

# Measuring The Value Of Information: An Asset Valuation Approach<sup>1</sup>

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**Abstract.** Information is increasingly being recognised as one of the firm's most valuable assets. However so far it has resisted quantitative measurement. While it consumes vast and ever increasing quantities of organisational resources in its capture, storage and processing, it typically receives no financial recognition on the balance sheet. The objective of this paper is to develop an approach to valuing information which is both practical to apply and consistent with accepted accounting principles. It begins by examining the nature of information as an asset, and defines a number of "laws" that govern its behaviour as an economic good. It then looks at alternative asset valuation models from accounting theory and how they may be applied to measure the value of information. Finally, an approach is proposed which adapts existing asset valuation methods to reflect the unique characteristics of information as an asset. Measures of the value of information may be used to measure IT effectiveness, increase organisational awareness of the value of information, guide IT strategic planning and cost-justify DSS/EIS developments.

## 1. INTRODUCTION

*“When you can measure what you are speaking about and express it in numbers, you know something about it, but when you cannot measure it your knowledge is of a meagre and unsatisfactory kind”*

— Lord Kelvin

## Information: A Strategic Business Asset

There are a number of well-publicised cases of organisations who have used information technology (IT) to transform their business and achieve significant competitive advantage. At the same time, empirical studies carried out in a wide range of industrial contexts have shown little, if any, positive relationship between IT investment and overall financial performance of the firm (Markus and Robey, 1988; Roach, 1989; Weill, 1990).

In many cases, investment in IT has actually been found to have a *negative* impact on the firm's performance. A recent Australian study examined four banks of a similar size who

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spent several years developing systems to support their core business (Broadbent and Weill, 1993). The amounts spent doing this differed by a factor of five. At the end of this, only one gained a competitive advantage— the one that spent the smallest amount.

What is different about organisations that successfully use IT for competitive advantage, that they can achieve so much more than their competitors while spending much less? A recent study found that the common factor in these companies is that they focus on the *information* itself rather than the technology as the basis for achieving competitive advantage (Glazer, 1991; 1993). In the Australian study cited above, the factor that gave the successful bank the edge was integrating their customer information together. Technology is only the means of delivering information— information is the underlying asset that can be used to gain strategic advantage.

## A Valuable but Unvalued Asset

Information is increasingly being recognised as a key economic resource and as one of the firm's most important assets. According to Peter Drucker (1992), one of the most influential authors in the management field

“From being organised around the flow of things and the flow of money, the economy is being organised 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 organisational 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 capitalised, the valuation of information has been largely ignored, even though this is a much more valuable asset from a business viewpoint.

Hardware and software are merely mechanisms used to create and maintain information— information is the underlying business asset that is produced and maintained by this technology. Information provides the capability to deliver services, make better decisions, improve performance, achieve competitive advantage and can also be sold directly as a product in its own right. Using a manufacturing analogy:

- Data is the raw material
- Software and hardware are the plant and equipment
- Information is the end product that is delivered to the customer.

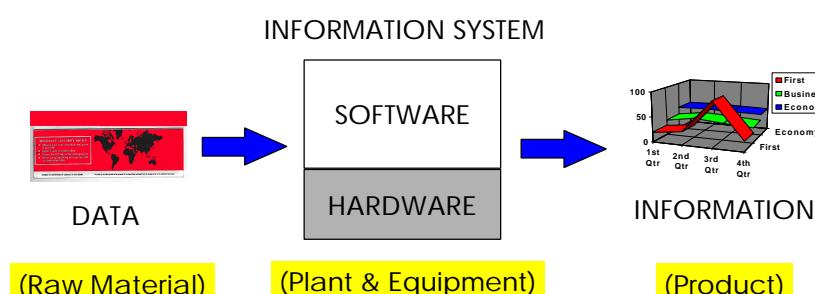


Figure 1. The Information Production Process

The overwhelming component of both the cost and value of an information system resides in the information stored rather than the hardware and software used to store it. To take an

example, a customer information system in one organisation required \$500,000 worth of hardware to operate (calculated as a proportion of usage). The in-house developed software cost \$2 million to develop. However every year, over ten million dollars was spent entering customer information and keeping it up to date—these costs were hidden in the salary budgets of user departments.

To be most effective, IT strategies should be focused on enhancing and sustaining the value of information (the product) rather than on systems and technology (the production equipment). Business strategies are generally evaluated in terms of how they contribute to the value or profitability of the firm—the “bottom line”. Similarly, IT strategies should be evaluated in terms of how they contribute to the information “bottom line”—the value of information delivered to users. To do this, we need some way of measuring the value of information.

## Objectives of this Paper

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 valuation. The objective of this paper is to develop a method of valuing information assets, which is both practical to apply and consistent with accepted accounting principles.

## 2. THE NATURE OF INFORMATION AS AN ASSET

### Is Information an Asset?

Information is commonly referred to in the academic and popular literature as an “asset”. But is it really? The 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).

## The Seven “Laws” of Information

Like other organisational assets, information has a cost (how much it costs to acquire, store and maintain it) and a value (how much it is worth to the organisation). However this is where the similarity ends. Information does not obey the same laws of economics that other assets do—it has some unique properties which must be understood in order to be able to measure its value (Glazer, 1993). We have attempted to define the nature of information as an asset by identifying a number of general principles or “laws” which govern its behaviour as an economic good.

### First Law: Information Is (Infinitely) Shareable

Perhaps the most unique characteristic of information as an asset is that it can be shared between any number of people, business areas and organisations without consequent loss of value to each party (see Figure 2). The World Wide Web perhaps provides the ultimate example of how the same information can be shared by a virtually unlimited number of people. This is quite different to how other assets behave. Most assets are *appropriable*—either you have it or I have it. In the case of information, we can both have it (Glazer, 1993). For example, sharing finances, equipment or staff between business areas results in each business area receiving some proportion of the total value of the assets. In contrast, information can be shared by multiple business areas with the same value to each party as if they had exclusive use of the information. From the firm’s perspective, value is therefore *cumulative* rather than apportioned across different users.

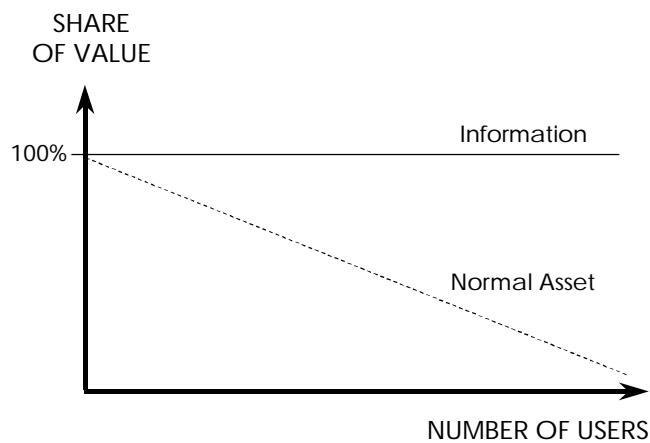


Figure 2. Shareability of Information

As an example, if one department in an organisation maintains a currency rate table, this information can be shared with another department without increasing the cost or reducing the value of the information to the first department. The alternative to this would be making decisions without the required information (with consequent loss of business

effectiveness) or the second department maintaining its own currency rate table (with consequent increase in costs).

In general, sharing of information tends to *multiply* its value—the more people who use it, the more economic benefits can be extracted from it. A major problem in practice is that there are barriers, both institutional and personal, to sharing of information. “Knowledge is power”, and as a result, people do not share information easily (Davenport, 1994). *Information hoarding*—where people deny others access to information—represents a loss of business opportunity, because it prevents the potential value of information being realised.

Unfortunately, not only can information be shared, but it can also be infinitely *replicated*—this is the result of not sharing information. Unfortunately, duplicating information does not double its value—two copies have the same value as a single copy because no “new” information is created. Duplication leads to no additional value, only additional costs. Costs of redundant data include: costs of re-keying data into multiple systems, storage costs, additional systems development effort, interfaces to keep data consistent and manual reconciliation effort (Moody and Simsion, 1995). Empirical studies show that in medium to large organisations there is an average of ten copies of each item of corporate data (O’Brien and O’Brien, 1994). Clearly, the cost of maintaining such levels of redundancy would be enormous. The fact that it is allowed to happen in such an apparently uncontrolled manner reflects the lack of financial accountability in information management activities.

## Second Law: The Value of Information Increases With Use

Most resources exhibit *decreasing returns to use*—that is, they decrease in value the more they are used. For example, vehicles depreciate based on kilometres travelled, aircraft based on flight hours, plant and equipment based on hours in operation. However information actually increases in value the more it is used—that is, it exhibits *increasing returns to use*. The major cost of information is in its capture, storage and maintenance—the marginal costs of using it are almost negligible.

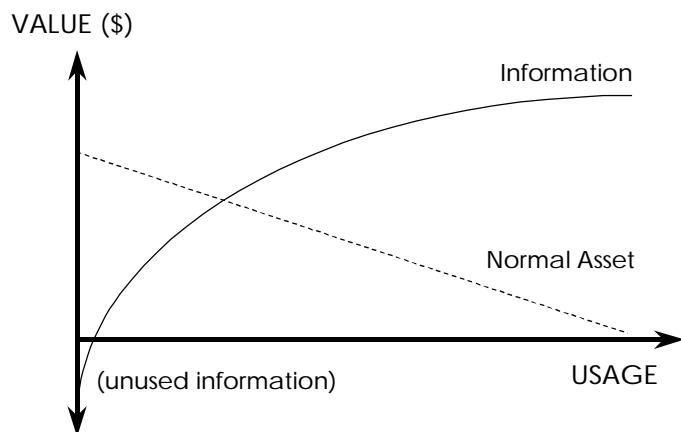


Figure 3. The value of information increases with use

Information has no real value on its own—it only becomes valuable when people *use* it. From an accounting point of view, something can only be an asset if it provides future services or economic benefits. If information is not used, it cannot possibly result in economic benefits and is therefore not an asset. Unused information is really a *liability*, because no value is extracted from it, and the organisation incurs future costs of storage and

maintenance. In many organisations, there is a large amount of information that is collected and stored but never used—this represents waste.

The prerequisites for using information effectively are:

- knowing it exists
- knowing where it is located
- having access to it
- knowing how to use it

Information is at its highest “potential” when everyone in the organisation knows where it is, has access to it and knows how to use it. Information is at its lowest “potential” when people don’t even know it is there. In most organisations there is a huge amount of computer based information that could be used for business advantage. However the opportunities for using information are often not realised because people don’t know it exists. As obvious as it seems, few organisations have a catalogue of their information assets and where they are located—an information “asset register”. Clearly, such a situation would be intolerable for physical or financial assets. However information is not subject to the same audit requirements as other assets.

Another important issue is that of *information literacy*. It is often assumed that if information is provided to people that decision-making will automatically improve (Ackoff, 1964). However the quality of decision making depends on both the quality of information provided and the ability of decision-makers to interpret the information and use it to take appropriate action—information literacy. There is little point in improving the accuracy and timeliness of data if people don’t know how to use it effectively. Equal emphasis therefore needs to be placed on improving people’s information literacy skills as improving the quality of information itself.

### Third Law: Information is Perishable

Like most other assets, the value of information tends to depreciate over time. The speed at which it loses value depends on the type of information. For example, once a customer has changed their address, the old address may be of little or no importance. On the other hand, product sales figures may be relevant for years into the future. As shown in Figure 4, information effectively has three “lives”: an operational shelf life, a decision support shelf life and a statutory shelf life.

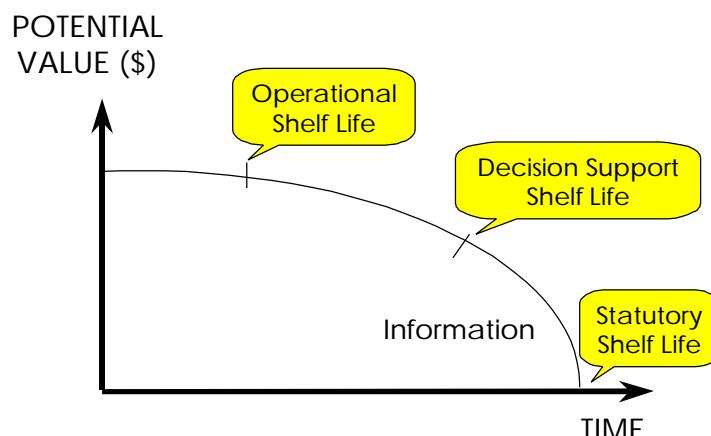


Figure 4. Depreciation of value over time

For example, airline tickets must be kept for a year for operational purposes because tickets are valid for one year after purchase (operational shelf life). However for decision-making purposes, ticket sales for the last five years may be relevant to help spot trends and patterns (decision support shelf life). Beyond this, there are legal requirements to keep records for ten years (statutory shelf life).

Information has a relatively short useful lifetime at the operational level. Usually, the only information of relevance is very recent information—a customer's current address or their last bill. It has a much longer lifetime for decision support purposes. In practice, operational systems often discard information once it has exceeded its operational shelf life, making it unavailable for subsequent decision-making purposes. Data warehousing provides a mechanism for storing historical information which has exceeded its operational life, and making it available for decision support and analysis (Inmon, 1992).

## Fourth Law: The Value of Information Increases With Accuracy

In general, the more accurate information is, the more useful and therefore valuable it is. Inaccurate information can be very costly to an organisation in terms of both operational errors and incorrect decision making (Wang and Strong, 1996). The level of accuracy required is highly dependent on the type of information and how it is used. For some information, 100% accuracy may be required (e.g. aircraft maintenance data or banking records), while for other information 80% may be good enough for practical purposes (e.g. employee home phone numbers).

As shown in Figure 5, there is a point of diminishing marginal returns, where increasing the accuracy further provides little additional benefit—100% accurate information is rarely required in a business context. Once the accuracy of information falls below a certain level, it becomes a liability rather than an asset. At this point, it becomes “misinformation” and people will stop using it.

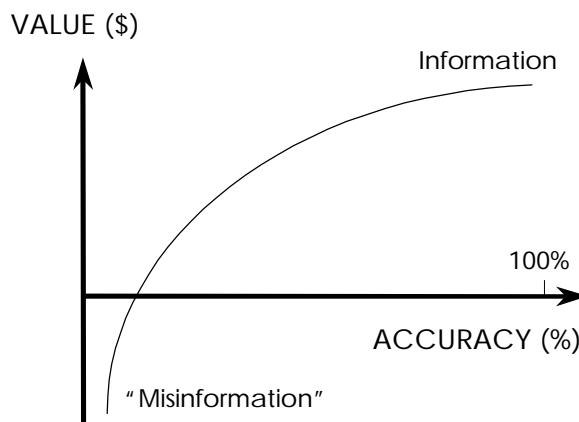


Figure 5. Value increases with accuracy

For decision making purposes, often just knowing the accuracy of information is as important as having accurate information. If decision-makers know how accurate (or inaccurate) the information they are working with is, they can incorporate a margin for error into their decisions (Haebich, 1996). However in practice, the accuracy of data is rarely measured—people rely instead on subjective opinions and anecdotal evidence.

## Fifth Law: The Value of Information Increases When Combined With Other Information

Information generally becomes more valuable when it can be compared and combined with other information. For example, customer information and sales information are each valuable information sources in their own right. However being able to relate the two sets of information together is infinitely more valuable from a business viewpoint. Being able to relate customer characteristics with buying patterns can help to target marketing efforts so that the right products are promoted to the right people at the right time.

Producing decision support information generally requires consolidating information from a wide range of different operational systems. In most organisations, the lack of integration of information in operational systems is a major impediment to producing decision support information. Data from different systems can often only be merged and consolidated with significant manual intervention, translation and discrepancy resolution (English, 1993). It is estimated that 80% of the effort in building EIS is in extracting and reconciling data from different sources and converting it to a common format (Inmon, 1992). Lack of data integration also causes problems at the operational level (Goodhue et al, 1992). For example, a customer may notify their local bank branch (where their savings account is held) of a change of address, but their credit card and home loan statements may still be sent to their old address.

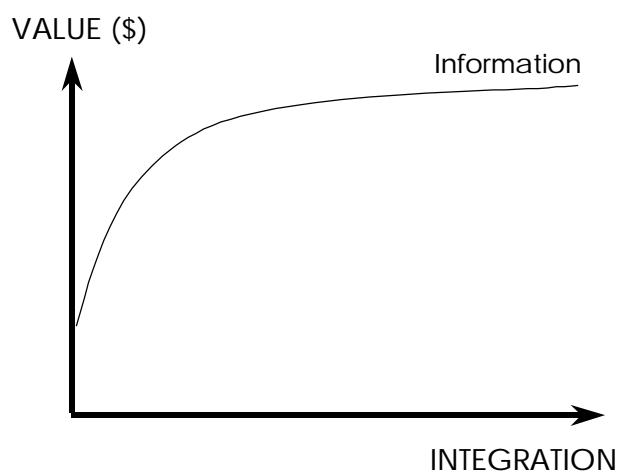


Figure 6. Value increases with integration

Most of the benefits of integration can be achieved by standardising a relatively small percentage of data. The most important data items for integration purposes are *identifiers* (to enable the linking of information from different sources about a single object together) and *coding schemes* (which are used as the basis for aggregating data for management reporting). Following the Pareto Principle (or “80/20 rule”), integrating 20% of the data generally leads to 80% of the benefits (as shown in Figure 6). Integrating beyond this point may have diminishing returns, and may actually be counterproductive (Goodhue et al, 1992). The dream of total integration as promoted by early data management advocates is neither realistic nor justified from a business viewpoint.

## Sixth Law: More Is Not Necessarily Better

In most cases, the more of a certain resource you have (e.g. finances), the better off you are. A common management problem is deciding how to allocate limited resources (e.g. people or finances) among a number of competing causes. However with the increasing use of information technology, information is anything but scarce. In fact, the biggest problem in most organisations today is not the lack of information but the overabundance of information. Psychological evidence shows that humans have a strictly limited capacity for processing information (Miller, 1956; Newell and Simon, 1972). When the amount of information exceeds these limits, *information overload* ensues and comprehension degrades rapidly (Lipowski, 1975). It has been found in practice that decision making performance decreases once the amount of information exceeds a certain optimal point (O'Reilly, 1980; Driver and Mock, 1975; Jacoby et al, 1974).

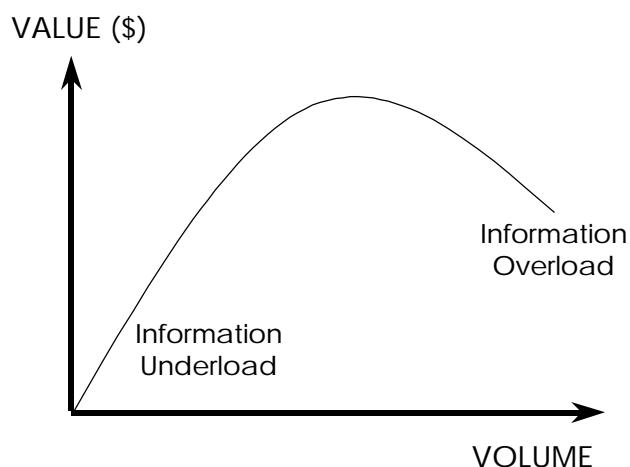


Figure 7. Volume vs Value of Information

However an interesting paradox exists here. The law of diminishing marginal utility (from economics) says that the more people have of a given commodity, the lower its value to them. However empirical studies show that the *perceived value of information* to decision makers continues to increase beyond the point of overload. Human decision-makers tend to seek more information than can be optimally processed. Although the excess information leads to reduced performance, it actually leads to increased confidence and satisfaction with the decision by the decision-maker (O'Reilly, 1980; Driver and Mock, 1975; Jacoby et al, 1974). The explanation for this is that people seek more information than can be efficiently processed in an effort to avoid mistakes and reduce uncertainty. This suggests that people believe that "more information is better" and are not aware of their own information processing limits.

## Seventh Law: Information is not Depletable

Most resources are depletable— the more you use, the less you have. However information is self-generating— the more you use it, the more you have (Glazer, 1993). This is because new or *derived* information is often created as a result of summarising, analysing or combining different information sources together. The original information remains and the derived information is added to the existing asset base. Fundamentally, this is why

information is not a scarce resource. Techniques like data mining are used specifically to generate new information from existing holdings of data.

## A Misunderstood Asset?

Of all the corporate resources (people, finances, assets, information), information is probably the least well managed. If most organisations managed their finances as badly as their information, they would probably be out of business. The amount of duplication, lack of standardisation and lack of attention to quality of information would probably not be tolerated for other assets. However one explanation for why information is so poorly managed is not well understood. For this reason, defining “laws of information” may provide the basis for improving the management of information. Laws of information need to be understood in order to manage information effectively, in the same way that it is necessary to understand laws of human behaviour to manage people effectively, or laws of economics to manage finances effectively.

## 3. ALTERNATIVE MEASUREMENT MODELS

In this section, here we look at some existing measurement models and their suitability for measuring the value of information.

### Communications Theory

The mathematical measure of information used in communications theory (Shannon and Weaver, 1949) has not proved to be a useful foundation for information measurement in practice, except in purely engineering contexts. The major limitation with this approach is that it focuses on the amount of information transmitted and ignores any consideration of content or meaning (Glazer, 1993). However the meaning of a piece of information is of principal concern to most business users of information and the major determinant of its value. The fact that a certain volume of data per second is transmitted over a certain distance says nothing about its value. As discussed earlier (Law 6), more information can actually lead to reduced effectiveness.

### 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:

- Use of the asset
- 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)

### Cost (Historical Cost)

Using this method, the asset is valued based on how much was originally paid to acquire the asset (purchase price or development cost). The rationale behind this is that cost approximates the value of the asset at the time of acquisition. The assumption is that a firm, behaving rationally, will only spend money to acquire an asset if it believes it will receive at least an equivalent amount in the future in service potential or economic benefits. This is the traditional cost accounting approach to valuing assets, and is still the most widely used method in practice. It has been the subject of much criticism (Ijiri, 1971), but no alternative model has gained sufficient support to replace it (Henderson and Peirson, 1998). The major advantage of the historical cost method is that it is the easiest to collect, and (arguably) the most reliable and objective. Its major weakness is that it may not reflect the current value of an asset. For example, a property may have been purchased at a given price, but its value may have increased or decreased dramatically since that time.

### Market (Current Cash Equivalent)

Using this method, an asset is valued based on how much other people or organisations are prepared to pay for it—this equates to *value in exchange*. For example, property can be valued based on its estimated selling price. The major strength of this method is that it gives a good indication of the current value of the asset. A growing number of accountants believe that market prices should be used instead of historical costs for all valuations—this is called *current cost accounting* (Chambers, 1966). Empirical evidence suggests that current cash equivalents are available for most assets, and that they can be determined with a reliability comparable to historical cost (McKeown, 1971; McDonald, 1968; Sterling and Radosevic, 1969). The weakness of this method is that it is more time-consuming and expensive than measuring historical cost (Henderson and Peirson, 1998). Related concepts to market price are *replacement cost* (the cost of replacing the asset by a new one), *current cost* (the cost of replacing the asset by a similarly used one) or *net realisable value* or NRV (which is the amount the asset could be sold for, less any costs of selling it).

### Utility (Present Value)

Using this method, the asset is valued based on the present value of expected future economic benefits—this equates to *value in use*. For example, property may be valued based on the discounted value of expected future rents. There is wide agreement that, conceptually, this is the best approximation to the true economic value of an asset (Godfrey et al, 1997). The major weakness of this method is the difficulty of determining the specific future cash flows related to the asset, which is often quite subjective and therefore of doubtful value to statement users. For most assets, there is great difficulty estimating future economic benefits; difficulties in converting these economic benefits to monetary equivalents which can be discounted; and there is the technical problem of choosing a discount rate (Henderson and Peirson, 1998). In practice, this method is primarily used for long term monetary assets (e.g. bonds, leases), where the future cash flows are specified by contract and can therefore be determined objectively. For non-monetary assets, it is virtually impossible to determine their future cash flows (Godfrey et al, 1997).

Figure 8 illustrates the differences between the asset valuation methods for valuing property assets.



- If information is collected at reduced cost—for example using automated data capture (ADC) or electronic data interchange (EDI) technology—is it worth less, even though it may be more accurate?
- Is more information always better (Law 6)?

## 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 organisation 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 organisation, 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 modelled 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.

## 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 organisation 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 judgement to estimate the increased revenues or reduced costs to the organisation 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 (Law 2). 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.

## Conclusion

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.

## Proposed Modifications to Historical Cost Valuation Method

We propose the following modifications to the historical cost method for valuing information, which incorporates the laws of information defined previously:

- Cost of collection should be used as the baseline for measurement of value for operational data. This should be standardised by using a standard data entry cost for each data item. If business areas are more efficient in capturing this information (e.g. using electronic data capture) or less efficient (e.g. using multiple step data collection), the value will be the same.
- Management information should be valued based on the cost of the processes used to extract the data from operational systems.
- Data which is collected redundantly should be considered to have zero value to avoid “double counting” (Law 1).
- Unused data should be considered to have zero value (Law 2)—this can be determined via data usage statistics.
- The number of users and number of accesses to the data should be used to multiply the value of the information (Law 2). When information is used for the first time, it will be valued at cost of collection. Each subsequent use will add to this value. This allows the historical cost of the information to be modified in the light of its use in practice, and reflects the cumulative nature of its value across different users.
- The value should be depreciated based on the “shelf life” of the information (Law 3).
- The value should be discounted by its accuracy relative to what is considered to be acceptable (Law 4). In practice, this would probably have to be done based on perceptions of accuracy, because of the cost of empirically measuring accuracy.

Using these modifications to the historical cost method, more incentive is given to making existing information available to more people and new uses rather than simply creating more information. Information that is not used will have a cost but no value. Valuation of information using this approach will help to highlight which information is most valuable (most highly used) and has the best return on investment (cost compared to value).

## 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 IT industry in the future. Information currently consumes huge but unreported amounts of resources in the economy. The percentage of an organisation'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 organisations to write off the costs of information as an expense in the current accounting period than to capitalise 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.

## 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 information systems, 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:

- Awareness of the value of information as an organisational 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.
- Improving accountability: Measuring the value of information using the modified historical cost method described in this paper will give organisations a more accurate idea of how much information is costing them, and what value they are getting out of these investments. In most organisations, there are enormous hidden costs in collecting, storing, analysing and maintaining information which are never quantified. Management can analyse 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).
- 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 in-

formation “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 (DSS), 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.

## Further Research

This paper has developed a number of principles for valuing information, but is far from providing a complete methodology for doing so. It represents an important first step towards developing an approach to measurement of information which is both theoretically sound and practical to apply. It is essential for ideas, principles and methods developed in a research environment to be tested in practice (Scott-Morton, 1984). The next step is to apply the method in practice and evaluate its usefulness. Not having done this, we cannot be sure whether it is useful or even *possible* to measure the value of information in a meaningful way. The method is currently being applied in a number of organisations as part of an ongoing action research programme. The experiences gained in practice will be used to validate and refine the method.

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