Usefulness of real-time information:
views of professional investors and analysts

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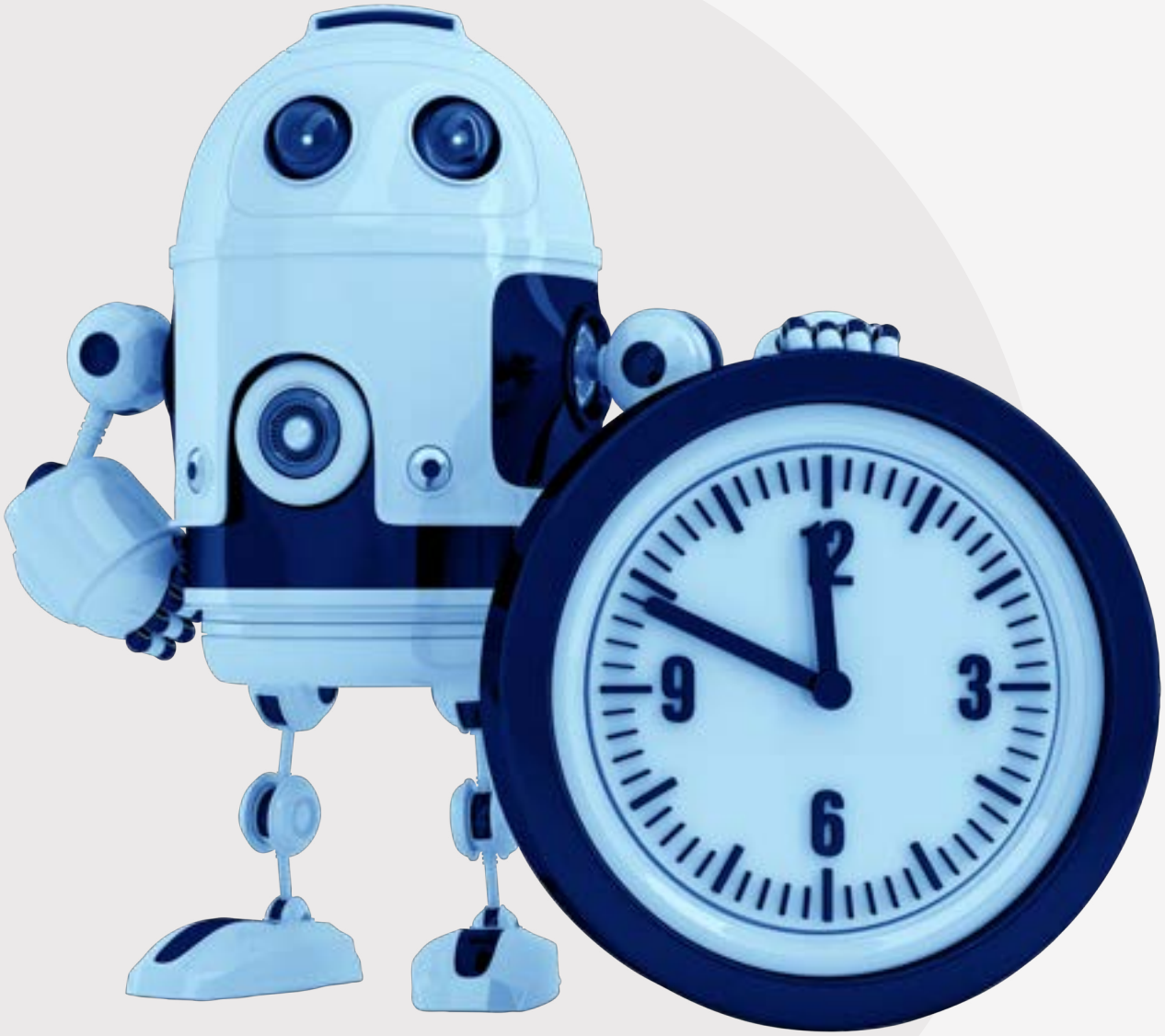

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Foreword

Advances in technology, an explosion in the volume and variety of information available and fundamental changes in the way in which we work and utilise data are transforming the landscape for accounting and reporting. The Covid crisis was a further catalyst for change, but the transformation in working practices, automation and information needs had already started – and some would say the pace of change in accounting was already lagging some other industries.

While some technology developments come with challenges, they also create formidable opportunities. As technology accelerates and we build on those rapid advances to drive still further innovation, the potential for change is exponential. The challenge is to maintain visibility and control of the opportunities that these advances can generate and ensure that we, as accountants and stakeholders in corporate reporting, are ready for that pace of disruptive change.

One of those disruptions concerns a corporate reporting paradigm shift, where corporate reports that only include historical financial information are no longer considered sufficient to meet the information needs of all stakeholders. We increasingly live in a world of Big Data and massive computer processing power, where data aggregators and media channels, such as Bloomberg, Reuters, MSN and others, have the capability to obtain and disseminate information about company performance well before the company itself publishes its results. But is this faster / more frequent information actually useful, utilised and desired for decision-making by key stakeholders?

Against this background, this research project by Subhash Abhayawansa (Swinburne University of Technology), Mark Aleksanyan and Ioannis Tsalavoutas (University of Glasgow, Adam Smith Business School) and Kenneth Lee (London School of Economics and Politics), specifically sets out to:

- Gain an evidence-based understanding of professional investors' and financial analysts' perceptions and usage of real-time and quick-time data in their practice of analysis of company performance, equity valuation and investment decision-making;
- Assess analysts', investors' and other stakeholders' current and future perceived demand for real-time information in general, and quick-time corporate reporting information in particular; and
- Assess users' perspectives on the need for a new corporate reporting and assurance paradigm, and/or future regulation of real & quick-time data.

This report aims to inform the debate specifically about the relevance of the current corporate reporting paradigm in the era of real-time/quick-time information. In this context 'real-time' will be understood as immediately available data, and 'quick-time' refers to data which is available well ahead of a company formally publishing it.

James Baird
Chair of the Research Panel

December 2022

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Definitions of terms and abbreviations used in the report

Information types/properties:

Corporate-reported information

This is a collective term that refers to publicly available accounting (i.e., financial statements and financial reporting) and non-accounting information (i.e., non-financial reporting, such as operating information/updates, sustainability and risk reporting, corporate governance, auditing information) reported/disclosed by companies.

RT – real-time information/reporting

This term refers to information that is (or could be) relayed/disclosed publicly without (or with only a short) latency or lag relative to the underlying event/state that the said information is capturing. Real-time information could constitute publicly available information that is (or could be) relayed by companies (i.e., corporate-reported accounting and non-accounting information) or publicly available information from external/alternative information providers/sources. A hypothetical example of real-time corporate-reported accounting information would be company disclosing its revenues as soon as they are earned on an ongoing basis. An example of real-time corporate-reported non-accounting information would be barrels of oil produced in real time or company operating information. Examples of publicly available real-time information from external/alternative information providers/sources would include information on real-time prices of assets, currencies and commodities, real-time satellite imagery tracking traffic flows, shipments, and retail car park occupancy.

HF – higher-frequency information/reporting

Unless specified otherwise, HF information/reporting refers to information that is (or could be) disclosed publicly on a more frequent basis (or at shorter intervals) than mandatory reporting by public companies in a given jurisdiction. For example, public companies whose shares are admitted to trading on regulated markets within the UK or the EU are required to issue half-yearly and annual financial reports[1], disclose material price-sensitive information on an ongoing basis and provide notifications of major holding when triggering events[2] occur. Thus, in relation to public companies, higher-frequency information is information that is (or could be) reported by companies more frequently than on a half-yearly or quarterly basis (e.g., on a monthly, weekly or daily basis) or in response to legal and regulatory requirements. Examples of higher-frequency reporting by companies would include provision of daily, weekly or monthly updates of accounting line items (e.g., revenues), volumes of production, shipments, bookings, reservations, new contracts, and customer traffic. Examples of higher-frequency information generated and reported by other information providers/sources would include daily pricing information on commodities, currencies, market and sector news flow.

[1] See FCA's Disclosure Transparency Rules (DTR) on Periodic Financial Reporting (www.handbook.fca.org.uk/handbook/DTR/) and EU Transparency Directive (www.esma.europa.eu/regulation/corporate-disclosure/transparency-directive).

[1] For example, see https://www.esma.europa.eu/sites/default/files/library/practical_guide_major_holdings_notifications_under_transparency_directive.pdf

Definitions of terms and abbreviations used in the report

User types:

Users (of information)

The term ‘users’ only refers to professional investors (buy-side users) and sell-side analysts (sell-side users). This report does not consider and does not study other types of users.

Professional investors (also referred to as buy-side users)

This term refers to investment professionals who work in asset management companies (also referred to as buy-side firms) and who are responsible for, or are involved in facilitating, investment decision-making. Examples of professional investors include buy-side analysts, fund managers and technology or data experts who generate information inputs for investment decisions or develop new/alternative investment styles and approaches.

Sell-side analysts (also referred to as sell-side users)

This term refers to professional actors whose primary responsibility is to gather and process information and produce investment research on covered companies for consumption by buy-side users. In this research report, this term refers to both equity and fixed-income (credit) analysts.

User employer types:

Buy-side firms

This term refers to institutions where professional investors are employed. These include asset management companies and asset management arms of investment banks.

Sell-side firms

This term refers to institutions where sell-side analysts are employed. These may include investment banks, brokerage houses, independent research houses, as well as firms that provide ‘paid-for’ research coverage.

Definitions of terms and abbreviations used in the report

Investment/analytical approaches:

Quantitative users and quantitative investment or analytical approach

These terms refer to users and their investment or analytical practice where information processing and investment decision-making is primarily based on application of mathematical and statistical methods, and/or extensive application of computer algorithms (including those utilising machine learning) and automation.

Fundamental users and fundamental investment or analytical approach

These terms refer to users and their investment or analytical approach where information processing and investment decision-making is primarily based on the users’ own subjective/manual analysis and interpretation of information, rather than mechanistic application of a quantitative approach.

Short-term vs. long-term investment or analytical horizon

The term short-term horizon (long-term horizon) refers to an investment or analytical horizon of less than (greater than) one year. There is no universally accepted definition of the notions of ‘long-term’ and ‘short-term’ horizon and different users may define them differently. Most of our interviewees, who identify themselves as long-term focused investors, note that once they have invested in a stock their target is to hold it for longer than one year. In contrast, users who identify themselves as short-term focused hold their investments for as short a time as a day.

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Background, aims and research questions

The existing corporate reporting model is constructed around a well-established pattern of annual, semi-annual or quarterly publication of information. This research examines the potential for a real-time (RT) or higher-frequency (HF) corporate reporting model. We identify factors influencing professional investors' (buy-side users') and sell-side analysts' (sell-side users') perceptions of and their potential demand for corporate-reported accounting and non-accounting RT/HF information. While the main focus of this study is on corporate-reported accounting and non-accounting RT/HF information, because there are no mandatory requirements for public companies to report on a RT/HF basis, to gain a comprehensive understanding of users' perceptions and needs, we also explore the relevance to users of RT/HF information that is publicly available from alternative information sources. We address a range of related broad research questions (which are disaggregated further into more specific questions in Section 1.2), including:

- What are the perceptions of users on the usefulness of RT/HF information?
- What advantages and limitations do users identify with regard to RT/HF information in general, and RT/HF corporate reporting in particular?
- What are the practical impediments to the use of RT/HF information in general, and what skills and resources are needed to effectively assimilate it?
- How uniform or diverse are opinions across different types of users about the usefulness of and potential demand for corporate-reported RT/HF information?

Research approach

The data was gathered using in-depth semi-structured research interviews with a sample of users. These users comprised professional investors and sell-side analysts in the UK and Australia. The findings presented in this report are based on the analysis of data collected from 47 interviews.

Main findings

For most of the professional investors and sell-side analysts, their experience with RT/HF information was limited to RT/HF information sourced from specialist information providers or, more rarely, their in-house data 'laboratories'. In general, our interviewees had not been exposed to corporate-reported accounting or non-accounting RT/HF information outside of a few instances of companies in specific sectors (or during certain time periods) reporting certain types of accounting (e.g., revenues) or non-accounting (e.g., production or booking volumes) information on a monthly, weekly or daily basis. On reflection of this lack of pervasiveness of corporate-reported RT/HF information, we endeavoured to understand the potential preference for such information amongst sell-side and buy-side users.

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We observe no differences in views expressed by users based in the UK and Australia. However, we observe different levels of support amongst different types of users for a transition to a RT/HF model of reporting of information by companies. In fact, the user type and their modus operandi (rather than the perceived attributes of RT/HF information per se) are the primary determinants of users' attitude towards and appetite for RT/HF information. We identify two specific dimensions of user type/modus operandi that appear to drive their information requirements: (a) users' investment or analytical approach (i.e., fundamental vs. quantitative), and (b) users' investment or analytical horizon (i.e., short-term vs. long-term focused).

- The users adopting a short-term investment or analytical horizon (i.e., whose investment or analytical horizon is less than one year) and those adopting a quantitative investment or analytical approach (i.e., those who rely on quantitative investment or analytical methodologies and/or automation of information gathering, processing and decision-making) tend to consider RT/HF information highly valuable. These users prefer corporate-reported RT/HF information because such information can reveal emerging trends more quickly and help them better time the market, enhancing their competitive advantage. Among these users the preference for corporate-reported non-accounting (e.g., operational) information as well as RT/HF industry- and market-level information was greater than for corporate-reported accounting information.
- The users adopting a fundamental investment or analytical approach (i.e., those who base their decision-making on their 'subjective'/'manual' analysis and interpretation of information) and users who have long-term focused investment or analytical horizons display little if any appetite for RT/HF information in general, and corporate-reported RT/HF information in particular.

The reasons for the lack of interest in RT/HT information displayed by investors and analysts that follow a fundamental investment or analytical approach or target a long-term investment horizon can be categorised into three groups: (1) perceived negative consequences resulting from the use of corporate-reported RT/HF information; (2) challenges in using and producing RT/HF information; and (3) the perceived threat to practices of users, resulting from the availability of corporate-reported RT/HF information. They are elaborated below:

Perceived negative consequences resulting from using corporate-reported RT/HF information

- Corporate-reported RT/HF information can induce investors to react to short-term trends (or create noise), resulting in undesirable volatility in asset prices.
- Corporate-reported RT/HF information can bear little relevance to companies' long-term fundamentals and performance prospects. Such information can be easily misinterpreted and lead to less accurate forecasts by sell-side analysts and poor investment decisions by investors.

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- Corporate-reported RT/HF information can induce short-termism amongst users irrespective of their investment or analytical approach or horizon.
- Corporate-reported RT/HF information can promote short-termism amongst corporate managers, distracting or disincentivising them from engaging in value-adding activities and decision-making focused on sustaining value creation for the long term.

Perceived challenges associated with the usage and quality of RT/HF information

- Corporate-reported RT/HF information can create an information overload and, as a result, inhibit the ability of fundamental investors and analysts to produce value-adding research and make insightful investment decisions.
- Corporate-reported RT/HF information would be incompatible with the current analytical models of users adopting a fundamental investment or analytical approach.
- RT/HF information could only be useful if users had the resources, capabilities and skills needed to assimilate this information.
- The usefulness of corporate-reported RT/HF information is deemed conditional on reporting companies being able to provide additional commentary over and above what is currently provided and answering user queries triggered by the new information provided. Provision of RT/HF commentary by companies is not deemed feasible by users.
- Corporate-reported RT/HF information is deemed to be lacking reliability due to its vulnerability to manipulation and the associated difficulty of obtaining assurance on it. The lack of external assurance would make RT/HF reporting inherently less robust, resulting in a potentially higher incidence of errors in reported information and reducing users' confidence in its reliability.

Perceived threat to practices of users adopting a fundamental investment or analytical approach posed by RT/HF corporate reporting

- Corporate-reported RT/HF information can reduce the usefulness of sell-side analysts' research as it can undermine analysts' information intermediation (information discovery) role and their ability to create differentiated research.
- RT/HF information can reduce the ability of professional investors adopting a fundamental investment or analytical approach to generate superior returns, as there would be less information to be discovered and, thus, less information asymmetry to exploit using their superior research skills.

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Situations in which RT/HF information can potentially become useful for users adopting a fundamental investment or analytical approach

- In periods of crises and high market uncertainty (e.g., the Covid-19 crisis period) corporate-reported RT/HF information can assist users in forecasting company performance and value companies more accurately.
- Corporate-reported RT/HF information is deemed useful for analysing companies whose performance is difficult to predict for various life-cyclical or structural reasons (e.g., young, high-growth companies and companies in highly volatile sectors).
- If corporate-reported RT/HF information becomes prevalent, and the technology and talent needed to process it more accessible, then at least some of the users adopting a fundamental investment or analytical approach and/or a long-term investment horizon would start using RT/HF information.

Users are witnessing continuing growth in the volume of publicly available business information (including RT/HF information that is available from alternative sources). Despite the lack of interest in RT/HF information users adopting a fundamental investment or analytical approach are cognisant of the need to prepare for the challenges posed by the increasing information volume. In fact, they recognise that ignoring corporate-reported RT/HF information (if or when it becomes a reality) would not be an option. This is because of the fear that they would be 'missing out' and 'left behind' if such information was provided, and they did not embrace it. Hence, even if they do not support the introduction of a RT/HF corporate reporting model, they would nevertheless, likely, use this RT/HF information.

Large research and investment houses have been seeking to develop data analytic and automation capabilities in-house or by hiring staff with data science, programming and data analytical knowledge; and smaller firms are also aspiring towards it. These capabilities are currently being used or planned to be dedicated for collecting and analysing greater volumes and varieties of corporate-reported as well as industry and market information with the intention of developing a potential source of competitive advantage. These resources and capabilities would enable users to also take advantage of corporate-reported RT/HF information (if it were to become available) and be competitive in a more informationally efficient environment.

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Additional findings

While in the eyes of most users there is no pressing need for companies to transit to a RT/HF corporate reporting model, many identified two areas of corporate reporting in which they would like to see improvements. These include digitisation and consistency and comparability (across companies, periods and jurisdictions) of corporate-reported accounting and non-accounting information. The evidence of a significant demand for digitisation and standardisation of reporting is an attestation to the continuing relevance of corporate-reported information.

It is important to note that we did not design our interviews to explore users' perceptions around digitisation and consistency/comparability of corporate-reported information. We include these findings in this report because they were raised by a number of respondents during the interviews, and we believe them to be of value and relevance to readers of this report.

Implications for practice

- **Limited utility:** Companies entertaining the possibility of adopting a RT/HF reporting model are encouraged to exercise caution and consider their target audience, as only quantitative users and users targeting a short-term investment/analytical horizon perceive such information as unconditionally useful, while for other types of users the usefulness of RT/HF information would be limited to 'special case' situations, such as for companies operating in highly volatile/fast-moving sectors or in periods of market shocks.
- **Sell-side technology gap:** Sell-side analysts are facing existential challenges due to a continued trend of reduction of research budgets that the asset management industry allocates to sell-side research (and a further squeeze of research budgets following the introduction of MiFID II in 2018), and the rise of quantitative technology-driven investing. To remain relevant and competitive in the market for information and investment research, the sell-side research industry needs to develop their technological sophistication and capabilities to adapt to the changing information and reporting landscape.
- **Continued investment and engagement by the buy-side industry:** The asset management industry has already taken steps to expand its technological capacity and human capital to exploit opportunities presented by more frequent and varied information from companies and other providers. This has been particularly prevalent in larger investment firms. Smaller buy-side firms should expand their capacity and engage with the transition to increased information diversity and intensity if they are to be competitive and overcome the MiFID II-induced disadvantages relating to accessing sell-side research.

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- **Developments in audit methodology:** The audit profession needs to develop tools, methodologies, skills and capabilities to be in a position to provide assurance if and when accounting information is to be produced and reported by companies on a RT/HF basis.
- **Skills shift:** Educational institutions, professional bodies and other private sector training entities need to integrate the principles and practice of coding, data science and data analytics into their curricular and continuous professional development programs to ensure that the information management, analytical skills and supporting technology capabilities of investment and finance professionals stay relevant and current to the needs of the investment community.

Policy recommendations

- **Investor diversity:** Regulators and policymakers need to recognise the diversity in capital market participants and understand how that diversity of users manifests in their specific information requirements before making policy decisions. We suggest that the following three dimensions of user diversity are particularly relevant and should be considered when assessing users' information needs in new policy initiatives: (1) users' functional role (professional investors vs. sell-side analysts); (2) users' investment or analytical approach (fundamental vs. quantitative); and (3) users' investment or analytical horizon (short-term vs. long-term).

  Academic researchers need to appreciate the heterogeneity in user information needs dependent on the type of users, and their perceptions and practices when designing research aimed at informing policymaking.
- **Digital adaptation:** Government support in the form of grants and tax concessions could incentivise SMEs operating in the investment advisory field to invest in digital technologies. Without additional support especially small scale and boutique equity research firms will be unable to cope with the changes in the nature and frequency of availability of information (including potential increase in RT/HF information) and be competitive. Government incentives for digital adaptation in sell-side and buy-side firms is in the public interest as more efficient processing of information and generation of better insights about firm performance enabled through new technologies will ultimately enhance capital market efficiency.

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Additional recommendations

The following recommendations are based on additional findings that do not ex-ante relate to the stated objectives of the empirical investigation in this study. These additional recommendations are presented as they would benefit the readers of this report.

- **Digitisation:** Regulators, standard-setters and the accounting profession should work together to expand and accelerate various XBRL and related initiatives[3] across the globe to digitise and standardise the provision of accounting information as a precursor to moving to a RT/HF corporate reporting model in the future. Also, the investment community should actively engage in the debates and decisions around the digitisation of accounting information to ensure their requirements are met by new regulations and standards.
- **Consistency of accounting information:** Regulators and standard setters should work towards improving the definitional consistency of commonplace accounting measures to enable inter-company comparison of financial performance and position to facilitate future provision and use of corporate-reported RT/HF information.

[3] For example, in February 2022, the UK Department for Business, Energy and Industrial Strategy published Corporate Transparency and Register Reform White Paper, which will require company accounts to be filed with Companies House in a digital format using the industry standard Inline Extensible Business Reporting Language (iXBRL) and full tagging of reported financial information to make it machine readable. This is envisaged to bring the UK into line with international best practice, ensure comparability and accessibility of financial information across jurisdictions, and create a more informative, responsive and reliable companies register, which will benefit millions of businesses, investors and other users who access it every day. (see assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1060726/corporate-transparency-white-paper.pdf, pp.61-62).

Introduction and background

1.1 Research context and problem

Progressively, the world is transitioning to a real-time economy, where every attempt is made to reduce latencies in production, dissemination, acquisition and analysis of information, and ultimately in decision-making processes. One can conjecture that, in today's era of the knowledge economy, the growing availability of company-, sector- and market-level RT/HF information provided by alternative information sources might be challenging the primacy of mandatory (and infrequent) reporting of information by companies. Indeed, some asset managers are now emphasising the importance of alternative RT/HF information/sources, such as real-time information on traffic flows through websites and credit-card spending (Doshi et al., 2019), satellite imagery (Katona et al., 2019) and social media information (Grennan and Michaely, 2020). For example, in their quest for alternative information sources and innovation in information analysis processes, the world's largest asset manager, Blackrock, has announced large scale investments to exploit these opportunities, with the development of an Artificial Intelligence Lab (Wigglesworth and Flood, 2018).

Corporate reporting inter alia aims to provide useful information to capital providers. When it comes to decision-making by professional investors and sell-side analysts, the predictive value of corporate-reported information depends on its timeliness, i.e., the time gap between the underlying economic events/transactions (which affect the current and prospective financial position and performance of the firm) and the communication of this information to external users. If corporate information production and reporting processes experience diminished latencies, then costs of capital are likewise reduced, conferring a potential competitive advantage on those firms adopting rapid information dissemination practices (Liu and Vasarhelyi, 2014).

Prior research shows that investors and financial analysts regard corporate-reported accounting and non-accounting information as essential for their practice of analysing company performance, stock valuation and investment decisions (Riley et al., 2003; Slack and Campbell, 2008; Vafaei et al., 2011; Wang and Hussainey, 2013; Moumen et al., 2015; Slack and Tsalavoutas, 2018; Cascino et al., 2021). While one might perceive that investors and analysts would prefer more information to less information and, therefore, favour more frequent reporting by companies, the extant literature presents mixed findings on the benefits of higher frequency reporting. For example, more frequent provision of information such as quarterly reporting is found to be more useful to investors as it can reduce information asymmetry and cost of equity (Fu et al., 2012) and provide positive information spillover effects (Kajüter et al., 2019). However, Kajüter et al. (2019) find that the

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market perceives quarterly reporting as a net burden on some firms. In addition, interim reporting can engender managerial myopia (Gigler et al., 2014; Kraft et al., 2018), leading to negative consequences such as real activities manipulation (Ernstberger et al., 2017), reduction in firms' investments (Kraft et al., 2018) and reduced risk taking (Balakrishnan and Ertan, 2018).

Modern internal reporting systems can measure financial performance and the financial position of the firm at any point in time, and most current business software packages have a large component of 'on-demand' ready-made reports available to management as needed (Liu and Vasarhelyi, 2014). In essence, the technology to allow companies to produce RT/HF information internally, and report it to users externally, already exists. Yet, the traditional external reporting model has remained static, with infrequent and fixed 'within year' reporting seasons and rigid accounting rules creating, arguably, dated 'one size fits all' reporting.

For example, ICAS discussion paper on Future of Corporate Reporting (ICAS 2018), produced jointly with a group of investors, describes the traditional reporting as one that constrains experimentation with more user-friendly and accessible ways of reporting; and this is going to become more important as technological developments facilitate different and better ways of providing information and enhancing access to different users. The paper highlights that the annual report has become over-complex and multi-focused, making it harder for users to access key information and extract it amidst the fog of details.

Professional investors and sell-side analysts (as users), on the other hand, are increasingly empowered by developments in information processing technologies and the expansion of 'alternative' information and external information providers. This enables them to obtain relevant company-, sector- and market-level information on a more continuous basis. The received wisdom and anecdotal evidence suggest that RT/HF information harvested and distributed by external information providers can be important for professional investors' and sell-side analysts' decision-making. A recent survey of 65 Fortune 1,000 companies by NewVantage Partners (2019) reports that 92% of companies have been seeking to become nimble, data-driven businesses and increased their investment in big data[4] or Artificial Intelligence initiatives, with 55% (21%) of companies spending over $50m ($0.5b) on these resources. Importantly, 77% of the surveyed firms were large investment banks and asset management companies, i.e., information market actors typically regarded as buy-side and sell-side users of corporate-reported information. The survey provides early indication that acquisition and consumption of 'alternative' information is increasingly becoming indispensable to the survival and success of many such users. Thus, the initial evidence is that of a changing paradigm of users'

[4] According to Zhang et al. (2015), the following qualities define the term Big Data: massive volume, high velocity of data added on a continuous basis, large variety of types of data, and uncertain veracity.

information needs, which might also have implications for how they engage with corporate information in their practice. However, the extent and nature of investors' and analysts' demand for and potential usage of RT/HF information for company analysis and investment decision-making largely remains a 'black-box'. We do not know the extent to which users are willing or able to embed this information into their decision-making; what types of RT/HF information are considered relevant; which settings increase/reduce the usefulness of this information, and, more generally, how RT/HF information can impact their practice.

To the best of our knowledge, no prior study has provided direct, first-hand evidence on sell-side analysts' and professional investors' perceptions about, and their demand for, RT/HF information on companies they cover or invest in. However, what is clear is that RT/HF information is likely to have a broad impact on corporate operations and how companies are analysed and valued. A Chartered Global Management Accountant (2013) survey of more than 2,000 Chief Financial Officers (CFO) and finance executives concluded that approximately 87% predicted that real-time information and big data will likely transform how business would be done in the next ten years. It is believed that "companies will increasingly ask finance to provide a real-time, forward-looking perspective of corporate performance, instead of relying on accounting information that is typically historical in nature" (CGMA 2013, p. 8).

1.2 Aims, objectives and research questions

Information is a form of capital, the raw material for creating value in the new economy (Kaplan et al., 2004, p. 249). In today's accelerating knowledge-economy information is, arguably, the most vital of capitals. Advances in information technology make information more readily available and accessible to users than ever before, but at the same time contribute to its exponential growth, not the least because in many domains it allows information to be produced continuously, in real-time.

The growth in the volume, variety and frequency of information available to company management and its importance as a new type of asset/capital for companies has motivated researchers to look 'inside the organisation' and study how companies (should) internally account for the acquisition, production and use of this information capital.[5] The focus in this literature has been on gaining an understanding of how this higher volume, variety and frequency information is being used inside companies to improve their decision-making. Here, the focus is on companies as consumers, and management and financial accountants as internal users of this information (e.g., see Warren et al., 2015; Bhimani and Willcocks, 2014; Richins et al., 2017). Arnaboldi et al. (2017) outline a broad agenda for

[5] For example, see studies published in recent Special Issues in the Accounting, Auditing and Accountability Journal (on Social Media and Big Data, see Vol. 30 (4)), and Accounting Horizons (on Big Data, see Vol. 29 (2)).

research on the interplay between accounting and high volume/variety/frequency information, such as: the role of accountants inside organisations in using this information, including with whom they should work to use it more effectively; and the implications of predictive analytics for organisational decision-making. However, to our knowledge, there are no studies on the usefulness and usage of RT/HF information for users, such as professional investors and sell-side analysts. Little is known about whether and how investors and analysts use (or would use) RT/HF information when assessing companies and making investment decisions; what value these users attribute to RT/HF information and what challenges and opportunities they (might) confront in using it; what role this information plays (or may play in the future) in their practice and how their practice is or can be affected by the evolving information environment.

The aim of this report is to address this knowledge gap, and the specific objectives are:

1. To gain an evidence-based understanding of the extent and nature of professional investors' and sell-side analysts' current or potential demand for, and the perceived usefulness of, RT/HF information (including RT/HF corporate-reported information) in their practice of investment research production and investment decision-making, as well as factors that affect the perceived usefulness and usage of this information.
2. To assess users' current and likely future demand for RT/HF information in general and RT/HF corporate reporting in particular.

In order to address this project's aim, the following research questions have been formulated:

On perceived usefulness of RT/HF information

1. What is the extent and nature of users' reliance on, and demand for RT/HF information?
2. What is the perceived value of RT/HF information (including RT/HF corporate-reported information) to users and how would users assimilate this information into their analysis and investment decisions?
3. How important is that corporate-reported RT/HF information is assured or regulated in some way, and what would users require from assurance/regulation?
4. What changes (if any) to corporate reporting would meet users' information demand, and why?

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On information usage capabilities and challenges

5. What are the perceived impediments to users' consumption of RT/HF information and implications to their practice?
6. What data-analysis skills, technological capabilities and resources do users, and their organisations, have or need to develop to assimilate RT/HF information?

On potential disparity of perceptions and practices across different user types

7. How does the different investment or analytical approaches of different types of user groups, and different institutional contexts, influence users' views about and appetite for RT/HF information?

On challenges and opportunities of RT/HF reporting

8. What do users perceive as advantages and limitations of companies adopting RT/HF reporting?

Related literature

Mandatory corporate financial reporting, as envisaged in the modern-day conceptual frameworks of major accounting standard-setters, is primarily meant to fulfil a decision usefulness objective, subsuming a valuation objective and a managerial stewardship objective (Cascino et al., 2021). The various conceptual frameworks recognise capital providers as primary users to whom general purpose financial reports are directed (e.g., IFRS Conceptual Framework 2018, para 1.2).

How, and to what extent, traditional financial reports are relevant to investors is an ongoing question. A significant body of research conducted over many decades documents that the relationship between the market value of companies and information provided in traditional corporate reports has weakened considerably (Lev and Zarowin, 1999; Balachandran and Mohanram, 2011; Lev and Gu, 2016), suggesting a notable decline in relative importance to investors of traditional financial reporting. Although such summary accounting information as book value of equity and earnings might have become less relevant, recent studies show increased importance for capital providers of other elements of information provided in traditional corporate reports, e.g., amounts relating to intangible assets, growth opportunities, and alternative performance measures (Barth et al., 2021; Davern et al., 2019). Also, new types of reporting, such as integrated reports, which enhance the understandability of financial information by combining it with other information, have been found to enhance the relevance of traditional financial reports in some settings (Baboukardos and Rimmel, 2016; Permatasari and Narsa, 2021). The research on the value relevance of accounting information highlights the need to adapt financial reporting to the evolving needs of the capital market.

While the debate on whether there has (or has not) been a declining trend in the relevance of traditional reporting continues, in the modern-day information environment, the existing corporate reporting is likely to account for only a fraction of information available to, and used by, investors for decision-making. Indeed, Cascino et al. (2021) present empirical evidence that periodically reported corporate accounting information accounts for less than 35% of information sources that investment professionals use in their decision-making, with the remainder encapsulating manifold alternative information sources, such as alternative quantitative and qualitative information on the business of the firm, competitors and the product market. Investor demand for easier and timelier access to information has led to a significant increase in the quantity of alternative, internet-based information (e.g., investor news, websites, social media platforms) available for investors (Pennington and Kelton, 2016). The decline in the usefulness of traditional financial reports is often attributed to the inability of anachronistic standards and periodic reporting to keep pace with the growth in a multitude of information types and sources available to investors (Pei and Vasarhelyi, 2020) and idiosyncratic information preferences of diverse types of investors. Pei and

[6] As described in Grennan and Michaely (2020), among other functions these firms provide financial news aggregation, data mining for investment signals, evaluations and rankings of financial advice. The authors also estimate that at least 60% of these firms target institutional investors.

Related literature

Vasarhelyi (2020) argue that traditional corporate reporting neglects many sources and types of investor decision-relevant information, including information on peer performance, market data with short measurement intervals, investor sentiment, press coverage, social media and internet of things.

With the proliferation of financial websites, modern investors have more information at their disposal than ever before, as they are increasingly able to use alternative information sources (e.g., social media, investor blogs, and satellite, sensor, credit card, internet activity data) previously considered too cumbersome to inform their investment decisions (Grennan and Michaely, 2020). Grennan and Michaely (2020) document the growing importance of 'equity market intelligence financial technology firms' that help investors to synthesize many information sources, including non-traditional ones, relevant for equity investment recommendations.[6] They argue that these firms change how information is consumed and disseminated and present early evidence that these firms contribute to changes in informational efficiency of equity prices. In addition, they document reduced demand for, and less reaction by investors to, 'original-content' financial information and financial analysis (produced by equity analysts) in those periods when investors visit the websites of financial technology/data firms. In a similar vein, Pei and Vasarhelyi (2020) argue that the rise of quantitative/algorithmic investing that relies on higher-frequency alternative information is rendering traditional corporate reporting information obsolete and conclude that these changes in the fundamental information set of decision-makers in today's markets make prevalent the need for higher quality financial reporting paradigms to supplement this information set.

An important development in the market for information is the prospect of the use of Blockchain technology by reporting companies to enable more timely production of information. For example, Dai and Vasarhelyi (2017) suggest that Blockchain technology can be used to enable a real-time, verifiable, and transparent accounting ecosystem. They also argue that Blockchain has the potential to transform current auditing practices, resulting in a more precise and timely automatic assurance system. Yermack (2017) posits that Blockchain-like technologies will also have a transformational impact on both financial accounting as well as corporate governance, with the emergence of real-time continuously updated financial statements, greater transparency of stock trading, reduced insider trading and greater reliability of shareholder voting. Yermack (2017) surmises that Blockchain-type technologies can transform corporate disclosure, with beneficial effects on frequency, timeliness and informativeness.

Against this backdrop of early evidence and arguments levelled in the literature, our project seeks to gain an in-depth understanding of the extent of analysts' and investors' appetite for RT/HF information from traditional (i.e., company) and alternative sources; users' assessment of usefulness and relevance of such information and sources; and users' perceptions about the extent to which companies' modern reporting practices live up to users' evolving information needs.

Research approach

This research is carried out by way of in-depth semi-structured research interviews with professional investors and sell-side analysts in the UK and Australia. The semi-structured interview format ensures comparable coverage of pertinent themes and topics across all respondent groups while at the same time allowing deep-dive conversations. This approach is best suited for gaining insights into and nuanced understanding of individual users' experiences, attitudes and perceptions about RT/HF information and technology within the settings of their practice. Not only is this approach instrumental in uncovering a priori unknown factors that are shaping different users' views on RT/HF information and technology, but it also allows subsequent probing into the underpinning reasons and rationales of the uncovered effects. This approach is particularly suitable for studying novel topics where little or no prior research evidence is available upon which one could build – which is largely the case with the phenomenon investigated in this study.

3.1 Interviewees

The sample of interviewees comprises professional investors (including senior data and technology experts working in their financial institutions) and sell-side analysts. We focus on these groups because they are amongst the most informed, sophisticated and demanding types of information users in the market for information and because of the impact their decisions and actions have on the financial markets.

In this report, 'professional investors' (also referred to as 'buy-side users') are defined as practitioners responsible for making or facilitating investment decisions and/or managing assets for their institutional and private clients. Examples of professional investors include buy-side analysts, fund managers and technology or data experts who generate information inputs for investment decisions or develop new/alternative investment approaches. Professional investors are typically employed in asset management companies and investment management divisions of investment banks. By 'sell-side analysts', we mean information intermediaries who work in stock brokerage firms, research departments of investment banks, independent research houses, as well as providers of sponsored research. Their primary responsibility is to produce investment research for consumption by external (buy-side) investment clients. This group of actors are referred to as sell-side users in this report. It is important to acknowledge that neither the buy-side nor the sell-side is a homogenous group of users, as different users may pursue different investment or analytical approaches and practices. When recruiting participants, we strived to ensure the representation of users that pursue different investment or analytical approaches, users employed in different types of organisations and functional roles.

Research approach

The majority of interviewed candidates have been identified through ThomsonOne global database and Linkedin, while a small number of interviewees were recruited from the researchers' industry contacts. In total, 47 users were interviewed. The list of interviewees with some further details is provided in Appendix A. However, details are kept at a general level for confidentiality reasons to ensure that the interviewees and/or their organisations cannot be identified from the information in the table. Each interviewee is referred to in the text by a unique alphanumeric code (e.g., B1 or S1).

In terms of general descriptive characteristics, 53% of interviewed users represent the buy-side practice, and 47% are from the sell-side. About 70% of interviewees were based in the UK, and the rest in Australia. The sample covers interviewees who had between two and 32 years of professional experience, with an average of 18 years. About 83% of interviewees had prior work experience in one or more financial institutions (and 68% previously worked in two or more financial institutions) other than their employer at the time of the interview. A significant number of buy-side users previously worked in sell-side roles/firms, and a sizeable proportion of buy-side and sell-side users (23%) also previously worked in accounting firms. Overall, this suggests that our sample of users comprises highly experienced professionals. In terms of interviewees' employer institutions, 45% of interviewees were employed at asset management companies, 25% at pure research/brokerage houses, 23% at (predominantly top-tier) investment banks, with the remainder working in wealth management, credit rating and private equity firms.

3.2 Interview protocols and transcript analysis

Prior to commencing our programme of interviews, ethical approvals were obtained from the University of Glasgow, the London School of Economics and Political Science and Swinburne University of Technology. These stipulated the parameters of engagement with interviewees, including assurances of confidentiality and anonymity and interviewees' signed permission to record interviews.

The interviews took place between April and October 2020. Because this period coincided with the Covid-19 social-distancing measures, all interviews were conducted remotely via Zoom video calls. All interviews were recorded and transcribed verbatim. The duration of interviews ranged from 38 to 100 minutes, with an average duration of approximately 65 minutes. The average length of an interview transcript was 8,780 words.

The interview protocol included a range of open-ended questions. The purpose of the initial few questions was to better understand users' context (e.g., their professional background, current role and remit, and organisational settings). The remaining questions were designed to elicit users' views on various aspects of the topic of RT/HF information and technology within the context of their settings. These included questions on such aspects as:

Research approach

(1) Users' perception of the current state and the prospect of, and issues related to, RT/HF information and reporting practices by companies that they cover or invest in;

(2) The state and changes of users' task and information environment, and details of their practices in relation to information gathering, processing and decision-making;

(3) Users' aspirations (demands) for RT/HF information in general and RT/HF reporting by companies in particular, and perceived advantages, opportunities, costs, barriers and implications of RT/HF information for their decision-making and practice;

(4) The state of and trends, changes and prospects in users' employer institutions in terms of the development and assimilation of technology, capabilities and skills for utilisation of RT/HF information.

For more details, an abridged interview protocol used for interviewing buy-side users is presented in **Appendix B**.

Research approach

The vast majority of interviewed users had extensive prior experience both in terms of the number of years of working and the range and scope of prior organisations and roles they worked in. Thus, most interviewees were 'qualified' to express views and reflect on interview questions from different vantage points – with their current as well as past 'professional hats' on. To tap into this contextually rich knowledge base, the interviewed users were prompted to reflect upon the interview questions from the perspective and position of their practices and institutional settings of their current and previous roles and employer organisations. For example, a fund manager who used to work in a sell-side role and, prior to that, in the accounting profession, was asked to answer the questions reflecting on their experience as a sell-side analyst and an accountant as well.

Interview transcripts were carefully read, analysed and coded into thematic nodes created through thematic analysis of interview data. Thematic analysis implies an identification of coherent and meaningful patterns (themes) that emerge from the analysis of interviewees' responses in relation to specific questions/topics (Abhayawansa et al., 2015; Spence et al., 2018; Slack and Tsalavoutas, 2018). Each coded node represents a collection of meaningful snippets of text (i.e., passages from different interview transcripts) that convey/express similar/corroborating ideas/arguments in relation to a specific theme. "If codes are the bricks and tiles in a brick and tile house, then themes are the walls and roof panels" (Clark and Brown 2013, p.3). Thus, data analysis followed an inductive process focused on identifying relevant themes and the development of associated categories, with a view to eliciting and explaining behaviours and relationships (Parker, 2008).

The findings and discussion presented in this section are organised into four related topics. Section 4.1 presents the findings on users' perceptions about the availability of RT/HF information. The findings presented in Section 4.2 relate to general drivers of users' demand for RT/HF information. Section 4.3 reveals users' rationales against the use of RT/HF information, while users' rationales in favour of the use of RT/HF information are explained in Section 4.4. Section 4.5 presents findings on users' more pertinent information needs.

4.1. Perceived availability (supply) of RT/HF information

Before investigating the drivers of users' appetite for RT/HF information, it is important to document users' perceptions about the extent of availability of relevant RT/HF information. Given the focus of this study, and in light of the exponential growth of information volume available to users, a natural point of interest is whether users observe a growing availability of relevant RT/HF information emanating directly from reporting companies. On this question, our interviewees were unanimous: while the volume of information emanating from companies has increased dramatically, there has been almost no RT/HF reporting of information by companies or a discernible increase in the periodicity of information disclosure and reporting by companies.

> *Companies don't tend to provide updates that often to the market in between [mandatory] reporting. Some do, but some provide very little. … Have I seen a change? I think if anything, they're probably providing slightly less. [S4]*

However, a small number of interviewees noted an increase in reporting frequency in some sectors.

> *You'll get monthly updates for certain companies, so there is more disclosure than there has been in the past. … It's generally more the online IT type companies and generally ones that are fast-growing that will provide the information… [S14]*

Interviewees also pointed out differences that they observe across sectors in terms of the tendency to report information more frequently than what is mandatory, as some sectors are believed to lend themselves to high(er) frequency reporting more than others.

> *It varies quite widely by sector. So, for example, in something like software, it was the usual reporting periods. In the Auto-space, they would report monthly sales, so you would get volume data on a monthly basis. In the Aerospace and Defence, the biggest emblems [company name] and [company name] will provide monthly data in terms of deliveries, but for the most part in UK mid-cap land you are only getting full set of the accounts twice a year. [S17]*

Research findings and discussion

However, there is a growing availability of externally generated RT/HF information (i.e., from sources other than the reporting companies themselves) that can be instrumental in users' analysis and prediction of companies' performance and value. Often referred to as 'alternative' information and generated by the use of technology, this information is created on demand by specialist data companies or in-house by users' organisations (e.g., by an investment bank's data lab). Many users perceive this information as potentially relevant quasi-company RT/HF information, and the following extract is illustrative of similar views expressed by several interviewees.

> *So, we've got a team at [bank X] called [technology division Y] … They track ferries going around the world and all that kind of thing, and they track mobile phone data, and there is an incredible amount of rich data going on in there, because, can you imagine, somebody knows how many people visited one of [company name] sites, but by viewing mobile phone data they might actually eventually get a more accurate version of the sales rate on that site then [company name] itself, because when [company name] will go through their accounting function it'll get old, you know. But actually, people might be able to see it much more quickly by looking at some of this kind of holistic, top-down data. So we're not in that world yet, but we're moving towards it, and I've got our guys in [technology division Y] asking me, "Can we look at all the builders, merchants across the UK and track the footfall for you," you know, I mean, it's there… the data is there… it hasn't really been harnessed yet. [S10]*

Thus, 'alternative' RT/HF information is already available to those investors and analysts who have the resources to obtain it. The question is whether users have the appetite for using it and what determines their demand for RT/HF information. This is addressed below.

4.2. Determinants of users' demand for RT/HF information

Users' perceptions about the usefulness of, and the appetite for, RT/HF information differ consistently between different types of users and their operating and organisational contexts. We unpack the factors that shape users' appetite for RT/HF information below.

4.2.1. User's investment or analytical approach and investment horizon

Our gathered evidence suggests that, in general, sell-side users tend to be much less reliant on automation and information processing technology than users on the buy-side, and they exhibit less appetite for RT/HF information. This position remained unchanged despite the advances in information gathering and processing technologies and their increased accessibility to users over the past decade. In addition, users' appetite and preference for RT/HF information is influenced by their investment or analytical approach, investment horizon, and the number of stocks they cover or invest in.

As a large number of companies needs to be analysed or considered for investing, automation of information gathering and processing, and use of technology for decision-making in general, is more prevalent amongst buy-side users than sell-side users. For buy-side analysts, screening the target universe of assets against a predetermined set of metrics is essential, as a large universe of stocks is being considered. This can be performed more efficiently through process automation, as explained below.

> *What we've done is identify what we think are the main factors, and we daily download FactSet data, we download sort of the entire database. Extract the price and accounting information we want, pre-programmed in Python code that takes up price and accounting data and forms the ratios that you find in the academic literature... it then ... ranks all the different stocks and forms a kind of global heat map: green and dark green for positive signals, yellow, red for the negative signals and it pings it to us automatically. So, an automatic process whereby every data change is reflected in the heat map the next day, so it's a daily process. ... I think we're handling 100 million data points, but there's no human intervention in sorting the data. ... the valuations done automatically. [B5]*

Most sell-side analysts, in contrast, regard themselves as sector specialists, and they add value to clients by producing differentiated research on a relatively small number of companies they cover. Their work is predicated on their ability to identify and interpret nuanced/idiosyncratic corporate information *'with deep understanding of companies and industries' [S11].* Particularly regarding corporate accounting information, fundamental sell-side analysts are more interested in nuances and accuracy than it being produced on a RT/HF basis.

However, the extent of reliance on automation and technology differs considerably even within the buy-side community and depends on a variety of factors discussed in this report. One of these factors is the user's investment or analytical horizon. In general, RT/HF information is regarded as useful and relevant, and is actively sought after, by buy-side users that have a short-term investment or analytical horizon[7] (these typically include quantitative funds and long-short hedge funds) and sell-side analysts producing research that caters to the needs of this type of buy-side clients.

> *[RT/HF information] probably could be very valuable if you're a hedge fund or day trader; you're trading around specific events. [B8]*

[7] While there is no universally accepted definition of the notions of 'long-term' and 'short-term' investment horizon, as different users may define them differently, in this research the term 'short-term' ('long-term') refers to an investment or analytical horizon of less than (greater than) one year. Most of our interviewed users who identify themselves as long-term focused investors note that once they have invested in a stock they tend to hold it for several years. In contrast, users who identify themselves as short-term focused might hold their positions for as short a time as a day.

Research findings and discussion

In contrast, RT/HF is generally perceived to be of low or no value by users who regard themselves as fundamental investors with a long-term investment horizon, and sell-side analysts servicing such buy-side users. These users typically consider a relatively limited number of assets/stocks. Once invested, the positions may be kept for up to several years (ensuring low portfolio turnover), with only occasional rebalancing if significant market events or changes in company prospects occur. These investors and analysts typically make their investment decisions and predictions based on their analysis of the long-term investment prospects of assets. The following comment made by a buy-side user highlights that the short-lived information advantage provided by RT/HF information is not material when investing for the long term.

> *I would say the trend within [investment house X] is [to] use less technology and real-time information for analysis and instead focus on alternatives, 'analogue' sources of insight, e.g., investigative journalists, learning from academic experts or building stronger relationships with companies to extract better insight. ... It's true there are more specialist sources of information on offer than previously, for example, services like App Annie that can show usage trends for mobile apps. These may confer a brief informational advantage but are of marginal benefit if your investment horizon is 5-10 years. [B9]*

At the other end of the spectrum are quantitative users, whose information processing and investment decision-making is primarily based on mathematical and statistical methods, extensive application of computer algorithms and automation, with no upper limits on portfolio turnover. These users' investment universe can often comprise virtually all tradeable assets/stocks. Their quantitative approach is inherently data-driven and data-hungry, making RT/HF information a valuable resource: they continuously explore and exploit alternative sources of RT/HF information and technology to generate superior investment returns. The following comment highlights how a change towards a quantitative approach to investing can change buy-side users' preference for RT/HF information.

> *We have shifted in the 15 years ... from one that would predominantly use standard company delivered information or market-level information to one that uses very little of that data and now either buys or collects as real-time as possible alternative data to make those investment decisions. [B24]*

Table 1 (overleaf) summarises the findings discussed in this section.

Table 1. Factors affecting users' perceived relevance of and demand for RT/HF information

Factors	RT/HF is relevant for:	RT/HF is less or not relevant for:
Investment or analytical approach*	Buy-side users who rely on a quantitative investment or analytical approach	Buy-side and sell-side users who rely on a fundamental investment or analytical approach
Investment or analytical horizon**	Buy-side and sell-side users with a short-term investment or analytical horizon, and users with flexible/undefined horizon	Buy-side and sell-side users with long-term investment or analytical horizon
Number of stocks covered or invested in***	Buy-side and sell-side users with a mandate to cover or invest in a large number of stocks	Buy-side and sell-side users who focus on covering or investing in a small number of stocks

* All sell-side analysts who we interviewed follow the fundamental (rather than quantitative) approach. Analysts that follow the quantitative approach typically work for/as professional investors.

** While there is no universally accepted definition of the notions of 'long-term' and 'short-term' investment horizon, in this research the term 'short-term' ('long-term') refers to an investment horizon of less than (greater than) one year. Most of our interviewed users who identify themselves as long-term focused investors explain that once they have invested in a stock, they tend to hold it for several years. In contrast, users who identify themselves as short-term focused might hold their positions for as short a time as a day.

*** A buy-side user's investment coverage is typically determined by an investment mandate that may specify, among other parameters, the target number of stocks to be included in their portfolio from a target investment universe. While some mandates might target a small number of stocks, for examples, 40 stocks of a given type, other mandates might target a global universe of thousands of stocks.

Research findings and discussion

4.2.2. Users' technological capabilities and institutional disposition

The extent of the desirability of RT/HF information is also predicated upon the extent of adoption by users (and their firms) of technology that enables automation of information gathering, processing and decision-making. The adoption of technology, particularly amongst asset management companies that only pursue a fundamental (i.e., non-quantitative) investment or analytical approach and a long-term investment horizon, requires significant investment in acquisition or development of relevant skills and expertise and development and (back)testing of data-analytic and technology-driven investment processes. Thus, the extent and speed of uptake of technology by such users is a function of organisational resources and in-house skills and capabilities. As indicated by the following comments, it is the bigger, better-resourced investment houses that are positioned more favourably for the uptake of technology and the acquisition and development of relevant skills for consumption of RT/HF information.

> *So, I think the access to the technology, the data, the people have been a huge investment. And again, I don't think many investment teams have had that, you know, that backdrop. [B24]*

> *...the firm I work for hired data scientists... and once I had someone who was a cloud engineer and a programmer, there was nothing to stop us from doing it [information gathering and processing automation] ourselves with a bit of time and energy, and that's what we did. [B5]*

Reflecting upon the changing landscape of investment practice and the increasing importance of data/technology skills, many of our interviewees wished they possessed such skills.

> *Do we use machine learning? We've got quite a few people on the desk very keen, including myself. I love the idea of machine learning. I play around with it in my spare time. Do we use it at the company at the moment? No, we don't. And one of the reasons for that is probably going to be a knowledge/expertise issue. We are still kind of building up our internal knowledge into which of these algorithms or processes would actually work for what we do. It also comes down to if it would actually add value? [B7]*

According to our interviewees, data science departments, teams or labs now exist in most big research and investment houses. Aspirations for such departments/teams are also evident amongst the smaller players. There is evidence that even buy-side and sell-side firms adopting a fundamental investment or analytical approach are increasingly looking for and hiring individuals with advanced technical and data-analytic skills. As one senior sell-side analyst admits, '*there was always a natural inkling to have people that were accountants or economists, but I definitely try to look for someone that's got some coding experience' [S22]*. Similarly, a

buy-side analyst claimed, *'if we're going to expand headcount, we would probably look for someone who is a bit more tech-savvy' [B10]*. Universities have programmes offering knowledge and competencies in both data science/analytics and finance to cater to these needs.

> *We have links to certain programs, particularly [university X]. And again, what's happened in the last four or five years? You don't need to hire finance people and data scientists; they come out sort of combined from the programs these days. Because the programs have changed enough, they teach those sorts of two aspects together. [B24]*

However, recruiting people with data science and data analytical knowledge is challenging for financial institutions, not only because of the shortage of such skills.

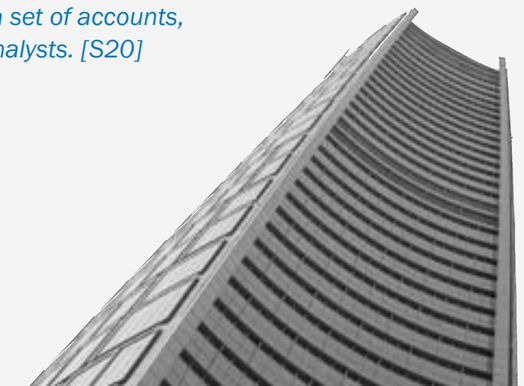
> *All the big players in tech like Google, Amazon, Apple, Facebook are luring away a lot of the talent. If anything, it's seen as a bit cool; it's a great working environment. And so, a number of the graduates we're losing, that would have historically come into finance are instead going into the tech sector and seeing that as more exciting. ... here is huge demand around the industry for people with those skills. .... there are more and more career options open to them, and therefore there's less talent that's coming across into the financial industry. [B25]*

The difficulty of competing with tech companies has driven financial institutions to scout for required talent amongst school-leavers.

> *In our company, we run a program called [program name], where we hire people from high school. Not even after university, from high school. And last year, we had a couple, and they were... again because they had skill sets in Python and good technical knowledge; their contribution was incredible.*
> *And it's incredible how much you could contribute if you could manipulate data if you know how to program. And then the financial aspect you can learn over time. [B8]*

Others attempt to develop the skills in-house.

> *... we might end up having a bit like, you know, when I joined the [firm name], and we got a training module on accounting and a training week on valuation techniques and stuff, I guess, you know, you're going to have to train people up a bit more on data science, and you'll get to a stage where a bit like I'm not a qualified accountant but I can kind of work my way through a set of accounts, you'll have some amateur data scientists I guess as junior analysts. [S20]*



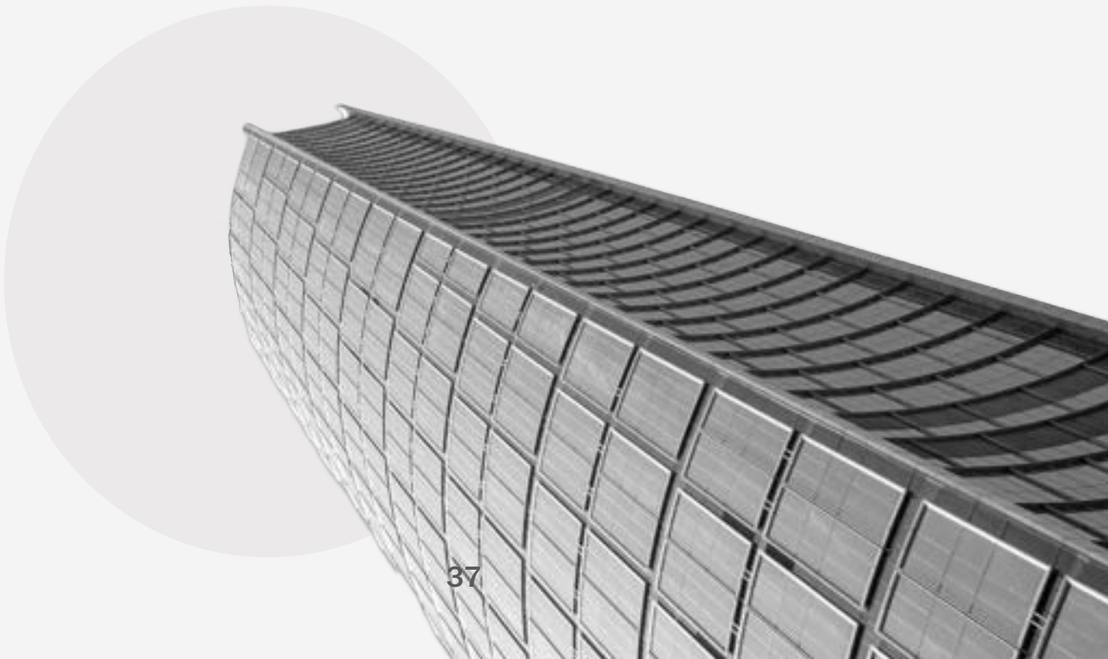
Institutions, particularly large divisionalised investment houses, that possess data science departments/labs find integrating data science/analytics into their research and investment processes challenging. From the point of view of sell-side analysts, the problem is articulated as *'I would say the vast majority of analysts, including myself, have no idea what our data scientists can really do because we don't really know what they do or what they can do' [S22]*. Similarly, data scientists'/analysts' lack of knowledge of investment analysis impedes their usefulness.

> *I think we just need a bit more of that type of resource in the [equity research] department... I feel, sometimes at the moment what you've got is a group of people who know a lot of stuff but they've never been an equity analyst, so but the two don't always marry up as doing what's optimal and making best use of that research. [S20]*

Some large investment houses have seen the problem successfully overcome by hiring consultants.

> *That's why the consultant we are using in [firm name] who comes over, you know, four times a year, he's really good because he speaks both languages. Oh my God, he is so valuable, he can talk to the IT team when I get angry, and he can talk to me and make sense. And it's like, so actually having the linguistic and cultural skills to span investment analysis and cloud engineering is really quite rare and valuable. [B5].*

Having presented key findings about factors that determine the importance of RT/HF information for different types of users, the following two sections present and discuss findings about users' most salient arguments in favour of, or against, RT/HF information.



4.3. Reasons against using RT/HF information

4.3.1 Increased market volatility

RT/HF corporate-reported information could induce more frequent trades and over-reactions by investors, inducing undesirable short-term volatility in asset prices and the market.

> *...even quarterly reporting is not great for investors because it increases the volatility in the share price ... one month doesn't tell you a great deal ...you have a good month, the next month you have a bad month, and the next month is okay, across the quarter then you're in line, but if you've got the first month of the quarter was fantastic, the share price reacts to that positively and then the next month is terrible and goes down a lot, that's not conducive to a properly functioning stock market. ... There's no scenario you can paint me where having real-time access to companies' managements accounts is going to be beneficial for anybody. [S10]*

Increased volatility can be a desirable feature for investors who pursue short-term and quantitative investment strategies, as higher volatility creates more inflection points for trading.

> *And maybe some people like that [RT/HF information], because you can trade signal and noise, but for us, for me, I don't want to trade noise. I want to trade reality, and so it's less valuable to me. [B14]*

However, the fundamental (i.e., non-quantitative) long-term focused investors view this as a threat to the stability and predictability of the market. They argue that the promotion of RT/HF reporting by companies can perpetuate short-termism in the capital market.

> *so what that means is the intensity of competition, and the variability in returns on capital becomes extreme and ever short-term. ... given the angst that came out of the great financial crisis around short-term behaviours, real-time reporting does nothing to abate those concerns, in fact, it probably elevates them. ... you have to think about the kind of behaviours that [RT/HF information] engenders. [B2]*

Such short-term trading behaviour has implications for the fairness of value distribution – value will get re-distributed from long-term shareholders to short-term traders and derivative holders.

> *If you were to see the detailed numbers, like every month trading data, I think that's when you would see for more companies a greater degree of volatility. ... if you do create more volatility in the share price, effectively, you're making the options more valuable from a company derivative perspective. And the value is then transferred away from the current shareholders to the traders and the derivative holders. [B13]*

4.3.2. Potential to mislead users and the risk of misinterpretation

Corporate-reported RT/HF information is likely to be more volatile and prone to reporting manipulation, making it a less reliable indicator of true underlying trends and events. This raises the risk of users misinterpreting information or potentially reading too much into it with trivial informational value for understanding the value creation prospects of companies.

> *Higher-frequency data just creates this opportunity because it's always going to be a lot of investors going to react on some piece of really bad news, some piece of really good news that might have very little to do with the kind of long-term prospects of a company. [B7]*

> *we're very cautious about individual data points; we prefer to look at a trend. And I'm looking up one-month data point on house prices, it is fairly dangerous, you know, we need to look at it over two, three, four months for a year, I would say. And that brings us back to that point about real-time data potentially being misleading, almost dangerous. The housebuilders drip-feed information as all companies do in the way that suits them best. They're not going to start highlighting a terrible sales week. There will be terrible sales, and if we could see them in real-time, we might overreact to them. [S16]*

Moreover, the following comments indicate that due to seasonality in sales and for businesses that do not have a regular stream of sales over a period, it would not be possible to reliably extrapolate RT/HF corporate-reported information into longer-term performance predictions.

> *Also, keep in mind that you do have some seasonality. ... I mean, not every day in a quarter you make 1/90th of the full quarter. So, you've got the variability... if you report too frequently, you're just losing the perspective. [B16]*

> *if you look at some of the software companies that have grown extremely rapidly ... one day you'd see a big customer signs and their revenue going up, and the next day nothing happens, and the next day someone signs and their revenue goes up $10, and the next day someone leaves, and it goes down $500. Having that short-term noise is not necessarily helping, even though if you sit back and look at a monthly or quarterly figure, you can see the trend more clearly. So, in the short-term, I don't think it's going to increase peoples' ability to do that. [S12]*

The following comments highlight that the combination of high seasonality in sales and high fixed costs as well as small company size makes RT/HF corporate-reported information potentially less meaningful.

> *in the industry with high fixed cost, I don't think you can have high-frequency earnings data simply because you have to amortise your fixed costs…if you have high fixed costs and intra-quarter seasonality of your revenue line, high-frequency earnings just make no sense. [B16]*

> *[under RT/HF] that month won't look so good, but the next month does, so yes, it does get ironed out, and timing irons things out, so I think it can actually create more issues for a company, particularly smaller companies if they had to report on a real-time basis. [S6]*

RT/HF information could undermine users' efficient filtering and processing of information and ultimately, negatively impact the accuracy of their forecasts and valuations.

> *That kind of thing can cause problems … having more information on latest trends can be negative for your ability to forecast a company and to determine the value of a company. [S11]*

> *Two of the companies that we used to cover used to produce monthly sales data. The hedge funds were all over this, and they got terribly excited about it … [but]… it became so unbelievably complex … and they spent most of their time trying to explain away why weeks were different this year to last year… that both companies decided to stop giving monthly data at the end because it created too much noise for the hedge funds to play around with it. [S22]*

It is not surprising that these criticisms were brought about by investors and analysts focused on the long-term value of investee companies. To them, RT/HF information does not help better assess the long-term trends and prospects of the companies they follow or invest in.

> *Whether you make money or lose money in a company relates to future prospects. It doesn't relate to necessarily the minutiae of what's happening on a day-to-day basis in the management accounts. [B9]*

> *If you're tracking a company, you know, their accounts on a weekly basis, you're starting to really focus on short-term, which is not what we are looking for; we're looking for long-term investment. … I think that would probably push this further down that short-termism viewpoint. [S2]*

4.3.3. Inducing short-termism amongst users

Increased availability of RT/HF information has the potential to induce short-termism amongst buy-side and sell-side users irrespective of their investment or analytical approach and investment horizon focus. In a competitive market for information and investment research and the demand to create 'alpha'[8], users are under pressure not to disregard such information. If disregarded, they fear a potentially important trading signal might go unnoticed, undermining an alpha-seeking investor's return generating opportunities relative to those investors who act on such information. Similarly, to remain relevant to varied clients' needs, sell-side analysts would be expected to also have a 'real-time' view and constantly update forecasts and recommendations on stocks they follow.

> *from the point of view of the analyst, I would worry that you would be stopped being able to think longer term, you start becoming obsessed about the next weekly reports, or the next daily report, and we have a lot of hedge fund clients, so they take up a lot of time, and I'm sure they would be obsessed by it [RT/HF]. And it might mean we wouldn't be able to do the analysis on things that are happening over a longer time horizon, …[where] often some of the greatest value can be added. [S19]*

The undesirable consequence of this behaviour is short-termism, leading to potentially more frequent changes of investment recommendations, valuations, and excessive trading, as the following sell-side analyst indicates.

> *if you are getting things more frequently, you're quite often then pressured to react to that information more quickly as well, and if it does turn out that it's less than accurate or there are quality issues associated with that piece of information that's led to a rating change, then you could potentially be moving ratings on the basis of faulty information. [S1]*

4.3.4. Inducing short-termism amongst companies

One of the concerns that users express is that RT/HF corporate reporting would induce short-termism amongst corporate managers and distract them from carrying on their job. This concern is commonly expressed by those investors who seek long-term capital appreciation and sell-side analysts servicing them. Reporting on an RT/HF basis may prompt a shift in the focus of company management away from creating long-term shareholder value and incentivise such behaviour. It is feared that company management would become more concerned with delivering short-term performance results that meet or beat investors' and analysts' expectations.

> *I think the more market focuses on short-term data, the more companies focus on delivering the short-term data. And sometimes that actually does the opposite and impacts on their long-term performance from what we would like to see the company deliver. [B1]*

[8] Alpha refers to excess returns earned on an investment above the benchmark return (or a suitable market index).

… if you put companies under increasing pressure to not just report monthly numbers, but to post growth from one month to the next, the entire incentive system could be skewed. [B7]

[RT/HF poses a risk for] companies in it being too short-term and they're thinking and managing for the market rather than what's right for the business. And that has been one of the reasons why the private equity model has thrived because there are certain things that you want to do away from the gaze of the public eye. [B14]

Even corporate quarterly reporting, which is a requirement in the USA but is also used by many companies in the UK, is considered excessive by some long-term horizon focused users.

> *The CEO of [company name] talks about it, and that is quarterly reporting. What they've said is that they want companies to move away from quarterly reporting because they think that it encourages short-term mentality, short-term focus, it's a waste of management's time, etc. So, you know, for you to say to me, "Okay, what do you think about real-time reporting?" I'd say, "Well, that's even worse really, you know, because you're going to have everyone jumping on every single daily movement." [S8]*

However, these concerns are not shared by quantitative or short-term horizon focused investors who seek to profit from short-term fluctuations of asset prices and, therefore, would prefer to have information reported on a more RT/HF basis.

4.3.5. Creating work and information overload

One concern that is commonly noted by investors and analysts that follow the fundamental investment or analytical approach is that with the potential availability of RT/HF corporate-reported information the volume of this information would become unmanageable. One buy-side analyst commented on this issue very bluntly: *'that's actually being a pain in the ass for most analysts because actually, although yes we say we want more information, you can be completely overwhelmed by information' [B6].* The following comment echoes the widespread concern amongst buy-side users that information overload created by corporate-reported RT/HF information will hinder their ability to identify and separate out relevant information (signal) from noise.

> *We are actively following 150 companies. If 150 companies are producing data every month, I mean, that's, you know, we're looking at thousands and thousands of data points a year, and your ability to make a sensible, reduced-emotion decision is just really hard when you get data all the time. [B13]*

In addition to creating information overload, for sell-side analysts, this would also mean that they will have to produce and publish commentaries and research updates at an even higher frequency, detracting them from producing more in-depth, impactful, value-adding research.

> *I think more financial information over a shorter time period is not necessarily helpful. … What we don't want to become is commentators on noise. My view is somewhere between six-monthly reporting and quarterly reporting, and you run into that trap of the noise overweighing the signal. [S13]*

> *every time it comes out, say you cover ten companies, you're gonna have every month, you have to do ten of these potential updates, and a lot of time spent with investors talking about it – good, because more billable hours – but that might stop you being able to do your big sort of 50-page report on some long-term trend, which is right. For instance, this time of year, May-June, has been very quiet and allowed me to do work I was wanting to do a long time ago. If instead, I was going to have to focus on monthly reports, that would get a bit irritating. [S19]*

A sell-side analyst highlighted that the effort needed to process RT/HF information to generate meaningful information is not cost-beneficial:

> *The danger is that it's not the quantity of data; it's the quality of data that counts. … A general challenge for analysts in the market is there's all this data out there and noise; the trick is to look for the data that's meaningful. I would not want that. … On a cost-benefit basis, the cost will be too much more noise to get the benefit of that extra data that might have been overlooked or not. [S3]*

To overcome the limitations associated with human cognition for processing RT/HF information, technological resources and capabilities for automating the processing of information will need to be developed or acquired.

> *You would have to find new processes to process this additional information, or you'll be working longer hours trying to look at everything on a monthly basis. Unless you can come up with some tools to analyse the stuff for you, it just adds to the workload to no real value. [S2]*

4.3.6. Users' lack of resources, capabilities and skills

Closely linked to the problem of potential information overload, discussed in the previous section, is the issue of limited technological capabilities and resources to harness the potential of RT/HF information. The extent of uptake of technology is generally determined by three factors: (1) organisational resources (financial, technological and human) and users' capabilities and skills, which are often a function of the institution's size, (2) the investment or analytical approach (i.e., fundamental vs. quantitative) adopted by the sell-side and buy-side firms, and (3) the degree of trust or conviction that data or technology-driven research or investment processes can generate more benefits (e.g., bigger alpha) than the existing approaches.

The lack of resources, capabilities, and skills is identified by many sell-side and buy-side users as a factor limiting their ability to consume and, therefore, their appetite for RT/HF information. This is more often the case amongst smaller investment/research houses and users adopting a fundamental investment or analytical approach. This is because they are, typically, less data-driven and less reliant on automation and technology for valuations and investment decision-making.

> *… of course we're interested in using big data analysis and big datasets, but we don't have a team of software engineers, trying to, I don't know, trawl the web and find out everybody who has Google searched grocery shopping or something like that and trying to create some kind of software around it. [S8]*

These firms do not have the resources to invest in the development of relevant skills and technology. The following comments from both buy-side and sell-side users highlight this issue.

> *And for RT/HF information to be harnessed and analysed, you need the bandwidth to do that. If everybody's reporting all the time, you either need more people, and I know the answer to that question if I go to my boss and say, "Can we have more people?" It's a very short word, only two letters long. Or you need to work out a way of artificially harnessing it, which relies to a degree on either very good AI or standardisation. And I guess the comfort on using your AI to do the heavy lifting for you to pick up the stuff that you need to look at is a question of how good your AI is. [B18]*

> *As a general statement globally for the past ten years, research inside of big investment bank is being seen as a cost centre and has been starved of funding. So, the answer is there isn't any more money; there's a lot less money going into research than perhaps there was even ten years ago, and that's probably going to continue, which means we just don't have the technological sophistication that some of our clients do. [S14]*

The following comment exemplifies how the lack of technological capabilities disadvantages smaller fund managers in extracting the insights that RT/HF information could provide.

> *We choose to have a longer-term time horizon, partly because we are not going to win, competing with high-frequency traders, because they've got technological advantages over us. So, they will beat us. So, don't get in a fight that, you know, you're going to lose. … given the size of our fund, we cannot compete with a quant fund that's got 300 data scientists, or even 30 data scientists, they will be in a position to analyse and attack and take from the data things that… even if we try to there is no way that we compete. [B13]*

The excessive workloads of users also limit their ability to upgrade their technical knowledge that might otherwise be seen as a solution to resource shortages. As an example of this, one of the sell-side analysts commented:

> *if [company name] wants to give me a month off to go and do the training, I'm very happy to go and do that, and I think it'd be a great skill to have, but when you're working twelve-hour days and the idea of staying in the same seat and logging on for three hours of data science training in the evening, I'm afraid doesn't really hold much appeal for me at the moment. … There's definitely a strategy telling us all to use more data, but I'm not convinced that we're being equipped with the resource to use that data perhaps. [S20]*

Investment institutions – large and small – that pursue quantitative investing and analytical approach purposefully develop and integrate information processing technology and automation capabilities, but the actual level of sophistication and pervasiveness of technology in their investment processes are determined by their resources. In contrast, institutions that only pursue the fundamental investment or analytical approach – even the large and well-resourced ones – appear reluctant to 'modernise' their business and expand their technological capabilities. For the majority of the latter type of users, it is not about the lack of resources but about institutional conservatism and conviction in verity of their existing investment or analytical approach. Sell-side analysts expect the demand for generating insights from RT/HF information to come from fund managers. The following comment highlights this sentiment.

> *if you wanted to make use of this new data, it would have to be a massive investment in research capabilities and functions globally, and that would ultimately have to come from as a desire about fund manager clients to see that happen. So, the answer is if our fund manager clients wanted us to do it and were prepared to back us to do it as an industry, then it would be done. It would cost a lot of money, it would need a change to my skill set, it would need a change in most analysts' skillsets going forward. And the question is whether it would make economic sense for the entire industry to go down that path, I don't know. [S14]*

Then there are big and small institutions that are less fixated on one particular research or investment approach. These institutions have either been experimenting with or adopting technology and data-driven approaches for some of their research and investment processes and products. In these types of institutions, the decision to adopt data or technology-driven processes is mostly predicated on their assessment of how effective the new technology is likely to be in achieving benefits (e.g., improved investment performance) that exceed the cost of developing or acquiring these technological capabilities and skills. As the following comments exemplify, the users attribute the under-developed nature of technological tools to limiting their appetite for RT/HF information.

The hope would be if you can basically chuck all your financial information into a neural network, and the deep learning algorithm will then spit out a prediction. And the truth is, there is so much noise in financial data that basically you put in all of that jumble and what you get out is hopelessly overheated and has no predictive power at all. So, you need to break the problem down for the machine into something that it can learn. … We've struggled to find benefits on the medium horizon, though. So, we don't see generally deep learning algorithms applied on a medium-term horizon …. [B25]

A lot that still needs to be done on that linguistic semantics understanding. And my feeling from talking to people that are at the cutting edge of the industry on the speech recognition side, that really, they are still struggling and there's a lot of linguistics that is almost just purely built in as rules-based. So, it's just a rule of, if this – do this, if this – do that, rather than true adaptive learning in terms of the semantic meaning. And I think it's… it's an area which has maybe stalled a bit in the industry. We are limited very much by what the cutting-edge algorithms are doing currently. [B25]

4.3.7. Concerns about reliability, assurance and low marginal utility

A potential lack of reliability and assurance was revealed as a factor limiting the usefulness of RT/HF information for decision-making. The main concerns are that: (1) RT/HF corporate information can be management accounts that are not prepared in accordance with generally accepted accounting principles; (2) RT/HF corporate information can be easily manipulated to show companies in a better light; and (3) the impracticality of getting RT/HF information audited before release. The following comment made by a buy-side user vividly articulates these concerns.

Especially in the US firms, the number of non-GAAP metrics they use, you know, I was looking at US burger chain, [company name]. They have so many adjustments for share compensation, stripping up amortisation…. And the footnotes, you know, page after page of definitions of these non-GAAP unaudited metrics. And why do they do it? – to paint a story, to send a positive message to manipulate your thinking. So, the games have absolutely been played, and the games, I think, would get greater with selective choices or disclosure around the real-time information. They would seek to disseminate information that suited their incentive, I suspect. And being unaudited, you know, I mean, do frauds happen? – all the time. And especially see them at this point in the cycle when there is a turn down. I think that will be a big problem. Like it always has. … I'm one of the people who is very sceptical of the unaudited or the non-GAAP stuff, and quite aware right now that there are a lot of market participants, who seem to move prices of the models, who don't care. And in a weird way, its hundreds of them and one of me. [B5]

Even in the absence of incentives to manipulate, the lack of external assurance would make RT/HF reporting inherently less robust, resulting in a potentially higher incidence of errors in reported information and increased likelihood of future reversals or restatements by companies, reducing confidence in RT/HF information accuracy. The following comment is reflective of several similar comments made on this matter.

It's much more important to have audited accurate information with a delay than to have unaudited information that may or may not change. … because let's say for argument's sake you had the management accounts on a monthly basis, number 1) they're not audited, so they might be management accounts, but then there might be errors that come up. 2) You would just constantly be changing your earnings forecasts around, which is not really analysis, that's just kind of looking at things that have happened retrospectively. … I can't see that working. [S10]

Another related issue highlighted especially by sell-side analysts was the potential for accruals-based earnings management, and the negative impact managed earnings can have on analysts' forecasting. The following comments reflect this perspective.

It [RT/HF reporting] would probably cause more problems than benefit because I understand that a lot of accounting transactions go through, and they get reversed or they are just nominal transactions and that gets, you know, until they are audited they will cause blips, and it would cause more issues in that, you might have a mismatch of a lot of revenue going through, and the expenses will go at a later stage and doesn't match up, get booked in a different month. Or vice versa, those spend a lot of money in one month, and the revenue comes in the next month, and that's simply just invoicing and timing that, you know, somebody would sign a contract, and you'd spent, and they agree to purchase something, you spend the money on it in one month, and they pay you the next month, and have put in the time periods would not match up and would cause probably more issues rather than benefits, on the accounting side. [S9]

Nevertheless, both buy-side and sell-side users acknowledge that despite the reliability and validity concerns, if it becomes available, ignoring RT/HF information would not be an option. This is because, due to the nature of their work, they would be expected to consider and react to all available information when performing fundamental analysis and making investment decisions. Nonetheless, long-term investors and analysts see RT/HF corporate information as having little incremental value (information content) even if it is accurate/reliable or audited.

4.3.8. Threat to the practice of sell-side analysts

Sell-side analysts' value addition to clients mainly comes from their ability to offer an information advantage, i.e., their ability to distil relevant information from diverse sources and transform it into differentiated research insights, predictions, and stock ratings for clients. Several sell-side analysts argued that disclosing corporate information on a more RT/HF basis would reduce their ability to generate and maintain their information edge. Some even hinted at an existential threat to their practice as buy-side clients' demand for the services of sell-side analysts would diminish considerably. A sell-side analyst summarised this threat in the following comment.

> *From our business perspective, I would say that if it went very significantly in real-time, it would make our business redundant because a big part of our business and even I would also say the broader sell-side, is identifying things that aren't being appropriately priced. That's because the market may be pricing something based on what people's expectations are, and those expectations have struck off what the company may have told us two or three months ago, and things have changed. It's very hard to get ahead of that. If everything is available in real-time, no one is ahead of the curve. [S13]*

Our analysis reveals three ways in which the availability of RT/HF information threatens analysts' value proposition to their clients. First, sell-side analysts who primarily see their role as a conduit of information between the companies and the buy-side clients would be less able to add value to clients through their functions of information discovery and information channelling, as the following indicative quotes show:

> *[if companies start reporting real-time information] there'd be some analysts that are out of a job because they've made their entire career by just having a quiet word with the CFO, so if you can get that data on demand, then they don't have a reason to exist [S20]*

> *if a part of what I do is, you know, joining the dots between quarters or between years and, you know, the company tells me at the end of Q2, they give little hints about how they are going, and then, you know, part of my job is to have a view about what the next three months will evolve like… but if they're giving us an update every week on that, then there's no chance of any earnings surprise, and there is certainly no top line surprise. [B14]*

Second, RT/HF reporting of corporate information would leave less room for analysts to 'stand out' by generating differentiated forecasts and stock ratings because, if companies start reporting more frequently, *'you can almost predict with a high degree of certainty even if you're not that skilled as an analyst' [S12]*. The following quote is another good example of this sentiment of analysts:

> *it [RT/HF reporting] would disrupt sell-side analysts because part of what we do is finding out the latest trends and finding out information from elsewhere, so if the companies, if it was becoming directly available out there for everybody to see on a real-time basis, so it would make understanding the company and forecasting accurately a lot easier because you would have the most up to date information, but it wouldn't necessarily be a good thing for a sell-side analyst. [S11]*

Third, RT/HF information would force sell-side analysts to use technology/ automated tools for information processing and decision-making, reducing reliance on analyst's skills.

> *The more automated tools that you use to deal with these sorts of information, the less call there is for skill on the part of the sell-side analysts. [S12]*

Related to this third reason is the replacement of human sell-side analysts by machines, as humans would not be capable of processing the volume of information that would become available under RT/HF corporate reporting, as the following indicative quote highlights:

> *if you had that much information that was available, to look at a company's financials in real-time, there'd just be so much information. It's almost like you would have to find ways of automating analysts out of the equation. … [this] has to get run by machines and artificial intelligence. … so much computation of that data that I suspect humans get taken out of the picture relatively quickly … [S13]*

These analyst fears echo evidence from recent archival research findings in Coleman et al. (2021), who compare the accuracy and relevance of investment recommendations generated by human analysts vs robo-analysts. In particular, they find that robo-analysts revise their recommendations more frequently than human analysts and incorporate information from complex periodic filings. Importantly, robo-analysts exhibit long-term investment value with portfolios formed based on their buy recommendations significantly outperforming those of human analysts.

4.3.9. Limiting investors' ability to generate superior returns

Professional investors look for opportunities to generate superior returns by exploiting the information asymmetry in the market using their superior research skills. The shorter the interval at which a particular line item would be released by companies (e.g., revenue figures reported at daily or weekly intervals as opposed to quarterly or annual intervals), the inherently lower would be the incremental information content of this information item, as an indicative quote from the following buy-side user shows.

I think quarterly [reporting] is really good, and you probably have meaningful data, whereas from one day to the next – don't know how meaningful it would be. Imagine a company reported the earnings daily instead of quarterly. I mean, the amount of data you will be creating and maybe for not a lot of incremental value, investment value. [B7]

One sell-side analyst compared the incremental informativeness of RT/HF information with the usefulness of a 24-hour news cycle.

Does anybody benefit from having a 24-hour news cycle? Probably not. It probably makes things worse. [S8]

Availability of corporate information on an RT/HF basis is, therefore, viewed as limiting the process of information discovery because there is now less scope for surprises, insightful research and speculation. The following comment explains the buy-side perspective on mechanisms that reduce the information asymmetry in the market, like the provision of RT/HF information.

If they were reporting on a weekly basis, we would have less information discovery, on a quarterly basis, and therefore I think it would probably remove a little bit of the alpha that you can make as a human because you would have less surprises. … if you look at the past 10 -15 years, there's been much more information in the market, which makes much harder to generate alpha. So, my assumption is that if you remove information friction, you're removing alpha pools. And therefore, I don't think it would be a positive for us as fundamental investors, but I don't think either that will completely obliterate what we can do. But it would make things even harder because the perfect world is when you have no information out there, right? I mean for fundamental investors. … People are getting pushed very hard to find a way to create some edge. So, I think it's harder. It's a little bit perplexing because it is harder and at the same time it's harder because of the data, and at the same time you need those data because if you don't use them, you will be completely obliterated, so it's a tool and a threat at the same time, these days. [B16]

4.3.10. Difficulty of integrating RT/HF information into analysts' models

Based on the premise that RT/HF corporate information is likely to be reported on a less structured and standardised basis, e.g., contain non-statutory, unassured, management accounting-type information, some analysts expressed concerns over the difficulty of using existing analytical frameworks and valuation models with this type of RT/HF information. One reason is that the existing valuation models, designed to cater to periodic reporting, will need significant adaptation or complete redesign for use with RT/HF information.

we're not modelling companies on like management accounts; we're not modelling companies on a monthly basis. We model our companies on a half-yearly basis. A lot of my colleagues do a full-year basis and will then back out the half years. I look at quarterlies, but I don't model on a quarterly basis, so that [incorporating RT/HF information] becomes even more difficult from a modelling perspective. I don't think it would be of benefit. … you need a level of experience and understanding management accounts to understand how that translates to your model, and I think that that could create a lot of issues. [S6]

Any modifications will increase the level of model complexity and maintenance cost. The following comment exemplifies that integrating RT/HF information within the analyst analytical models will provide little incremental benefit in increasing forecast accuracy even if the models are modified. However, they do highlight that the learning such information would provide could enhance analysts' understanding of the company's business and invariably provide better insights into company value.

[our valuation models] are based on a yearly base, they have half years, but if you look at the way a DCF works, what you tend to find is the majority of the value sits in the terminal value…to the end. So, what small changes I make today, they don't really impact the total value. … My suspicion is, if we were to get real-time data and quite a lot more data, we discover how little we know about how the business works. So, there would be a point of actually learning what the data means and then getting to the other side of that saying, "Well, okay, which is the key pieces of information? [S17]

A related concern we identified in our interviews is that for RT/HF corporate-reported information to be useful, it needs to be consistent and comparable, allowing cross-company and over-time comparative analysis.

For us to do any sort of like-for-like analysis, the data needs to be comparable. … it's important that there's some sort of similarity. [S19]

Obviously if you can [work with standardised data] it's much more useful, if you can compare it like-for-like then it's useful … from an investor point of view and a sell-side point of view, if you can compare the companies then it makes sense, it does add to the quality of the data. [S18]

4.3.11. The impracticality of RT/HF reporting by companies

Our interviewees appreciated the challenges of reporting RT/HF information by companies. It was widely acknowledged that companies are already operating under onerous reporting and disclosure requirements, and any transition towards a more RT/HF corporate reporting model will unnecessarily strain companies and overwhelm the management.

> *I would love real-time, but thinking from the corporates' side though, from the business' perspective, there's already pretty burdensome financial reporting. If we say even take the middle ground and say "financial results should come on monthly," I have no idea what kind of burden that is to companies, and whether or not all of a sudden you're having to triple your reporting staff … I understand there's some probably real-world limitation to how much you can do. [B10]*

Reliable and meaningful company-level RT/HF information is inherently more difficult to generate in some sectors than others. As indicative comments from the following buy-side users show, RT/HF information companies in some sectors might potentially provide are more meaningful and reliable than in others, and some sectors are more amenable to this type of reporting:

> *it's general retail or food retail, … airlines, so they tend to report monthly kind of booking numbers… those are the obvious ones, and maybe kind of conversely, some of those sectors where more judgment is involved in the revenue, and then, you know, we see less. I mean, if you're [airline company name], you know, you either sold the seat, or you haven't. Whereas, if you're, you know, a construction company, the revenue that you're recognising this quarter is as much, you know, down to your judgment as it is to actually what you've done. So, it would feel to me that that's where there is perhaps the biggest difference; there are some sectors where it is easier to produce more regular data. [B13]*

> *The polar opposite of that is something with an incredibly long sales cycle. Where sales take years to negotiate, where they're very lumpy, and they tend to be announced by press release anyway. So, you know, if I'm [company name 1] or [company name 2] and I'm negotiating with [airline company name 1] or [airline company name 2] about my latest sort of order intake of 737 Max's… So, I think there are different things in different sectors…some sectors will naturally lend themselves more to it. [B14]*

Not only would companies need to commit additional resources to report on a RT/HF basis, but also, they would need to cope with an inevitable increase in queries and requests for information from analysts and investors. Company management would be expected to provide continuous additional commentary and/or management-analyst/investor meetings to supplement their RT/HF reporting. As the following comments indicate, RT/HF information would not be as useful to investors and analysts without the additional explanations.

> *if I really want to understand the company, I need to pre-call it. I need to speak to the CFO or somebody who's going to… "Hey, your sales look a bit weak at the moment, you know, we're already in the third week of May, you know, report at the end of June. What's going on?" Now is the company really wanting to give a running real-time commentary on how things are going? No, clearly, they don't want to do that. And they shouldn't; they should run their businesses. So, I would argue, you know, how usable is that data if it doesn't come with an explanation. [B14]*

> *I come back to the [company name] and [company name] thing, they did provide monthly sales, and in the end, they found it just provided too much volatility, and they spent most of their time trying to explain away why weeks were different this year to last year. [S22]*

As the above interviewee comments highlight (see also Section 4.3.4), RT/HF corporate reporting could distract management from focusing on running their business to create long-term value. The following comment from a sell-side analyst echoes this sentiment shared by other interviewees.

> *the dissemination of that [RT/HF] information and the requirements by companies to answer questions on that would take up more time and allow less time for the companies to get on with running their businesses. [S6]*

Another common concern shared by sell-side and buy-side users is the potentially detrimental impact of the disclosure of proprietary information on companies' businesses. RT/HF reporting will increase the risk of over-exposure of companies' businesses.

> *there is a balance between the data they can show and the competitive nature of those data, which in some industries is not so easy to do. [B16]*

> *I don't want companies disclosing things that will give me a sort of very short-term sugar rush but then threaten their competitive position as well. I mean, sometimes companies don't want to tell everything in real-time; there are reasons for that. [B31]*

4.4. Reasons in favour of using RT/HF information

4.4.1. Revealing emerging trends and changes in trends

The ability to predict whether a company will meet its management earnings guidance is important, especially for investors who adopt a short-term investment horizon – who attempt to time the entry and exit from positions strategically. As one sell-side analyst summarised, their job is about *'timing, it's all about timing for everyone' [S14]*. Some sell-side analysts, in fact, consider one of their main roles to be making such predictions, as exemplified by the following comment.

My job is to try and figure out whether a company is going to meet their earnings guidance or not … that's what people pay us for to try and figure out, try and help them within the short-term, you know, a short-term request, so if you can figure out an industry trend in real-time then you might be able to sort of say well, they're either going to hit their numbers, or they're not going to hit their numbers. [S14]

One of the main benefits of having information on an RT/HF basis is the ability it provides to detect industry trends early, enabling analysts and investors to more accurately forecast earnings and continually update them. A credit analyst summarised this view:

So at the moment, we're sort of having to wait for disclosures on a half-yearly basis, sometimes quarterly information comes through in Pillar 3 documents from the banks so you're having to wait at least three months if not six months to get an update on some of these performance trends and as you'll be aware, there's a lot that can happen within that period. If we were getting this information on a monthly basis, it would allow us to monitor trends more, or notice if trends were emerging more quickly, have conversations with the institutions to see what the cause of those movements are and then also determine whether that has an impact on our credit ratings. [S1]

As the above comment indicates, the trends that get revealed by the analysis of RT/HF information will trigger conversations between analysts and company managers to gain a better understanding of the company's business. In this regard, the benefits of RT/HF information extend beyond short-term earnings forecasting, as the following sell-side analyst points out, referring to the relationship between short-term and long-term forecasting.

Part of longer-term forecasting is knowing what is going on in the short-term … you can't say that [information about] the long- or short-term has got more impact on the longer term; so the quicker you can pick up trends, the better you can forecast longer term as well. … you can change your views on that longer-term value more efficiently than if you have to wait to get that information … Ultimately, you find out in a quarter or in a half-year that the revenue is down 10%, it's going to impact the share price then; if you find out earlier that it's down 10% it will impact the share price quicker. [S11]

4.4.2. Assisting in forecasting during uncertainty and market shocks

The RT/HF reporting is beneficial for buy-side and sell-side users during uncertain times or circumstances that they have not faced before, such as the economic and social crisis caused by the Covid-19 pandemic. Many interviewees who didn't see RT/HF information otherwise useful saw it as highly relevant during periods of crises, as indicated in the following representative comment:

I would say, overall, in a benign economic environment, you're less interested in the daily data because of volatility is going to be lower, and you're perhaps more focused on other things. In the very interesting times to invest, like now [Covid-19 pandemic], you're very interested in the more granular data. So, perhaps one stance on your question would be, in times of crisis, I want as much data as I can get. And I'm more likely to look at it because it's going to be very different from yesterday's, very different from a month ago. And if not much is happening, I'm probably not going to look at it. [B22]

During times of crisis, two factors are at play. First, analysts' and investors' lack prior knowledge and experience of 'what to make of it' and how the ensuing circumstances might impact company values and the market. Second, in periods characterised by an increased pace of changes and developments at the sector and company level, periodic reporting by companies has even less predictive value. It is the combined effect of these two factors that heighten analysts' and investors' appetite for more RT/HF reporting by companies. RT/HF information will allow users to gain the essential experiential knowledge about how things evolve during crises more quickly and enable users to conduct more timely assessments of the impact of evolving events on companies' risk, performance, prospects and value. The following sell-side analyst comment clearly articulates how RT/HF information is useful for spotting trends during crises.

Look, right now is a classic case in point with the whole covid-19 stuff where we're seeing massive impacts on companies' revenues, but it's very hard to see how big they are going to be. If you've got daily data from the company, you are going to be able to make a much better forecast of how big that revenue downturn is going to be and likewise how quickly we are going to start recovering, how quickly it's going to bottom out and start recovering. At the moment, you're relying on the company giving you an update, and they are giving more regular updates than normal, but of course, if you could see it for yourself in Australia, the company's daily reporting system, accounting systems, you would be able to come to a view on that much more quickly. [S11]

4.4.3. Better understanding of company performance

We find that company- and sector-level factors which make earnings and costs difficult to predict can have a bearing on the potential usefulness of RT/HF information. One such factor is the stage the company is in its life cycle. The following comments explain why sell-side and buy-side users find RT/HF information useful from companies lacking an established track record, experiencing significant growth or whose business is undergoing transformation. The first comment below highlights that RT/HF information can provide early indications of the sales growth rates for new businesses.

[for larger established companies] the need for that kind of more short-time data is maybe less than for a company that is just kind of beginning to..., like for example, not profitable. Then, I would be really, really interested in what's happening with their sales. And if they are actually recording any sales. And because the numbers are small, I would want to know how quickly they are actually adding to ... sales on a shorter time scale. [B1]

In the following comment, a sell-side analyst takes the example of a mining company that has newly commenced exploration to highlight the importance of RT/HF information on production levels.

[RT/HF information is useful for] a mining company that has problems at a project, or a mine, or it's trying to get it up and running, and you're wondering are they going to meet the production targets this month? Are they going to get to their target? With another mining company might be just very stable, and you wouldn't be interested in that [RT/HF information]. [S3]

The comment below indicates that RT/HF information is useful for growth companies but not for value companies.

So, it comes to about, "Are you in the value segment of the market, or are you in the growth segments of the market?" So, the way I perceive this, the more you're into a growth sector, the more you want high-frequency data, just telling you revenues or sales are going up. [B6]

RT/HF information can be particularly important for understanding high-risk companies, such as those at the risk of financial distress. As explained in the following comment, RT/HF information would allow analysts and investors to closely monitor and spot important inflection points in such companies and/or reassess their view and investment position in a timely manner.

Several companies that I look at do tend to get themselves into financial problems, so what we can do as creditors is if they're in financial difficulties, we can work with them to help them out. But we can demand extra things from them as a result. So I have a company... they got into trouble in..., and one of the conditions we imposed on them was for improved reporting, and so... every month they put out operating statistics as to volumes and revenues from each of their various products, and their cash levels and their debt levels. ... it allowed us to see if there was a recovery coming in the company's operations, that would mean that we didn't effectively have to write off some of the debt... [B18]

The sector-level factors driving the usefulness of RT/HF information on companies are the pace of growth and volatility. Following are some indicative quotes from our interviewees explaining why the provision of RT/HF information might or might not be relevant in some sectors.

Some chemical companies that sell ingredients to food and beverages, for example, that's an extremely slow-moving business. You just, you just don't need [RT/HF information]...and the variability and the variance around the expected numbers, in terms of volume is very low, it's not a commodity, the pricing doesn't move up and down. ... So, the whole P&L of those businesses is very stable. Having one more monthly data for those businesses, totally irrelevant.... If we take semiconductors, for example, which we trade as well in the team, we are tracking on a monthly basis, ... So, it's, it's a very fast-moving industry. And therefore there, the value of having monthly data is much higher. So, to me, I would say, it really depends on ... the pace and the volatility of what's driving the earnings of these guys. [B16]

Particularly in my space, in technology, things can change much more quickly, so I think there's more of a need for more regular updates. [S11]

[RT/HF information] is not as critical for us because the commercial market for property is a slower market. [S9]

4.4.4. Fear of missing out

Despite their detestation of RT/HF information, users note that ignoring corporate-reported RT/HF information (if or when it becomes a reality) would not be an option because of the possibility of missing out on potentially important information. The following comment by a buy-side user explains that while they wouldn't demand RT/HF information from companies if it is provided, they would have to use it. For the buy-side users, it is about not missing out on what might turn out to be an important inflection point in an investee company.

Now, in terms of anything more frequent than quarterly reporting, you know, even weekly, monthly, daily data, I'd say, sometimes it kind of creates a burden. So, if a company has released something you feel inclined, you have to look at it, because everybody else will be looking at it. So, in a sense, because it's there, I have to go and get in touch with it, feel it. ... I have to at least be attuned to it and be aware of it and make sure I'm not the guy who's sitting there waiting for the earnings release where everybody else saw the movie a month before me. [B14]

For the sell-side users, it is also a matter of maintaining their reputation and credibility as knowledgeable information intermediaries in the eyes of their buy-side clients.

Some of them want different information, but most of them are driven by one thing, and that is a fear of missing out. If you have information... whether it's data or feedback or whatever it is, most of the clients are driven by the fact that they don't want to miss out on something. They think if their competitors are getting information on something and they're not, they're missing out. That's

what drives demand for data, for everything. That's what drives the full market stop on the buy-side, fear of missing out. [S4]

We want to make sure that we're across every newswire that we can to make sure that we don't miss anything. [S5]

you don't want to miss anything. We all live in a world where we want to tighten the net really around all that data. … yeah, definitely, you know that that's the analyst's worst nightmare, isn't it? Someone else has got information that they don't. [S10]

4.5. Making corporate information more useful

Our review of the literature indicates that the value relevance of accounting information remains a contentious issue, with some studies documenting a gradual decrease in value relevance of traditional reporting (Lev and Gu 2016) while others finding no such effect (Barth et al. 2021). Hence, we probed our interviewees to understand how corporate reporting might be improved to make it more useful to them and whether RT/HF information can play a role in this regard. A sizeable minority of the interviewed users struggled to pinpoint an area/aspect of corporate reporting where further improvements or changes could be helpful to their practice. In fact, some users, particularly long-term focused investors, noted that the existing corporate reporting already generates an excessive amount of information or produces it at shorter (i.e., quarterly) intervals than what they deemed necessary and sufficient. However, particularly on the issue of the most desirable reporting frequency, there is no consensus amongst users. While quantitative users and users with short-term investment or analytical horizon express preference for quarterly or higher-frequency reporting, users that follow a fundamental investment or analytical approach with a long-term investment or analytical horizon are finding even quarterly reporting excessively frequent. The following two quotes exemplify the contrasting views of fundamental long-term focused vs short-term focused/quantitative users.

Fundamental investor:
It's probably too much information. That's a problem. Because I think the reporting requirements for public companies have unintended consequences. It becomes undesirable for companies to become public. So I think that's something to bear in mind. Who invented the quarterly reporting requirement? If you're running a business for ten years, it's kind of non-sensical. [B9]

Quantitative investor:
I think… higher-frequency information would be very beneficial as well. Because there is, to some extent, the fact that it's down to fairly infrequent updates that you hear from these companies, there's a huge pressure that then gets put on those announcement days when the information gets fed out into the market. Whereas a more continuous process, in itself, it almost becomes more real-time between the state of the company and the price in the market and the trading that can be done around that. [B25]

There were numerous calls for improvements in consistency and comparability of reported information, rather than the frequency and timeliness of it, as the following sell-side analyst comment, amongst many others, indicates.

I think companies should be consistent with what they disclose. It's one of my great bugbears that every quarterly trading update will contain slightly different information because it's what allows them to be positive about something that's happened in that quarter, so I think the consistency of metrics is important. [S20]

There were special mentions of the need for information on Environmental, Social and Governance (ESG) matters, such as gender equality and carbon emissions, and consistency in the provision of that information. The following quotes are indicative of our interviewees' views on the need for ESG data.

Even to this day, very few companies report on a lot of these measures that investors would like to hear about. You know there is a big thing about gender diversity and equal pay, but if you see how many companies report on their pay policies, it's probably 10%, then how could you [compare]… so this is the type of information that the buy-side will be very interested to…. and not just the buy-side, I think regulators and public bodies will be interested to see from corporates. [B8]

In a couple of years' time, I think most of us are going to have to disclose the carbon weight of our portfolios. And I don't think there is consistency from company to company in terms of how you calculate the carbon, … that needs to be a standardised process. [B18]

Buy-side and sell-side users alike call for more standardised reporting and more consistently defined accounting line items and other reportable metrics, which would allow better like-for-like comparison and analysis across jurisdictions, companies and over time. In the following comments, users highlight the need to adopt a standardised format to ensure consistency of information, especially if it is provided on an RT/HF basis.

It just goes back to the consistency of information because if we have consistent information, we can plug it into all sorts of different formulae and get answers where you can compare five years ago to today, whereas if you aren't getting that consistency of information, you can't do that to the same degree. If you've got consistency of data, you can think of new ways to analyse it, but it's hard to think of new data that they could give us that we could plug into existing ways of analysing it. [S12]

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> *From our perspective, it's probably more important to have the standardisation and, if anything, a more automatic data feeding process than it is to have high frequency information. So, to some extent, if the data is coming more frequently, but continues to be very disparate, being able to then make use of that and adapt to it may not be feasible. [B25]*

Digitisation and use of protocols enable the standardisation of corporate-reported information. Those analysts and investors who predominantly invest in or cover European stocks emphasised the digitisation of reports to improve the accessibility of corporate reports and the comparability of the information therein. As the following comment indicates, enhancing the machine readability of data can create an appetite for RT/HF information too.

> *If companies will also be bound to produce a specified and fairly rigid format where the information was available electronically, that could just be kind of pulled in by API or... then definitely, why wouldn't you want that. [B14]*

Several sell-side and buy-side users expressed their frustration with a time-consuming and error-prone process of having to manually extract accounting line items from some of their covered companies' reports and manually enter these items into their spreadsheets. Following are two comments amongst numerous others advocating for the use of platforms, such as Excel, for the provision of accounting information.

> *I think it would be very useful if the companies actually published in Excel format ... take a standardised model and publish their information into that Excel format on a half-yearly basis, I think that would be quite beneficial to the investment community. ... [company name] provide all their statements, balance sheet, cash flow statements in Excel format going back several years, and you can download that from their website ... if all companies were doing that, it would probably make the discovery process a lot quicker. [S6]*

> *In UK companies, it's all in their annual reports, and it can get lost in mountains of text, and it takes, updating a model, a UK insurance model... about five times longer than a US insurance model because the US insurance companies have them all in a nice little Excel spreadsheet... UK annual reports is just diabolical because you'll have one number on page 52 and another number on page 100. [S18]*

This clearly offers support for the continuation of initiatives to standardise and digitise corporate reporting information through technologies such as XBRL. This would accelerate users' on-demand data access and, if necessary, facilitate further automation of information gathering and processing. The UK and EU have already made important steps in this regard, although much remains to be done. The importance of this is arguably greater if the information is to be provided on an RT/HF basis.

Conclusions and implications to policy and practice

5.1 Conclusions

The most salient conclusion from the evidence presented in this report is that there is no widespread support for a move to a RT/HF model of corporate reporting of accounting and non-accounting information. The objections to evolving accounting along these lines are numerous and compelling, ranging from practical issues such as information overload and incentivisation of short-termism amongst investors and analysts, to more nuanced points regarding the threat to the practice of users adopting a fundamental investment or analytical approach. Although there is support from certain groups, in particular quantitative investors (i.e., those employing data-intensive quantitative models) and those who do not pursue a long-term investment or analytical horizon, the existing pattern of dissemination of corporate-reported information – for most companies on a less than quarterly basis – was deemed by many to be sufficient. Consistent with how standard setters approach accounting changes, we would argue that our evidence suggests the costs of any move to a RT/HF reporting model would outweigh the benefits considerably.

5.2 Policy recommendations and implications for practice

As outlined above, the most important policy recommendation arising from our findings is that the empirical evidence we gathered does not support the case for a major expansion in the frequency of corporate reporting.

However, there is a range of other policy and practice recommendations arising from our findings:

- **Limited utility:** As per our findings, the demand for RT/HF information comes from a minority of user types, i.e., users who adopt data-intensive quantitative methodologies often associated with short-term investment horizons. Other users find RT/HF information useful only during periods of crisis (e.g., the COVID-19 pandemic) or for companies operating in highly volatile sectors or having certain characteristics that make their revenue/production levels difficult to forecast. As the perceived utility of corporate-reported RT/HF information is conditional on user and company characteristics, we recommend that companies assess the information needs of their investors and sell-side analysts when contemplating the adoption of an RT/HF reporting model.
- **Digitisation:** In our interviews, although users were happy to retain the current, mostly annual or semi-annual, circulation pattern for accounting information, there is a demand to continue to advance the digitisation of financial reporting. In other words, users' current concerns are not about the lack of availability of RT/HF information, but about (digital) accessibility and comparability of what is already being reported. In particular, there is a desire for financial statement information to be provided in machine-accessible formats at a suitably detailed level. Therefore, we advocate for the continued expansion and acceleration of the various XBRL and related initiatives across the globe.

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- **Consistency of accounting information:** The challenges for users of interpreting accounting information and how it might be improved often arose in our discussions. A critical theme in these debates was around the perceived lack of inter-company consistency in accounting information. Rather than demand a move of the accounting ecosystem to an RT/HF model, users were more interested in initiatives to deliver superior information consistency. This evidence emphasises the importance of recent initiatives by the International Accounting Standards Board, in particular, the 'Primary Financial Statements' project[9], which inter alia addresses the definitional consistency of commonplace accounting measures, such as operating profit.
- **Investor diversity:** The diversity of opinion in our evidence, even from within the same user group, is a salutary reminder of the need to embrace heterogeneity. For example, the bifurcation between long- and short-term investors as well as investment approach differences – fundamental versus quantitative investors – means that any reference to investors as a homogenous group is largely meaningless. Increasingly, regulators, academics and policymakers need to embed this variegation in their evidence collection and policy deliberations (irrespective of the particular topic/issue in focus). A failure to do so would expose markets to poorly thought through initiatives that have only limited appeal and ultimately higher risks of failure as they ignore the needs and positions of all relevant user groups.
- **Sell-side technology gap:** Our empirical evidence reveals a clear 'technological gap' between the stronger resources and data sophistry of the buy-side and the weaker resources on the sell-side. Particularly, in the context of MiFID II[10], where the sell-side is under more pressure to justify how they add value, a further investment may be needed to fill at least some of this gap.

[9] In December 2019, the International Accounting Standards Board (IASB) issued an Exposure Draft, General Presentation and Disclosures (ED/2019/7), in which it proposes to replace IAS 1 Presentation of Financial Statements with a new standard, with new disclosure and presentation requirements for the primary financial statements. The measures proposed in the new standard are intended to address investors' concerns around the transparency and comparability of financial statements by removing inconsistencies in entities' reporting (see https://www.ifrs.org/projects/work-plan/primary-financial-statements/#current-stage).

[10] The Market in Financial Instruments Derivatives (MiFID) II (formally, Directive 2014/65/EU of the European Parliament and of the Council) was implemented in January 2018 with the objective of inter alia formalising and clarifying the payment mechanisms to be used by investors for sell-side research services (see eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0065). Under MiFID II, the cost of research provided by sell-side firms to asset managers is 'unbundled' from the cost of other services of sell-side firms. However, several academic studies and industry reports have documented negative unintended consequences of MiFID II to sell-side analysts (for example, see www.ft.com/content/1f56cf42-7550-11e8-aa31-31da4279a601, Lang et al. 2021, and Fang et al. 2020).

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- **Continued buy-side investment and engagement:** The investment community has already taken steps to expand its capacity to be able to exploit the opportunities presented by more frequent and varied information from companies and other providers. This has been particularly prevalent in larger firms. We support this development and encourage more buy-side firms to engage with the transition to increased information diversity and intensity. Additionally, it was clear from our empirical evidence that investors greatly value ease of access to, and consistency in, accounting information. Therefore, we recommend that the investment community engages as actively as possible in the debates and decisions around the digitisation of accounting information.
- **Developments in audit methodology:** It was clear that one of the concerns with the provision of RT/HF accounting information centred around how reliable this information would be. Users were worried that, somewhat inevitably, such information would be subject to less rigorous audit tests and checks to facilitate more rapid dissemination. To counter this perception audit firms need to develop tools, skills and methodologies appropriate to verification in a RT/HF environment.
- **Shift in skills needed:** The skills needed for data manipulation analysis to take advantage of developments in technology was a clear conclusion drawn from the findings. The demand for these skills means that there are significant training and development needs across market participants. Educational institutions, professional bodies and other private sector training entities need to integrate the principles and practice of coding and data science into academic and professional qualifications as well as ongoing training.
- **Digital adaptation:** Government support in the form of grants and tax concessions could incentivise SMEs operating in the investment advisory field to invest in digital technologies. Without additional support especially small scale equity research firms will be unable to cope with the changes in the nature and frequency of availability of information (including potential increase in RT/HF information) and be competitive. Government incentives for digital adaptation in sell-side and buy-side firms is in the public interest as more efficient processing of information and generation of better insights about firm performance enabled through new technologies will ultimately enhance capital market efficiency.

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5.3 Limitations and opportunities for further research

This research report explores users' current and potential future demand for an RT/HF corporate reporting model, and factors affecting users' appetite for it. Future research could expand and build on the insights provided by this study in several ways. First, the research offers insight into the current practices of professional investors and sell-side analysts in terms of how they perceive, manage and use RT/HF information, and this may present opportunities for further research into the value of specific types and sources of RT/HF information. Any such future research should also recognise and account for (or focus directly on examining the impact of) the heterogeneity in users' perceptions and practices that are driven by differences in their functional roles, investment or analytical approaches and horizons. Second, although our sample was relatively large for an interview-based study, and included senior individuals in the field, understanding how widespread and 'generalisable' our observations and conclusions is problematic without adopting a more formal sampling approach. Future research studies could leverage the valuable insights provided by our study by adopting a different methodological paradigm and employing surveys to generate the required evidence for statistically generalisable conclusions. Third, our focus on users has bracketed out the views of preparers (the reporting companies), auditors and other professional actors in the market for information about the feasibility of any move to an RT/HF corporate reporting model. Exploring the views of these groups would provide further evidence about the possibilities of RT/HF corporate reporting. Further, our research reveals significant developments in the market for information with the increased availability and use of 'alternative information' sources outside the corporate reporting system. Thus, future research could explore how this information is used and the likely shape of future demand for this form of 'alternative information' as it is often referred.

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Appendix A

Summary information about buy-side interviewees

User group (code)	User's employer type	User's functional role	User's investment/ analytical approach	Experience (years)	Interviewee location
B1	asset management company	equity analyst	fundamental	19	UK
B2	top-tier investment bank	equity analyst	fundamental	25	UK
B3	asset management company	credit analyst	fundamental	2	UK
B4	asset management company	fund manager (equity)	fundamental	17	UK
B5	asset management company	fund manager (multi-asset)	mixed	30	UK
B6	asset management company	fund manager (equity)	fundamental	21	UK
B7	asset management company	fund manager (equity)	quantitative	13	UK
B8	asset management company	fund manager (equity)	quantitative	16	UK
B9	asset management company	fund manager (equity)	fundamental	7	UK
B10	asset management company	fund manager (equity)	quantitative	14	UK
B11	asset management company	fund manager (equity)	fundamental	20	UK
B12	asset management company	fund manager (equity)	quantitative	9	UK
B13	asset management company	fund manager (equity)	fundamental	28	UK
B14	asset management company	fund manager (equity)	fundamental	25	UK
B15	asset management company	fund manager (equity)	fundamental	15	UK
B16	asset management company	fund manager (equity)	quantitative	20	UK
B17	asset management company	fund manager (equity)	quantitative	5	UK
B18	asset management company	fund manager (fixed income)	fundamental	22	UK
B19	asset management company	head of data team	other*	15	UK
B20	private equity company	investment adviser (equity)	other*	7	UK
B21	top-tier investment bank	investment adviser (equity)	other	22	UK
B22	asset management company	investment adviser (fixed income)	fundamental	15	UK
B23	asset management company	investment strategist (equity)	quantitative	17	UK
B24	asset management company	technology expert	quantitative	19	UK
B25	asset management company	technology expert	quantitative	8	UK

Appendix A

Summary information about sell-side interviewees

User group (code)	User's employer type	User's functional role	User's investment/ analytical approach	Experience (years)	Interviewee location
S1	rating agency	credit rating specialist	credit rating specialist	16	Australia
S2	research/brokerage house	equity analyst	equity analyst	27	Australia
S3	research/brokerage house	equity analyst	equity analyst	30	Australia
S4	research/brokerage house	equity analyst	equity analyst	15	Australia
S5	research/brokerage house	equity analyst	equity analyst	14	Australia
S6	research/brokerage house	equity analyst	equity analyst	20	Australia
S7	research/brokerage house	equity analyst	equity analyst	20	Australia
S8	research/brokerage house	equity analyst	equity analyst	19	Australia
S9	research/brokerage house	equity analyst	equity analyst	20	Australia
S10	top-tier investment bank	equity analyst	equity analyst	30	Australia
S11	research/brokerage house	equity analyst	equity analyst	22	Australia
S12	research/brokerage house	equity analyst	equity analyst	21	Australia
S13	research/brokerage house	equity analyst	equity analyst	17	Australia
S14	investment bank	equity analyst	equity analyst	16	Australia
S15	top-tier investment bank	equity analyst	equity analyst	26	UK
S16	top-tier investment bank	equity analyst	equity analyst	20	UK
S17	top-tier investment bank	equity analyst	equity analyst	20	UK
S18	research/brokerage house	equity analyst	equity analyst	20	UK
S19	top-tier investment bank	equity analyst	equity analyst	8	UK
S20	top-tier investment bank	equity analyst	equity analyst	20	UK
S21	top-tier investment bank	equity analyst	equity analyst	15	UK
S22	investment bank	equity analyst	equity analyst	32	UK

* These users are not directly responsible for investment decision-making. Their role in their organisations is to lead the development, testing and integration of cutting-edge, data science and technology-based investment and analytical strategies, systems and solutions, as well as acquisition, testing and development of alternative data sources.

Appendix B

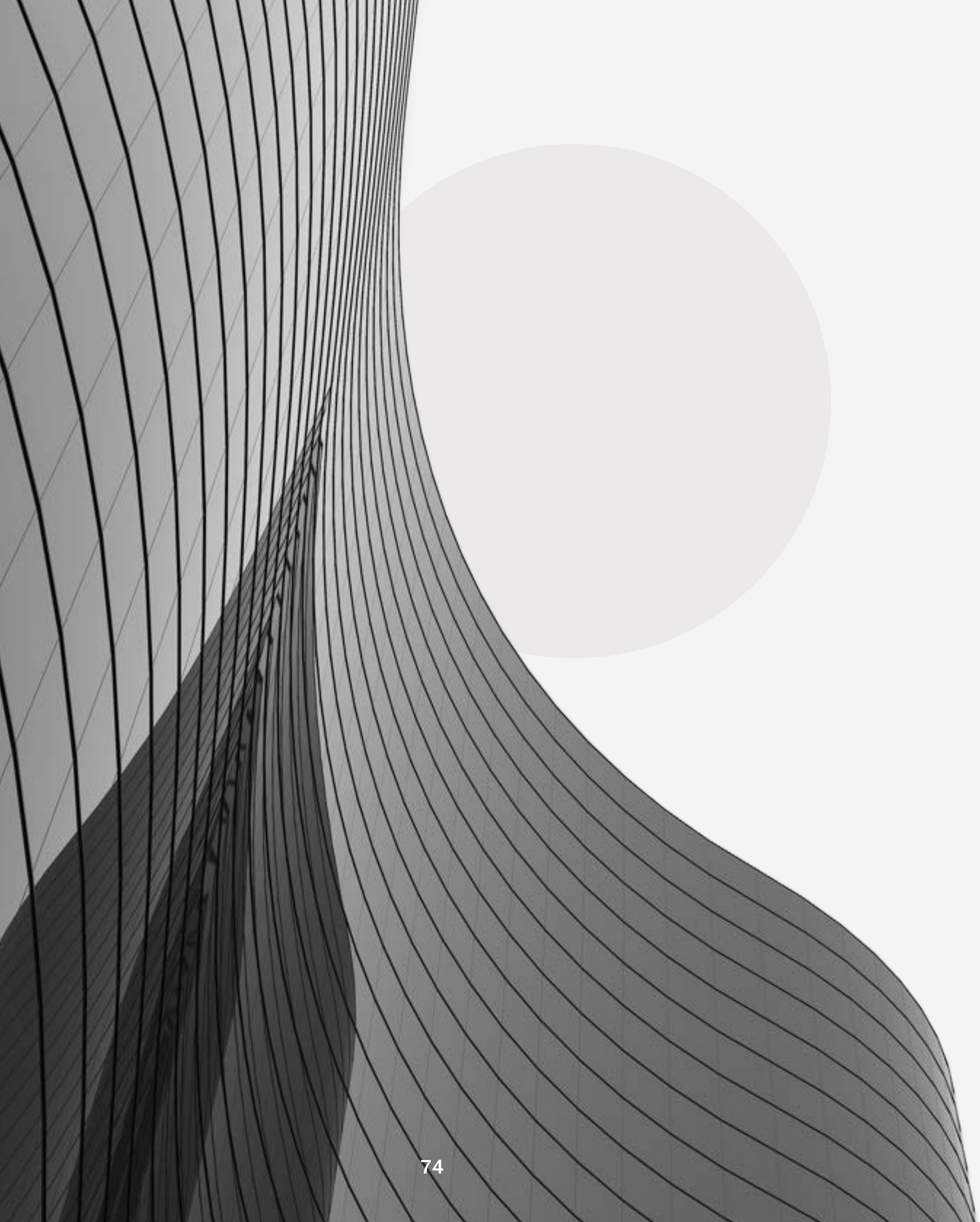
An abridged interview protocol for buy-side users

1. **A brief project spiel** – read out by the interviewers at the start of the interview to set the scene.
2. **Ice breaker questions** covering the interviewee's professional background and experience, current role, details about assets under management or research coverage, investment or analytical approach.
3. **The flow of information to users from companies and alternative information sources.** Questions on:
   - the frequency at which the investee/covered companies communicate information at present, including statutory corporate reporting as well as information produced between the reporting seasons
   - types of information communicated by companies between the reporting seasons (nature) and how it is communicated (medium)
   - any time-related changes in frequency, nature and medium of information emanating from companies
4. **Users' information needs and preferences, and factors affecting them.** Questions about:
   - the extent of users' reliance on company communicated information in their everyday practice
   - users' appetite for companies to report on RT/HF basis
   - specific information items that would be useful to have on an RT/HF basis
   - the extent of users' reliance on alternative sources of company-, sector- and market-level information, including RT/HF information; types of alternative information/sources used, and time-related changes
   - influence of users' functional role, investment or analytical approach/process and coverage on their attitude and appetite for RT/HF information
   - influence of the level of users' expertise in information technology
   - the current state of, and the extent of reliance on, technology (e.g., data scraping, natural language processing, machine learning, artificial intelligence) in users' own practice and their organisation
   - influence of users' employer settings on their views about RT/HF information (e.g., institutional focus on a particular investment or analytical philosophy or approach, availability of resources and in-house data/technology expertise)
   - influence of the characteristics of investee/covered companies and/or market conditions on users' appetite for RT/HF information.

Appendix B

An abridged interview protocol for buy-side users

5. **Perceived problems and benefits of RT/HF information to users' practice.** Questions on:
   - what RT/HF information is already used and how, and how it is obtained
   - usefulness of the currently available sector- and market-level RT/HF information
   - decision usefulness if companies start reporting on a RT/HF basis
   - implications to different aspects of users' practice if companies start reporting on a RT/HF basis
   - settings or situations in which company-reported RT/HF information is likely to be beneficial or unhelpful.
6. **Characteristics of RT/HF information that can impact its usefulness.** Questions about:
   - properties of RT/HF information that make it desirable or undesirable
   - the importance of accuracy and reliability of RT/HF information
   - comparative importance of low-frequency audited (e.g., annual reports) vs higher-frequency non-audited (quarterly reports) corporate information
   - the desirability of external assurance (auditing) of accounting information if companies start providing it on a RT/HF basis
   - the desirability of standardisation, digitisation and regulation of company-provided RT/HF information
7. **Closing question inviting users to suggest and elaborate on any omitted but relevant theme.**



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