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Integrated Thinking: Measuring the Unobservable

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Abstract

Purpose

The purpose of this paper is to add to the growing literature on integrated thinking and reporting by exploring the challenges of measuring integrated thinking in academic research. It provides a review of previous studies, presents a proxy measure to quantify the level of integrated thinking, and investigates companies' approach towards integrated thinking in practice.

Design/methodology/approach

First, we propose a measure to quantify the level of integrating thinking. Second, we implement factor analysis to identify a parsimonious representation and explore the relevance of each variable in explaining our proposed measure of integrated thinking. Third, we implement cluster analysis to determine the natural grouping of firms with a certain level of integrated thinking and to identify the existence of distinctive companies' approaches.

Findings

The findings suggest that our proposed measure of integrated thinking could be reduced into two main principal components that explain the current practices and the future direction. Firms' integrated thinking practices can be clustered into groups denoting various practices among firms, and exhibit routine over time. Across clusters, firms reveal significantly different characteristics highlighting the existence of systematic demographic differences.

Research limitations/implications

This research does not endeavour to overcome all the measurement issues related to integrated thinking. It attempts to measure the level and companies' approaches towards integrated thinking that can inspire further empirical studies in this field.

Originality/value

This study answers the call for empirical investigation on internal aspects of integration. This paper provides academics, companies, and policymakers with a proxy measure of integrated thinking that can inspire empirical studies and advance our understanding of integrated thinking practices.

Keywords: Integrated thinking. Integrated reporting. Principal component analysis. Cluster analysis. IIRC

Article Classification: Research paper

1. Introduction

Integrated reporting is a new reporting framework promoted by the International Integrated Reporting Council (IIRC) that proposes to overcome the criticisms of traditional accounting reporting models by recommending the integration of financial and non-financial information in a single concise report (Busco *et al.*, 2019; De Villiers *et al.*, 2017a; IIRC, 2013). The framework requires organisations to report their performance with respect to six capitals (financial, manufactured, intellectual, human, social and relationship, and natural) and to explain how these capitals contribute to the organization's value creation process (IIRC, 2013). Whether prepared in response to existing compliance requirements or as a voluntary reporting choice, integrated reporting is expected to become the corporate reporting norm over time.

“An integrated report is a concise communication about how an organization's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation of value over the short, medium and long term” and “should be prepared in accordance with this Framework” (IIRC, 2013, p.7)

Integrated reporting is presented by its proponents as a process founded on integrated thinking, which results in a periodic and concise report. Instead of producing numerous, disconnected and static communications, companies can prepare a single concise report as a result of a process of integrated thinking, that can be defined 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, 2013, p.2).

*“Integrated Thinking refers to the conditions and processes that are conducive to an inclusive process of decision making, management and reporting, based on the connectivity and interdependencies between a range of factors that affect an organization's ability to create value over time” (Busco *et al.*, 2017, p.4)*

Over the last decades, in response to the global financial crisis and the need to overcome the concerns of traditional financial reporting, there has been an increasing adoption of integrated thinking and reporting practices among companies as well as a growing attention by academic research. Many studies focus on theoretical analyses and case studies (i.e. Adams *et al.*, 2016; Eccles and Serafeim, 2014; Eccles and Krzus, 2010; Haller and van Staden, 2014). Other studies focus on country-level and company-level determinants of integrated reporting (i.e. Busco *et al.*, 2019; Frías-Aceituno *et al.*, 2013, 2014; García-Sánchez *et al.*, 2013; Jensen and Berg, 2012; Vaz *et al.*, 2016). A stream of research investigates the economic consequences of integrated reporting (i.e. Barth *et al.*, 2017; Bernardi and Stark, 2016; Serafeim, 2015). Few studies explore integrated thinking practices (i.e. Dumay and Dai, 2017; Feng *et al.*, 2017; Guthrie *et al.*, 2017; Maniora, 2017). Despite the relevance of integrated thinking within the overall integrated reporting literature, there is few empirical studies on integrated thinking practices highlighting the need for further research and exploration on the internal aspects of integration (Feng *et al.*, 2017).

What seems to be missing, to the best of our knowledge, are empirical studies that explore the challenges of measuring integrated thinking and reporting. Indeed, the principles-based nature of the IIRC framework leaves to managers' discretion the application of the

integrated reporting principles. This has the important benefit of ensuring an appropriate balance between flexibility and prescription, and recognising companies' individual circumstances (IIRC, 2013); however it creates difficulty in the assurance, regulation and research (De Villiers *et al.* (2017a). This also leads to measurement issues as it becomes difficult to determine whether and to what extent a company complies with the IIRC framework, and whether and how a company is implementing an inclusive decision-making process, i.e. integrated thinking. In absence of a unique and objective measure, previous studies use different approaches to investigate and measure integrated reporting (i.e. Busco *et al.*, 2019; Frías-Aceituno *et al.*, 2013, 2014; García-Sánchez *et al.*, 2013; Maniora, 2017; Serafeim, 2015; Venter *et al.*, 2016). The challenges of identifying an appropriate measure is even more pronounced in the context of integrated thinking, thus limiting opportunities for empirical studies in this field and highlighting the need to investigate this research gap.

Within this debate, this paper makes the following contributions to previous research in the field of integrated thinking. First, we propose a measure of the level of integrated thinking that enables both quantification and comparative evaluation. We follow a consolidated approach in previous literature and specifically we inspire from academic research that uses Thomson Reuters Asset4 scores to measure integrated thinking and reporting (i.e. Busco *et al.*, 2019; Maniora, 2017; Venter *et al.*, 2016; Serafeim, 2015). Second, we implement factor analysis to identify a parsimonious representation and explore the relevance of each component in explaining our proposed measure of integrated thinking to address the first research question: *i) How can integrated thinking be measured?* Further, we implement cluster analysis to determine the natural grouping of firms with a certain level of integrated thinking and to identify the existence of distinctive companies' approaches towards integrated thinking to address the second research question: *ii) What are companies' approaches towards integrated thinking?* Without attempting to overcome all the measurement issues and quantification challenges, we hope our endeavour to measure integrated thinking and companies' approaches can inspire further empirical studies in this field and advance our understanding of integrated thinking practices.

The remainder of the paper is organised as follows. Section 2 reviews the literature. Section 3 describes the methodology. Section 4 discusses the main findings. Section 5 concludes the paper.

2. Literature Review

2.1 Previous studies in the field of integrated thinking and reporting

Over the last decades, a growing number of studies investigate integrated thinking and reporting practices (for a systematic literature review, see De Villiers *et al.*, 2014, 2017a; Dumay *et al.*, 2016). Early research focuses on theoretical analyses (i.e. Adams, 2015; Eccles and Krzus, 2010; Flower, 2015; Haller and van Staden, 2014) and case studies (i.e. Adams *et al.*, 2016; Eccles and Serafeim, 2014). Other studies investigate the determinants of integrated reporting and find firm size, gender diversity, profitability, industry concentration, and growth opportunities (i.e. Frías-Aceituno *et al.*, 2013, 2014; García-Sánchez *et al.*, 2013; Girella *et al.*, 2019; Jensen and Berg, 2012) and country level factors (Vaz *et al.*, 2016; Jensen and Berg,

2012) to be key drivers of the decision to publish an integrated report. Another stream of research investigates the consequences of integrated reporting, and find integrated reporting to be positively associated with quality of management (Churet and Eccles, 2014), enhances ability to attract institutional investors (Serafeim, 2015; Steyn, 2014), improves external engagement with stakeholders, leads to better resource allocation and cost reduction (Burke and Clark, 2016), and increases analyst ability to make accurate earnings forecasts (Flores *et al.*, 2019). Barth *et al.* (2017) investigate the economic consequences of integrated reporting quality through the capital market channel and real effects channel and note that integrated reporting is achieving its dual objective of improved external information and better internal decisions. Bernardi and Stark (2016) show the effectiveness of integrated reporting on analyst forecast accuracy. Caglio *et al.* (2019) examine the economic benefits associated with textual attributes and the external assurance of integrated reporting, in the mandatory setting of South African listed companies. Few studies explore integrated thinking and reporting practices. Busco *et al.* (2018) discuss how business organisations can rethink their management processes, accounting tools and reporting solutions, and show how companies are contributing to the sustainable development goals. Using a case study approach, interviews and documents analysis, Lodhia (2015) explores the journey towards integrated reporting by a customer-owned bank, showing how this organisation has been able to recognise the value of integrated reporting, and embed financial and non-financial responsibilities (i.e. economic, social and environmental) within the organisational structure. Malafronte *et al.* (2020) explore companies' journey towards integrated reporting and the role of corporate culture in the decision to prepare an integrated report.

Recent studies have been published in special issues of *Accounting, Auditing and Accountability Journal* in 2018 and *Meditari Accountancy Research* in 2017. Among these, De Villiers *et al.* (2017b) present a conceptual model of the overall integrated reporting process; on the same line, Rinaldi *et al.* (2018) conceptualise and analyse the development of integrated reporting as an “idea journey” to highlight challenges, success, strengths and weaknesses of the integrated reporting journey. Early studies discussed the issues related to the implementation of integrated reporting. Abeysekera (2013) stresses the importance of assurance and the need to modify the business model in order to integrate financial performance with the social and environmental performance, and proposes a template for integrated reporting in organisations. Cheng *et al.* (2014) reviews the issues related to the implementation of integrated reporting that were emerging and being discussed before the release of the integrated reporting framework in late 2013. Stent and Dowler (2015) analyse the gap between integrated reporting and current corporate reporting, and observe current reporting processes lack the integration, oversight and due attention to future uncertainties required by integrated reporting. Other studies explore the challenges of producing an integrated report (McNally *et al.*, 2017), the issues in the IIRC framework (Dumay *et al.*, 2017), the resistance to the introduction of integrated thinking and reporting, and the need to improve the usability of the IIRC framework for small and medium enterprises (Del Baldo, 2017). The readability of integrated reports is analysed in du Toit (2017). Lai *et al.* (2018) present the experience of an insurance company and the several benefits perceived from the integrated reporting journey.

A more recent stream of research focuses on the integrated thinking journey. Guthrie *et al.* (2017) explore the relationship between integrated reporting and organisations' internal

processes in the Italian public sector, using official documents, press releases, and semi-structured interviews with major internal actors of five organisations; they find that the adoption of the framework has led to integrated thinking but the change is more incremental than revolutionary. Dumay and Dai (2017) explore integrated thinking as a cultural control using a case study of a small Australian bank. Based on interviews with key integrated reporting stakeholders and two pilot organisations, Feng *et al.* (2017) report that the concept of integrated thinking has not been fully defined by the IIRC and there is no consensus on what it means at the conceptual level. Maniora (2017) examines the impact of integrated reporting on the integration of environmental, social, and governance issues into a company's business model and the related performance changes. Venter *et al.* (2016) investigate the relationship between integrated thinking and the transparency of tax disclosures focusing on the corporate reports of a sample of 45 large firms, and find them to be positively associated. Al-Htaybat and von Alberti-Alhtaybat (2018) describe the integrated thinking and reporting journey in a global service company and document that integrated thinking comes first and is managed from the top. Busco *et al.* (2019) investigate the determinants of companies' levels of integration and suggest the need for a tailored approach rather than a one size fits all within the debate on the future developments of integrated thinking and reporting. Although integrated thinking and reporting research is emerging in the recent reporting literature, there is need for understanding integrated thinking in practice and its development over time (Feng *et al.*, 2017).

2.2 Measuring integrated thinking and reporting

Most of the empirical studies measure integrated reporting as a dummy variable equal to one if a company publishes an integrated report, and zero otherwise (i.e. Frías-Aceituno *et al.*, 2013, 2014; García-Sánchez *et al.*, 2013; Girella *et al.*, 2019). Other studies adopt a different approach based on content analysis (i.e. Zhou *et al.*, 2017; Vitolla *et al.*, 2019) or measure integrated reporting quality using the scores of the annual "EY Excellence in Integrated Reporting Awards" (Barth *et al.*, 2017). However, these measures are not free from criticism and previous literature has discussed the measurement issues related to integrated reporting. Indeed, the principles-based nature of the IIRC framework creates issues in the assurance, regulation and research on integrated thinking and reporting. Following the discussion presented in De Villiers *et al.* (2017a), it is important to note that a report can be labelled as "integrated" by a company's management although may not be expression of the IIRC framework principles; and a report can be labelled as "annual report" while reflecting the IIRC principles. Moreover, an integrated report can be a stand-alone document or be embedded in the actual reporting structure of a company, i.e. annual and sustainability report. At the same time, it is not objectively agreed what is a high-quality integrated report and the IIRC framework does not outline specifically what measures need to be reported (Dumay *et al.*, 2016).

To overcome these issues, empirical studies have used proxies to measure integrated thinking and reporting; among these, Thomson Reuters Asset4 scores have been used in recent studies in this field. Serafeim (2015) uses the CGVS score from Asset4 as a measure of integrated reporting. The same variable is used as a measure of integrated thinking by Venter *et al.* (2016). Maniora (2017) refers to Thomson Reuters Asset4 and selects specific items to

build three measures: “integrated thinking” made of four individual items, “integrated management” made of four individual items, and “overall integration level” that is the overall CGVS mnemonic. De Villiers *et al.* (2017a) analyse the CGVS Asset4 components and observe these include drivers and outcomes, highlighting that “all four drivers and two of the eight outcomes refer to integration” and the remaining six outcomes reflect “reporting outcomes”, although they do not believe they capture the level of integratedness well; they conclude CGVS seems to be a measure of integrated thinking in a firm (performance) rather than the quality of its integrated reports (disclosure). Busco *et al.* (2019) reviews the components and definition of CGVS score as provided by Asset4 and conclude that the items composing the CGVS score refer to both the internal processes (i.e. thinking) and the reporting outcomes (i.e. reporting); therefore they use CGVS as a measure of the level of integration in both thinking and reporting. The difficulty in finding an appropriate measure represents a far more relevant issue in the context of integrated thinking. Indeed, defined as “*conditions and processes that are conducive to an inclusive process of decision making*” (Busco *et al.*, 2017), integrated thinking is challenging to measure. Therefore, most of the research on integrated thinking is based on case studies and interviews (i.e. Al-Htaybat and von Alberti-Alhtaybat, 2018; Feng *et al.*, 2017; Guthrie *et al.*, 2017). The measurement issues of integrated thinking limit opportunities for empirical studies in this field. This paper aims to fill this gap and contribute to previous literature by proposing a measure of the level of integrated thinking and identifying companies’ approach towards integrated thinking. In doing so, we follow a consolidated approach in previous literature, that consists of identifying a proxy for concepts that are otherwise unobservable and hence difficult to measure. Among these, previous studies within Corporate Social Responsibility (CSR) literature have used Thomson Reuters Asset4 ESG data to proxy for the level of CSR (i.e. Qiu *et al.*, 2016; Rjiba *et al.*, 2020). Similarly, within the literature on corporate culture, several authors provide proxies to measure an organisational culture that is unobservable and hence difficult to measure (i.e. Fiordelisi and Ricci, 2014; Malafronte *et al.*, 2020).

3. Methodology

3.1 Sample

The sample is composed of European listed companies in the EURO Stoxx 600 Index over the period 2014-2018. Data is collected from Thomson Reuters Asset4 (Datastream) on an annual frequency. Table 1 presents descriptive statistics of the main variables used for the analysis.

[Table 1 about here]

3.2 Measuring integrated thinking

We inspire from recent studies that have reviewed and used Thomson Reuters Asset4 scores to measure companies’ integrated thinking and reporting practices. De Villiers *et al.* (2017a) discusses the measurement issues to consider in integrated reporting research, and the use of Thomson Reuters Asset4 scores in academic research to measure integrated thinking. Busco *et al.* (2019), Serafeim (2015), Venter *et al.* (2016) use Thomson Reuters Asset4 score to measure

the level of integrated thinking and reporting. Maniora (2017) select specific items from Asset4 to build measures of integrated thinking (four items), integrated management (four items), and overall integration level (CGVS mnemonic). Following from these studies and more specifically Busco *et al.* (2019), we screen Asset4 database for variables that are a manifestation of the vision, policy, strategy, and seek to capture monitoring, commitment, implementation, engagement, improvement, and integration of financial and extra financial information. After careful consideration, we retain variables that represent if integration is incorporated into managers' day-to-day decision making, i.e. integrated thinking, and exclude those that measure a firm's ability to communicate, i.e. reporting outcomes. This process narrows down the list to four items that serve as proxies of integrated thinking. The first item (*POLICY*) captures the existence of an inclusive decision-making process through the establishment of a company's policy for the integration of financial and extra-financial aspects of the business. The second item (*MONITORING*) highlights how well the company monitors its integrated strategy against a sustainability index and through external auditing of its reporting practices. Further the third item (*IMPROVEMENT*) illustrates the forward-looking aspirations for integrated thinking through the definition of targets to be achieved on the integration strategy (*IMPROVEMENT*), and finally the fourth item (*GCSIGNATORY*) exhibits a firm's commitment towards corporate sustainability initiatives by being a signatory member of the United Nations Global Compact. Each item represents a relative score ranging from 0 (minimum value) to 100 (maximum value), derived from equally weighting and z-scoring the underlying data points and comparing them against all companies in the database. We have also analysed the level of the integrated thinking variable for the companies involved in the IIRC pilot programme and that are also part of the sample. Interestingly, these companies report significantly higher mean values of integrated thinking variable.¹

To provide further elaboration on our proposed measure of integrated thinking, we first implement principal component analysis, without factor rotation and with factor rotation, on these variables in order to identify a more parsimonious representation of integrated thinking measure and explore the relevance of each variable in explaining a company's level of integrated thinking. Further, we undertake cluster analysis to allow for the inclusion of the four integrated thinking variables as sources of configuration definition, thus enabling the creation of potentially rich descriptions of clusters (or groups) of firms with a certain level of integrated thinking practices. Results are reported and discussed in Section 4.

¹ We are very grateful to the reviewer for suggesting an analysis of the level of integrated thinking for the IIRC pilot companies, that provides external evidence in support of the integrated thinking variable built from Thomson Reuters Asset4.

4. Results

4.1 Principal component analysis

We use principal component analysis (PCA) as a method to transform the integrated thinking measure presented in Section 3.2, by reducing its dimensionality while retaining the maximum possible variation among the integrated thinking proxies. Using PCA (exploratory factor analysis) we create for the first principal component a linear equation that extracts the maximum total variance of the variables while the second principal component removes the variance explained by the first component and creates a second combination with the maximum remaining variance orthogonal to the first principal component (Jolliffe, 2002). Results are presented in Table 2. To determine the suitability of factor analysis for the data, we perform the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy that provides a value of 0.639, indicating that factor analysis may be useful. Similarly, the Bartlett's test of sphericity is significant at $p < 0.01$ indicating the correlation matrix is significantly different from an identity matrix, thus confirming sample adequacy for the factor analysis.

We implement PCA both without factor rotation (Table 2, Panel A) and with factor rotation using varimax with kaiser normalisation as rotation method (Table 2, Panel B). We implement factor analysis using a similar approach adopted in other studies in accounting and finance (i.e. Caglio *et al.*, 2019, Trumpp *et al.*, 2015). In the process of extracting factors, we find two components with an eigenvalue greater than 1. From Table 2 Panel B, for the full sample (2014-2018), the two factors explain a cumulative 69.95% of the variance among the four integrated thinking variables. We notice a consistent pattern in factor loadings as presented in Table 2. Specifically, three items (*POLICY*, *MONITORING* and *GCSIGNATORY*) load on Factor 1, and one item (*IMPROVEMENT*) loads on Factor 2 indicating the possibility of reducing the four integrated thinking items into two main factors.

The first factor with significant loading for *POLICY*, *MONITORING* and *GCSIGNATORY* items may be denoting the current level of integrated thinking practices within the organisation. The first item (*POLICY*) encapsulates the policies and procedures necessary to ensure integration thinking processes within the firm. The second item (*MONITORING*) captures the monitoring of the integrated strategy, i.e. current practices against the set policies. The third item (*GCSIGNATORY*) depicts the company's initiative to be a part of the United Nations Global Compact, i.e. current corporate sustainability commitment. Thus, the three items can be grouped into a single factor epitomising a firm's "current integrated thinking practice" (backward looking). The second factor with significant loading for the item *IMPROVEMENT* characterises a firm's commitment towards setting specific objectives to be achieved on its integrated strategy. Objectives represent the future goals to be achieved for improving and advancing integrated thinking within the firm and thus encapsulate "future integrated thinking directions" (forward looking).

In summary, the outcome from PCA indicates that our measure of integrated thinking could be either used as an index (determined as average value of the four items) or reduced into two main separate factors, representing both current practices as well as future aspirations for integrating thinking within the firm.

[Table 2 about here]

4.2 Cluster analysis

We undertake cluster analysis with an attempt to determine the natural grouping (or cluster) of firms with a certain level of integrated thinking. Cluster analysis is one of the data mining methodology used for identifying patterns or groups of similar objects within a dataset and has been used in Accounting and Finance research studies. For example, Ittner *et al.* (1999) use cluster analysis to identify organizations that employ conceptually distinct supplier strategies, selection and monitoring practices. Leuz *et al.* (2003) perform a cluster analysis to identify grouping of countries with similar institutional characteristics. Degeorge *et al.* (2013) employ cluster analysis to divide countries into three levels of financial development. Further, researchers investigating management control practices regularly use cluster analysis methodology (i.e. King and Clarkson, 2015).

For the purpose of this study, this exploratory clustering method is largely intended to generate rather than test specific hypotheses related to these groups. Although there are numerous different specifications of cluster analysis (Everitt *et al.*, 2011), we follow one of the most commonly used partition clustering methods, i.e. k-mean, and at priori specify the three-cluster solution. The k-mean clustering method uses an iterative process and assigns each observation to a group whose mean is the closest; based on this categorisation it determines new group means. This process is repeated until no observation changes group. The algorithm begins with k (3) seed values, which act as k (3) group means. Our choice of k-means clustering method is primarily based on the relative ease of application and sample size considerations. To assess the validity of the three-cluster solution, we visually assessed the resulting dendrogram for cluster analysis, further we also conducted ANOVA using Scheffe multiple comparison tests to check heterogeneity across the clusters. The results suggest that the four integrated thinking dimensions in the three clusters are statistically and significantly different ($p < 0.05$), thus confirming the stability of the three-cluster solution.

Table 3 presents the final centroids (i.e. mean values) of the three clusters for the four integrated thinking variables. Based on the cluster characteristics we label the cluster that have higher centroids across most measures as *Exemplars*. Likewise, the cluster whose centroid is lower than other clusters on most measures is labelled as *Minimalists* and finally the cluster that falls in between these two clusters is named as *Developers*. Figure 1 provides a visual representation of the three clusters.

[Figure 1 about here]

[Table 3 about here]

To validate the relationship between the four integrated thinking measures and the three clusters, we use canonical discriminant analysis to identify the underlying dimensions which defined the clusters (Miller and Roth, 1994). The results are presented in Table 4. Both functions have eigenvalue greater than 1 and explain 82.79% and 17.21% of the variance respectively. The standardised discriminant function coefficients indicate *GCSIGNATORY* is the most important variable in forming function 1, while *POLICY* is the most important variable in forming function 2. The remaining two variables have lower contribution towards forming either of the two functions.

[Table 4 about here]

[Figure 2 about here]

Figure 2 indicates that the clusters are differentiated from each other through the two discriminant functions. The resulting canonical correlations are 0.97 and 0.87 respectively and the

Wilk's lambda values are significant at 0.01 level. The results indicate that 100% of cluster 1 (*Exemplars*), 100% of cluster 3 (*Developers*), and 90.1% of cluster 2 (*Minimalists*) are correctly classified. The results confirm that the patterns of integrated thinking are independent and free from significant misclassification and our sample could be clustered into groups with significantly different pattern of integrated thinking adoption.

Of the 593 firms that were categorised into the three clusters over the period 2014 to 2018, most firms tend to remain in the same cluster group across years. A higher percentage of *Exemplars* (79.6%), *Minimalists* (93.2%) and *Developers* (89.0%) firms maintain their cluster classification across years. The movements between clusters are relatively smaller, i.e. 16.4% of firms switch between *Exemplars-Developers* clusters and 11.0% *vice versa*. The results exhibit consistency in integrated thinking levels across the three clusters exhibiting routine: firms tend to maintain their level of integrated thinking or switch to the closest group, consistently with the findings of Busco *et al.* (2019).

4.3 Interpretation of clusters

Based on the ranking of integrated thinking practices across the three clusters and the relative ranking of the practices within each cluster, we detail below the characteristics of the firms in the three clusters.

Cluster 1 – Exemplar firms (N=241) tend to place relatively higher emphasis on the integrated thinking dimensions related to monitoring of the integrated strategy through belonging to sustainability index or through external audits and being a signatory of the United Nations Global Compact, i.e. engagement in corporate sustainability initiatives. A further review of firm variables indicates nearly 28% of the firms in this cluster belong to an environmental sensitive industry and are older firms. Apart from having overall better integrated thinking levels, firms in this cluster have overall better Environmental, Social and Governance (ESG) performance (*ESG*, *ECON_SCORE*, *ENV_SCORE*, *SOC_SCORE*), albeit overall lower financial performance (*ROA*, *TOBIN*). Exemplar firms have better governance characteristics exhibiting bigger boards, more meetings and better board structure (*BOARD_SIZE*, *BOARD_MEET* and *BOARD_INDEP*). Most prominently, companies in this cluster are bigger across all size measures (*TOT_ASSET*, *TOT_EMPLOYEE*, *TOT_SALES*, and *TOT_MKTCAP*). This provides an indication that firms in the *Exemplars* cluster may be bigger firms, with better governance and ESG performance.

Cluster 2 – Minimalist firms (N=124) tend to place relatively lower emphasis across all the four integrated thinking dimensions. Specifically, the firms in this cluster have weaker policy for maintaining an overarching vision and strategy to integrate financial and extra financial aspects of their business, have less monitoring initiatives of their integrated strategy and less engagement in corporate sustainability initiatives. However, *Minimalists* set objectives to be achieved on the integrated strategy, which are comparable to firms in the *Exemplars* and *Developers* clusters. *Minimalist* firms tend to exhibit characteristics mostly opposite to firms in the *Exemplar* cluster. *Minimalist* firms are comparatively younger (*AGE*) and do not primarily belong to environmental sensitive industries (only 8% of firms in this cluster operate in a sensitive industry *SEN_IND*). *Minimalist* firms have lower levels of integrated thinking compared to *Exemplars* and *Developers* and comparatively higher financial performance with respect to the other clusters (*ROE*, *ROA*, and *TOBIN*). *Minimalist* firms are smaller in size (*TOT_ASSET*, *TOT_EMPLOYEE*, *TOT_SALES*, and *TOT_MKTCAP*), exhibit lower ESG performance (*ESG*, *ECON_SCORE*, *ENV_SCOR*, and

SOC_SCORE) and have mediocre corporate governance mechanisms (*BOARD_SIZE*, *BOARD_INDEP*).

Cluster 3 – Developer firms (N=138) tend to exhibit integrated thinking levels lower than firms in the *Exemplars* cluster but higher than *Minimalists* cluster. In some aspects, e.g., related to devising policy for maintaining an overarching vision and strategy for integration, *Developer* firms perform slightly better than *Exemplars* while in other aspects, e.g., being a signatory of the Global Compact and engagement in corporate sustainability initiatives, *Developer* firms perform lower than *Minimalist* firms. Overall, firms in *Developer* cluster have firm specific characteristics between the other two cluster dynamics. *Developer* firms can be considered as firms in the development phase of their integrated thinking strategy and journey.

[Table 5 about here]

5. Conclusions

The integration of financial and non-financial information in a single integrated report has rapidly gained considerable prominence as one of the main management and accounting innovations of the recent decades. Fuelled by the criticism of the traditional reporting models and the increase in investors' expectations on corporate reporting and communication, this voluntary reporting tool has witnessed gradual adoption among firms globally. The extant of literature in the field of integrated thinking and reporting is on the rise and keeping pace with interesting experiences of companies in the integrated thinking and reporting journey, further nurturing curiosity among the academic research community.

Few studies have attempted to explore integrated thinking levels, processes, and drivers highlighting a research gap and emphasising the challenges of investigating the phenomenon. Measuring integrated thinking is one of such challenges that has limited the empirical exploration in this field. This paper attempts to address this research gap by proposing a measure of integrated thinking that is both quantifiable and comparable, across firms and over time. We define our measure of integrated thinking by rationalising the choice of variables that could help proxy for the level of integrated thinking practices within an organisation. Further, we conduct a series of empirical testing to examine the reliability and validity of our integrated thinking measure. We conduct principal component analysis to identify a parsimonious representation and explore the relevance of each variable in explaining our proposed measure of integrated thinking. Our findings identify four items that can be either used as an overall measure of integrated thinking (composed of average values of the four items) or could be reduced into two main principal components (explaining cumulative 69.95% of the variance). The first principal component, formed of three out of four items, may be denoting the current level of integrated thinking practices within the organisation encapsulating current policies, monitoring and commitment towards integrated thinking. The second component may be characterising a firm's commitment towards setting specific objectives to be achieved on its integrated strategy, i.e. a more forward-looking perspective on integrated thinking. The factor reduction process (from four items to two factors) could be useful in future studies implementing regression based methodologies, that may use integrated thinking as independent variable in the empirical model, circumvent the issues around multicollinearity. Next, we implement cluster analysis to determine the natural grouping of firms with a certain level of integrated thinking and to identify the existence of distinctive companies' approaches towards integrated thinking. Our finding indicate

that firms' level of integrated thinking can be grouped into three distinct clusters – *Exemplars*, *Developers* and *Minimalists*. Overall, across the period of analysis, firms exhibit consistency in integrated thinking level across the three clusters exhibiting routine. Moreover, firms in the three clusters have significantly different firm specific characteristics across size, governance, financial and ESG performance highlighting the existence of systematic demographic differences among firms across clusters.

The results from this study have practical implications for company managers, investors, other stakeholders and for the wider research community. A quantified metric of integrated thinking would provide company managers with a measure to help take a holistic view of the value creation process within their business model and support quality assurance processes. A proxy measure of integrated thinking would be beneficial to investors and other stakeholders to monitor companies' journey towards integration. Along with other financial and non-financial metrics, the measure of integrated thinking would be pertinent and informative for stakeholders, thereby increasing the decision usefulness of information. For the academic research community, a quantitative measure of the level of integrated thinking would open avenues for further quantitative studies that could explore the relationship between integrated thinking and other related concepts. Within this context, this research aims to open the debate on measurement issues and potential solutions related to integrated thinking.

Without attempting to address all quantification and measurement issues related to integrated thinking, our paper is an endeavour to provide a proxy to quantify the level of integrated thinking. Future studies can inspire from our measure and quantify companies' level of integrated thinking to be used in the empirical methodological setting. Whether used as an average of the four items that proxies for policy, monitoring, improvement and commitment towards integrated thinking or used in the two-principal component form, our measure of the level of integrated thinking can inspire further quantitative investigation that could further enrich the debate in the field of integrated thinking and reporting. Further research can explore the comparability of thinking levels across firms and over time. Future studies can also investigate the relationship between integrated reporting and integrated thinking, addressing the mystery of what comes first. Further studies can also examine the drivers of the level of integrated thinking, and unravel if these are similar or different from the drivers of integrated reporting. Finally, it would be interesting to explore the effects of integrated thinking both internally (inside the firm) as well as externally on the wider stakeholder group (outside the firm).

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Table 1. Variable definitions and descriptive statistics

This table reports descriptive statistics and definitions of the key variables used for the analysis. Data is collected from Thomson Reuters Asset4. The period of analysis is 2014-2018. Obs.=2,654

Variable	Description	Mean	Std.Dev.	Min.	Max.
<i>POLICY</i>	Policy for maintaining an overarching vision and strategy that integrates financial and extra-financial aspects of the business (Asset4 mnemonic CGVSD01S)	71.97	28.65	11.91	91.95
<i>MONITORING</i>	Monitoring the integrated strategy through belonging to a specific sustainability index AND through conducting external audits on the reporting (Asset4 mnemonic CGVSD03S)	73.07	30.03	25.01	99.31
<i>IMPROVEMENT</i>	Specific objectives to be achieved on the integrated strategy (Asset4 mnemonic CGVSD04S)	48.66	4.50	47.78	100.00
<i>GCSIGNATORY</i>	Signatory of the Global Compact (Asset4 mnemonic CGVSO03S)	68.63	32.71	32.95	99.23

Table 2. Principal component analysis

This table provides the results of the principal component (exploratory factor) analysis of the four integrated thinking measures presented in Table 1. Panel A reports the results without factor rotation. Panel B reports the results with factor rotation using Varimax with kaiser normalisation as rotation method.

Panel A. Factor analysis without rotation

Variable	FACTOR PATTERN											
	Overall		2018		2017		2016		2015		2014	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
<i>POLICY</i>	0.5506	0.0090	0.5145	-0.2445	0.5662	0.0853	0.5633	0.0291	0.5480	-0.0302	0.5425	-0.0621
<i>MONITORING</i>	0.6114	0.0108	0.6147	0.0367	0.6141	0.0661	0.6128	0.0365	0.6147	-0.0053	0.6062	-0.0042
<i>IMPROVEMENT</i>	0.0868	0.9849	0.0861	0.9684	0.0551	0.9598	0.0800	0.9759	0.1021	0.9889	0.1098	0.9900
<i>GCSIGNATORY</i>	0.5617	-0.1727	0.5916	0.0336	0.5470	-0.2592	0.5484	-0.213	0.5582	-0.1454	0.5711	-0.1268
<i>Eigenvalue</i>	1.79	1.00	1.72	1.01	1.80	1.03	1.80	1.01	1.84	1.00	1.82	1.00
<i>Proportion</i>	0.4488	0.2507	0.4291	0.2527	0.4496	0.3673	0.4470	0.2526	0.4591	0.2490	0.4557	0.2484
<i>Obs</i>	2654		463		584		553		538		516	

Panel B. Factor analysis with rotation (Varimax with Kaiser Normalisation)

Variable	FACTOR PATTERN (ROTATED)											
	Overall		2018		2017		2016		2015		2014	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
<i>POLICY</i>	0.5480	0.0541	0.5298	-0.2093	0.5650	0.0935	0.5600	0.0671	0.5482	0.0261	0.5460	-0.0012
<i>MONITORING</i>	0.6084	0.0609	0.6108	0.0780	0.6131	0.0749	0.6090	0.0778	0.6120	0.0577	0.6029	0.0634
<i>IMPROVEMENT</i>	0.0058	0.9887	0.0207	0.9720	0.0413	0.9605	0.0139	0.9791	0.0003	0.9942	-0.0013	0.9960
<i>GCSIGNATORY</i>	0.5740	-0.1261	0.5880	0.0733	0.5507	-0.2513	0.5616	-0.1754	0.5701	-0.0875	0.5817	-0.0623
<i>Eigenvalue</i>	1.79	1.01	1.71	1.01	1.80	1.03	1.78	1.01	1.83	1.01	1.81	1.00
<i>Proportion</i>	0.4475	0.2520	0.4283	0.2535	0.4495	0.2570	0.4461	0.2535	0.4569	0.2512	0.4531	0.2510
<i>Obs</i>	2654		463		584		553		538		516	

Table 3. Cluster Analysis

This table provides the results of the cluster analysis on the four integrated thinking measures presented in Table 1. The table reports the final centroids of three clusters and the ANOVA results from Scheffe test.

Integrated Thinking measures	Final centroids			ANOVA	
	Exemplars N = 1373	Developers N = 778	Minimalists N = 503	F statistics	p value
<i>POLICY</i>	82.61	86.99	19.68	4802.05	0.00
<i>MONITORING</i>	87.43	67.38	42.66	633.19	0.00
<i>IMPROVEMENT</i>	48.64	48.96	48.29	3.46	0.03
<i>GCSIGNATORY</i>	99.04	33.44	40.04	18088.80	0.00

Table 4. Canonical discriminant analysis

This table provides results of the canonical discriminant function analysis and the canonical loading (correlation) for the four integrated thinking variables presented in Table 1, across the two functions.

Functions	Eigenvalue	% of Variance	Cumulative %	Canonical correlation
1	14.85	82.79	82.79	0.97
2	3.09	17.21	100.00	0.87

Canonical loadings (correlations)	Functions	
	1	2
<i>POLICY</i>	0.22	0.95
<i>MONITORING</i>	0.22	0.15
<i>IMPROVEMENT</i>	-0.03	-0.01
<i>GCSIGNATORY</i>	0.96	-0.26

Table 5. Differences across clusters

This table reports the mean values of a range of firm specific characteristics reported by the firms in the three clusters (*Exemplars*, *Minimalists* and *Developers*). ANOVA test is conducted to find statistically significant differences between the cluster means. *SEN_IND* is a dummy variable = 1 for firms operating in environmentally sensitive industries, 0 otherwise. Sensitive industries are identified by the Standard Industry Classification (SIC) codes described in De Villiers and Marques (2016). ***, ** and * denote significance at 1%, 5% and 10% respectively.

Definition	Variables	EXEMPLARS	DEVELOPERS	MINIMALISTS
DEMOGRAPHIC				
Dummy = 1 for sensitive industries	<i>SEN_IND</i>	0.28***	0.18***	0.08***
Age of the firm in years	<i>AGE</i>	84.67***	75.44***	56.49***
INTEGRATED THINKING MEASURES				
Asset4 mnemonic CGVSD01S	<i>IT - POLICY</i>	82.61***	86.99***	19.68***
Asset4 mnemonic CGVSD03S	<i>IT - MONITORING</i>	87.43***	67.38***	42.66***
Asset4 mnemonic CGVSD04S	<i>IT - IMPROVEMENT</i>	48.64	48.96	48.29
Asset4 mnemonic CGVSO03S	<i>IT - GCSIGNATORY</i>	99.04***	33.44***	40.03***
Average of the four Integrated thinking measures	<i>IT</i>	79.43***	59.19***	37.67***
GOVERNANCE				
Size of the board	<i>BOARD_SIZE</i>	12.54***	10.08***	9.42***
Number of board meetings	<i>BOARD_MEET</i>	9.65***	8.32	8.31
% of board attendance	<i>BOARD_ATTEND</i>	94.39	96.61***	93.85
% of independent directors	<i>BOARD_INDEP</i>	61.05***	57.83**	54.55***
ESG PERFORMANCE				
Environmental, Social & Governance score	<i>ESG</i>	87.12***	81.44***	47.07***
Economic score	<i>ECON_SCORE</i>	81.14***	75.92***	45.47***
Environmental score	<i>ENV_SCORE</i>	87.07***	77.61***	49.88***
Social score	<i>SOC_SCORE</i>	87.17***	78.34***	51.15***
PERFORMANCE				
Return on equity	<i>ROE</i>	16.12	19.96	31.96**
Return on asset	<i>ROA</i>	5.64***	7.87**	10.02**
Tobin Q ratio	<i>TOBIN</i>	1.70***	2.03***	3.01***
Debt to equity ratio	<i>LEVERAGE</i>	25.23	22.01***	25.24
SIZE				
Ln of total assets	<i>TOT_ASSET</i>	17.22***	16.11***	15.50***
Ln of total number of employees	<i>TOT_EMPLOYEE</i>	10.23***	9.19***	8.48***
Ln of total sales revenue	<i>TOT_SALES</i>	16.31***	15.35***	14.47***
Ln of total market capitalisation	<i>TOT_MKTCAP</i>	16.63***	15.98***	15.49***

Figure 1. Centroids of the three-cluster solution

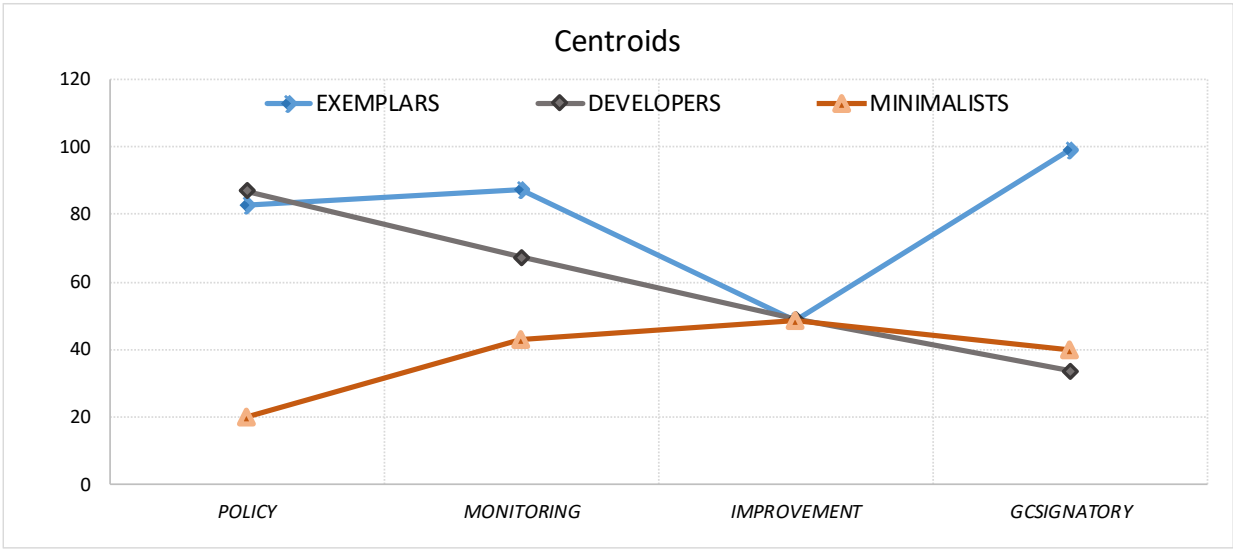


Figure 2. Centroids of the three clusters represented using canonical discriminant functions

