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The impact of information technology on information asymmetry

Z Xiao[1], PL Powell[2] and JH Dodgson[3]

[1]*Cardiff Business School, Cardiff University of Wales, Colum Drive, Cardiff CF1 3EU;* [2]*Information Systems Research Unit, Warwick Business School, University of Warwick, Coventry CV4 7AL;* [3]*Department of Mathematics, Napier University, Sighthill Court, Edinburgh EH11 4BN, UK*

While much research has been undertaken on the impact and consequences of information systems on direct users of the systems and on their organizations, comparatively little recent work has addressed the impact on users of the information. For instance, accounting is the most widespread quantitative information system in use and one which has been profoundly affected by information technology (IT). Yet, existing studies of the impact of IT on accounting focus only on accountants themselves and internal financial reporting and they ignore external users of accounting information. As a first step toward a broader perspective, this paper empirically examines the effect of IT use on the information asymmetry (IA) between managers and external users by contrasting the role of IT in internal and external reporting. The paper suggests that IA has been aggravated, and IT use has played a role in this exacerbation. The implication is that the effect of IT use in accounting is not confined to accountants and individual organizations but extends to external stakeholders.

Introduction

The purpose of accounting is to identify, collect, process and communicate economic information about an entity to a variety of interested parties (Bodnar & Hopwood, 1990). Accounting is the most widespread quantitative information system in use and one which has, unsurprisingly, been profoundly affected by information technology (IT). Yet, as in other elements of the information systems (IS) discipline, while much research has been undertaken on the impact and consequences of IS on direct users of the systems and on their organizations (e.g. accountants themselves and internal reporting to managers), less work has addressed the impact on more remote users of the information generated (e.g. external users of accounting information). Consequently, issues which may be of more significance to a wider set of stakeholders are unexplored. As IT use in accounting has become more intensive, a broader perspective on its impact is overdue.

Adopting a broader perspective entails an investigation of information asymmetry (IA) by comparing the impact of IT on different groups of accounting information users. At least two lines of inquiry may be pursued: the impact of IT on the IA between corporate managers and external users, and the impact of IT on the IA among groups of external users. The issue of whether the use of IT ameliorates or exacerbates IA is of interest to regulators, managers and users of accounting information.

As a first step towards a broader perspective, this paper examines the effect of IT use on the information asymmetry between managers and external users, by contrasting the role of IT in internal and external reporting in the UK. Evidence here shows that both internal and external reporting have been improved, but the internal improvement is greater than that in external reporting, suggesting an aggravation of IA. IT has played a role in this exacerbation although it may have contributed positively to both internal and external reporting. The main implication is that the effect of IT use in accounting is not confined to internal users and individual organizations, but extends to external stakeholders. This research also serves as an example of the way in which different stakeholders are impacted upon by IT.

The next section places the issue of information asymmetry in an accounting context, followed by a brief examination of the nature of IT. The following section proposes two hypotheses for testing. The data collection method is then described, and the hypotheses tested. The paper concludes with a discussion of the implications of this research.

Accounting and information asymmetry

Information asymmetry means that, in any relationship, someone possesses private information which other parties do not. There are different types of information and hence different types of IA. Two frequently mentioned

types of information, in the accounting literature, are accountability information and decision relevant information, though these may overlap. Accordingly, a distinction may be made between decision relevant information asymmetry and accountability IA.

Accountability information can generally be defined as reporting "on the control and uses of resources by those accountable for their control and use to those to whom they are accountable" (Rosenfield, 1974, p 126). While decision relevant information stresses relevance, the main characteristics of accountability information are objectivity and neutrality. Accounting traditionally focuses on this type of information, although it has placed an increasing emphasis on decision orientation in recent years.

Focusing on decision relevant information, information economics defines information as "decision-relevant knowledge which alter existing optimal conduct or decisions" (Bromwich, 1992, p 122). Adopting this definition, information should not only be relevant to decision making, but also lead to the alteration of decisions. Thus additional knowledge which does not have an impact on a decision (i.e. which merely confirms the decision maker's existing beliefs, or which changes these beliefs but does not alter decisions) is not classified as information.

However, the definition of decision relevant information is less strict in accounting, where information is seen as decision relevant if it has predictive and feedback value (FASB, 1978). Here predictive value does not necessarily mean that accounting information provides direct predictions; it can arise from accounting information about past activities which help prediction or improve the underlying decision model. Feedback value accrues if accounting information confirms existing predictions or causes changes in them; only the latter of which might have value from an information economics perspective.

This paper does not tackle IA from an information economics perspective. Rather, it defines it in an accounting sense with reference to both decision relevant information (as defined in accounting) and accountability information. This treatment is consistent with the fact that accounting information systems (AIS) provides both types of information. In addition, it allows the use of the qualitative characteristics of accounting information, well defined in the accounting literature, as a means to measure IA. However, such a treatment does not distinguish the two types of information (though this is a difficult or even impossible task), and thus cannot make use of the delicate models advanced in information economics and agency theory.

AIS serve various groups of users, such as internal managers, shareholders, creditors, government, suppliers and customers, employees, and financial analysts. Accounting IA exists among internal managers, between internal managers and external users, and among external users. This paper is concerned with the asymmetry between internal managers and external users. This is addressed by contrasting internal reporting with external reporting, two components of AIS. Before detailing the importance of the examination of this particular asymmetry, it is necessary to briefly outline internal and external reporting.

Internal reporting is accounting information reported to managers, while external reporting is that disclosed to external users. They are similar in a number of aspects. First, some information reported to internal and external users may be produced by the same systems and from the same sources. Second, both comprise mainly historical information (i.e. information about past activities). Third, both consist of mainly financial information (i.e. information measured in monetary terms). The main difference between internal and external reporting is that externally disclosed information is only a subset of the information available to managers, both in volume and in type. Moreover, there is always a time lag between internal and external reporting. Furthermore, while external users are normally provided with highly aggregated information, internal managers have access to individual items.

The main forms of external reporting are annual, semi-annual and quarterly reports although stock prospectuses, tax returns, and reports to creditors are also external reporting mechanisms. Note that external reporting is not the same as public reporting as some of the reported information (such as that to creditors) may be private. Many problems have been identified with existing external reporting systems. They provide, in most cases, general purpose reports: a single set of financial statements containing highly aggregate information designed for various groups of external users (Sorter, 1969). In addition, they are criticised for concentrating on legal form rather than economic substance, on the past rather than the future, and on cost rather than value (i.e. income determination and asset valuation are based on historic cost). They also lack timeliness and information about the company's objectives and its management and ownership (ICAS, 1988). Further, it is an eclectic system which uses various valuation models which lacks comparability (ASB, 1993). To overcome these problems, there have been sustained calls for improved external reporting from researchers (AAA, 1966), accounting professional bodies (ICAS, 1988), and regulators (ASB, 1993). As a result, many changes have taken place in the last decades, such as the inclusion in the annual report of a statement of the responsibilities of auditors and directors, a statement of total recognised gains and losses, a longer auditor's report, the cash flow statement, and the operating and financial review.

Internal reporting aims to assist managers in running the company. Managers can have monthly, weekly and

even real-time financial information. Not only are they able to access all information available, but they can also invest in new systems. As a result, many advanced management accounting techniques have been adopted to assist short and long-term decisions, such as relevant costing, and activity-based costing. However, internal reporting is not problem free. Bromwich and Bhimani (1994) argue that there is a need for internal reporting to: (1) be more responsive to new issues brought about by managerial and technological innovations; (2) pay more attention to strategy; (3) provide more market-oriented information; and (4) be less short-termist and to integrate better financial information with non-financial information. However, the problems with internal reporting are fundamentally different from those in external reporting. The main difference is that, in the former, the problems are mostly related to how to produce new types of information, while those in the latter are largely concerned with how and whether to disclose to external users the information already available to managers. Problems in internal reporting should also be problems in external reporting, but not *vice versa*. Even if some deficiencies are shared by both external and internal reporting, they would be less severe in the latter.

According to ICAS (1988) and Lee (1988), information which external users need in order to make decisions is the same in kind, but not in volume, as that which management need, although others disagree (Arnold *et al*, 1980). ICAS (1988) also observe that corporate reports provided to external users are little used by managers as they have better internal reporting systems, which indicates the existence of an information gap. Innes and Moyes (1991) identify the need for disclosing to external users a statement of objectives, more segmental information and non-financial performance measures. They also find that information which is currently available to managers about the economic environment and future prospects, market share, competitors, employees, and forecasts of cash flows and profits, is not generally disclosed to external users.

The above shows the existence of an information gap between internal managers and external users. However, the concern here is whether or not the existence of such a gap is significant. This may be discerned from two aspects: the importance of accounting information and the consequences of the asymmetry.

Empirical studies have examined the 'informativeness' of accounting reports in terms of the impact of accounting earnings on security characteristics such as prices, returns, and trading volumes. Evidence suggests that financial reports are only one source of information to the market. However, even under the strict definition of information, there is evidence to show that financial reports do not merely repeat items already available from other sources. Chambers and Penman (1984) suggest that accounting reports contain information about specific firms which is not provided by other sources, regardless of the time lag of the reports. Specific items found to have an effect on the stock market include quarterly earnings announcements and segment earnings (Bromwich, 1992).

Support of the usefulness of financial reports for decision making can also be found in a study of users' information needs (AICPA, 1994). This finds that many users adopt approaches to investment and credit decisions which require extensive amounts of company-specific information of the type commonly found in external reporting. Such approaches include: (1) fundamental approaches that seek to value a security by assessing the amount, timing, and uncertainty of future cash flows or income, and (2) anticipation approaches that predict an entity's short-term earnings, changes in earnings, and changes in trends of earnings as a means to predict short-term changes in the prices of its securities. The types of information that are useful include background information, leading indicators, segment information, and historical information for sufficient historical periods. Two other findings are also relevant here. The first is that users need multiple sources of information so that they can choose and assess the reliability of the information, indicating the usefulness of financial reports even if they repeat other sources. Second, users need information from management perspectives, suggesting the existence of an information gap between managers and external users.

Apart from aiding decision making, accounting information also serves many accountability purposes such as stewardship, performance evaluation, management compensation determination, income distribution, and resource allocation. The importance of these uses is well documented (e.g. Ijiri, 1975; Bromwich, 1992). In particular, Walker (1988) suggests that public accounting information for accountability purposes, though post-decision information, may generate social benefits such as: (1) to extend the range of trading opportunities with a view to improve risk sharing (a point also made by Gjesdal, 1981); (2) to reduce wasteful private information production and search; (3) to improve control of external investors over managers; and (4) to reduce the costs involved in signalling insider information by managers to the market.

The consequences of IA has been well illustrated in agency theory. This theory defines an agency as a contractual relationship where a principal (such as shareholders) engages an agent (such as managers) to carry out some service on their behalf which involves the delegation of decision-making autonomy to the agent (Jensen & Meckling, 1976). Information asymmetry exists between the agent and the principal. Typically, the agent has superior access to information. In particular, the principal is not always able to observe the agent's behaviour and level of effort. Thus assuming the agent

is self-interested, agency theory deals with issues of how to motivate the agent to act in the interests of the principal and how to distribute risk efficiently between the two (Atkinson & Feltman, 1982).

When combined with unconstrained opportunism, IA results in moral hazard and adverse selection problems. Moral hazard occurs when the agent's action is unobservable by the principal and has a different value to the agent as compared to the principal, and when self-interested agents pursue their own ends at the expense of the principal by shirking, duty evasion, and insider-dealing using private information (Holmstrom, 1979). The adverse selection problem refers to the likelihood that, due to IA, either the agent or the principal may choose an inferior course of action when superior options exist (Akerlof, 1970). For example, a self-interested manager may choose to continue a project although it is failing and when discontinuation would benefit shareholders.

Various mechanisms have been proposed to overcome or prevent these problems. Some are designed assuming the existence of asymmetrical information, such as third-party monitoring, incentive schemes, efficient contracting, ethics (Noreen, 1988) and management labour market (Fama, 1980). Another approach is the development of more complete IS in order to reduce or eliminate IA (Walker, 1987; Harrison & Harrell, 1993). This latter approach is more effective and positive. When all information is public, the agent would not shirk even if they had an incentive to do so, because the principal knows they are shirking and will penalise them.

The above discussion signifies a need for reducing IA. However, any such attempt is constrained by at least two factors: the cost/benefit determination of increased disclosure and commercial sensitivity. These factors will be considered further later. However, the above analysis is sufficient to suggest that it is important to investigate if the use of IT impacts on IA.

Information technology

IT is defined here as computer-based information processing and communication technologies. IT enhances information capabilities in terms of, *inter alia*, speed, accuracy, memory and tolerance, and its use provides more options in processing and communicating. IT is programmable and reproductive. Moreover, it can be a control tool since it processes and communicates information which may be vital for decision making, organising and controlling. Beniger (1986) argues that both information processing and communication are inseparable components of the control function, and thus a society's ability to maintain control is directly proportional to the development of IT. Hence, the choice and use of IT is determined not only by technological attraction, but also by non-technical factors such as information needs, and social, political and economic influences (Langrish *et al*, 1972).

As IT use is subject to human intentions, the consequences of use, to some extent, depend on who is in control. IT can be used to benefit those in control, although unintended results both positive and negative may occur. However, the question of whether these benefits are passed to others is uncertain. Thus, a distinction needs to be made between the private value and the social value of IT use. The use of IT which benefits an individual organization may not benefit other interested parties.

The above suggests two points. First, a unilateral and determinist view of the impact of IT, whether human intention determinism or technological attraction determinism, is incomplete. A pluralist view which accommodates both technological attraction and human intentions is more appropriate. This views IT as a double-edged sword for both individual organizations and society, and highlights that IT may exacerbate IA between managers and external users. However, not all people share this view. For example, Hopwood *et al* (1990) suggest that IT would have a great potential for businesses and the accounting profession, but fail to recognise the differential impact and negative effects of IT on various users, be they immediate or indirect. They, thus, come to the conclusion that commercial exploits of IT should be unconstrained.

IT may be seen as having three dimensions: its availability, its use, and its future development. Availability is more suitable for the examination of the influence of IT on the choice of alternative technologies or systems, while IT developments are appropriate for forecasting the future impacts of IT. This work focuses on the use of IT, since the purpose is to evaluate the actual effect of IT on internal and external reporting.

Use of IT in accounting has, in turn, two dimensions, the level of IT use and the change in use over time. The level of IT use measures the extent and sophistication of IT use at a particular point of time, while the change in use over time measures either the total amount of change that occurred during a certain period of time (a stock concept) or incremental changes over that period (a flow concept). Note that the level of IT use and the total change in use overlap to some extent, and that it is difficult to obtain data about incremental changes in use over time. Therefore, this paper primarily focuses on the level of IT use although it examines the impact of IT on internal and external reporting since the early 1980s. The advantage is that this choice reflects the fact that any change in internal and external reporting over a specified period may be partly attributed to the earlier uses of IT. That is to say, past use of IT creates inertia which may arise from two sources. First, prior use of IT gives individuals and the organization experience with applications. Second, existence of a technological base

means less effort is needed in later periods to achieve computerisation and to make changes in internal and external reporting.

The impact of IT use in accounting on internal and external reporting

The impact of IT is defined as IT-related changes in internal and external reporting. IT-related changes imply that IT is either a cause or a facilitator. This reflects that the relationship between IT use and changes in internal and external reporting is reciprocal or symmetrical. It may be that more IT use causes a change, but it may also be the case that a change requires greater IT use. In the former, IT acts as a cause while in the latter IT is a facilitator. Here, no distinction is made between these roles since one is difficult, if not impossible to make. Instead, the impact of IT is meant to include both. This treatment echoes Rosenberg (1968) who casts doubt on the necessity or possibility of specifying which of two reciprocal variables is the original cause, while acknowledging that the discovery of symmetrical relationships is valuable for understanding social phenomena. Moreover, taking a dynamic view, an association between IT use and changes in internal and external reporting may be seen better as the result of successive and cumulative interactions between IT use and the particular change. Thus, IT use can be seen as both a cause and a facilitator of change.

Most organizations have automated basic elements of internal reporting systems (Clark & Cooper, 1985). IT also supports accountants in analytical and decision-oriented tasks and allows them to change from accumulating, analysing and preparing financial information towards interpretation, evaluating performance, and involvement in decision making (Collier, 1984). As a result, information quality has been improved in terms of comprehensiveness, accuracy, timeliness, frequency and relevance (Mantle, 1983; King *et al*, 1991). Legitimately, management has full access to this improved information. However, the benefits to internal users cannot be similarly extended to external users.

In the long run, IT use may benefit external users, for instance, by networks allowing more frequent and on-line reporting (ITG, 1989). Moreover, extensive use of IT will increase expectations of external users and regulators which may result in increased legal requirements. Evidence for this is emerging. For example, the Securities and Exchange Commission (SEC) has implemented EDGAR [Electronic Data Gathering, Analysis and Retrieval] (Coffey, 1994) which requires listed companies to file financial reports electronically and disseminates information to users in a more timely and/or on-line basis.

However, several barriers may prevent external users of information from enjoying as many benefits as corporate managers. First, there is a commercial sensitivity problem; managers have to protect proprietary information and are also both able to, and have incentives to, suppress some non-proprietary information (Dye, 1985). Moreover, while financial reporting is costly, the true exchange value is difficult to establish because there is neither an accepted and practical measurement unit (Boulding, 1966), nor a usual price system for accounting information (Bromwich, 1992). This makes it difficult for the provider to identify benefits from disclosure. Therefore, unless there are foreseen benefits, such as when managers believe that their company is undervalued (Verrecchia, 1983), managers are reluctant to disclose additional information beyond minimum requirements. Generally, because accounting information possesses some characteristics of a public good, its provision is hampered by problems of free riding (i.e. it is costly to exclude non-purchasers from its use) and joint supply (i.e. its use by one user does not exclude its use by another) (Bromwich, 1992). Finally, even if management is willing to share all the improved information obtained through IT use with external users, the cost and complexity of the technology required to deliver it to a large number of external users is prohibitive (though the Internet may provide such a tool). Consequently, increasing quantity and improved quality of information generated for internal reporting through greater use of IT are not likely to be incorporated on the same scale in external reporting and, as a result, not only is it likely that IA exists, but it is also likely that IA has been increased. Therefore, it is hypothesised that IT use in accounting causes or facilitates greater internal reporting change (IRC) than external reporting change (ERC).

There are at least two ways to test the above hypothesis. The first is to test if IT-related IRC is greater than IT-related ERC, but the practical problem here is the difficulty, or perhaps impossibility of isolating the proportion of change that is caused or facilitated by IT use when changes may arise from many factors. The second approach starts by measuring the IRC and ERC that have taken place, and the level of IT use. Here, confirmation of the hypothesis requires that IRC is greater than ERC, and the level of IT use is at least equally associated with both. This paper uses this second method. It should be noted that in using this approach, some variables need to be controlled as they may contaminate the association between IT use and IRC and ERC. Three variables (organization size, stock exchange listing status and gearing) are suspected for the following reasons.

Organization size affects demand for information, intention to supply information, and capacity for processing and communicating information. Large firms disclose more information to external users than small ones for a number of reasons (Singhvi & Desai, 1971), including: (1) processing and dissemination of information is relatively less costly for large companies than

for small; (2) large firms are financed more through financial markets, and more disclosure will increase financing benefits; (3) large companies are more closely scrutinised by the public and government, and therefore more extensive disclosure may reduce public criticism and undesired pressure or government intervention; and (4) smaller companies are more likely than large to feel that full disclosure could endanger their competitive position. These also suggest that large companies are more likely and more able than small ones to change and improve external reporting. Size, therefore, can be expected to have a positive association with ERC.

Size may be seen as a proxy for organizational complexity. The larger the organization, the greater its complexity, the greater the control and co-ordination needed, and the greater the volume of information that needs to be handled. This has two implications. First, large firms, compared with small, have to meet more intensive and diversified information demands from internal users, and are under greater pressure to improve internal reporting to obtain good organizational performance. However, large companies are better resourced than small ones to meet greater internal information demand. Thus, it may be expected that size has a positive association with IRC. Second, IT may be more extensively used to enhance information capacity. Moreover, large companies are better resourced for more extensive and advanced IT use. Therefore, it may be expected that size has a positive association with the extent of IT use.

Listing status is associated with the extent and quality of financial disclosure to external users for two reasons (Singhvi & Desai, 1971; Firth, 1979). First, being more externally financed, listed companies have to compete with each other for lower financing cost and higher security liquidity. Thus, the extent of their external reporting may be more extensive than unlisted companies, and these companies are more likely to improve external reporting. Also, listed companies have to comply with additional reporting requirements, and their financial reporting practice should change along with changes in these requirements. Given these, it may be expected that there is a positive association between listing status and ERC. As the information disclosed to external users is, of course, available to managers, a positive association may also exist between listing status and IRC. Moreover, listed companies may have to use more IT in accounting to meet greater information demand. Further, financial market regulators may promote IT use for external reporting purposes by either requiring listed companies to implement a type of IT or by directly implementing IT-based reporting systems. This is evidenced by EDGAR. For these reasons, it is predicted that listing status is positively associated with IT use.

Agency theory argues that as the gearing ratio (the ratio of the firm's debt to equity) increases, managers have a greater incentive to transfer wealth from creditors to themselves and to existing shareholders in the face of IA (Fama & Miller, 1972; Jensen & Meckling, 1976). However, potential wealth transfer is positively related to the residual loss since creditors would anticipate these opportunistic activities and thus seek compensation by discounting the firm's security. Therefore, if managers and shareholders agree not to exercise opportunistic behaviour, they would benefit from a higher security price and an increase in firm value because such agreements (debt covenants) reduce the probability of suboptimal investments. Although managers and shareholders have to bear the costs of establishing and executing these contracts, the costs are small compared with the investor's price discount. Financial reporting plays a central role in many debt covenants because they use accounting data. Moreover, the higher the gearing ratio, the greater the monitoring and, thus, the more extensive disclosure required by the creditors. Therefore, gearing may have a positive association with ERC. Similarly, because managers have to avoid technical default, the higher the gearing ratio, the more extensive and frequent internal reporting they require. Thus, gearing may also have a positive association with IRC. Last, when the gearing ratio is high, more extensive and frequent internal and external reporting is required which, in turn, demands more extensive use of IT.

Research method

The data used to test the above hypothesis were acquired by mail with a questionnaire as part of wider research investigating the impact of IT on accounting. Interviews were also undertaken for the project but they are less relevant here.

Sample

The sample frame is FAME (FAME User Manual, 1993). FAME holds financial information on some 130 000 major UK companies. Here, only public companies are surveyed because, by definition, private companies are privately owned and thus less concerned about public reporting. For purposes of contingent analysis (Rosenberg, 1968) in the whole project, the sample size was determined to be 1500 by considering the number of sub-samples required, sub-sample size, and predicted response rate (in this case, 6, 50 and 20% respectively), following Hoinville *et al* (1989).

Questionnaire

This consisted of questions concerning IT use in accounting, IRC and ERC, the role of IT in accounting method choice and change, and the financial reporting environment. This paper involves the first two aspects. Questions were designed to describe the use of IT in accounting, drawing upon previous studies on IT use in

accounting (e.g. King *et al*, 1991), IT forecasts (for instance, Straub & Wetherbe, 1989) and IT implementation (such as Bailey & Pearson, 1983). Six of these are used here (abbreviations are in brackets):

- extent of computerisation of basic accounting systems (BEXT);
- years of IT use in accounting (BYRS);
- types of IT-based accounting systems in use (BTYPE);
- types of IT applied in accounting (BTEC);
- ratio of workstations to accounting staff (BRAT);
- level of IT integration (BSTAT).

Fifteen items listed below were selected to reflect both internal reporting change (IRC) and external reporting change (ERC) following a review of the literature on financial reporting and information systems evaluation. Seven indicators relate to relevance, namely forecast information, external information, comparative information, non-financial information, business strategy-specific information, segmental information and user-tailored information. Relevance refers to the ability of a piece of information to affect a decision, and is regarded as having predictive, confirmative or evaluative value (ASB, 1995). To achieve relevance, there is a need to report more of the above information (ICAS, 1988).

Factors	*Variables*	*Abbreviation for IRC*	*Abbreviation for ERC*
relevance	forecast information	XFOR11	XFOR21
	external information	XEXT11	XEXT21
	comparative information	XCOM11	XCOM21
	non-financial information	XNON11	XNON21
	strategy-specific information	XSTR11	XSTR21
	segmental information	XSEG11	XSEG21
	user-tailored information	XTAI11	XTAI21
time	timeliness	XTIM11	XTIM21
	frequency	XFRE11	XFRE21
reliability	auditability	XAUD11	XAUD21
access	accessibility	XACS11	XACS21
	availability	XAVA11	XACS21
comprehen-	understandability	XUND11	XUND21
sibility	presentation	XPRE11	XPRE21
cost	cost	XCOS11	XCOS21

The time dimension of information provision is measured by two items: timeliness and frequency. Since computerisation may have changed many traditional features of data processing, the reliability of information is considered to be a matter of auditability. Hence, auditability is used as an operational definition of reliability. Two items represent the possibility that users are able to access information: accessibility of formal reports and information availability via self-retrieval or request. Inclusion of the second item is based on the consideration that users might access information in a less formal manner as opposed to traditional annual and half-year reports. Two items, understandability and presentation, reflect whether information reported is communicable and comprehensible. Finally, cost is used to measure change in reporting cost.

Choice of the above items is information characteristics-oriented. Information characteristics are well documented (ASSC, 1975; FASB, 1978–1985) and widely used in research. For example, Gorry and Scott Morton (1971) hypothesise that information attributes can be treated as dependent variables in studying IS, and Stamp (1982) investigates the relative importance of twenty qualitative characteristics of financial information. Moreover, the approach allows survey respondents to state the degree of a change in each item. All items are assessed on a five-point Likert scale, respondents being required to specify any change, and to assess the importance of IT if there is a change.

In order that a reliable comparison can be made between IRC and ERC, both are measured by the same indicators. In so doing, there is an assumption that the items have value to both internal and external users of accounting information. Though they are items valued by accounting practitioners, researchers and standard setters for external reporting purposes, their importance in a public rather than a private setting is, as yet, to be rigorously tested.

Ideally, the time span for comparison would start from the time when a company started using computer-based IS in accounting, but this is impracticable. Some were computerised thirty years ago and it would be impossible for the respondents to know or recall what happened then. Consequently, only changes over the last ten years are investigated on the grounds that PCs, database technology and networks have become increasingly popular since then.

Respondents

Corporate financial directors were chosen as respondents since they make major decisions in financial reporting. Moreover, many are responsible for the companies' IT implementation (King *et al*, 1991).

Survey

Two pilot studies were undertaken, the first to evaluate the draft questionnaire by discussion with financial directors or chief accountants in three public companies. Then, 100 companies were randomly sampled from FAME. Questionnaires were sent to financial directors aiming to estimate the response rate and to test further the questionnaire. The formal survey received 311 usable questionnaires, a rate of 20.8%. There were also 51 responses without completing the questionnaire, the main reasons being company policy, resource constraints and irrelevance. Ferber's test (Ferber, 1948, 1949) was performed for non-response bias based on the returned questionnaires and shows that there is little non-response bias.

Of the 308 respondents who disclosed their positions, 53.5% are financial directors, 18.6% accountants, 8.6% IT managers, 10.6% other executives or non-IT managers, and 6.2% company secretaries. Though the

targeted respondents were financial directors, accountants are also well qualified to complete the questionnaire. Company secretaries have to respond to all external information requirements. As some questions are about IT use in accounting, IT managers are certainly aware of the answers. Moreover, by definition, they are involved in direct data processing, end-user supporting or reporting system development, and thus they are associated with financial reporting.

Other data

In addition to those obtained from the questionnaire, further data were retrieved from the sampling frame, including company size, listing status, and gearing. These variables are used later for control purposes. Since there is no single accepted measure of size, three are used: (1) five-year average annual turnover; (2) five-year average total assets; and (3) five-year average employee numbers.

Analysis

Data analysis involves two aspects: (1) examining whether IRC is greater than ERC, and (2) examining whether the association between IT use and IRC is as strong as that between IT use and ERC.

A comparison of IRC and ERC

A frequency analysis of the changes in individual items designed to measure IRC and ERC suggests that both internal and external reporting have experienced change (mostly positive). Parallelism also exists between IRC and ERC. For example, forecast information, frequency, timeliness and presentation have changed greatly in both internal and external reporting. However, it seems that IRC is greater than ERC. To confirm this, a one-sided Wilcoxon matched-pairs signed-ranks test is performed. The method is used, first, to test if the aggregated IRC (SIRC) is greater than the aggregated ERC (SERC), where SIRC and SERC are the sum of the values of individual indicators of IRC, and second to see if individual internal reporting aspects have undergone greater change than corresponding external aspects. The test confirms that SIRC is significantly greater than SERC, the ρ value is well below 0.01. In 14 out of 15 aspects, IRC is greater than ERC (one-tailed ρ values are well below 0.01). The only exception is that the change in the cost of internal reporting does not differ from that of external reporting.

The association between IT use and IRC and ERC

Thus, it is clear that IRC is greater than ERC, indicating an exacerbation of the information asymmetry between managers and external users. This section investigates whether IT use has a role in this exacerbation by comparing the association between IT use and IRC with that between IT use and ERC. The associations are obtained from partial correlation analysis and the difference between them is examined using Williams' T-test (Williams, 1968).

Data preparation

To make the data manageable, three overall indices for IT use, IRC and ERC are constructed instead of using their individual indicators. Development of the indices involves two stages. First, it is necessary to test their internal consistency. Details of the tests are summarised in Table 1. Cronbach's Alpha (Cronbach, 1970) is applied, which measures the internal consistency of items in an index by correlating the score of an item with the total score of the remaining items. Generally, if the items in the index are consistent (that is, they are measuring the same thing), they should be highly correlated with the total score of the other items, and the alpha measure tends to be high. Nunnally (1978) suggests that an alpha value around 0.60 is acceptable.

Table 1 indicates that items in the IRC index and ERC index are consistent, implying that the indices are reliable as both alpha and standardised alpha are over 0.80. Here the standardised alpha is obtained when all items are standardised to have a variance of 1. The alpha and standardised alpha for the IT use index are both around 0.589 when all six indicators described are used. The item Workstation to staff ratio (BRAT) has the lowest correlation with the total score of the other items. When this item is excluded from the index, alpha increases to 0.653 and the standardised alpha to 0.659, satisfying Nunnally's standard.

The other aspect of developing an index is to assign a value to it. There are two ways to do this. The first is to add the scores of the indicators of each index, and the other is to use the factor scores from factor analysis. Both methods have been attempted. The overall scales by summing up individual indicators respectively of the IT use, IRC and ERC indices are termed SITUSE, SIRC and SERC. The results from the factor analysis are summarised in Appendix 1. Two different situations arise from the factor analysis. Since only one factor is obtained for the IT use index, the factor score for this factor, termed FITUSE, is directly used as the value of the index. In contrast, as several factors of the IRC and

Table 1 Reliability analysis of the IT use, IRC and ERC indices

Index	*Alpha*	*Standardised Alpha*
IT use index (excluding BRAT)	0.653	0.659
IRC index (all items)	0.830	0.838
ERC index (all items)	0.911	0.912

Table 2 Descriptive statistics for variables to be used in further analysis

Variable	*n*	*Mean*	*Median*	*Minimum*	*Maximum*	*Skewness*	*Kurtosis*
ITUSE	311	12.57	12.00	5.00	18.50	0.0	0.28
SIRC	281	13.91	14.00	–1.00	30.00	0.17	–0.24
SERC	236	8.12	7.00	–4.00	30.00	0.75	–0.08
Sales (£000)	281	335121.04	18088.00	19.00	14820000.00	7.93	75.26
Assets (£000)	285	874844.23	20442.00	191.97	21359000.00	7.85	76.96
Employees	263	5518.29	282.00	1.00	286530.00	8.02	71.77
Gear	265	197.64	57.00	0.00	9457.00	9.72	110.14

ITUSE = Level of IT use; SIRC = IRC based on summed individual scores; SERC = ERC based on summed individual scores.

ERC indices can be produced, the overall values of the two indices, termed FIRC and FERC have to be summed from the factor scores of the constituent factors.

Initial analysis

Table 2 presents descriptive statistics for all variables except listing status. Clearly, gearing and the size variables exhibit positive skewness and kurtosis. For further analysis, a log transformation of these variables is carried out.

Pearson correlation coefficients among the variables in Table 2, and Spearman correlation coefficients between each of these variables and listing status are shown in Table 3. Note that listing status can be seen as an ordinal variable in the sense that listed companies, compared with unlisted ones, are required to comply with additional reporting requirements, thus Spearman correlation analysis is appropriate for examining its relationship with other variables in Table 3.

These analyses shown in Table 3 serve three purposes. First, they show whether there is any association between the level of IT use and IRC/ERC. If not, no further investigation is necessary. The results indicate a positive and significant association, and this is true irrespective of the ways in which the values of the indices are obtained.

Second, they are used to contrast the two approaches to the derivation of values for the three indices. The two approaches produce very close results. For example, the factor score (FITUSE) and the summed value (SITUSE) for the IT use index have a positive association of 0.996,

Table 3 Correlation coefficients matrix

	Logsal	*Logemp*	*Logass*	*Logear*	*LIST*	*FIRC*	*SIRC*	*FERC*	*SERC*	*FITUSE*	*SITUSE*
Logsal	1	0.868**	0.859**	0.027	0.550**	0.129*	0.186**	0.243**	0.242**	0.464**	0.454**
		(256)	(265)	(243)	(282)	(253)	(257)	(211)	(217)	(273)	(282)
Logemp	868**	1	0.764**	–0.022	0.497**	0.209**	0.268**	0.268**	0.255**	0.479**	0.494**
	(256)		(263)	(240)	(263)	(234)	(237)	(196)	(202)	(255)	(263)
Logass	0.859**	0.764**	1	0.031	0.552*	0.142*	0.190**	0.186**	0.199**	0.391**	0.379**
	(265)	(263)		(256)	(284)	(254)	(258)	(212)	(218)	(276)	(285)
Logear	0.027	–0.022	0.031	1	0.128*	0.137*	0.129*	0.189**	0.214**	–0.002	0.001
	(243)	(240)	(256)		(261)	(233)	(236)	(195)	(201)	(254)	(261)
LIST	0.550**	0.497**	0.552*	0.128*	1	0.000	0.051	0.092	0.081	0.071	0.097
	(282)	(263)	(284)	(261)		(276)	(281)	(230)	(236)	(301)	(311)
FIRC	0.129*	0.209**	0.142*	0.137*	0.000	1	0.940**	0.672**	0.594**	0.254**	0.218**
	(253)	(234)	(254)	(233)	(276)		(276)	(229)	(234)	(269)	(276)
SIRC	0.186**	0.268**	0.190**	0.129*	0.051	0.940**	1	0.696**	0.638**	0.305**	0.276**
	(257)	(237)	(258)	(236)	(281)	(276)		(230)	(236)	(274)	(281)
FERC	0.243**	0.268**	0.186**	0.189**	0.092	0.672**	0.696**	1	0.954**	0.233**	0.195**
	(211)	(196)	(212)	(195)	(230)	(229)	(230)		(230)	(224)	(230)
SERC	0.242**	0.255**	0.199**	0.214**	0.081	0.594**	0.638**	0.954**	1	0.212**	0.179**
	(217)	(202)	(218)	(201)	(236)	(234)	(236)	(230)		(229)	(236)
FITUSE	0.464**	0.479**	0.391**	–0.002	0.071	0.254**	0.305**	0.233**	0.212**	1	0.996**
	(273)	(255)	(276)	(254)	(301)	(269)	(274)	(224)	(229)		(301)
SITUSE	0.454**	0.494**	0.379**	0.001	0.097	0.218**	0.276**	0.195**	0.179**	0.996**	1
	(282)	(263)	(285)	(261)	(311)	(276)	(281)	(230)	(236)	(301)	

Note: Two-sided tests; * significant at 0.05, and ** at 0.01. Sample sizes are in brackets. These are used throughout the paper.
Logsal = Log of sales; Logemp = log of employees; Logass = log of assets; Logear = log of gearing; LIST = listing status; FIRC = IRC based on factor scores; SIRC = IRC based on summed individual scores; FERC = ERC based on factor scores; SERC = ERC based on summed individual scores; FITUSE = IT use based on factor scores; SITUSE = IT use based on summed individual scores.

significant at 0.001. Thus, only one (the summed value approach) is used in subsequent analysis.

Third, they provide information for the selection of control variables for further analysis of the relationship between the level of IT use and IRC/ERC. Although three variables (size, gearing and listing status) have initially been considered for this purpose, whether they will actually be used depends on whether they meet the following criteria: "Generally, only variables that are associated with both the independent variable and the dependent variable can potentially bias the results. Thus only variables that show an association with the independent and dependent variables under investigation are selected as control variables." (Frankfort-Nachmias & Nachmias, 1992).

Table 3 shows that all the transformed size variables (Logsale, Logemp, and Logass) are positively associated with both the IT use variable (SITUSE) and the two financial reporting variables (SIRC and SERC). This suggests that company size should be controlled in investigating the relationship between the level of IT use and IRC/ERC.

However, although gearing (Logear) is positively associated with both IRC and ERC, it has no significant association with the level of IT use. Therefore, it is excluded from further analysis. Moreover, since listing status (LIST) is not significantly correlated with the level of IT use, IRC and ERC, it is not considered in further analysis.

Further analysis

Partial correlation analysis investigates the relationship between the level of IT use and IRC/ERC while controlling for size (Table 4). All three size measures are used and their results are close. It is clear from the table that, when size is controlled for, there is a positive and significant association between the level of IT use and IRC, but no significant association exists between the level of IT use and ERC.

A Williams' T-test is used to further test whether the difference between the paired coefficients in Table 4 is significant while taking account of the fact that IRC is statistically associated with ERC. The procedure is described in Appendix 2. The results are summarised in Table 5 and indicate that the differences are significant in all cases at 0.05 or below. Since exact normality cannot be assumed, the significance levels are only approximate. However, there is clear evidence that IT use is more associated with IRC than with ERC.

In summary, the evidence that IRC is greater than ERC suggest an exacerbation of existing IA. The fact that IT use is significantly associated with IRC indicates that IT has played a role in IRC, while the result that IT use has no significant association with ERC means that IT use has no bearing upon ERC. The combination of these results suggests that, while more and better information is made available to managers by the use of IT in accounting, this improvement has provided little benefit to external users. This is consistent with the hypothesis that IT use in accounting facilitates or causes greater IRC than ERC.

Discussion and conclusions

Following an examination of the impact of IT on accounting, Hopwood *et al* (1990) advised the Institute of Chartered Accountants in England and Wales not to exert influence on the development of IT applications or its commercial exploitation. An implicit assumption of this might appear to be that the effect of IT use in accounting is confined to accountants or their organizations, and that IT use in accounting is no more than technological innovation.

However, confirming much of the IS literature which suggests that the consequences of introducing IS are more widespread and unpredictable than expected, this paper argues that IT, which is instrumental to financial reporting, is a double-edged sword. It is shown that IT has now been used extensively in accounting and, as a result, more and better information is available. While managers have full access to this information, outsiders do not, resulting in the exacerbation of accounting information asymmetry between the two.

This effect of IT use in accounting suggests that it is not merely a matter of technological innovation, but involves the interests of many users of accounting information. It also indicates that the effect of IT use in accounting is not confined to accountants and individual

Table 4 Partial correlation coefficients between the level of IT use and IRC/ERC controlling for size

Comparison	*Control Logsale*	*Control Logass*	*Control Logemp*
SITUSE and SIRC	0.224** (255)	0.171** (234)	0.218** (254)
SITUSE and SERC	0.114 (215)	0.063 (199)	0.080 (214)

Table 5 One-sided Williams' T-test of the equality of two dependent correlation coefficients

Size Measure	*n*	r_{13}	r_{23}	r_{12}	*T*	*D.F.*
Logsal	215	0.224	0.114	0.622	1.89	212
Logemp	199	0.171	0.063	0.611	1.74	196
Logass	214	0.218	0.080	0.623	2.38	211

Note: for a one-sided test at levels of 0.05 and 0.01, critical values are 1.64 and 2.33 respectively (normal approximation for large degrees of freedom).

organizations. Thus, it could be argued that the approach recommended to financial reporting regulators needs reappraisal. To the extent that IT use has a negative effect on IA between managers and external users, it could be argued that regulators have a responsibility for IT use in accounting.

Whilst monitoring and controlling IT use in accounting may be desirable as a potential mechanism for reducing IA, it is infeasible. This infeasibility stems from three sources. First, though this paper demonstrates that IT use may increase IA, further research would need to confirm its findings before regulators could consider action. Second, there would need to be sufficient evidence of the cost-benefit of such regulation since any such move would be highly complex and costly. Third, even if the causal link was established, regulation of the effect (information asymmetry) rather than the cause (information technology) would appear to be more sensible. This might involve producing more stringent regulations on financial reporting. However, though it poses few resource requirements for regulators, resistance from financial information providers may be provoked.

Past research on the impact of IT on accounting has had a narrow focus on accountants, and on internal accounting and reporting. This partly reflects the separate development of the accounting and information systems disciplines. It is argued here that a broader research focus and perspective is needed so that the impact of IT use on external users of accounting information is also considered.

By examining the effect of IT use in accounting on the IA between managers and external users, this paper represents a first step towards a broader focus and perspective. However, the following limitations should be borne in mind. The first lies in the survey design which is weak in drawing causal inferences. Although such a design is consistent with the reciprocal nature of the relationship between IT and financial reporting, the inability to draw causal inferences and hence to distinguish the two roles of IT in IRC/ERC (cause and facilitator) hinders the possibility of making more emphatic recommendations. A second limitation relates to the questionnaire. While this paper has addressed issues of non-response bias using the Ferber test, and used interviews to obtain in-depth information, no effective counter is available to hidden delegation which may have contaminated the data.

This paper has shown, using the example of the accounting domain, that information technology has differential effects on users of information. Although this proposition is alluded to in many IS discussions, it is seldom investigated or tested. This paper indicates that IT exacerbates information asymmetry between users internal and external to the firm.

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Appendix 1: Factor analysis

Initially, all items of an index enter the analysis. One factor is obtained for the IT use index. However, different and inconsistent factors are produced for the IRC and ERC indices. This obstructs use of the results for comparing the relationship between IT use and IRC, and that between IT use and ERC. Moreover, the factors in the ERC and the IRC indices are difficult to interpret because some original items have superficially been clustered to a factor. This highlights a problem with a statistical approach to dimensionalisation: they only recognise the numbers, not the meaning behind them. Thus the dimensions so produced may only be seen as dimensions in a statistical sense. To overcome this, the factor analysis is applied again on each subjectively formulated dimension. Table 6 presents a summary of this attempt.

Items in the IRC and ERC indices are grouped along subjectively formulated dimensions to which they attach. The factor analysis using principle components analysis as the factor extraction procedure has been performed for each dimension. Note that in every case, only one factor has been extracted and further rotation is not required or necessary. This may be seen as a justification for the dimensions so developed. Also the sizes of the variance explained by the factors are much larger compared with those obtained from an earlier attempt. The factor scores so obtained are used in the construction of the overall scores of the IRC and ERC indices.

Appendix 2

The T-test is designed to compare two dependent correlation coefficients r_{13} and r_{23}, using the following test statistic:

$$T = (r_{13} - r_{23}) \sqrt{\frac{(n-1)\,(1+r_{12})}{2\left(\frac{n-1}{n-3}\right)|R| + \bar{r}(1-r_{12})^3}}$$

where $|R| = (1 - r_{13}^2 - r_{23}^2 - r_{12}^2) + 2r_{13}r_{23}r_{12}$, $\bar{r} = (r_{13} + r_{23})/2$, r_{13} is the coefficient between variable 1 and variable 3, r_{23} is the coefficient between variable 2 and variable 3, and r_{12} is the coefficient between variable 1 and variable 2, and n is the sample size. Assuming normality, under $H_0 : \rho_{13} = \rho_{23}$, T follows Student's t-distribution with $(n-3)$ degrees of freedom (Williams, 1968). A one-sided Williams' T-test with the alternative hypothesis being $H_1 : \rho_{13} > \rho_{23}$ is applied to investigate the difference between the two dependent correlation coefficients in Table 4. In the table, r_{13} are the coefficients in the first row and r_{23} the coefficients in the second row. Since the pairwise exclusion method is used to treat the missing values in the partial correlation analysis, n has two values. To be conservative, the smaller is used.

Table 6 Summary of factor analysis of the IT use, IRC and ERC indices

Index	*Factor*	*Variables attached to the factors*	*Var. explained (%)*	*KMO*
IT use index	ITUSE	F1: BEXT, BTYP, BTEC, BYRS, BSTAT	43.1	0.72
IRC index	Relevance	F1: XFOR11, XEXT11, XSTR11, XSEG11, XTAI11, XNON11, XCOM11	38.6	0.81
	Access	F1: XACS11, XAVA11	73.2	0.50
	Time	F1: XFRE11, XTIM11	85.1	0.50
	Comprehension	F1: XPRE11, XUND11	74.1	0.50
ERC index	Relevance	F1: XFOR21, XEXT21, XSTR21, XSEG21, XTAI21, XNON21, XCOM21	51.1	0.87
	Access	F1: XACS21, XAVA21	79.8	0.50
	Time	F1: XFRE21, XTIM21	89.9	0.50
	Comprehension	F1: XPRE21, XUND21	83.4	0.50

Notes to the table: (1) Factor extracting method: principal components analysis; (2) Factor rotating method: varimax; (3) Missing value treatment: pairwise deletion; and (4) Refer to text for the items that the abbreviations in this table stand for.

About the authors

Zezhong Xiao (MEcon, MSc, PhD) is a lecturer in accounting at the Cardiff Business School, the Cardiff University of Wales, and associate professor of accounting and information systems in Beijing Business School (or Beijing Institute of Business). His main research interests are in the development of accounting and economic systems in the People's Republic of China and the impact of information technology on corporate financial reporting. He has published in, among others, *International Journal of Accounting*, *Advances in International Accounting*, *Information Technology and People*, *British Accounting Review*, *Accounting Research*, and *Auditing Research*. He has authored *Computer Auditing* and co-authored *Computerised Accounting and Auditing*. He has also co-translated, from English into Chinese, *A History of Accounting Thoughts* by Michael Chatfield. *The Philosophy of Auditing* by RK Mautz & Hussein A Sharaf, and *Montgomery's Auditing* by JD Solvin *et al*.

Philip L Powell (BSc, PhD, CITP, MBCS) is a reader in information systems, and director of the Information Systems Research Unit, Warwick Business School and an ICAEW Academic Fellow. He has authored books on information systems and financial modelling, and has published in *Omega*, *JORS*, *Accounting and Business Research*, *Information Systems Journal*, *British Journal of Management*, *Organizational Computing*, *Journal of Strategic Information Systems*, *Journal of Management Systems*, and *Decision Support Systems* amongst others. He is managing editor of the *Information Systems Journal*, and associate editor of the *Journal of Strategic Information Systems* and *OR Insight*. His main interests are in the organizational impacts of IS and IT, especially decision support systems and expert systems, and the ways such systems might be evaluated throughout the project cycle.

Jeffrey H Dodgson (HND, MSc, PhD, C.STAT) is a senior lecturer in mathematics at Napier University. His research interests are in the effect of preliminary testing on subsequent inference, aspects of neural computing *vis-a-vis* statistical methods, and the teaching of experimental design. He has published in, among others, *Applied Statistics*, *Journal of Statistical Computation and Simulation*, *NICAR Journal of Construction Management*, and *Information Technology and People*.