

Flow Parameters and Quality in Accounting Information Systems

Akhilesh Chandra, North Carolina A&T State University. chandraa@ncat.edu

Ravi Krovi, North Carolina A&T State University. krovir@ncat.edu

Balaji Rajagopalan, Illinois State University. brajag@odin.cmp.ilstu.edu

Abstract

This paper develops a conceptual framework that depicts how the parameters of information flow affect its quality. The framework provides a theoretical basis to simulate the effect of flow related parametric changes on the qualitative features of accounting information. The flow parameters are defined and derived based on measures used in the analysis of fluid flows. The qualitative features of accounting information are based on usefulness considerations as defined by the Financial Accounting Standards Board (FASB). Unlike other organizational systems, accounting information systems have a wider range of internal (such as inventory cost reports) as well as external (such as documentation of organization's financial health) reporting requirements. This framework is an initial step towards a more precise assessment of quality in accounting information systems.

Introduction

In this paper, we propose a framework that utilizes principles of fluid dynamics to study accounting information flow. It predicts changes in qualitative characteristics of accounting information as it traverses its path in time and space through the organizational network. The sets of determinants proposed in this study are amenable to quantification. Such a possibility allows for the measurement of changes in relevance and reliability of accounting information in a statistically predictable manner; since neither the primary features nor their ingredients are quantifiable. In the absence of these determinants, providing relevant and reliable accounting information becomes a function of experience and judgment. This study derives its motivation from earlier attempts that alluded to the possibility of using fluid dynamics parameters to quantify FASB's guidelines (Chandra, Krovi, and Rajagopalan, 1993).

From the perspective of management, knowledge of factors that affect information quality assumes significance in efficiently and effectively providing decision support. The proposed *factors are expected to provide quantitative guidelines* about the qualitative features of information established by the FASB. For example, 'relevance' is a significant interesting

criterion of accounting information. However, it would be useful if the user has an objective process to measure relevance. Such measurement would minimize subjective evaluations of relevance across decision contexts. The development of an index or a quantitative parameter to uniformly interpret and measure relevance would facilitate a neutral but objective evaluation process that is independent of the variances of decision situations. Systems designers also need to take these factors into consideration to increase the decision usefulness of information for its users. For example, information quality is a function of time, level of management, and decision context. Knowledge of information flow characteristics involving these three factors either individually or interactively should help generate an effective systems design.

The paper proceeds along the following lines. The second section describes the nature of information in the context of FASB's qualitative features. This is followed by a discussion of the relationship between flow parameters and qualitative features in the next section. The paper concludes with a discussion and directions for future research.

Qualitative Features Of Information

FASB (1980) in its Conceptual Framework has established the relevance and reliability as primary qualitative features of accounting information. These features are subject to the cost-benefit and materiality constraints. The cost-benefit constraint evaluates the net value of providing information. Information with an expected benefit less than its cost of generating it for the user may be difficult to justify on a value-added criterion (except in cases where information is mandatorily required, for example, by law). The materiality constraint provides a benchmark to evaluate the relative significance of data. The significance is measured in relation to other data values. The materiality criteria might limit the processing of data that would otherwise result in a useful information. FASB also identified specific components that constitute each of the two decision specific qualities of accounting information. Timeliness, predictive value, and feedback value constitute relevance; whereas verifiability, neutrality, and representational faithfulness together provide reliability of information. The qualitative framework represents the decision-usefulness paradigm for external reporting. However, a closer analysis of the above properties reveals that essentially the same qualities are required for making internal decisions by the management at various levels in an organization. The generic nature of these qualitative features is the basis of their universal application to any decision-making situation. This generality makes the accounting information systems 'isomorphic' in nature, although their appearance may be

dissimilar in specific detail. The present study builds on the qualitative framework of CON2 in relating the dynamics of the information flow. Figure 1 adapted from the CON2, briefly sketches a hierarchical framework of the following qualitative features of accounting information.

Relevance : The capacity of information to make a difference in a decision by helping users to form predictions about the outcomes of past, present and future events or to confirm or correct prior expectations.

Reliability : The quality of information that assures that information is reasonably free from error and bias and faithfully represents what it purports to represent.

Timeliness: Having information available to a decision-maker before it loses its capacity to influence decisions.

Verifiability : The ability through consensus among measures to ensure that information represents what it purports to represent or that the chosen method of measurement has been used without error or bias.

Neutrality : Absence in reported information of bias intended to attain a predetermined result or to induce a particular mode of behavior.

Predictive Value: The quality of information that helps users to increase the likelihood of correctly forecasting the outcome of past or present events.

Feedback Value: The quality of information that enables users to confirm or correct prior expectations.

Representational Faithfulness: Correspondence of agreement between a measure or description and the phenomenon that it purports to represent.

Flow Parameters and Qualitative Features

Fluid dynamics studies the position of fluid particles on a longitudinal basis (Batchelor, 1967). The dynamic behavior of fluids is best understood using the following analogy drawn from every day life:

The velocity and force of water in a faucet are different in water pipes from that in the head of a shower. The properties of water change as it passes through pipe bends, shower mouths, and through pores. Changing the nature and design of pipes, shower mouth, and spores, and the traversal path of water systematically influences its properties. Such change helps in generating the desired volume and force of water through the shower. In short, knowledge of the fluid flow dynamics is an essential pre-requisite to systematically alter its properties.

Any change in the position of a fluid particle with a consequent change in the values of other dimensions such as mass, length, and temperature provides useful information to explain and predict the properties of fluid over time. The properties of fluid flow relevant to this study are velocity, type of flow, and viscosity. These properties are discussed within the context of an accounting information system in the following paragraphs.

1. Velocity of Information:

The traversal speed of accounting information affects its qualitative characteristics. Managers frequently communicate organizational policies, rules and regulations to employees. Such communication takes place through either general memorandums affecting organization wide work force, or specific reports aimed for an individual or group of them in a division. Information transfer from managers to employees containing organizational directives is often uni-directional in nature.

Accounting information can traverse through three channels: formal, informal, and horizontal. However, in the view of the supporting nature of the accounting function, the formal channel is expected to carry the dominant information load. Most of the accounting related information along the informal channel is expected to be in response to managerial communications through the formal hierarchy.

The impact of a change stimulus on the organization starts information flow. The source of stimulus can be either external or internal to the organization. Thus, the velocity of information flow would be determined by the nature of the change stimulus and its processing by the organization according to perceptions held by its agents. Examples of internal change stimulus include cost related reports of activities/products, performance reports on segments, budget compilations, and variance reports. External change stimulus stems from various interest groups, which include government agencies, stockholders, and financial institutions. These interest groups demand information relating to earnings, dividend policy, income/cash flow position, changes in accounting methods, and future plans.

2. Type of Information Flow:

The type of information flow is defined as either smooth or turbulent. A smooth flow results when there is minimum variance between the expected and actual uncertainty in information. Alternately, the turbulent nature of information flow is characterized by a large

variance between the actual and expected uncertainty levels. The degree of variance is a relative number, and is a function of contextual factors, which may include time, decision dynamics, and nature of segmental and/or firm operations.

If accounting information system suitably adapts to the changing external environment, then the variance in the actual cash flows and the expected cash flows should be minimal. Lower variance would imply a smooth flow of information. Alternately, the information flow will be characterized as turbulent in nature. A laminar (turbulent) flow of information should be accompanied with equal (unequal) variance between sales and purchase (and production).

3. Viscosity of Information:

Fluids are composed of molecules that are continually interacting with each other. Similarly decision maker knowledge or information can be said to be comprised of knowledge elements called *infocules*. A computational analogy for an infocule is a <condition>-<action> pair in an expert system. These infocules may be affected by changes in data, changes in the flow, changes in the environment, as well as by other infocules. For example, since cash is an idle asset, there is a trade-off between holding no-cash versus excess cash. A zero cash balance may potentially lead to bankruptcy. Conversely, a cash balance that is more than the needs of a business indicates sub-optimal utilization of its liquid assets. This example has two infocules:

- (1) Holding no cash causes bankruptcy, and
- (2) Holding excess cash is an under-utilization of cash.

Each of these infocules can also be used independently in any decision context. Information viscosity is affected by the interaction of such infocules. The resulting friction between two infocules is the source of resistance to any attempt to adapt them to a decision making task. In the previous example, the two infocules (viz., 'holding no cash' versus 'holding excess cash') are conflicting pieces of information. This property of inherent conflict between infocules makes it less *flexible* for the decision-maker. Hence, infocules may either contradict or support each other. Two infocules contradicting each other reduce the flexibility to make a decision. Reduced flexibility increases the viscosity of information flow making it less possible to change its character. For example, the infocules in the previous example are contradictory which makes it difficult to decide about the optimum level of cash holdings. Alternately, infocules supporting each other reduce the viscosity of information flow by enhancing the flexibility to make decision.

Discussion

The quality of information system is a function of the precision and reliability of the data and process. Yet planning activities inherently feed on an element of uncertainty regardless of the precision of the data-mining tool. The uncertainty adversely affects the predictive value thereby impairing relevance compared to a situation where uncertainty is close to being negligible. The presence of uncertainty prevents a smooth flow of information and dilutes a complete verification of facts thereby affecting reliability. The turbulent nature of information and a greater chance of variation in facts cause information to lose relevance and reliability. A reduction in relevance and reliability together impairs information quality.

There have been other studies which have addressed the issue of quality assessment in the accounting domain (Chen et al., 1997; Kaplan et al., 1998). For example, Kaplan et al. (1998) used a decision support systems approach that combines a set covering model with auditor heuristic judgements to assess data quality. Our study takes a different view of the problem of quality assessment in accounting information systems. Specifically our focus is at the information and knowledge level to assess data quality. The advantage of our approach is that it relies on widely accepted guidelines set by FASB. As pointed out earlier, the proposed framework relating flow parameters and information quality is just an initial step towards more precise quality metrics. We have also outlined a rudimentary approach to quantifying flow parameters. Clearly, the model requires further testing and validation. Survey based ratings of the qualitative features by information consumers in real world settings can be used to test the posited relationships in the model. Carley (1996) used computer simulations to mimic and explore various aspects of organizational behavior. By using distributions (empirical or assumed) which relate flow parameters to the qualitative features, we also plan on developing a computational model of information flow. The computer model for example could then be used to understand the conditions (such as organizational hierarchy, information content type, time horizon etc.) which might lead to poor quality information. This is similar to the approach of Ballou et al. (1998) who simulated an information manufacturing system and tracked various parameters to measure timeliness, cost, and quality. The dynamics of information flow also form an important link towards understanding how organizational actors interact and use information for making decisions. The identification of variables and relationships affecting information quality is an ideal starting point for implementing such a computational model of information flow between organizational actors.

Conclusions

Accounting information systems play a crucial role in organizational processes. In light of their internal and external reporting requirements, adequate controls should be in place to ensure that the data and information which are processed by these systems are of a high quality. However, quality is a relative term due to varying perceptions of what exactly constitutes an important construct. This problem is particularly evident given FASB's conceptual framework of different qualitative features. The foregoing discussion in the previous sections has brought to light the determinants of these qualitative features. A better understanding of the accounting information life cycle is a prerequisite for organizations to successfully implement quality programs and tools. In this paper, we have developed a framework which illustrates how information flow parameters affect quality. Future research will focus on model testing and validation.

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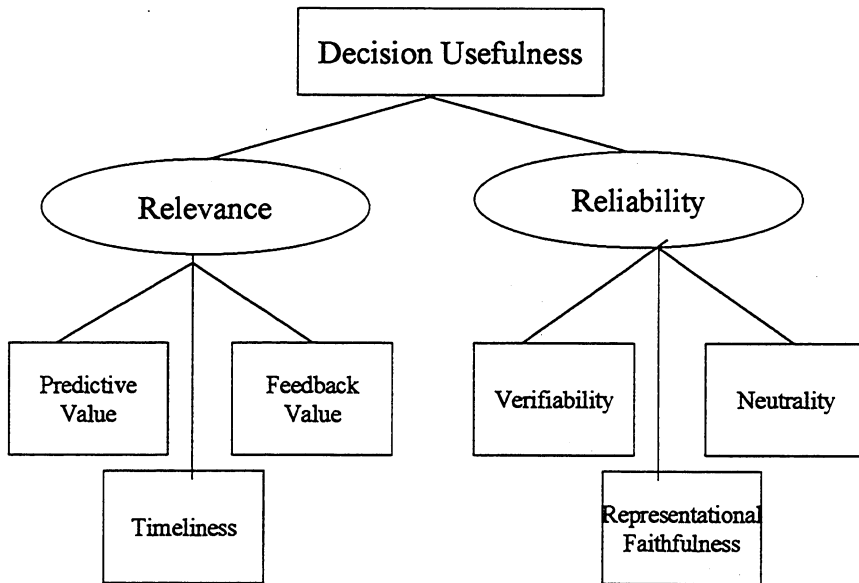


Figure 1: Qualitative features of Information
Source: Adapted from FASB Concept Statement 2