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User-Customized Financial Reporting: The Potential of Database Accounting and the Internet

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Executive Summary

One of the most widely-accepted ways for publicly-held firms to communicate the results of their operations to stockholders, creditors, and other external stakeholders is to issue financial statements. The existence of multiple acceptable, yet not reconcilable, accounting procedures causes these financial statements to be inefficient and ineffective communication devices. Critics of existing financial reporting standards have argued that the operation of an efficient capital market requires a more effective dissemination of information to investors, creditors, and other stakeholders than current accounting standards provide. Financial economists that have studied capital markets have found that these markets may not be highly efficient, especially for smaller firms and for firms with lightly-traded equity securities.

This paper acknowledges that events approaches to accounting that use relational databases are becoming prevalent in larger firms. These approaches identify semantic accounting phenomena of one sort or another and make these semantic primitives available to accounting information users in various ways. This paper describes how current advances in inter-entity networking, such as the Internet, and database management software, such as data warehousing, OLAP, and data mining tools, could ultimately provide substitutes for periodic paper-based financial statements.

This paper discusses the prospects for extending database accounting to financial reporting applications. One major barrier to the extension of these accounting approaches to financial reporting has been the difficulty of delivering information stored in large databases to widely-dispersed users. The Internet may provide a means for overcoming this barrier. A second major barrier has been the need to restrict access to certain portions of the database while providing sophisticated querying capabilities. The paper describes how the currently emerging integration of advanced database manipulation tools with the World Wide Web (the Web) can offer ways to overcome this second barrier. Finally, the paper notes some concerns about auditing and controlling third-party access to firms' databases to prevent extraction of sensitive information.

Introduction

Financial statements compiled in accordance with Generally Accepted Accounting Principles (GAAP) are an important source of information about publicly-traded business firms for investors, creditors, labor unions, and the general public (Ball and Brown, 1968; Beaver, 1968; Chambers, 1966; Edwards and Bell, 1961; Paton and Littleton, 1940; Watts and Zimmerman, 1986). Critics such as Canning (1929), Vatter (1947), Chambers (1964), and Briloff (1972), however, have argued that accounting numbers fail to provide financial statement users with consistent, meaningful, and useful information on which to base investment and credit decisions. Some of these critics, notably Briloff (1972), went so

far as to argue that firms could—and did—intentionally mislead their investors. A continuing stream of empirical results suggest that the capital markets may not be efficient, particularly for small-capitalization or lightly-traded issues (see Bendleman, Jones, and Latane, 1996; Bernard, 1990; Bernard, Thomas, and Abarbanell, 1994; and Mendenhall, 1991 for recent examples).

Although investors obtain information from sources other than accounting reports (see Watts and Zimmerman, 1986, Chapter 2 for an excellent discussion), Beaver and Rappaport (1984) and Burton (1984) both predicted that computing technology would soon cause financial statement users to increase their expectations about the level and quality of accounting information that firms should provide. McCarthy's (1979, 1982) database modeling efforts, inspired by Sorter's (1969) events-based accounting theory, have led to database implementations (Grabski and March, 1994; Hale, 1992; Perry and Schneider, 1995) that let users examine and summarize financial information according to their own needs. For example, users of database accounting systems can easily make comparisons across time periods, between firms, and among industries using their own criteria. Unfortunately, traditional methods of providing financial information, such as issuing annual financial statements printed on paper to stockholders and other third parties, have yet to change significantly. Accountants have been using the same reporting mechanisms for almost a century (Elliot, 1996). The Internet makes it possible to provide almost universal access to timely, detailed data. Stakeholders can examine these data on line or download them to perform whatever analyses are most useful for their own individual decisions. This paper identifies some of the benefits, requirements, and potential disadvantages of providing user-customizable access to accounting databases throughout the Internet.

Benefits

Timeliness

Elliot (1996) identified five defining attributes of existing GAAP-basis financial statements that, he argued, adequately capture only two of the three dimensions of a business enterprise. He stated that GAAP-based financial statements are only issued annually or quarterly, that they provide results too late to be interesting to users, that they present only financial information in historical cost metrics, and that the information they present is in a highly aggregated form. Elliot (1996) argued that what financial information consumers really want is a resource that adequately presents all three dimensions—including time—of an enterprise. He felt such a resource should: provide on-demand access to continuous information flows, should use value metrics instead of historical cost metrics, should include non-financial data, and should provide these data in formats that users could customize and that would include drill-down and drill-across capabilities. Elliot (1996) predicts that the value chain linkages forged using electronic data interchange (EDI) over the past fifteen years (Borthick and Roth, 1993; Cathey, 1991; EDICA, 1990; Ferguson, Hill, and Hansen, 1990; Powers, 1989) provide an excellent model that accountants could extend to financial statement users—the providers of enterprise capital.

Finer Data

GAAP-based financial statements are based on double-entry bookkeeping—a technique that dates back some five centuries. Pacioli (1494) gave generations of accountants this valuable tool for identifying and recording essential business transaction elements. Double-entry bookkeeping uses debits and credits to record changes in three categories of abstract entities called *accounts*: assets, liabilities, and equities. Accounting lore holds that summaries and aggregations of these three abstractions can provide information about firms' values and wealth changes (FASB, 1990; Ijiri, 1975; Sorter, 1969). Reducing each transaction to its effects on these abstract entities made record keeping feasible five centuries ago.

Sorter (1969) and Johnson (1970) argued that accounting should abdicate its role as aggregator of transaction data. They proposed that accounting systems should store information about economic events and that accountants should devote their energies to helping users obtain and aggregate information as needed instead of being the persons that determine information formats and aggregation levels. McCarthy (1979; 1982), Gal and McCarthy (1985), and others have used Chen's (1976) entity-relationship approach to model accounting events or similar concepts in relational databases (Parello, Overbeck, and Lusk, 1985). Using an entity-relationship modeling approach can

provide a rich semantic representation of each accounting event. For example, the rich semantic representation of sales transactions recorded in a relational database could include a virtually unlimited number of attributes for each sale.

Events approaches to accounting database development have appeared first in managerial accounting applications (e.g., Grabski and March, 1994) because it is almost always in the best interest of a firm to make information available to decision makers inside the firm. Additional information generally improves a manager's ability to make decisions and should, therefore, generate additional profits for the firm (Hilton, 1985). Because a database containing all relevant attributes of each transaction provides a greater amount of information than any double-entry bookkeeping-based accounting system, all managers and their employing firms would prefer such a *more fine* information system. *Fineness* is the degree of detail in an information system. A more fine information system is one that includes at least all of the information that exists in a less fine information system plus some amount of additional information (Blackwell, 1953; Hilton, 1985).

Flexibility

Burton (1984) described annual financial statements as rigid disclosures. He noted that this rigidity was the logical result of the historically high cost of data accumulation and the time-consuming efforts required to aggregate financial data into financial statements. Financial statements became standardized for many of the same reasons that Henry Ford offered his Model T in any color the customer wanted—as long as that color was black. Automobile manufacturers like Ford operating early in this century found that they could standardize their manufacturing processes and thus realize economies of scale. These economies of scale allowed them to produce large quantities of a homogeneous product at much lower costs than custom-manufacturing individual products to customer specifications would have permitted. Henry Ford's black Model Ts satisfied the transportation needs of many consumers well enough to be attractive, low-cost, high-volume products. Similarly, accountants responded to the high costs of data accumulation and aggregation by producing a standardized product—financial statements in accordance with GAAP—that met the needs of a large number of financial information consumers.

While accountants were busy preparing their financial statements and developing new and more complex rules of GAAP, information technology was progressing at an impressive pace. Recently, the cost of gathering data and creating customized reports has dropped to such a low level that managers in firms have come to expect to have the information they want, when they want it, and in the form they would like to have it (Borthick, 1992). Users of accounting information inside firms now access and analyze this detailed information rather than the rigid, periodic, highly-aggregated, historical cost-based statements used in prior decades when the costs of data collection and dissemination were orders of magnitude higher than today (Elliot, 1992; McKinnon and Bruns, 1992). Providing financial data on the Web would permit outside stakeholders to obtain benefits similar to those now enjoyed by decision makers within organizations.

When Sorter (1969) and Johnson (1970) first envisioned events-based accounting, they hoped that it would give financial statement users direct access to large portions of firms' financial information. In an events-based accounting system, economic events are stored in a disaggregate form that allows users to specify the retrieval form. Sorter (1969) argued that this direct access would overcome concerns about aggregation and lack of comparability in firms' financial reports. Borthick (1992) echoed Sorter's arguments and noted that financial statement users have become less tolerant of the limitations of accounting reports. The Securities and Exchange Commission (SEC) recently introduced a program to make information about publicly traded firms available on the Web (SEC, 1996). These filings contain the firms' financial statements and other information; however, they do not provide the level of access and flexibility that events-based accounting would provide.

When Sorter (1969) first discussed events-based accounting, the computing technology did not exist to place large databases of accounting information on-line. Even if the computing technology had not been a constraint, database theory had not developed ways to store and retrieve data with sufficient efficiency to make events-based reporting feasible. Since that time, McCarthy (1979, 1982) and others (Gal and McCarthy, 1985; Geerts and McCarthy, 1991; Grabski and March, 1994; Hale, 1992;

Schneider, Perry, and Bruton, 1995; Weber, 1986) have applied evolving database theory to accounting systems and have described a number of functional events-based accounting applications.

Requirements

Attest Function

The information flows to investors, potential investors, creditors, and other third-party stakeholders are, in most countries, subject to review by independent auditors. This tradition helps reduce the cost of capital to firms by providing some assurance as to the veracity of the reports and their conformance to accepted accounting principles. Replacing traditional accounting reports with on-line, user-defined access to databases of continuous information flows creates some new issues and concerns about the role of the auditor and the kinds of assurances the auditor can, or is willing to, provide. Vasarhelyi and Halper (1991) described on-line auditing approaches for continuous information flows. Elliott (1994) describes a number of new opportunities for automated audits in such an environment.

Hardware and Communications

To implement these new reporting schemes, firms must have adequate hardware and communications technology investments. These capabilities must combine to provide for continuous access by a large number of users without noticeable performance degradation. As accounting information becomes available in less-aggregated forms on these sites, users will demand increasing search capabilities that will require more memory, greater channel capacity, and permit more simultaneous users. Nothing is more frustrating to a potential data user than finding a site with useful information that is always too busy to accept another access.

Software

Users should, at a minimum, have the ability to obtain formatted reports that currently exist in print, such as income statements, cash flow statements, and balance sheets. Software should also provide drill-down capabilities in multiple dimensions. The most important new feature on these sites would be support for sophisticated ad hoc queries. Therefore, support for SQL or query-by-example (QBE) should be incorporated. The query results should be easily saved and downloadable into users' software running on their computers. The users can then perform sophisticated proprietary analyses on the downloaded data. The systems could include semantic models of the data available so that users could better understand the available data and their interrelationships (Papazoglou, 1995; Jih, et al., 1989).

Training

Of course, users will experience a learning curve when they first encounter these new data sources. The firms' sites could include tutorials that enable users to learn the resident query language (e.g., SQL, QBE), download data, and create customized aggregations of data in graphic forms.

Potential Disadvantages

Costs of Providing the Data

It is unclear whether the costs of making these financial reporting alternatives available to third-party stakeholders will ultimately be more costly to individual firms than the present production of paper annual and quarterly accounting reports. If the additional information increases market efficiency, firms will realize a long-run decreased cost of capital. Firms may, however, balk at making the significant current-dollar investments described in the preceding section without stronger assurances that these long-run cost savings will occur.

Data Use by Firms' Competitors

More information is almost always better for facilitating decisions (Hilton, 1985). The choice of what to disclose is not so straightforward for external reporting. As Demski (1973) noted, firms may have a significant incentive to limit the extent and nature of information disclosures to external consumers of financial information. The firm cannot move all interested third parties to a higher Pareto-optimum because the interested third parties may have conflicting utilities for additional information. For example, the firm's investors may become directly better off if they receive additional information about the firm. However, if that same information becomes available to the firm's competitors, government

regulators, or labor unions, the investors may become indirectly worse off because private firm information becomes public and reduces the value of the firm (Pacula and Schneider, 1996).

Selective Access: A Solution?

The level of access provided by events-based accounting databases combined with the world-wide connectivity of the Internet could revolutionize financial reporting. As the Internet becomes enabled with such features as the graphic user interface of the Web (Berners-Lee, et al., 1994) and increasingly sophisticated applications such as Java (Sun, 1996) permit the integration of relational database management products, the degree of access available on-line will increase tremendously. As relational database management products become more sophisticated (Stamen, 1993), provision of open access to large databases becomes realizable.

Large databases, often called data warehouses (Cafasso, 1995; Celko, 1995; Fairhead, 1995; Strehlo, 1996) have become increasingly common in larger firms. Firms use these large databases as resources to maintain their competitive edge (Atre and Storer, 1995) by finding new relationships in existing data that they formerly kept in separate databases. This process is called data mining (Grupe and Owrang, 1995; Hedberg, 1995; Watterson, 1995). More sophisticated tools for data mining and analysis are appearing regularly, including on-line analytical processing (OLAP) and multi-dimensional analysis products (Callaway, 1995; Mitchell, 1995; Ricciuti, 1994). These tools, combined with graphical user interface enhancements described in the preceding paragraph, provide bases for the development of Internet gateways. Such gateways could give external users access to large, firm-maintained, warehouses of information about economic events.

Each firm will need to develop security guidelines to prevent third parties from using these analytic tools to access sensitive information or to combine information in separate records of economic events to assess or estimate sensitive information. By providing selective access to large databases of economic events, firms can provide financial information consumers with less aggregated, more timely, and more customized sets of information on demand. Until firms develop in-process audit and control software, external accesses should be closely monitored on an individual basis to ensure that no external party obtains sensitive information.

Summary and Conclusions

Publicly-held firms communicate the results of their operations to stockholders, creditors, and other stakeholders outside the firm by issuing financial statements. The existence of multiple acceptable, yet not reconcilable, accounting procedures causes these financial statements to be inefficient and ineffective communication devices. Therefore, investors and financial analysts must obtain information from sources other than a firm's financial statements.

Events approaches to accounting that use relational databases are becoming prevalent in larger firms. These approaches identify semantic accounting phenomena of one sort or another and make these semantic primitives available to accounting information users in various ways. This paper examined how current advances in inter-entity networking—the Internet—and database storage and analysis software—data warehousing, OLAP, and data mining—could ultimately provide substitutes for periodic paper-based financial statements.

Finally, the paper noted some concerns about auditing and controlling third-party access to firms' databases to prevent extraction of sensitive information. The time for financial disclosures on the Internet that replace traditional financial statements is not here yet, but it is getting close.

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