Computing, Information Systems, Development Informatics & Allied Research Journal
ISBN 978-2257-44-7(Print) ISSN 2167-1710 (online)
Vol. 4. No. 2, 2013 – www.cisdijournal.net

QUANTITATIVE AND FINANCIAL MEASUREMENT OF THE VALUE OF INFORMATION

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ABSTRACT
The growing awareness of information cannot be overemphasized; nevertheless, there is the question of how to evaluate the value of information. This paper is a theoretical framework which determines the quality of information content with respect to financial and quantitative valuation. The framework identified information as one of the most important asset of an organization. The paper also equates the value of information to the damage that envisaged if such information is not applied. More so, the value information can also be determined by the individual using the information. This research also clarified the concept of information as misunderstood and finally the measures of the value of information can be truly determined based on the purposes of the information.

Keywords: Information, organizational asset, market value, Value of Information (VOI).

1. INTRODUCTION

Information is increasingly being recognized as one of an organisation's most valuable assets. However so far it has resisted quantitative measurement. While it consumes vast and ever increasing quantities of organizational resources in its capture, storage and processing, it typically receives no financial recognition on the balance sheet. There currently exists no consensus on how to measure the value of information. In practice, information has a *notional* value only: people think it is valuable but they can't put a number on it. Almost all the literature on the financial valuation of information systems has focused on the technology rather than the information content. Recently, there has been considerable interest in measuring of the *quality* of information (Wang and Strong, 1996), but this has not addressed the issue of financial/quantitative valuation. However there are some methods of valuing information assets, which is both practical to apply and consistent with some accepted accounting principles to measure quantitative value of information.

2. RELATED LITERATURES

2.1 The concept of Information

Information is a sequence of symbols that can be interpreted as a message, recorded as signs, or transmitted as signals. Information is any kind of event that affects the state of a dynamic system. Conceptually, information is the message (utterance or expression) being conveyed. The meaning of this concept varies in different contexts, Luciano (2010). Moreover, the concept of information is closely related to notions of constraint, communication, control, data, form, instruction, knowledge, meaning, understanding, mental stimuli, pattern, perception, representation, and entropy.
Information is increasingly being recognized as a key economic resource and as one of an organisation's most important assets. According to Drucker (1992), one of the most influential authors in the management field "From being organized around the flow of things and the flow of money, the economy is being organized around the flow of information" Despite gaining recognition as an asset in its own right, information has so far resisted quantitative measurement. While it consumes vast and ever increasing quantities of organizational resources in terms of data capture, storage, processing and maintenance, it typically receives no financial recognition on the balance sheet.

While hardware and (rarely) software assets are capitalized, the valuation of information has been largely ignored, even though this is a much more valuable asset from a business viewpoint .Information is recognized as a key resource in the society which makes societal change and improvement possible (Bentley,1981). Turner, (1988) also recognized information as the life-blood of the corporate being, as no organization can operate without any type of information system. Goodyear (1981) tersely defined information as anything which increases the recipients' knowledge.

2.2 Value of Information

Value Of information (VOI) is essentially an outcome of choice in uncertain situations. Individuals may be willing to pay for information depending on how uncertain they are, and on what is at stake. They may be willing to pay for additional information, or improved information, as long as the expected gain exceeds the cost of the information—inclusive of the distilling and processing of the information to render it useful.

VOI depends on the mean and spread of uncertainty surrounding the decision in question. VOI can be measured based on a given quality of information, or it can be measured based on how its value changes within different attributes of information—for instance, greater frequency of collection or improved accuracy. In cases where VOI pertains to nonmarket goods and services, output measures are also used. For instance, in the case of human health or safety, the "output" measure is typically expressed in terms of the value of a statistical life (a measure routinely used by government safety and health regulators). In cases where the information pertains to the environment, the "output" is often expressed in terms of measures of the value of environmental quality or the value of avoided damages due to actions that may be taken in light of the information.

Values are also dependent on the individual who is using the information. A decision maker usually has subjective probabilities about the quality of the information and will make use of additional information to "update" his prior beliefs. This influence on VOI is the widely accepted applicability of Bayesian probabilities to characterize how individuals perform this updating.

More specifically, the general conclusions from models of information are that its value largely depends on several factors:
1. How uncertain decision makers are;
2. What is at stake as an outcome of their decisions;
3. How much it will cost to use the information to make decisions; and
4. What is the price of the next-best substitute for the information.

2.3 Information as a misunderstood Asset.

Information is commonly referred to in the academic and popular literature as an "asset". But is it really? Some essential characteristics of an asset are (Godfrey et al, 1997; Henderson and Peirson, 1998):

1. Has service potential or future economic benefits: something is only an asset from an accounting viewpoint if it is expected to provide future services or economic benefits. The benefits may arise from either the use or sale of the assets. Information satisfies this requirement, because it provides the capability to deliver services and to make effective decisions.

2. Is controlled by the organisation: "control": In this sense means the capacity of the organisation to benefit from the asset and to deny or regulate the access of others to that benefit. Information also satisfies this requirement, if an organisation has information, it alone has access to it unless it sells or gives access to another party.

3. Is the result of past transactions: This means that control over the asset has already been obtained as a result of past transactions such as purchases, internal development or discovery. Information also satisfies this requirement. Information is usually collected as the by-product of transactions which have occurred (internal development), or may be the result of a purchase (e.g. a proprietary mailing database) or discovery (e.g. through analysis of data). Information satisfies the definition of an asset much better than employees or customers, which are also commonly referred to in the literature as assets. Employees and customers result in service potential and future economic benefits, but are not *owned* by the company if employees were to resign or customers to change suppliers, the company would lose the benefits without compensation (Henderson and Peirson, 1998). Information is a non-physical or *intangible* asset. However it is the service potential and economic benefits, not the physical form of an object, which is relevant in assessing whether an asset exists (Henderson and Peirson, 1998).

2.4 Valuation of information as an Asset
2.4.1 Accounting Valuation Models

If we consider information to be an asset, it makes sense that it should be valued using the same methods used to value other assets. According to accounting theory, the value of an asset may come from two sources:
1. Use of the asset
2. Sale of the asset

Where the benefits come from use of the asset, it is said to have "value in use", and where the benefits come from sale, the asset is said to have "value in exchange". In the case of information, benefits generally arise from *use* rather than exchange. In most cases, there are no "buyers" of the information, so its value in exchange is zero. There are three major asset valuation paradigms used in accounting theory (Godfrey et al, 1997), Cost (or Historical Cost), Market (or Current Cash

Equivalent) Utility (or Present Value) In this paper however, we will be looking at two Market (or Current Cash Equivalent) and Utility (or Present Value)

2.4.2 Market Value Of Information

The market value of information is the amount that other firms are prepared to pay for it. Using the internet, information is now being widely traded as a commodity. Information may be sold as a product or paid for on a usage basis. Market value is generally only applicable to a relatively small proportion of a firm's information. Information cannot be bought and sold in the same way as other assets and is usually only of value as part of a going concern therefore most information has no resale or liquidation value. The bulk of information in an organization is either:

Administrative: such information is generally of little interest to other external parties and is only of use for internal management purposes (e.g. budget figures)

Commercially sensitive: it is not in the firm's interest to sell the information for competitive reasons (e.g. sales information) **Confidential**: the firm is not allowed to sell or pass on the information for privacy reasons (e.g. personnel records or customer information). Interestingly, because information can be sold and still retained by the organization, it may have both market value and utility value, with its total value being the *sum* of these (for normal assets, the greater of the two is used). Also, the information can be sold over and over again without losing the asset (unless exclusive rights to the information are sold). In this respect, its selling price is modeled more accurately as a utility value the expected future cash flows as a result of sales of the information. For example, an Australian retailing firm sold their sales information to an information broker for $60 million per year. While this is a "market price" in that it represents what an external party is prepared to pay for it, it fits the utility model better because it generates future cash flows rather than a once off payment. Because information is not appropriable, the market value model does not apply except in special cases of intellectual property (eg. a patent), where exclusive rights to use an information product are sold.

2.4.3 Utility Value Of Information

The utility value of information is measured by the benefits that can be derived from it, in terms of future cash flows. A large electronics organization in the United States used this method to value their customer transaction information in one product line at $25 million (Glazer, 1993). This was done using managerial judgment to estimate the increased revenues or reduced costs to the organization as a result of having the information. A decision calculus methodology was used to assist managers in arriving at the estimate, using an iterative series of questions and responses. Theoretically, this is the best indicator of the value of information because it takes into account how the information is used. However the major weakness of this method is that estimates of the future benefits which can be obtained from information are highly subjective and time consuming to collect. It is difficult, if not impossible, to isolate the contribution of information to revenues or products. Information acts as a catalyst rather than a direct source of revenue. Its value lies in making better decisions, speeding the movement of goods and services through the economy and gaining competitive advantage.

The utility valuation method is theoretically the best valuation approach in terms of validity but is impractical to apply in practice, because of the cost of applying it and the subjective nature of the results (reliability). Market value is only applicable in a very small minority of cases where information is sold as a product in its own right. However when information is sold as a product, it fits better into the utility model because of the fact that it can be sold over and over again, without losing its value-in-use. The most workable approach seems to be the historical cost method (as it is for normal assets), because of its reliability, ease of collection and general applicability it is applicable to *all* information. However the standard historical cost method needs to be adapted to reflect the unique characteristics of information. Use of the method "as is" would lead to undesirable results, because it does not incorporate any concept of *use* for example, information that is never used will be valued the same as information that is highly used, given the same cost of collection.

3. APPLICATIONS OF THE METHOD

While it is important to address the question of "how" to measure the value of information, it is also important to address the question of "why", or relevance. That is, how can measures of the value of information be used in practice? Otherwise, measuring the value of information will remain nothing but an interesting theoretical exercise of little relevance to practice. In an applied discipline like computer science and information systems in general, it is not enough for a method to be theoretically sound; it also has to be *useful*. We believe measures of the value of information may be useful for the following purposes:

1. **Awareness of the value of information as an organizational asset**: any resource whose value is not quantified will generally not be valued as highly as those that are. Information does not appear on the balance sheet, and as a consequence it is undervalued compared to other assets. As a result, comparatively little attention is given to its management in comparison to even modest physical assets.

2. **Improving accountability**: Measuring the value of information using the modified historical cost method described in this paper will give organizations a more accurate idea of how much information is costing them, and what value they are getting out of these investments. In most organizations, there are enormous hidden costs in collecting, storing, analyzing and maintaining information which are never quantified. Management can analyze this expenditure and ensure that resources are being used in the most cost-effective manner. This will help increase accountability and reduce waste (e.g. through collection of redundant or unused data).

3. **Measuring IT effectiveness**: Information valuation provides a better approach to measuring IT effectiveness, because it measures the value of the product (information) rather than the production equipment (systems and technology). It directly measures the information "bottom line" the value created by IT in terms of information delivered to users. This should be used as the primary basis for developing IT strategies and evaluating proposed IT initiatives. Cost-justification of Executive Information Systems (EIS), Decision Support Systems, Management Information Systems (MIS) and Data Warehouses: There are major difficulties in cost-justifying such projects because they do not conform to the traditional cost displacement model of systems development that applies in operational systems. An information valuation paradigm is much more appropriate for such systems.

4. CONCLUSION

The valuation of information is an issue which has been almost totally ignored both in research and practice, but one which could have huge implications for the industry in the future. Information currently consumes huge but unreported amounts of resources in the economy. The percentage of an organization's resources devoted to information handling is growing exponentially, but typically receives no recognition in financial statements. One problem is that there is currently no generally accepted approach to measuring the value of information. A major barrier to developing a suitable approach has been that the nature of information as an economic good is not well understood. Information does obey the same economic laws as other assets, making it difficult to apply traditional valuation methods.

Another problem is that there are significant barriers in practice to the measurement of information. The cost of cash and taxation laws together conspire against the recognition of information as an asset. It is far more advantageous for organizations to write off the costs of information as an expense in the current accounting period than to capitalize them over its useful lifetime. For this reason, realistically speaking, it is unlikely that information will appear as a balance sheet item in the foreseeable future. However as a first step, we would like to see information assets included as an off balance sheet item, and used for internal management purposes. This would help to address the problem of accountability in information management activities.

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