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What comes first? The chicken–egg relationship between integrated thinking and reporting

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Abstract
This study provides new empirical evidence on the relationship between integrated thinking (IT) and integrated reporting (IR). It contributes to the chicken–egg debate between IT and IR by answering the question 'what comes first?' and examines the determinants of IT and IR for a sample of European listed companies. The findings from both the empirical analysis and interviews with IR preparers show that IT leads to IR, and vice versa, thus creating a virtuous circle where the decision to publish an integrated report favours an inclusive decision-making process, as well as embracing the IT journey favours the adoption of IR. These results could drive companies' internal choices and policymakers' initiatives aimed at progressing an integrated organisational culture by identifying the differential drivers of IR and IT and suggest that companies' journey towards integration can start either from the integrated report (IR develops IT) or from developing an IT culture that creates a fertile background for IR (IT leads to IR).

Keywords Integrated thinking · Integrated reporting · SYS-GMM · Mixed method

1 Introduction

The corporate reporting landscape has been continuously evolving over recent decades to satisfy the information needs of stakeholders, from annual reports to sustainability reports and, more recently, integrated reports. Integrated reporting (IR) is a comprehensive, concise communication about several aspects of an organisation's strategy, governance, performance, and prospects, delivering benefits for internal

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and external stakeholders in the short, medium, and long term (IIRC, 2013, 2021). As such, it incorporates new reporting concepts, such as prospective, non-financial, environmental, and social information (Brown & Dillard, 2014). Except in South Africa where integrated reporting is a mainstream component of the corporate governance code (IoDSA, 2016), the extent of adoption of IR principles and reporting in an integrated manner is voluntary. Nevertheless, firms globally have been facing pressure internally and externally to amend their reporting practices and provide value-relevant information through their formal reporting channels. These pressures arise from the need to differentiate from the competition, peer group, and stakeholder expectations, as well as from the aspiration to break down organisational silos, reporting on materiality, and management commitment to succinctly provide an integrated view of the business model (Bommel, 2014; Higgins et al., 2014).

The publication of the IIRC < IR > framework (IIRC, 2013, 2021) provides guidelines for firms that are considering shifting their reporting to an integrated regime. An increasing number of firms have adopted the IIRC < IR > framework and attempted to publish integrated reports, whether they label them as integrated reports or not. As stated by the framework, one of the integral components of the IR value creation process is integrated thinking (IT), defined as 'the active consideration by an organisation of the relationship between its various operating and functional units and the capital that the organisation uses and affects' (IIRC, 2021, p.3). In the long term, IT is expected to be embedded within mainstream business practices in the public and private sectors facilitated by IR as the corporate reporting norm (IIRC, 2013, 2021; VRF, 2021). Even after many years from their first launch, the integrated reporting concepts are still current and as such have been embedded in the heart of the ISSB global standards. Indeed, the IR framework and the ISSB standards jointly support a holistic view of the value creation process through governance and business model disclosure to drive connections between financial statements and sustainability-related financial disclosures (IFRS, 2024; VRF, 2021).

With the increasing adoption of IR practices by firms globally, academic literature in the field of IT and IR has developed considerably in the last decade. Previous studies have investigated early adopters of IR, looking at examples of successes and failures through case studies (e.g., Adams et al., 2016; Badia et al., 2019; Barnabè et al., 2019; Eccles & Serafeim, 2015; Fairfield, 2016; Knauer & Serafeim, 2014) and interviews (e.g., Adams, 2015; Cavicchi et al., 2019; Corbella et al., 2019; Eccles & Krzus, 2010; Flower, 2015; Haller & van Staden, 2014; McGuigan et al., 2021). Academic research on IR has a fair share of critics that challenge its ineffectiveness in changing corporate practices (Flower, 2015) and ensuring stakeholder accountability (Brown & Dillard, 2014). Bommel (2014) claims IR generates bias instead of a legitimate compromise, whereas Cheng et al. (2014) claim the IIRC < IR > framework creates ambiguity surrounding the meaning and assessment of capitals and complexities regarding the assurance of IR. Notwithstanding these critics, more recent studies investigate the benefits and challenges of IT and IR practices (Dumay et al., 2017; McNally et al., 2017) and explore their determinants (Busco et al., 2019; Frías-Aceituno et al., 2013, 2014; García-Sánchez et al., 2013; Girella et al., 2019; Jensen & Berg, 2012; Songini et al., 2021). Country-focused case studies on IR have been conducted across different geographies, such as South

Africa (Cerbone & Maroun, 2020; Du Toit, 2017; Elshandidy et al., 2022; McNally et al., 2017), Australia (Dumay & Dai, 2017; Vesty et al., 2018), Columbia (Macias & Farfan-Lievano, 2017), France (Albertini, 2019), Italy (Silvestri et al., 2017), Japan (Arul et al., 2021), Sri Lanka (Herath et al., 2021), India (Matta et al., 2022; Nurullah et al., 2023) and Jordan (Al Amosh & Mansor, 2021). More recently, academic studies have developed proxies to measure the level of integration within an organisation (e.g., Busco et al., 2019; Malafronte & Pereira, 2021; Maniora, 2017; Reimsbach & Braam, 2022; Serafeim, 2015; Venter et al., 2017), paving the way for further empirical contributions in this field.

Despite growing attention towards exploring companies' journey to integration, the relationship between IR and IT, that is, what comes first, has not yet been adequately discussed and debated. More recently, few studies have addressed the IT concept, providing definitions and theoretical guidelines for introducing IT and IR in an organisational context (Busco et al., 2017; CGMA, 2014). However, relatively few studies have analysed the relationship between IR and IT in an empirical setting. Al-Htaybat and von Alberti-Alhtaybat (2018) investigate the IT and IR phenomenon using a qualitative case study methodology. They find that IT developed naturally for their case organisation and fostered IR. However, their findings are limited to company-specific settings and cannot be generalised. Feng et al. (2017) interviewed Australian companies to explore how key stakeholders interpret and apply IT in practice. Their results indicate no shared consensus on IT among IR adopters and conclude that the understanding of IT within the practise is still evolving. However, given the small sample size, the results are not generalisable. While in theory IT can be considered the basis for undertaking IR (IIRC, 2013, 2021), firms' experiences and report preparers provide alternative perspectives. Further, preparing an integrated report could lead to identifying and investigating some materially relevant issues that had not been considered before, guiding the thinking that may not have happened before within the organisation. This begs the question of whether IR results from IT or vice versa. Empirical evidence on the causal relationship between these two interrelated concepts has not been adequately investigated and deserves further attention in the academic literature.

The relevance of IT and IR and their ability to create value for organisations in the short, medium, and long term, to build trust with stakeholders and make businesses better prepared to meet the challenges, are shared thoughts supported by empirical evidence from IR adopters. However, 'what comes first' is unclear; in other words, whether it would be best to start from IR or IT is a question with no unique answer. This is the main scope of this study. *What is the relationship between IR and IT? Can organisations start their IR journey and then develop the thinking, or should organisations start from IT?*

This study aims to address this gap in the current literature by providing an answer to the chicken–egg debate on what comes first, IR or IT? Our main findings show that IR and IT mutually reinforce each other over a period of time, indicating that it does not matter where the company starts its IR and IT journey either by attempting to publish an integrated report or by initiating internal changes that propagate IT. What matters is that firms should start the journey one way or the other. The IR and IT concepts within an organisation can be explained using the metaphor

of the brain and the body, where IT is the brain and IR is the body. Thus, IR and IT are connected and interlinked; that is, IT drives IR, and IR drives IT. These findings are robust to alternative specifications of the quantitative model and are supported by in-depth qualitative interviews, evidencing the validity and reliability of our findings.

The findings from this study provide useful contributions to the academic community, corporate reporting bodies, organisations already in the IR–IT journey, those intending to follow the early adopters, and company stakeholders. First, the evidence from this study corroborated using empirical proxies and triangulated through in-depth interviews support that IT and IR levels benefit each other and help firms progress in their IT and IR journey, implying that organisations intending to join the IR movement should start wherever it is most feasible for them. Second, this study proposes a quantitative proxy for measuring the level of IR and IT within an organisation, allowing quantification, thereby enabling comparative evaluation. This helps address 'how' companies can operationalise IT (Dumay & Dai, 2017). Third, using qualitative and quantitative evidence, this study addresses the chicken–egg debate of what comes first, IR or IT, and finds that IR and IT mutually reinforce each other. To the best of our knowledge, this is the first study to use a mixed-method approach to investigate the relationship between IR and IT levels. Finally, we find empirical evidence of the differential drivers and their effect on the IR and IT levels, contributing to previous studies (e.g., Busco et al., 2019) that have considered drivers and effects of the level of IR and IT for an organisation.

The remainder of the paper is organised as follows. Section 2 reviews previous studies on the relationship between IR and IT and develops the main research hypotheses to test. Section 3 describes the mixed-method approach used in this study, including details on the sample, variables, empirical models, and interviews. Section 4 provides the empirical results from quantitative analysis and in-depth qualitative interviews. Section 5 concludes the paper and discusses the implications of the study.

2 Literature review

2.1 Theoretical framework

The theory of organisational change (Laughlin, 1991) argues that organisations are made of three components, i.e., sub-systems, design archetypes, and interpretive schemes. Among these, sub-systems represent 'tangible elements about which intersubjective agreement is possible' (p.211) including people, machinery, buildings, etc.; the other two are intangible components which provide direction, meaning and interconnectivity to the various tangible aspects. Greenwood and Hinings (1988) define the design archetypes as structural and management processes, that are given coherence and orientation by an underlying set of values and beliefs, i.e., the interpretive schemes. An organisation needs to find a balance between these three components, and new changes lead to a new or different balance between sub-systems, design archetypes, and interpretive schemes. According to Laughlin (1991),

first-order changes occur in the design archetypes and/or the sub-systems, while values and beliefs remain the same; second-order changes derive from an environmental disturbance that penetrates the organisation, with changes flowing through the interpretive schemes to the sub-systems and design archetypes.

Laughlin's model is particularly suitable for understanding changes 'within' organisations, without ignoring the effects of the broader institutional field and its pressures (Narayanan & Adams, 2017) and has been used as theoretical framework in previous studies to explain the relationship between social and environmental accounting and organisational change (Akbas et al., 2021; Guthrie et al., 2017; Rodríguez-Gutiérrez et al., 2019; Stubbs & Higgings, 2014). Guthrie et al. (2017) follow this theoretical framework to investigate the internal mechanisms of change that can lead organisations to adopt IR disclosure and how these impact on integrated thinking internally. Following this framework, Rodríguez-Gutiérrez et al. (2019) provide insights into the transformative potential of IR and observe that the interconnection of different capitals (IIRC, 2013) and the steps required to achieve IT suggest that IR would represent a set of changes over previous sustainability reporting practices, corresponding to an apparent alternative design archetype whose conduciveness to integrated interpretative schemes still needs to be explored. In the context of our study, the theory of organisational change provides an interesting lens to explain the relationship between IR and IT. As a change over previous reporting practices, IR results into an alternative design archetype, potentially affecting the interpretive schemes. IR offers opportunities for significant changes in the organisation; this refers to both forms of changes, resulting not only in the production of a report but also in the process of integrated thinking.

2.2 Previous studies in the field of integrated thinking and reporting

Over the last decades, there has been a substantial increase in academic studies on IR and IT (for a review, see De Villiers et al., 2014; Dumay et al., 2016; Velte, 2022). Most prior studies consist of theoretical analysis, interviews, case studies (i.e., Adams, 2015; Adams et al., 2016; Adhariani & de Villiers, 2019; Badia et al., 2019; Barnabè et al., 2019; Eccles & Krzus, 2010; Eccles & Serafeim, 2015; Haller & van Staden, 2014, Rodríguez-Gutiérrez et al., 2019) and descriptive frameworks (i.e., AICPA, 2013; IIRC, 2013). Few recent studies have conducted literature reviews on the extant research within the domain of IR and IT (see Di Vaio et al., 2021; Jayasiri et al., 2022; Kannenberg & Schreck, 2019; Soriya & Rastogi, 2021; Vitolla et al., 2019). A stream of research has investigated the determinants of IR and IT, providing interesting insights into the factors affecting management decisions to embrace the IR and IT journey. IIRC (2021, p.54) defines IR as 'a concise communication about how an organisation'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'. Rinaldi et al. (2018) report that since the release of the <IR> framework in 2013, there has been a growing interest in IR among accounting firms, corporations, public sector organisations, and professional bodies globally (De Villiers et al., 2014, 2017a, 2017b; Dumay et al., 2017).

However, some studies have questioned the exact purpose of IR (Flower, 2015) and the IR concept (Bommel, 2014; De Villiers et al., 2014; Higgins et al., 2014). Moreover, recent studies (Coulson et al., 2015; Dumay et al., 2017; McNally et al., 2017; Simnett & Huggins, 2015) argue the challenges of implementing the IR framework. Rodríguez-Gutiérrez et al. (2019) explore the transformative potential of integrated reporting and document that the transition from a sustainability-reporting archetype to an integrated-reporting archetype does not seem to be easily achieved. Ortiz-Martínez et al. (2020) examine a sample of voluntarily issued integrated reports from 2011 to 2015 and find that IRs are incomplete, as they do not comply with all the IIRC guiding principles and that some principles are adhered to more than others. Vesty et al. (2018) theorise IR as an accounting compromise, noting that IR is getting harder to justify and highlights the challenges of providing a means to report on the organisation's broader societal impact, which goes beyond IR value creation.

Publishing IR is found to be driven by companies' characteristics, including size, gender diversity, profitability, industry concentration, and growth opportunities (i.e., Busco et al., 2019; Frías-Aceituno et al., 2013, 2014; García-Sánchez et al., 2013; Girella et al., 2019; Jensen & Berg, 2012; Manes-Rossi et al., 2021) as well as country characteristics (Jensen & Berg, 2012; Vaz et al., 2016). Previous studies in the field of integrated reporting provide evidence across different perspectives, including various geographic areas (Adhariani & de Villiers, 2019; Hsiao & Kelly, 2018; Robertson & Samy, 2015, 2020), mandatory settings (Ahmed Haji & Anifowose, 2016; Donkor et al., 2022; Steyn, 2014), public sector corporations (Tirado-Valencia et al., 2021), and higher education institutions (Hassan et al., 2019). From in depth semi-structured interviews of IR preparers of UK early adopter organisations, Robertson and Samy (2020) identify a wide range of rationales for adoption, with a predominance of sociological over economic rationales, including external pressures as well as internal aspirations to enhance reputation.

Research has expanded beyond the understanding of the perspectives and the challenges of the preparers towards exploring the nexus between IR and sustainability (Hamad et al., 2023; Le Roux & Pretorius, 2019; Rizzato et al., 2024), assurance (Simnett & Huggins, 2015), tax avoidance (Donkor et al., 2022), and the value creation disclosure of the capitals (Grassmann et al., 2019; Pigatto et al., 2023). Focusing on the economic consequences of IR quality, Barth et al. (2017) note that IR achieves its dual objective of improving external information and better internal decisions. Indeed, IR has been associated with increased management quality (Churet & Eccles, 2014), governance characteristics (Appiagyei et al.,, 2023; Engelbrecht et al., 2018; García-Sánchez et al., 2021), engagement with stakeholders, better resource allocation and financial performance (Burke & Clark, 2016; Gal & Akisik, 2020) as well as effects on stock markets (Hsiao et al., 2022; Serafeim, 2015; Steyn, 2014), increased analyst ability to make accurate earnings forecasts (Bernardi & Stark, 2018; Flores et al., 2019) and improved access to third-party financial resources under better conditions (Raimo et al., 2021).

Another stream of research focuses on IT, which 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 organisation's ability to create value over time (Busco et al.,

2017). IIRC (2021, p.4) claims that 'the more IT is embedded into an organisation's activities, the more naturally the connectivity of information will flow into management reporting, analysis, and decision-making and will lead to better integration of the information systems that support internal and external reporting and communication, including preparation of the integrated report'. Mervyn King, in a report published by the IIRC's Integrated Thinking and Strategy Group, discusses the need for organisations to 'foster a culture of collaboration and integration between different parts of the businesses, where IT 'is a unifying concept and a strategic tool that helps management to bring order to the manifestly complex environment in which businesses must operate in the twenty-first century' (IIRC, 2020, p. 1). IT involves identifying, executing, and monitoring business decisions and strategies for long-term value creation (Busco et al., 2020). Previous studies have explored the vagueness of the IT concept as an important obstacle to its adoption within organisations (Busco et al., 2021; Dumay et al., 2017; Feng et al., 2017).

In an organisation, IT is evident when senior management commits to a sustainability culture (A4S, 2013). Particularly, the role of a leader has been highlighted as a key driver of IT as it should begin at the upper echelon level of the organisation, which cascades down to the bottom and becomes a part of the organisational DNA (SAICA, 2015). Thus, the level of board commitment to the IT process is vital (De Villiers & Hsiao, 2017; Feng et al., 2017), as is management commitment towards achieving long-term strategies, mitigating key risks, meeting stakeholder needs, and achieving organisation-wide connections (Busco et al., 2019). IT has been explored as a cultural control (Dumay & Dai, 2017) with respect to transparency of tax disclosure (Venter et al., 2017), and the IT journey is investigated through companies' case studies (i.e., Al-Htaybat & von Alberti-Alhtaybat, 2018; Devalle et al., 2021; Guthrie et al., 2017). Tirado-Valencia et al. (2021) examine the influence of contextual factors on how IT is reflected in the reports of public companies and find limited evidence of contextual and institutional factors on the level of IT. IT is found to improve stakeholders' understanding of value creation (Stubbs & Higgins, 2014), foster environmental and social value creation in the corporate sector (Reimsbach & Braam, 2022), increase transparency (Abeysekera, 2013) and facilitate internal decision-making (CIMA, 2017). Dimes and de Villiers (2021) examine the role of management control systems in the successful implementation of IT in a case study setting and find evidence of the internal benefits of embedding IT.

Malafronte and Pereira (2021) address the measurement issues of integrated thinking to help advancing further studies in the field. Using a consolidated approach in literature and a series of empirical testing, they propose a proxy for IT and identify distinctive clusters reflecting companies' approach to IT. With the aim of refining integrated thinking, Maroun et al. (2023) review a proprietary tool used by an established sustainability and integrated reporting firm to evaluate integrated thinking, and further apply this to a sample of South African IR preparers. The tool includes a set of indicators used by the firm to evaluate the advancement of IT for its clients; each indicator can be assessed by evaluating information obtained from corporate reports, companies' web pages, and other sources.

Mio (2016) concludes that IT reflects the connectivity element of IR, and Rinaldi et al. (2018) consider IT an integral component of the value creation process. IT

enables organisations to better understand the relationship between different functional units, thereby helping to break down internal barriers to working, monitoring, and managing information and communicating the value-creation process (WICI, 2013). Applying the IT principles should lead to integrated, interdisciplinary decision-making and value creation (Busco et al., 2017). Few studies have discussed the absence of consensus on what IT means at the conceptual level (Feng et al., 2017) and the measurement issues related to IT (Malafronte & Pereira, 2021).

2.3 The relationship between integrated thinking and reporting

While providing a definition of IR and IT, the IIRC framework (IIRC, 2013. pp. 33) describes IR as 'a process founded on integrated thinking' and adds that IT 'leads to integrated decision-making and actions'; thus, it seems to consider IR as an outcome of IT; that is, companies may start with implementing a holistic approach within the organisation and realise the need to prepare an integrated report. WICI (2013) outlines IT as the basis for IR and that IR in organisations further helps to embed IT, implying that the processes of IR and IT mutually reinforce each other. IT is considered to form a part of the DNA of the IR (Al-Htaybat & von Alberti-Alhtaybat, 2018; Dumay & Dai, 2017; IFAC, 2015; Moolman et al., 2016; Stent & Dowler, 2015). Some companies may start with IT whereas others start with IR, but in the end, it is impossible to embrace IR without embracing IT; a good integrated report that properly reflects the collective mind of the board requires embracing IT throughout the organisation (Piermattei & Venturini, 2016).

To the best of our knowledge, there is limited research on the relationship between IR and IT. A stream of literature documents that IT represents the basis for IR. Al-Htaybat and von Alberti-Alhtaybat (2018) examine the link between IT and IR in a global organisation, which is the first provider of integrated report in its geographical area, showing how IT developed inside the organisation and IR was introduced as a result of that. Lodhia (2015) explores the drivers of the transition to IR of a customer-owned bank; to develop IR as a practice, organisations need to have clear rules and guidelines, and top management needs to define values, strategies, and operations aligned with the strategic goals to enable IT. Similarly, IIRC (2011, 2013) observes that significant changes and benefits from IR have their foundation in IT, and Giovannoni and Fabietti (2013) argue that IT is the logic that guides IR. However, IR facilitates IT (Adams, 2015) as it requires senior executives and board members to think long term about their business model, how they create value and to whom, materiality issues, risk, and strategy together, which gives IR the potential to affect change within the organisation. Guthrie et al. (2017) find that, while adopting IR, managers develop new organisations' internal processes that foster IT, and top management engagement provides a key mechanism in moving towards IR and IT. For firms in the IR journey, IR helps drive better IT internally, helping businesses to make clearer links between financial and non-financial key performance indicators by aligning environmental, social, and governance issues in the business model, thus IR reflects and supports IT (Blacksun, 2012). Arul et al. (2021) suggest

that IR and IT may not co-exist in the way the IIRC envisages, suggesting that both concepts are worthy of independent consideration.

However, evidence on the relationship between IR and IT is limited and requires further investigation; the literature review conducted by Vitolla et al. (2019) suggests the need for empirical testing of the impact of IR on the degree of IT and vice versa. Moreover, previous studies addressing the relationship between IR and IT provide a company-level analysis, using case studies, and thus reflecting 'what comes first', either IR or IT, in the experience of a particular organisation. We extend this literature by investigating the relationship between IR and IT for a wider sample and introducing mixed methods, that is, quantitative and qualitative analyses. Following the theory of organisational change (Laughlin, 1991), we analyse integrated reporting as a change in the corporate reporting practices that permeate the whole organisation, leading to changes in the design archetypes, the interpretive schemes, and the sub-systems, i.e., second-order changes. We expect that IR and IT mutually reinforce each other, and offer opportunities for significant changes in the organisation, i.e., the level of IR enhances the level of IT (H1), and the level of IT enhances the level of IR (H2).

H1 The level of IR has a positive and significant impact on the level of IT.
H2 The level of IT has a positive and significant impact on the level of IR.

3 Methodology

To gain a comprehensive understanding of the relationship between IR and IT, we undertake a mixed-method approach, using quantitative and qualitative analyses. While previous studies in this field have used either qualitative or quantitative methods, we combine the best of both methods and address the apparent limitations of each method when used in isolation to investigate the complex dynamics of the IR and IT processes. The choice of the mixed method is also motivated by the intention to provide some level of triangulation that helps validate and increase the reliability of the research findings. We employ a convergent design where the results from qualitative and quantitative phases are merged subsequently at the data analysis stage. This choice of research design was agreed as the best course of strategy to study the complex relationship between IR and IT based on the researchers' experience and knowledge on the subject matter. A priori, we attached equivalent status to the two methods without tending to classify a method as main or subsidiary.

The quantitative analysis is introduced in Sect. 3.1, which details the sample selection process (Sect. 3.1.1), the variables used to measure IR and IT (Sect. 3.1.2) and test the causal relationship between IR and IT using the Granger causality test (Sect. 3.1.3) and panel causality models (Sect. 3.1.4). The qualitative analysis is based on in-depth interviews with key personnel involved in the IR and IT journey for their organisations across distinct geographies (Europe, America, Africa, and the UK) and regulatory settings (mandatory vs voluntary IR). The details of the qualitative analysis are provided in Sect. 3.2.

Table 1 Sample distribution

Panel A. Country	N	%	Panel B. Industry	N	%
United Kingdom	148	25.3	Industrials	113	9.3
France	83	14.2	Financials	107	18.3
Germany	69	11.8	Consumer Discretionary	88	15.1
Switzerland	52	8.9	Health Care	54	9.2
Sweden	41	7.0	Consumer Staples	44	7.5
Netherlands	29	5.0	Basic Materials	41	7.0
Italy	28	4.8	Technology	30	5.1
Spain	26	4.5	Real Estate	30	5.1
Denmark	21	3.6	Utilities	29	5.0
Finland	16	2.7	Telecommunications	24	4.1
Belgium	15	2.6	Energy	24	4.1
Norway	14	2.4	Total	584	100.0
Ireland	12	2.1			
Others^{+}	30	5.1			
Total	584	100.0			

This table reports descriptive statistics of the sample distribution. The sample comprises 584 companies based in 18 European countries (Panel A) and belonging to 11 single-digit ICB (Panel B). Others^{+} include Austria, Cyprus, Luxembourg, Poland, and Portugal

3.1 Quantitative analysis

3.1.1 Sample

The sample for this study draws from companies listed in the Europe Stoxx 600 index, representing small, mid, and large capitalisation companies across 18 European countries. Based on the availability of relevant data for this study, the final sample includes 584 unique companies that make 5,037 firm-year observations from 2009 to 2018. Table 1 presents the sample distribution across countries in Panel A and the single-digit Industry Classification Benchmark (ICB) in Panel B.

3.1.2 Variables

Table 2 presents the variables used in the study. Firm-specific variables are sourced and built using Datastream and Thomson Reuters, whereas macroeconomic

Table 2 Variables

Category	Variable name	Description	Data source
Integrated Reporting	*REPORTING*	Average of the eight CGVS mnemonic CGVSD02S, CGVSO01S, CGVSO02S, CGVSO04S, CGVSO05S, CGVSO06S, CGVSO07S and CGVSO08S (see Appendix 1)	Authors' estimation from Asset4
Integrated Thinking	*THINKING*	Average of the four CGVS mnemonic CGVSD01S, CGVSD03S, CGVSD04S and CGVSO03S (see Appendix 1)	Authors' estimation from Asset4
Size	*SIZE*	Natural log of market capitalisation	Datastream
Performance	*ROE*	Return on equity—ratio of net income to common equity	Datastream
Capital Structure	*LEVERAGE*	Total debt divided by total assets	Datastream
Governance	*BOARD_SIZE*	Size of the board of directors	Datastream
	BOARD_MEET	The number of board meetings	Datastream
	BOARD_INDEP	Percentage of independent directors	Datastream
Other firm characteristics	*STRG_SHARE*	Strategic number of shares is the percentage of total shares in issue held strategically and not available to ordinary shareholders (holdings of 5% or more)	Datastream
	CEO_SHARE	Dummy variable, = 1 when CEO compensation is linked to shareholder return	Datastream
Industry	*IND_SEN*	Industry sensitivity—dummy variable, = 1 for firms operating in environmentally sensitive industries, 0 otherwise. Sensitive industries are identified by the SIC codes described in De Villiers and Marques (2016)	Authors' estimation using SIC code from Datastream

Table 2 (continued)

Category	Variable name	Description	Data source
Macroeconomic	*GDP*	Growth in gross domestic product collected at country level	Bloomberg
	MKT_INDEX	Europe Stoxx 600 market index annual return	Bloomberg
	EPI_INDEX	Environmental performance index—a measure of environmental responsibility by country. Values can range between 0 and 100	Yale Center for Environmental Law and Policy
	INV_PROT	The strength of the investor protection index is an average of 3 indices—the extent of disclosure index, the extent of director liability index, and the ease of shareholder suit index	World Bank
	VOICE_ACC	Voice and Accountability—reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media	World Bank

This table presents the main variables used in this study along with its description and source

variables are collected from the World Bank, the Yale Center for Environmental Law and Policy, and Bloomberg.

We capture the level of IT (*THINKING*) and IR (*REPORTING*) within an organisation each year using the Thomson Reuters Asset4 database. Asset4 database is well regarded by scholars and non-governmental organisations; it is arguably the largest CSR database with comprehensive coverage of firms in many different countries; unlike other databases, Asset4 also provides raw data to users, allowing users to create their own measurements (De Villiers et al., 2022).[1] We collect individual component scores of the variable CGVS, defined as the 'a company's management commitment and effectiveness towards the creation of an overarching vision and strategy integrating financial and extra-financial aspects', thus reflecting a firm's ability to 'convincingly show and communicate' the integration of financial and non-financial dimensions in its day-to-day decision-making processes.

Although Thomson Reuters Asset4 scores have been used in several studies in the field of IR and IT (i.e., Busco et al., 2019; Malafronte & Pereira, 2021; Maniora, 2017; Reimsbach & Braam, 2022; Serafeim, 2015; Venter et al., 2017) there is a debate in the literature on what the CGVS score and its components are perceived to capture, that is, thinking, reporting, or both. Serafeim (2015) pioneered using the CGVS score and considered it a proxy for the level of IR within the organisation. De Villiers et al. (2017b) discuss the measurement issues to consider in IR research and highlight the shortcoming of using CGVS as only a measure of IR, claiming the publication 'is an early study, explaining why a lesser proxy sufficed'. Venter et al. (2017) find that CGVS measures four 'drivers' and eight 'outcomes' of the vision and strategy of firms' boards and believe that it relates closely to the IIRC (2013) concept of IT. Maniora (2017) selects specific items from Asset4 to build measures of IT (four items), integrated management (four items), and overall integration level (CGVS). A recent study by Busco et al. (2019) considers that the components of the CGVS score capture both IR and IT, whether integration is incorporated into managers' day-to-day decision-making, that is, IT, as well as the ability to communicate, that is, reporting outcomes. Thus, CGVS can be considered a relative measure of the level of integration in both thinking and reporting and, as such, a measure of both IR and IT. We inspire from Busco et al. (2019) and consider that the CGVS score, with its 12 components, represents a measure of both IR and IT. Further, we follow Malafronte and Pereira (2021) to classify the 12 components that make up the CGVS score into *THINKING* and *REPORTING* based on whether they relate to the

[1] De Villiers et al. (2022) presents a review of 285 studies using Asset4 data published in quality academic journals. They explore how researchers use Asset4 ratings, including Asset4 pillars, categories, data points and indicators; how they justify their use of Asset4; what are the research themes and opportunities for future research. They acknowledge that there is an increasing number of databases, that provide evidence to investors, financial analysts, and fund managers that their ratings are based on careful analysis of high-quality data collected from multiple sources, that their measurements of constructs are valid, and are also frequently used by researchers. They recommend researchers to carefully assess and justify why their chosen rating system is the right one; they also observe that the pillar scores have been used in many studies, while the categories, indicators and data points have not been used much, thus suggesting many opportunities to examine finer-grained constructs and measure nuanced constructs.

Table 3 Level of Integrated thinking (*THINKING*) and Integrated reporting (*REPORTING*)

Variables	N	Mean	Min	Median	Max	Stdev
CGVSD01S	5,037	70.66	9.84	80.17	91.95	26.80
CGVSD03S	5,037	71.28	24.65	82.07	99.31	30.62
CGVSD04S	5,037	48.43	47.61	47.99	100.00	4.58
CGVSO03S	5,037	66.37	32.34	98.54	99.38	32.80
THINKING	5,037	64.19	28.80	65.33	97.44	17.53
CGVSD02S	5,037	68.37	13.03	80.66	96.48	28.32
CGVSO01S	5,037	57.78	30.88	36.05	99.74	30.91
CGVSO02S	5,037	54.22	32.57	34.45	99.80	30.11
CGVSO04S	5,037	66.33	22.01	90.69	96.59	32.90
CGVSO05S	5,037	75.90	12.15	83.92	86.33	21.34
CGVSO06S	5,037	64.98	22.12	90.63	94.76	33.42
CGVSO07S	4,491	60.48	0.00	62.00	74.63	14.50
CGVSO08S	3,458	62.63	1.93	69.57	88.29	23.77
REPORTING	5,037	62.85	21.10	67.72	91.02	17.16

This table reports the descriptive statistics for *THINKING* and *REPORTING* and their subcomponents for the entire period

incorporation of integration into managers' day-to-day decision-making, that is, IT, or the ability to communicate, that is, reporting outcomes (Table 3).

To identify the proxy of IT, we consider the variables capturing a company's integration policy (CGVSD01S), its monitoring (CGVSD03S), setting objectives (CGVSD04S) on integrated strategy, and being a signatory of the global compact (CGVSO03S), which represent a company's thought process and are expressions of IT dynamics within the firm. Our *THINKING* measure is obtained as the average of these four CGVS components. We measure *REPORTING* based on eight components: if the company describes the implementation of the integration strategy (CGVSD02S), reports about challenges or opportunities linked to integration (CGVSO01S), explains how it engages with stakeholders (CGVSO04S), and publishes CSR or Sustainability report (CGVSO05S), which are apparent reporting items. Reporting if the company integrates financial and extra-financial factors in the MD&A section (CGVSO02S) relates to the specific section of the report and, hence, the scope of information availability (i.e., reporting). Similarly, variables that represent if the company's CSR report is compliant with GRI guidelines (CGVSO06S), has an external auditor for its CSR or Sustainability report (CGVSO08S), and extra-financial reports consider its global activities (CGVSO07S) are derived from the act of reporting and so are included as proxies of reporting. Our measure of *REPORTING* is obtained as the average of the eight CGVS components.

Each of the 12 components that make up the CGVS index ranges from 0 to 100 and is derived from the underlying data points collated at an annual frequency for each company. The individual company score for each year is obtained by equally weighting and z-scoring all underlying data points and comparing them against all

companies in the Asset4 universe, using a proprietary system.[2] Consequently, the variables *THINKING* and *REPORTING* represent relative measures of the extent to which a company practices IT and IR in a year and are expressed as a percentage between 0 (minimum level) and 100 (maximum level). Table 3 shows descriptive statistics of the variables *THINKING* and *REPORTING* along with their corresponding sub-components, and Appendix 1 reports definitions of the CGVS components as provided by Thomson Reuters.

The following section describes the models used in our analysis to address the research question. We test whether *THINKING* drives *REPORTING* or vice versa using a Granger causality test followed by system of generalized method of moments models.

3.1.3 Granger causality test

To test the effect of *THINKING* on *REPORTING* and the possibility of reverse causality, we develop Eqs. (1) and (2), following Malafronte et al. (2016) and Foresti (2006) application of Granger causality. Equation (1) specifically tests H1, whereas Eq. (2) tests the possibility of reverse causality (H2). We use a restricted model with one lag of the dependent variable to test for Granger causality, as follows:

$$THINKING_{i,t} = \alpha + \beta THINKING_{i,t-1} + \tau REPORTING_{i,t} + \mu_t \tag{1}$$

$$REPORTING_{i,t} = \theta + \phi REPORTING_{i,t-1} + \psi THINKING_{i,t} + \eta_t \tag{2}$$

In Eq. (1), the IT level (*THINKING*) is a function of the lagged level of IT (*THINKING*) and the level of IR (*REPORTING*), whereas, in Eq. (2), the IR level (*REPORTING*) is a function of the lagged level of IR (*REPORTING*) and the level of IT (*THINKING*). Based on the estimated coefficients for Eqs. (1) and (2), four different scenarios of the relationship can be expected.

1. Unidirectional Granger causality from *REPORTING* to *THINKING*: in this case, the level of IR increases the prediction of the level of IT, but not vice versa. Thus $\tau \neq 0$ and $\psi = 0$.
2. Unidirectional Granger causality from *THINKING* to *REPORTING*: in this case, the level of IT increases the prediction of the level of IR but not vice versa. Thus $\tau = 0$ and $\psi \neq 0$.
3. Bidirectional (or feedback) causality: in this case, $\tau \neq 0$ and $\psi \neq 0$; thus, the level of IR increases the prediction of the level of IT and vice versa.
4. Independence between *THINKING* and *REPORTING*: In this case, there is no Granger causality in any direction; thus, $\tau = 0$ and $\psi = 0$.

[2] The Refinitiv ESG scoring methodology has recently changed and some studies are reviewing this change in methodology to assess potential impacts on the reliability of the findings (i.e., the working paper by Berg et al. (2021) analyse the changes to the historical ESG ratings of Refinitiv ESG (formerly ASSET4) and find different results depending on whether the original or rewritten data are used). However, in the context of our study, our measures are not affected by the changes in the ESG scoring methodology as we look at the CGVS subcomponents rather than the overall E, S, G, and ESG scores.

Hence, based on the estimation of these results, it seems possible to detect the causal relationship between the level of IR and the level of IT.

3.1.4 System of generalized method of moments models

Following the Granger causality test, we acknowledge that examining the relationship between IR and IT could be influenced by endogeneity bias due to reverse causality, sample selection bias, or unobserved heterogeneity. First, a sample selection bias could exist, as firms that report information on IR and IT could differ systematically from those that do not. Thus, the factors that affect a firm's IT level could also be correlated with the IR level. Second, reverse causality can occur if IR and IT affect one another. Third, unobserved heterogeneity arises when there is an omission of variables in our causality model.

Endogeneity in panel data is commonly controlled with generalized method of moments (GMM) or with two-stage least squares approach. We employ the two step GMM approach as it treats all control variables as endogenous without the need to identify exogenous instruments. Moreover, identifying exogenous variables to instrument the endogenous variable can be challenging and eventually the instruments may never be precisely exogenous. By relying on internal instruments using lagged values or internal transformation addresses the possibility that the current level of IR (IT) may not be affecting IT (IR) but rather the previous year's IR (IT) could be playing a significant role.

A system of generalized method of moments (SYS-GMM) proposed by Blundell and Bond (1998), can control for endogeneity in our estimations and help capture the relationship between IR and IT. We employ the two step GMM as the standard GMM model considers only the first difference of each variable in a regression, while the lagged levels of explanatory variables are used as instruments. The two step GMM uses the levels equation into the estimation procedure to produce a system GMM of two equations involving both the levels equation itself and the first-differenced equation. The two-step GMM estimator has a smaller asymptotic variance and statistical tests based on the two-step estimation are asymptotically more powerful than those based on the one-step estimator (Hwang & Sun, 2018).

$$THINKING_{i,t} = \alpha + \beta_1 THINKING_{i,t-1} + \beta_2 REPORTING_{i,t} + \sum_j \gamma_j FIRM_{j,t} + \sum_k \delta_k COUNTRY_{k,t} + +IND_i + YEAR_t + e_{i,t} \quad (3)$$

$$REPORTING_{i,t} = \alpha + \beta_1 REPORTING_{i,t-1} + \beta_2 THINKING_{i,t} + \sum_j \gamma_j FIRM_{j,t} + \sum_k \delta_k COUNTRY_{k,t} + IND_i + YEAR_t + e_{i,t} \quad (4)$$

The dependent variable in Eq. (3) is the IT level (*THINKING*). It is a function of the level of IR (*REPORTING*) and lag of IT level (*THINKING*), firm-level controls, such as firm size (*SIZE*), performance (*ROE*), capital structure (*LEVERAGE*), and

governance variables (*BOARD_MEET*, *BOARD_SIZE*, *BOARD_INDEP*). i ($i=1$, 2…, 584) identifies the sample companies and t represents the period ($t=2009$, 2010, …, 2018). We also control for other firm characteristics, including *STRG_SHARE, CEO_SHARE, IND_SEN* (following Busco et al., 2019; De Villers et al., 2011; Frías-Aceituno et al., 2013, 2014; García-Sánchez et al., 2013; Qiu et al., 2016).[3] We use country-level variables to control for the country's economy (*GDP*), the stock market (*MKT_INDEX*), environmental impact (*EPI_INDEX*), investor protection (*INV_PROT*), and World Bank measures (*VOICE_ACC)* following previous studies (i.e., Busco et al., 2019; De Villiers et al., 2017b). Further, we control for industry (IND_i– using ICB code) and year ($YEAR_t$) fixed effects in the regression models. $e_{i,t}$ is the error term. Similarly, in Eq. (4), the dependent variable is the IR level (*REPORTING*) and is a function of the level of IT (*THINKING*) and lag of IR level (*REPORTING*). All the other controls in the regression model are the same as those presented in Eq. (3). See Table 2 for further details on the variables.

Equations 3 and 4 is instrumented with lagged values of the explanatory variables. As lagged values are usually weak instruments, combining the first-difference estimator with the estimator in levels, two step SYS-GMM efficiently deal with endogeneity issues within the model specification. To satisfy the orthogonality condition, we collapse instruments after two lags (Roodman, 2009) as large number of instruments would lead to finite sample bias. We use Hansen's (1982) J test to measure the validity of instruments and apply the Windmeijer corrected standard errors (Windmeijer, 2005) to correct for downward bias in estimated parameter standard error.

3.2 Qualitative analysis

The qualitative analysis draws from interviews with individuals directly involved in their organisation's IT and IR journey. Following Feng et al. (2017), we include a cross-section of IR preparers rather than focusing on a single case or participant group. Participants were recruited from a panel of firms invited to present at a global conference. Based on participants' availability and willingness to participate in the study, we conducted five in-depth semi-structured interviews (approximately five hours). While we have no reason to believe such a convenience sample would bias our findings, we acknowledge this possibility. The choice of in-depth semi-structured interview method was considered appropriate to the scope of the investigation as it enabled a more detailed and deeper response from interviewees without limiting their answers to particular choices (Mack et al., 2005). The semi structured interviews also enabled us to collect data in a very direct and relatively straightforward way and was deemed the best tool to undertake an in-depth investigation in the opinions and experiences of key personnel involved in their firm's IR–IT journey. This also enabled the researchers to obtain internal information through the valuable insights and wisdom based on the experience and position of the selected interviewees.

[3] We use a one-period lag of all firm-specific independent variables in our regression model to control for endogeneity.

The literature review and the quantitative analysis guided our interview question development. Our main scope of inquiry revolved around the following broad open-ended questions. To set the context of the interview, we started with the question "When and how did your company start its IR journey?". To ensure the interviewees had sufficient knowledge and experience to contribute to answering the research questions, we asked "What is your role/How are you involved in the IR process of your organisation?". In order to understand the motivations and drivers of IR in the organisation we asked, "What led your company towards adopting IR?". To enable a deeper discussion on IT, and the relationship between IR and IT, we questioned "How do you conceptualise IT in your firm?" and "What do you think is the relationship between IR and IT for your firm?". To conclude the interview, we asked "Is there anything else you would like to share about your firm's IR–IT journey?"

The questions were initially developed by the researchers and reviewed by an expert in qualitative research pertaining to its language, wording, order, and relevance. Following the review process, a change in order of the questions and probing prompts were incorporate to explore views that required further clarification. Appendix 2 details the participants job title and the industry of the firm personnel interviewed. As evident, the respondents are very influential people in their organisations, who are directly involved in the IR journey of their organisation (most often from its inception stage) with access to privileged information. The interview questions were designed to ensure there were no inquiry on sensitive or private matters related to the firm. The authors do not believe that the interviewer's personal identify or self-presentation bias affected or distorted the interviewees responses in any way.

We believe that our number of interviews is appropriate considering the mixed-method approach applied for the scope of this study. Interviews were recorded and transcribed verbatim. We conducted the interviews in 2018, face to face and via conference calls based on the availability of the interviewees. We did not perceive any meaningful differences between face-to-face and audio or video interviews. In line with good research practices, consistent with studies that promote interviewee confidentiality and candour, and following other interview-based studies, we digitally recorded the interviews. The participants were allocated codes to maintain organisational and personal confidentiality. Each interview included a discussion on the IR journey of their organisation and the factors affecting the decision to start the journey, thus providing insights into the IR–IT relationship.

4 Results

4.1 Granger causality test

Table 4 reports the results of the Granger causality testing following Eqs. (1) and (2) to address the research hypotheses H1 and H2. Before undertaking a Granger causality test, we first test for stationarity of the *THINKING* and *REPORTING* series in the panel. To compute Granger causality, the two-panel series must be covariance stationary, so an augmented Dickey Fuller test using (Fisher type) panel unit

Table 4 Granger causality test

Panel A	*THINKING*	Panel B	*REPORTING*
L.THINKING	0.798***	*L.REPORTING*	0.728***
	(0.011)		(0.015)
REPORTING	0.152***	*THINKING*	0.146***
	(0.011)		(0.014)

This table shows the results of the Granger causality test. Panel A tests if the level of IR 'Granger causes' the level of IT, whereas Panel B tests if the level of IT 'Granger causes' the level of IR

*, **, *** indicate the significance level at 10%, 5% and 1% respectively

root test was estimated. For both series, the null hypothesis of non-stationarity was rejected at the 1% level.[4]

The results in Table 4 show that *REPORTING* Granger causes *THINKING* (Panel A) and *THINKING* Granger causes *REPORTING* (Panel B); that is, there exists a bidirectional (or feedback) causality where both coefficients of $\tau \neq 0$ in Eq. (1) and $\psi \neq 0$ in Eq. (2) are significant at the 1% level. Thus, it can be argued that current levels of *REPORTING* contribute to predicting the present value of *THINKING* even in the presence of past levels of *THINKING*. Similarly, current levels of *THINKING* contribute to predicting the present value of *REPORTING* even in the presence of past *REPORTING* levels. Collectively, this implies that the level of IR increases the prediction of the level of IT and vice versa. The findings from the quantitative analysis support the theoretically validated viewpoint of WICI (2013), who argues that IT is the basis for IR and that IT is facilitated through IR (Adams, 2015), implying that the IT and IR processes mutually reinforce each other. As a further robustness check, we re-estimate the Granger causality model using additional lags (lag2, lag3, etc.) of *REPORTING* in Eq. (1) and *THINKING* in Eq. (2); the resulting coefficients are not significant,[5] indicating that only one period lag (of *REPORTING* or *THINKING*) helps in predicting *THINKING* and *REPORTING*, respectively, and subsequent lags (more than one period) have no predictive ability.

4.2 SYS GMM models

To address the potential endogeneity issue caused by reverse causality between *THINKING* and *REPORTING*, we employ SYS-GMM models, and the findings are presented in Table 5. Panel A presents the results of the effect of IR on IT (Eq. 3) while Panel B present the effect of IT on IR (Eq. 4). Our results support the dynamic nature of IR and IT as the estimated coefficients of the lagged dependent variables are statistically significant in both Panel A and Panel B. This provides validation for the use of dynamic panel model over other causality models to draw statistical inferences; it also confirms the dependent nature of IR and IT from one period to

[4] The results are not reported here and are available on request.

[5] The results are not reported here and are available on request.

Table 5 SYS-GMM models

Panel A	*THINKING*	Panel B	*REPORTING*
L.THINKING	0.793***	*L.REPORTING*	0.656***
	(0.04)		(0.097)
REPORTING	0.130***	*THINKING*	0.308***
	(0.029)		(0.08)
L.SIZE	0.21	*L.SIZE*	3.806**
	(0.414)		(1.3)
L.ROE	− 0.568	*L.ROE*	1.314
	(0.819)		(1.422)
L.LEVERAGE	0.969	*L.LEVERAGE*	13.087*
	(2.617)		(7.545)
L.BOARD_SIZE	0.15*	*L.BOARD_SIZE*	0.322*
	(0.084)		(0.189)
L.BOARD_MEET	0.022	*L.BOARD_MEET*	− 0.021
	(0.042)		(0.086)
L.BOARD_INDEP	0.004	*L.BOARD_INDEP*	− 0.044**
	(0.011)		(0.022)
L.STRG_SHARE	0.008	*L.STRG_SHARE*	0.01
	(0.016)		(0.041)
L.CEO_SHARE	− 0.923*	*L.CEO_SHARE*	1.723
	(0.48)		(1.11)
IND_SEN	0.267	*IND_SEN*	− 16.884*
	(3.607)		(8.692)
GDP	− 0.03	*GDP*	0.071*
	(0.026)		(0.037)
MKT_INDEX	− 0.022	*MKT_INDEX*	− 0.073
	(0.04)		(0.075)
EPI_INDEX	0.002	*EPI_INDEX*	− 0.064
	(0.041)		(0.092)
INV_PROT	− 0.383*	*INV_PROT*	1.165**
	(0.218)		(0.506)
VOICE_ACC	− 1.318	*VOICE_ACC*	10.035**
	(1.719)		(3.343)
_cons	5.496	*_cons*	− 75.53
	(8.289)		− 53.838
Industry control	Y	*Industry control*	Y
Year Control	Y	*Year Control*	Y
N	3444	*N*	3444
AR (1) *p* value	0.00	*AR* (1) *p* value	0.00
AR (2) *p* value	0.25	*AR* (2) *p* value	0.14
Sargan p value	0.00	*Sargan p* value	0.00
Hansen *p* value	0.13	*Hansen p* value	0.12

This table shows the results of the SYS-GMM models. Panel A examines the effect of IR on IT (Eq. 3) while Panel B examines the effect of IT on IR (Eq. 4)

*, **, *** indicate the significance level at 10%, 5% and 1% respec-

Table 5 (continued) tively. Standard errors are reported in brackets. The variables used are listed in Table 2

another with current level of reporting (and thinking) being significantly determined by reporting (and thinking) in the previous period.

From Panel A, the coefficient of *REPORTING* is positive and statistically significant indicating *REPORTING* drives *THINKING* in support of our hypothesis H1. Similarly in Panel B, the coefficient of *THINKING* is positive and statistically significant indicating *THINKING* also drives *REPORTING* in support of our hypothesis H2. This, combined with the results from the reverse causality test, supports the view that IT is the basis for IR and that IT is facilitated by IR (Adams, 2015), implying that the processes of IT and IR are mutually reinforcing each other.[6] Our results are significant in the presence of a variety of firm and country specific characteristics that we used as controls in our model specifications.

From Table 5, we note a few differences between the drivers of *THINKING* and *REPORTING;* we find that companies' size (*SIZE*) and capital structure (*LEVERAGE*) report a significant positive impact on the level of IR but has no significant effect on IT. This could be the result of external factors, such as peer pressure, or the need to provide legitimacy in response to greater expectations among stakeholders. The positive and significant impact of company's size (*SIZE*) on IR is consistent with the predictions of the legitimacy theory and findings from Qiu et al. (2016) and Busco et al. (2019), confirming that size is a significant predictor of a company's reporting strategy. Contrary to previous studies (i.e., Grant, 1991; Russo & Fouts, 1997), the firm's financial performance (*ROE*) reports a non-significant coefficient i.e., performance does not drive management to undertake higher IR or IT levels. This indicates that the decision to report or think in an integrated manner is not driven by firm profitability nor constrained by resources implications. Companies operating in environmentally sensitive industries (*IND_SEN*) (i.e., chemicals, electricity, gas, wastewater, alternative energy, forestry, and paper) tend to exhibit lower levels of reporting. Firms in environmentally sensitive sectors may find it challenging to report non-mandatory disclosures that may possess greater reputational risk, thus exhibiting a lower level of reporting.

Among the governance measures, the size of the board (*BOARD_SIZE*) is found to have a significant positive impact on the level of *REPORTING* and *THINKING* while independence of the board has significant negative impact on levels of IR. Firms with bigger boards are more likely to encourage higher IR and IT levels to enhance accountability with stakeholders (Lai et al., 2018). This suggests that IR and IT may be driven top-down within an organisation by the board of directors, which realises the importance of creating conditions and processes that are conducive to an inclusive process of decision-making and management. Similarly, the negative relationship between board independence and integrated reporting seem to suggest that

[6] To address any self-selection bias, we re-estimate the model parameters by distinguishing between companies that do and do not explicitly provide reference to the IIRC's framework as a basis for their reporting. The results not reported here and available on request align with our main findings. We thank the reviewer for suggesting this robustness test.

less independent corporate boards offer opportunities to the management to focus on reporting and enhance its level of integration. When CEO compensation is linked to shareholder's return, this results in lower levels of integrated thinking.

These results collectively provide new evidence on the differential IT and IR drivers and contribute to previous studies (e.g., Busco et al., 2019) that have considered similar drivers and their effect on the level of IR and IT for an organisation. The differences in the IR and IT drivers indicate that there may be more complex internal factors in an organisation's decision to think and report in an integrated manner. To unravel these, we conduct qualitative in-depth interviews with individuals directly involved in preparing integrated reports for their organisation. The findings of the interviews are reported in Sect. 4.3.

4.3 Insights on IR–IT relationship from interviews

All interviews were recorded, anonymised, and professionally transcribed before being imported in QSR NVIVO software. The qualitative data analysis adopted the three processes identified by Saldaña (2016), in the first cycle coding the initial data is reduced; second cycle coding involved reorganising and analysing the first cycle codes; and finally post-coding where conclusions were drawn, and findings compared to the quantitative analysis. At the first cycle coding, after a careful reading of each transcript, a short analytic memo and reflective log outlining significant impressions on the data and participant were prepared for each interview. The first cycle coding involved 'mixing and matching' approaches namely, the elemental method (descriptive, in-vivo and process coding) with affective methods—evaluation coding, exploratory method (hypothesis coding), and procedural method (causation coding). The transcripts were then re-read to develop three main themes based on the data—IT drive IR, IR drive IT, and the relationship between IR and IT. Second cycle coding allowed a degree of re-organising and re-analysing the data coded using first cycle method. We re-read the transcripts to ensure that the conceptual organization of the first cycle codes had been achieved. The third cycle involved a process of relating these themes to the findings from the quantitative analysis. Only a selection of quotations has been included to represent the views expressed. Often the views expressed in the extracts were replicated in more than one interview. The findings emerging from the data collection and analysis are presented in this section. Specifically, we summarise the key findings from the interviews conducted with individuals directly involved in their organisation's IR and IT journey.

It emerges how IR is crucial for IT and integrated decision-making; indeed, the process of preparing an IR makes the people involved in the reporting process think differently, in an integrated manner; it challenges report preparers to think beyond the obvious financial capital toward a more multi-capital approach. IR also challenges firms to think beyond their regular business model and consider the implications of business operations on the value chain of the business.

> "I think [IR] pushes us to think differently than otherwise you would […] it is easy to think in terms of just financial capital, it is harder to think in

terms of manufactured capital when you are a bank, [IR] takes us to the next level of thinking about our impact on natural capital, social capital, it is not easy, and it pushes us wider in our value-chain thinking, rather than just our kind of traditional business model of we taking capital and turning it into funding" (BANK 1).

The implication of preparing an IR has a positive effect internally within the organisation and externally in the eyes of various organisational stakeholders. The IR process helps improve the learning of people involved in the decision-making process; this learning and experience resonate within the organisation to improve IT. IR also serves to garner credibility among stakeholders and satisfy certain regulatory reporting requirements for firms.

"It [IR] is a good tool for us to use internally, to educate people and get them to think differently. And because it is an external tool, it does bring credibility" (ENERGY).

Preparing an IR helps improve IT around sustainability issues within the organisation and serves the purpose of breaking down organisational silos and bringing people from different business functions towards a common goal, thereby generating conversations that otherwise would have not been possible.

"IR is perhaps a way to mainstream thinking around sustainability into the business, to provide something, or a subject or an issue, to bring different business functions together, to have an ongoing conversation around… [IR] provides a forum, so we have a working group focused on integrated reporting, that brings together the main functions involved in the preparation... the legal team, finance, investor relations, internal audit, the sustainability team...where we can discuss matters around integrated reporting, and how we are going to further improve our alignment with the framework […] IT is the prize. The report is just the means to build IT within the business, so one of the things which have come out of that group has been a much greater consideration of big sustainability issues and long-term sustainability challenges for the business" (ESTATES).

The IR exercise presents a more comprehensive view of the organisation's business processes and business value creation model in the stakeholders' minds, which creates a sense of purpose for the board to build on the shortfalls and push organisations to improve from one period to another continuously. Rather than having an external benchmark, firms consider their previous reporting as the basis for improving their future reporting exercises. Acknowledging various implications for a wider stakeholder community enables important conversations and discussions to affect the overall IT process positively.

"As we are moving on the world with better and better reporting, this opens the windows in the mind of our board and makes them realise the total impact that we have, in negative and positive ways, and on what is really important, not only for ourselves, but also for our stakeholders. By making

the integrated report and doing it in a certain way, you enhance and improve integrated thinking" (AIRPORT).

IR helps teams in different business functions think about sustainability issues and challenges in a holistic, integrated manner within the organisation. By engaging in IT, different teams can take a broader look at their overall business operations and develop more coherent strategies. This helps organisations become more resilient and better prepared to meet long-term objectives.

"[IR] helps break down silos within the business, that sort of cross-pollinates different areas of work, and build a more coherent approach to business strategy which is not just rooted in financial value but takes a broader view, helping to make the business more resilient and longer-term thinking" (ESTATES).

IR and IT are considered a journey, and organisations must start the journey somewhere. An organisation can start its journey by attempting to prepare an IR through adapting, inspiring, and following the IIRC < IR > framework. Within this context, organisations can be considered an open learning system, which considers the external changes in stakeholder expectations to acquire knowledge more widely from inside and outside the organisation (Wang & Ahmed, 2003).

"Theory says that you have to start with IT. That is what everybody keeps saying, but I've not found a company that started there. Most companies, at least our company, started with IR and copying or trying to adopt the framework from others […] We saw some other leading companies providing integrated reports and we thought, let us try. Let us try and take some first steps on this reporting journey" (BANK 2).

Interestingly, another organisation provided a different perspective, with IT being the driver of IR for one of the organisation. Over a period of time, the individuals involved in preparing the IR feel that reporting should be the result of the IT rather than the start of the journey. Although the organisation started its journey by attempting to prepare an IR, developing IT within the organisation now puts them in a better standing to prepare an IR. This difference could be since BANK 1 started IR in a mandatory setting while BANK 2 started IR voluntarily and not enforced through regulation.

"Reporting was […] the driver [of IT] for quite a while. Now we want to flip that, and we want to say that in the end, as it should be, that reporting should be the end of the process, not the start of the process" (BANK 1).

The learning and shortfalls from the IR exercise help organisations adapt and improve their thought process over time; that is, reporting leads to higher-order thinking. While IT and integrated decision-making are the end goals for the organisation, IR is perceived to be a small step in the right direction as a means to this end. Further, IR is seen as a small milestone towards achieving a higher purpose, that is, IT within the organisation.

> "We did the first materiality assessment [...], and we learned from that because we are trying to improve our IT within the company. So the effect of good reporting and learning from that is that you improve the thinking within the company […] I see IT as a journey and integrated reporting, taking small steps on that path, in supporting the journey of IT" (BANK 2).

IR is more than just a reporting (tick box) exercise and indicates that any reporting exercise made with the sole purpose of satisfying regulation by meeting regulatory requirements or driven by the stakeholder or peer group pressure would not achieve its intended benefits. IR exercise will be truly beneficial when it is driven by firms' desire to be integrated into their business operations, and reporting will ultimately be the by-product of the integrated thought process and actions.

> "Irrespective of what the IR requirements are, to be sustainable as an organisation we need to approach our business in an integrated way. And that then enabled us to report in an integrated manner more effectively because we are working in that way" (ENERGY).

The mutually reinforcing role of IR and IT is evident within the organisational setting, especially for firms already in the IR journey. To prepare an IR, some level of IT is required within the organisation. This can manifest itself through the management's desire to work in a holistic manner or through the existence of some form of internal mechanism that enables some level of IT. However, the reporting exercise accentuates the discussion and collaboration among teams within the organisation that help stimulate IT.

> "To start with IR, you need to have a certain level of IT. We strongly find that in most cases, it is IR that stimulates IT [...] by making the integrated report and doing it in a certain way, you enhance, you improve integrated thinking" (AIRPORT).

The relationship between IR and IT was described using the metaphor of the brain and body, where the brain is the IT, and the body is the IR. Both are connected and interlinked, and IT cannot be performed without IR and vice versa. Collectively IR and IT help organisations showcase and celebrate their success (positive and achievements) and address the shortfalls (areas of improvement) in their corporate reporting. The collective benefits were achieved only when the organisation ventured into the IR and IT journey, indicating the value of starting the journey in the hope that it leads to better decision-making outcomes in the future.

> "IR helps to make our board think more integrated. But then it stays with thinking, and now we have to go to integrated acting to act upon it., because if this is a theory of very holistic one that your brain is also your body, then there is no separation between your body and your brain. Your brain is also a body. Then we have to okay, if it all stays in the head of a board, this IT, Look, we have made this integrated report, and we know exactly where we are and what we have to do, where the hurting points are, where the good points are. IR has helped this understanding" (AIRPORT).

5 Conclusion

The implementation of integrated thinking and reporting in practice is a subject of increasing attention for companies, practitioners, and regulators. While previous studies explore benefits and challenges of integrated thinking and reporting (i.e., Dumay et al., 2017; McNally et al., 2017; Rodríguez-Gutiérrez et al., 2019), and investigate the drivers and possible consequences on internal and external stakeholders (i.e., Busco et al., 2019; Churet & Eccles, 2014; Frías-Aceituno et al., 2013, 2014; García-Sánchez et al., 2013, 2021; Jensen & Berg, 2012; Serafeim, 2015; Songini et al., 2021; Vaz et al., 2016; Velte, 2022; among others), what seems to be missing to the best of our knowledge is empirical studies investigating 'what comes first', so where organisations should start from, that is, the thinking or the reporting, and what could be the best way forward based on the experience of integrated reporting adopters. Our study extends this body of literature by providing new empirical evidence on the interplay between integrated thinking and reporting.

We expand previous studies in this field that use qualitative case studies methodologies (i.e. Al-Htaybat & von Alberti-Alhtaybat, 2018; Guthrie et al., 2017; Lodhia, 2015), by providing insights from quantitative analysis and interviews. Indeed, we employ a mixed method approach, that increases the confidence in our findings and help improve the validity of the research outcome in terms of their accuracy and authenticity. Our main findings suggest that the level of integrated thinking drives the level of integrated reporting and vice versa, i.e. a good integrated report benefits from an appropriate level of thinking embedded within organisational processes, and integrated reporting creates a fertile background for integrated thinking. The findings from this study align with the literature exploring companies' journey in integrated thinking and reporting, and the role of integrated thinking in fostering integrated reporting (i.e., Al-Htaybat & von Alberti-Alhtaybat, 2018; Dumay & Dai, 2017; Giovannoni & Fabietti, 2013; Moolman et al., 2016). We document that integrated thinking leads to integrated reporting, and vice versa, thus creating a virtuous circle where the decision to publish an integrated report favours an inclusive decision-making process, as well as embracing integrated thinking favours the adoption of integrated reporting. We also find evidence of differential drivers of integrated thinking and reporting which adds to previous studies (e.g., Busco et al., 2019; Frías-Aceituno et al., 2013, 2014; García-Sánchez et al., 2021; Jensen & Berg, 2012). We do so by using mixed methods, i.e. quantitative analysis and interviews, and using quantitative proxies that enhance the validity and reliability of our findings, while opening avenues for further research in this field.

The findings from this study have various implications for the academic community, organisations, and policy makers. From a theoretical point of view, the findings support the theory of organisational change and provide evidence of second order changes (Laughlin, 1991); integrated reporting offers opportunities for significant changes that permeate the whole organisation, resulting not only in the production of a report but also in the process of integrated thinking. These

findings contribute to previous studies (i.e. Guthrie et al., 2017; Rodríguez-Gutiérrez et al., 2019) and expand our understanding of the interplay between strategic management practices (i.e. thinking) and reporting mechanism (i.e. reporting), suggesting how a holistic approach can drive both incremental and transformational change within the organisation. Our findings emphasise the dynamic nature of organisational change, where continuous learning, adaptation and refinements are crucial. In terms of managerial and practical significance, this study contributes to new knowledge on how to embrace the journey effectively; it suggests starting somewhere, either building initiatives that allow to take a holistic approach to decision-making or start from an integrated report. Preparing an integrated report makes the organisation more aware of the progress and shortfalls in their integrated processes, and integrated thinking facilitates integrated reporting. Once the management focus and efforts are directed towards integration, then thinking, reporting, and management will improve and reinforce each other over the organisation's journey. Through the interrelationship and the mutually reinforcing roles of integrated thinking and reporting, organisations can not only stay ahead of continuously shaping regulatory landscape but also adopt a proactive approach which could position them as industry leaders, influencing standards and practices. In addition to the managerial implications at company level, the findings from this study are well positioned within the policy makers and standard setters' debate in this field; by providing insights on the integrated thinking and reporting journey, and confirm that they mutually reinforce each other, these findings would provide pathways through which policy makers and professionals can effectively promote their adoption and practice.

Further, the findings from this study have implications in the corporate governance field and enhance our understanding of corporate governance issues in relation to corporate reporting. The interplay between integrated thinking and integrated reporting shows that by improving their reporting practices, companies would enhance their internal decision-making processes; at the same time, when adopting a holistic approach through integrated thinking, organisations would be better prepared to produce reports that provide a comprehensive view of their company, reflecting the overall strategy and performance. The reciprocal relationship between integrated thinking and reporting helps to achieve a better alignment between strategic objectives and reporting, leads to a more informed and strategic decision-making process and higher stakeholder engagement, thus putting organisations in a better position to address various stakeholders' needs. As observed in Maroun et al. (2023), when the management of an organisation is informed by integrated thinking, it leads to high quality reporting to stakeholders, with reduced information asymmetry and enhanced accountability of economic, environmental and social performance. It also enhances the transparency of the reporting, making management accountable for the information provided and helping to address governance issues. This dynamic process, where integrated thinking and reporting mutually reinforce each other, leads to higher transparency and accountability, resulting into continuous improvement in both governance and reporting.

By proposing a consolidated proxy that helps measure organisations' integrated thinking and reporting levels, we believe that our study will help propel further

empirical quantitative studies within this field. This will provide a fresh perspective for an in-depth empirical examination of the benefits of integrated reporting to both financial markets and society at large, within a research field that has been mainly characterised by qualitative studies (case studies, interviewers, and narrative accounts). Additionally, these metrics provide new ways to differentiate, categorise, and evaluate organisations as part of shareholder engagement and from an investment standpoint. Further, the interrelated nature of integrated thinking and reporting, evidenced in our study, supports the principles and concepts within the < IR > framework that focus on bringing greater cohesion and efficiency to the corporate reporting process and adopting integrated thinking to break down silos and reduce duplications. Our results provide new evidence concerning the business case of integrated reporting; indeed, the crucial role of integrated thinking and reporting has been recognised by the ISSB, that has highlighted the synergies between integrated reporting and the sustainability standards, considered as complementary tools for investor-focused communications (IFRS, 2024). This reinforces the relevance of our study as a contribution to knowledge on the integrated thinking-reporting journey.

While we acknowledge that our research makes an important empirical contribution to the academic literature on integrated thinking and reporting, we anticipate that our study will generate further discussion rather than quell this debate. Further investigations could develop alternative proxies for the reporting and thinking levels within the organisation. Studies could investigate the tangible effects of changes in processes and their impact on the quality of integrated reports over time, measured using textual attributes. Further studies can help entangle how integrated thinking and reporting collectively affect the integrated decision-making process within an organisation. Finally, further quantitative studies can use our proxies to examine their effects on financial markets and society at large.

Appendix 1: Variables included in the *THINKING* and *REPORTING* measures as defined in "Corporate Governance/Vision and Strategy (CGVS)"

Mnemonic	Datastream definition	Category
CGVSD01S	Does the company have a policy for maintaining an overarching vision and strategy that integrates financial and extra-financial aspects of its business?	*THINKING*
CGVSD03S	Does the company monitor its integrated strategy through belonging to a specific sustainability index? AND Does the company monitor its integrated strategy through conducting external audits on its reporting?	*THINKING*
CGVSD04S	Does the company set specific objectives to be achieved on the integrated strategy?	*THINKING*
CGVSO03S	Is the company a signatory of the Global Compact?	*THINKING*

Mnemonic	Datastream definition	Category
CGVSD02S	Does the company describe the implementation of its integrated strategy through a public commitment from a senior management or board member? AND Does the company describe the implementation of its integrated strategy through the establishment of a CSR committee or team?	*REPORTING*
CGVSO01S	Does the company report about the challenges or opportunities linked to the integration of financial and extra-financial issues?	*REPORTING*
CGVSO02S	Does the company integrate financial and extra-financial factors in the management discussion and analysis section of the annual report?	*REPORTING*
CGVSO04S	Does the company explain how it engages with its stakeholders?	*REPORTING*
CGVSO05S	Does the company publish a separate CSR/H&S/Sustainability report or publish a section in its annual report on CSR/H&S/Sustainability?	*REPORTING*
CGVSO06S	Is the company's CSR report published in accordance with the GRI guidelines?	*REPORTING*
CGVSO07S	Does the company's extra-financial report take into account of the global activities of the company?	*REPORTING*
CGVSO08S	Does the company have an external auditor of its CSR/H&S/Sustainability report?	*REPORTING*

We build our measures of *THINKING* and *REPORTING* using the 12 components of the Asset4 mnemonic CGVS collected from Thomson Reuters Asset4, which represent various aspects of implementing a firm's overall integration strategy. This table presents variable names, descriptions, and how these are categorised between thinking and reporting for the purpose of this study

Appendix 2: Qualitative interview details

Identifier	Participant job title	Interview length (min)
AIRPORT	Senior Advisor: Corporate Affairs	63
BANK 1	Group IR Manager	68
BANK 2	Global Head of Advisory, Reporting & Engagement	46
ENERGY	Senior Vice President: Governance, Compliance and Ethics	49
ESTATES	Director: Global Sustainability	58

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest. The authors have no relevant financial or non-financial interests to disclose.

Ethical approval The research has received ethics approval by the University of Roehampton.

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