategy.</p>	agility, alignment, alliance, balanced decisions, beneficial relationships, benefit to society, broad participation, broaden horizons, broader perspective, broader societal impact, business model, capitals, causal relationships, common interest, community, consultation, contribution to society, creating value , customer engagement, dialogue , effective engagement, effective partnerships, environmental capital, environmental factors, external engagement, financial capital, future generations, future-orientated, good relations, government engagement, holistic approach, human capital, human-centric, impactful relationships, incentives, inclusive growth strategies, innovation, intangible assets, intangible value, integrated approach, integrated business model, integrated decisions, integrated planning, integrated stakeholder engagement, integrated sustainability, integrated value chain, integrated view, intellectual capital, inter-dependence, long-term , manufactured capital, material to stakeholders, materiality, multi-capital perspective, multiple capitals, mutual collaboration, mutually beneficial, natural capital, natural environment, non-financial capital, opportunity, optimal balance, participation, partnerships, performance and reward, positive engagement, public engagement, purposeful, range of stakeholders, responsive, risk, robust business strategy, robust relationships, satisfied customers, shared planning, shared vision, silent stakeholders, social and relationship capital, social capital, social investment, social value, socially aware, socially progressive, stakeholder communication, stakeholder consultation, stakeholder dialogue, stakeholder engagement, stakeholder feedback, stakeholder focus, stakeholder inclusivity, stakeholder interests, stakeholder needs, stakeholder participation, stakeholder relationships, stakeholder views, stakeholder-centric, stakeholder-inclusive , strategic alignment, strategic alliances, Strategic goals, strategic mission, strategic objectives, strategic partnerships, strategic plan, strategic relationships, strategic vision, strategy alignment, supply chain visibility, sustainability, sustainability goals, trade-offs, two-way communication, value chain, value co-creation, value drivers, value-based strategy, value-relevant , wider society, win-win , working relationships

<p>Hallmark 3: People and Culture An organisational culture of trust, collaboration and teamwork is promoted, which encourages knowledge sharing and knowledge building. Employees are motivated and engaged and take collective ownership of value creation.</p>	attract talent, attractiveness as an employer, coaching , cohesiveness, collaboration, colleagues, collective , committed, common values , communication, continuous improvement, continuous learning, cooperative, core skills, cultural shift, cultural transformation, cultural values, culture, diversity, education, emotional support, employee engagement, employee experience, employee forum, employee incentive, employee involvement, employee ownership, employee rights, employee value proposition, employee-centric , employment equity, empowerment, encouragement, equal opportunities, equitable, fair pay , feedback, healthy, honesty, humanity, humbleness, inclusive, interpersonal relationships, investing in employees, knowledge sharing, learning opportunities, learning organization, learning programmes, listening, long-term incentive plan, long-term retention plan, low staff turnover, loyalty, mentoring , merit based, minimize harm, morale, motivate, mutual cooperation, new skills, no harm , nurturing, openness , people-centred , personal accountability, positive working environment, proactivity, productive, reskilling, respect, reward and recognition , role based pay, safe production, shared capabilities, shared goals, shared intelligence, shared knowledge, shared ownership, sharing expertise, skills development , social interaction, stable workforce, supportive, talent management , talent metrics, talent pipeline, talent retention, talented people, talented workforce, team cohesion, team development, team dynamics, team effectiveness, team engagement, team goals, team outputs, team performance, team-based, teambuilding, teamwork, training, transformation metrics, transformed workforce, transparency, trust , trust-building, up-skilling, value driven culture, ways of working, wellbeing, zero harm
<p>Hallmark 4: Information systems There is an investment in enhanced management information systems that provide the data necessary for decision-making. There is a deliberate attempt to promote a cross-functional approach to decision-making and improve information flow across the organisation.</p>	access knowledge, accounting infrastructure, accounting system, advanced analytics, agile , analysis, assessing performance , assurance, audit, balanced scorecard, breaking down silos, broader performance measures, business partnering, business scorecard, business unit collaboration, comparable measures, connectivity, consistent measurement systems, controls , credibility, cross-functional , dashboards, data accuracy, data analytics , data assurance, data availability, data infrastructure, data sources, data-driven insights, decentralized , decision-making systems, department liaison, design thinking, efficiencies, functional integration, future-looking information, future-oriented information, high-quality data, improving systems, information flow, information process, information quality, information systems, insight-driven decisions, integrated indicators, integrated information, integrated measurement systems, integrated measures, integrated metrics, integrated performance, integrated process, inter-functional, internal control, KPIs, lean, management information systems, measurement tool, measuring value, metrics, multi-disciplinary teams, multiple objectives, non-financial indicators, organizational competencies, organizational integration, organizational restructure, overcome boundaries, performance indicators, performance measurement systems, performance scorecard, qualitative factors, reduce duplication, relevant objectives and targets, reliable information, reporting frameworks, reporting practices and data, reporting processes, reporting protocols, rigour, robust measures, silo mentality, siloed thinking, streamline, synergies , systems thinking, technology platforms, transformation agenda, veracity of systems

Appendix 3 – Variable definitions

Independent variables Definition

<i>IT_All</i>	Sum of IT_1, IT_2, IT_3 and IT_4
<i>IT_1_Board</i>	Number of mentions of IT_1_Board dictionary items
<i>IT_2_Strategy</i>	Number of mentions of IT_2_Strategy dictionary items
<i>IT_3_Culture</i>	Number of mentions of IT_3_Culture dictionary items
<i>IT_4_Systems</i>	Number of mentions of IT_4_Systems dictionary items

Dependent variables

<i>ROA</i>	Net income scaled by net assets
<i>Asset turnover</i>	Turnover scaled by net assets
<i>Profitability</i>	Net income scaled by turnover

Control variables

<i>Firm_size</i>	Natural log of total assets
<i>Firm_growth</i>	Year-on-year change in assets, divided by total assets
<i>Firm_maturity</i>	Natural log of age from founding to the reporting year
<i>Gearing</i>	Total liabilities scaled by the sum of total liabilities and book value of equity
<i>Complexity</i>	Log of the number of business segments
<i>Accruals</i>	The difference between net income (before extraordinary items and preference dividends) and operating cash flows, scaled by total assets
<i>Readability</i>	Log of report length (total word count) ⁵
<i>Prime</i>	One for firms with a primary JSE listing and zero otherwise

⁵ The Gunning Fog Index (another measure of readability) does not make allowances for the financial literacy of the audience (Loughran and McDonald 2014), making log of report length a more suitable control for our study.

Appendix 4 - Evidence of supporting hallmarks of Integrated Thinking in Integrated Report texts (random illustrative sample):

Hallmark 1: Board

“The role of the board in this evolution has been to ensure that the strategy of the company creates value not only for our shareholders, but for all our stakeholders. This has called for co-ordinated thinking to ensure that the trade-offs that are inevitable in managing the competing interests of stakeholders, ultimately result in the ethical and responsible creation of shared value.” (Sasol Integrated Report 2014, p23).

“The group recognizes that a balanced board supports value creation.” (MultiChoice Group Integrated Report 2019, p67).

Hallmark 2: Strategy

“Our primary stakeholders, as outlined in our vision, are our staff clients, shareholders, regulators and communities, and include ‘silent’ stakeholders such as future generations and the environment (human and environmental capitals).” (Nedbank Integrated Report 2019, p56).

“For awards to be made in 2020, the Committee is proposing a scorecard comprising the same measures as used for 2019 awards, but reducing the weighting on relative TSR from 70% to 50% and up-weighting our balanced scorecard of strategic KPIs. This allows for a greater focus on ESG metrics and will provide a better balance between internal and external, as well as absolute and relative performance.” (Kumba Iron Ore Integrated Report 2019, p114).

Hallmark 3: Culture

“The first was culture, with a focus on building a unique and appropriate culture, starting with our executive leadership team and cascading to management across the organization. This has resulted in staff morale and culture metrics today being close to world class levels.” (Nedbank Integrated Report 2014, p80).

“Inappropriate conduct and improper tone at the top at the LCCP and the areas of weakness from the culture survey is receiving heightened attention.” (Sasol Integrated Report 2019, p40).

Hallmark 4: Integrated Intelligence

“Integrated thinking is intrinsic to the way we manage our business and is supported by our internal reporting processes.” (Vodacom Integrated Report 2014, p2).

“The overhaul of our operating model, from product-based to one structured by value chain, has culminated in wide reaching changes made to our management, corporate and decision-making structures.” (Sasol Integrated Report 2014, p6).