Application of an Automated Information System in a Logistics Company in Thailand: A Case Study

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This research describes an innovative automated information system for sharing precise information between Business to Business (B2B) users in the fashion retail business. It then applies this system (AIS) to improve the quality of information in the case study company. The case study company is a medium-sized logistics enterprise that transports several categories of fashion products domestically and internationally. A Cost-Benefit analysis was conducted on the quantity and quality of shared B2B information in the case study company, using the Analytic Network Process (ANP) model. The results support the usefulness of this automated information system as a method for sharing information. Recommendations for making most effective use of the method are presented as well as several of its limitations.

Introduction

It is generally agreed that Information--if it is properly developed and used--is one of the most powerful tools businesses have at their disposal. To make effective use of information—as a business tool--Automated Information Systems (AIS) are increasingly being employed to assist or help businesses share important information among themselves, to create and sustain an effective information environment. An AIS is a computerised system that controls all transactions between internal or external users of organisation via the internet or the intranet. The focus of such systems is on achieving the sharing of information among the participants in an efficient and effective manner. The present study examines the application of a specially-developed AIS in the fashion retail industry in Thailand. This is an industry in which the sharing of information plays a pivotal role. The fashion industry with its important logistics distribution aspects is one of the foundation industries in Thailand. It is an industry that has become even more important to the country stronger as a result of the recent devaluation of the currency, the large number of people employed in it and the sheer number of companies involved. At the heart of the industry is a complex logistic distribution system that can only function effectively if there is high level of shared information between the different components of the system. It is our view that such a system needs or requires a special Database Management System (DBMS) to cope with the problems of integration that are involved, and to make sure the various facilitators and or inhibitors work well together.

The objective of this research is to propose a way to improve Information Quality (IQ) in a logistics distribution firm in the industry, especially with regard to the processing of complex order requirements. The major hurdle in implementing a DBMS in this industry is how to achieve precise information exchanges through the DBMS so that

the final customers or users receive better service in the fashion retail business. The firm in this case is a medium-sized logistics distribution company within the Thai fashion industry. The firm used a manual system previously, but currently employs an Automated Information System within its distribution network. The costs of implementing and running AIS are 'manageable' once or provided the firm or business reaches a certain size, when the amount of information that needs to be dealt with reaches a certain volume and economies of scale start to work in its favour. The management of this firm realizes it must improve its use or employment of the AIS because of its high Information Quality (IQ) requirements, itself a consequence of the fact that different data users have different quality requirements, and what is acceptable quality for one user might not be so for another. In addition, data that is sufficiently accurate and speedy for local users may not be acceptable at another site. The cost of inaccurate or inadequate data for this business is thus potentially very serious. Problems with information quality, with slow and inaccurate sharing of information, can result in tangible and intangible damage, varying from the loss of confidence among customers to the actual loss of orders. This is underlined by the fact that several customers of the case company cancelled or reversed their orders because they found a lot of mismatched data between their DBMS and that of the company.

The quality of information

It is accepted by most researchers known that Information Quality (IQ) as an attribute, is binary (Rothenberg, 1995). Given this feature of information, we should not conclude that a set of information is (or is not) of high quality, but should rather evaluate the quality of information in the context of its use and the specific purpose the business has for it, be it for sharing or just for its own, as has been argued by Rothenberg and Kameny (1994). Only when this has been done, only when this sort of evaluation has taken place, should researchers 'feed back' their results to the business or firm concerned to try to improve the efficiency and effectiveness of its use of information.

The evaluation of how well a particular firm or business is using or employing information has two distinct aspects, one involving 'correctness' of the data objective and the other the 'appropriateness' of data for some specific purpose (Rothenberg and Kameny, 1994). Data users typically agree that the purpose of IQ assurance—the assessment of the quality of information shared or used by a firm or set of firms--is to find out whether or not a firm is providing the best data possible (Lee and Wang, 1993).The trouble is that if users obtain IQ assurance results that they believe indicates that the 'best possible' data is being used (Lee and Wang, 1993), this obscures the need to evaluate data; it suggests that there is no need for further investigation; if the information is the best available or as good as can be produced, then there is no reason why not to use it; there is certainly no point in worrying about how good it is. The flaw is that saying that the information is as good as can be produced does not inform us how good it is. This is why we need an independent second evaluation of IQ, even when the data is reported by one valuation to be as good as possible. This latter evaluation should examine several activities--aspects of IQ—simultaneously to ensure that the data are correct and appropriate for their specific purpose.

Management assessment of information quality

The management assessment of IQ—the processes that occur or take place—typically involves the application of Total Data Quality Management (TDQM) ideas or concepts to improve how databases are 'managed' in reality. In practice, TDQM integrates Total Quality Management (TQM) methods with functional management techniques, which it then applies to people, processes and technologies to improve products and/or services. The aim is not only to produce specific changes, but to create a continuous improvement process.

TDQM consists of four major processes which have been described within the Defence Information Systems Agency and then enhanced by the authors. The first step in the process is to establish the TDQM environment by designing and then implementing an appropriate management and infrastructure support system. The second step is to identify suitable information quality projects. The third step is to apply the chosen set of techniques and methods to these suitable IQ projects, to improve the quality of information that is involved in each. The final step is to perform a cost-and-benefits analysis of these applications, to see if the results that are produced or to which the lead exceed the costs in involved, in time, effort and money.

Benefits and costs analysis of IQ projects

One of the most crucial tasks in IQ improvement in the fashion retail business is to identify the specific benefits and costs which requires, in turn, that the basic or fundamental 'causes' of the IQ problems be uncovered first. In the present context the various benefits that are produced are more difficult to quantify than are the specific costs involved; in particular, the benefits of customer loyalty, and reputation improvement are hard to quantify. If several project alternatives are available, it is advisable to adopt a holistic decision making approach such as the Analytic Network Process (ANP). This is a multi-criteria decision making (MCDM) approach that is appropriate for complex situations (Kahraman et al. (2006), Buyukozkan and Feyzioglu (2005), Kengpol (2006), Kengpol and O'Brien (2001), Kengpol and Tuominen (2006). Alternatively, an Analytic Hierarchy Process (AHP) can be tried for simpler situations as advised by Kengpol and O'Brien (2000). Other decision making models are presented by Pandey and Kengpol (1995). More details and an application of ANP approach are discussed in connection with case study below.

Case study on information quality

Introduction to the problem at a logistics distribution firm in Thailand

The firm that constitutes the case study in this paper is a logistics distributor that transports several categories of fashion products for domestic and export markets. Currently, they use a Local Area Network (LAN) system to connect five departments information-ally, namely Sales and Marketing, Finance and Accounting, Operations, Human Resource, and Health and Safety. This firm has had a fully integrated system in the B2B environment for a year; however, frequently mismatched pieces or bits of information are sent from its Database Management System (DBMS) to other departments within the firm. This

problem has been addressed and the management of the firm is fully committed to implement an improvement of their IQ in their AIS. One example of problems is the frequently 'mismatching' of orders and specific requirements between the Sales and Marketing Department and the Operations Department which has nearly led to the loss of orders and to the imposition of penalty charges. Another example is of 'mismatched' information being shared between the Human Resource Department and the Finance and Accounting Department. In this case the information consisted of 'unauthorised data' information which should not have been seen by the Finance and Accounting Department, and was beyond what they had requested. It is our view that these problems suggest that the AIS in this company needs to be improved and that this can best be done through TDQM aimed at bringing about sustained B2B customer satisfaction.

The effective use of TDQM does not happen by accident, it is instead the result of long process of development often taking a few years. There are distinct patterns in the way in which TDQM was applied in this particular company, the case study of this paper. For on thing, whereas the senior management in this company should have initiated the process, in fact TDQM was first introduced to the company by a group of middle managers. Such appearance creates difficulties to the organisation's culture. According to the 'seniority culture' in Asian countries, senior management needs to be considerably convinced and persuaded of the benefit of something before it can be introduced and then preferably by them. Fortunately, in the present case senior management agreed, after the event, that TDQM and IQ should be able to enhance AIS operations within the firm, and since then their full commitment has been obtained. . As this is the first time something like this has been attempted by this firm, senior management decided that it should be done initially at least on a small scale. The project was therefore restricted to just task or activity, whose goal was to eliminate or at least minimise the extent 'mismatched' information between B2B's users of DBMS in the AIS. This is a critical hurdle the company needs to overcome if it wants to keep its creditability among its customers. In order to improve IQ two steps were followed. First, an IQ plan was developed and implemented to minimise the amount of mismatched data between users and DBMS in AIS. The objective of this project was to increase the accuracy and the consistency of data used in the AIS in order to enhance the reputation of the firm. The project involved relations—with respect to information sharing--between DBMS and five departments, namely Sales and Marketing, Finance and Accounting, Operations, Human Resource, and Health and Safety. The project aimed to both enhance the DBMS program and to minimize human error in the process. After the core set of data quality had been identified, the IQ team, which consists of a project manager, programmers and department representatives, developed an implementation plan and identified the main hurdles, which they then tried to overcome. The quality data and procedures that were developed are illustrated in Table 1. Because of the view of managers in the firm that Validity is the most important data attribute, it was added to the attributes--of the data--of Timeliness and of Operations, of operational appropriateness. The 'filter' procedures that were finally used were based on the accuracy, completeness, consistency and validity of the data analysis.

The main results of the study are given in Table 2. As can be seen in Table 1, from an operational point of view the 'filter process' did contribute to the success of the IQ implementation project. Several of the specially-developed processes did reduce the extent of the mismatched data in the AIS.

Table 1: Core set of data quality and developed procedures for the firm

Data Quality	Developed Procedures (Filter)	Conformance Measures
Accuracy Analysis	Computational verification data between sources and end users.	Percentage of values that are correct when compared with the actual value. For example, it frequently happens that, loading some data from a terminal, it shows mismatched data. In particular, obtained incorrect data bundle with the correct data.
Completeness Analysis	Computational verification between data.	Percentage of data fields having values entered into them. For example, downloading data from its DB to column for analysis, but some fields are missing or null.
Consistency Analysis	Computational verification flow between point to point comparison.	Percentage of matching values across tables/files/ records. This is the most concerned because the credit of its business can be damaged if the inconsistency is frequent when they are communicating with the customer.
Validity Analysis	Valid integration of values within data set.	Percentage of data available within a specified threshold time frame (e.g., days, hours, minutes, seconds). In this case, it means the original data are considered to be valid or not. If yes, for how many percent.

Table 2: Results, causes and solutions of the project

Result Occurred	Causes	Solutions for AIS
Mismatched Data	Input into a wrong field	Design program and procedure to element; design an authorisation level for the users.
	Input of incorrect data	Design program and procedure to eliminate such as selected for string, number or others.
	No data but considered to be presented	Design a Data Map program and procedure to explain a perspective view of data in Database.

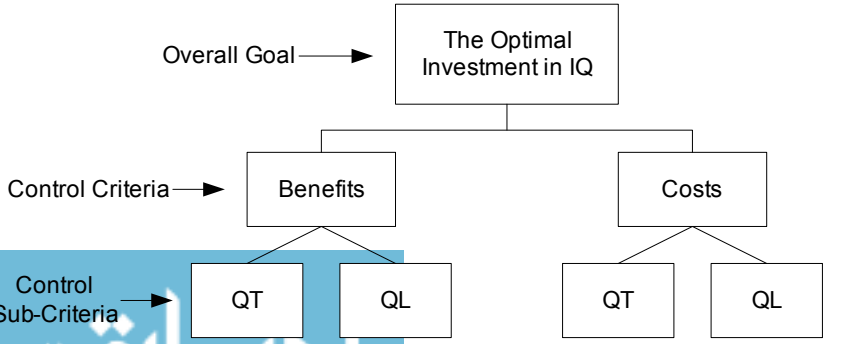
Benefits and costs of the programme

The results shown in Tables 1 and 2, makes it clear that in this case the main benefits of the programme exceeded the costs involved. The evaluation of risks is one of the most critical parts in the improvement review process, especially the risks of losing current customers and potential new customers who may move to other more reliable business partners. In evaluating which, if any, of the IQ improvement methods to choose, four distinct groups or clusters need to be considered as each can influence the decision process (Figure 1 and 2). There are different elements within each cluster or group here. These clusters and elements do not involve each or every criterion (Figure 3). The criteria chosen were based on a review of the existing literature, for example those by Kengpol and O'Brien (2001), Saaty (1996), Liberatore (1988) and on in-depth interviews with logistics distribution companies in Thailand. The scheme given below summarizes the main aspects of the ANP model.

1. Control Hierarchy in Feedback Network

As illustrated in Figure 1, the Control Hierarchy consists of the overall goal, the control criteria and the further control sub-criteria used for evaluation purposes. Quantitative Benefits (from investment in IQ) are given by the potential monetary gain from adopting IQ; e.g. savings of correction costs, energy savings, time savings etc. Qualitative Benefits are given by the knowledge and creative skills gained from the IQ technology, which include the problem-solving skills developed whilst learning. Quantitative Costs are defined in terms of money spent in the implementation of IQ, for example the costs of the programme itself, the staff training budget and other overhead budgets. Qualitative Costs can be thought of as the 'mental efforts' imposed on their staff. In this respect from the interviews there was a concern that the job efficiency of the previous staff chosen to work within an IT department may have fallen because of their need to learn and acquire skills in the implementation of IQ.

Figure 1: Control hierarchy (QT = Quantitative, QL = Qualitative)



2. Stakeholders

As illustrated in Figure 2, there are four clusters of stakeholders identified in this model. Each cluster can further divided into several elements.

(1) Cluster relationships and the ANP model

Figure 3 illustrates six cluster relationships which are associated with Control Hierarchy (Figure 1) and Cluster and Elements of Stakeholders (Figure 2). The relationships between clusters are represented by unidirectional or bi-directional arrows. The direction of each arrow indicates a direct influence between clusters. Inner dependence within a cluster may occur if the cluster is itself dynamically influenced by the control sub-criteria (such as the influence of the Financial Cluster on the Quantitative Benefits which comes from the savings budget, the budget spent on new IQ options). Each element in each cluster was subjected to pair-wise comparisons in this study. For the Control Hierarchy illustrated in Figure 1, we thus needed to generate more than a hundred matrixes-- from a total of more than 400 pair-wise comparisons-- to construct the 'supermatrix' for purposes of analysis. The details and explanations of the solution of such a 'supermatrix' can be found in Saaty (1994) and Sarkis (1998).

Figure 2: Clusters and elements of stakeholders

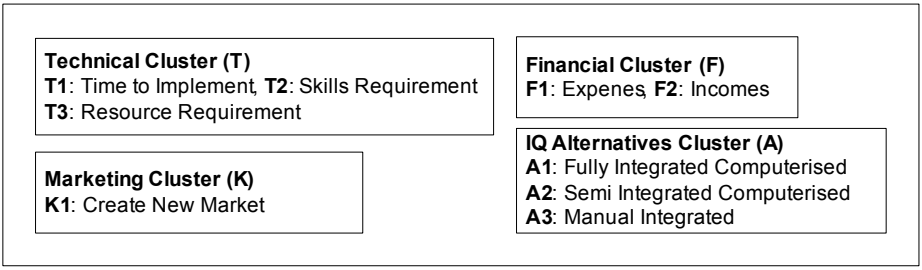
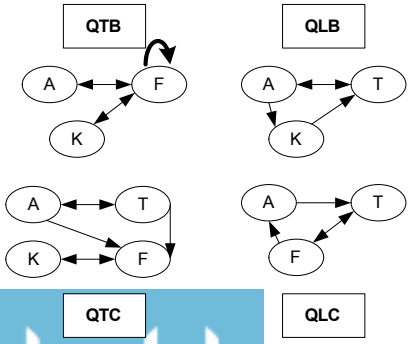


Figure 3: Control hierarchy



QT = Quantitative QL = Qualitative B = Benefits C = Costs

(2) Results and discussions

The results from the comparison of the alternative IQ improvement methods--compared to a logistics distribution--are shown in Table 3. This indicates that benefits-and-costs were given a weight of 0.50. In terms of benefits, the decision-maker (DM) gave the highest weight to the quantitative benefits (0.60). It was probably for this reason that the majority selected the Fully Integrated IQ System. However, the Manual Integrated IQ System was the only preferred technology in respect of every cost sub-critera.

Table 4 summarises the overall results. It combines the three sets of 'derived priorities' into a single index, which indicates the overall utility of the various strategies. This is the best combination to employ or use because the 'derived priorities' are ratio scales and the product and quotient of ratio scales can also be expressed as a ratio scale (Saaty, 1994). The results for the benefits-costs ratios suggest that the Fully Integrated IQ System is the most appropriate in these circumstances. It suggests that the Fully-Integrated IQ System is preferred due to its having the highest associated benefits.

Quantitative analysis

Table 5 illustrates the savings obtained using current costs as the baseline. For example with respect to controllable costs, Database (DB) Programmers' Operations indicates the total cost of employing programming staff to 'look after' the DB. DB Users Operations gives the total cost of employing user staff to key inputs and to calculate output data. Both costs are major expenses with regard to information technology for the firm. Subsequent to the establishment of the IQ improvement project, the new 'improvement costs' were 4.5 MB or 30% of the total savings (1.98MB). This estimate is based upon current costs (at 6.48 MB) of replacing staff by using the new 'enhanced programs' given in Table 1 as Development Procedures (Filter). In terms of specific risks, there are two main possibilities; loss of current customers and loss of potential new customers. The extent of

Table 3: Priorities and synthesised results of benefits and costs

	Benefits	(0.50)	Costs	(0.50)
	QT	QL	QT	QL
IT \ Priority	0.60	0.40	0.55	0.45
Fully-Integrated	0.41	0.35	0.36	0.33
Semi-Integrated	0.35	0.38	0.36	0.36
Manual-Integrated	0.24	0.27	0.28	0.31

Table 4: Overall results (with sub-criteria priorities)

	Benefits	Costs	Benefits/Costs	
Fully-Integrated	0.193	0.17325	1.114	1
Semi-Integrated	0.181	0.18	1.005	2
Manual- Integrated	0.126	0.14675	0.858	3

loss of current customers was calculated from in-depth interviews with current customers about their reasons for cancellation of orders, which were 'converted' to amounts in lost currency. The extent of loss of potential customers was 'calculated' from data from the Marketing Department regarding the expenses involved in contacting potential new customers. The results show that the loss of current customers has more impact on the firm (20 MB before compared to 7 MB after, giving a loss risk of -13 MB) than does the loss of potential new customers (8 MB before compared to 3 MB after, reducing the loss risk by 5 MB).

Conclusions

The main contribution of this paper, in our judgement, is in applying the IQ concept to improve the usefulness of an AIS in an industry where the sharing of information is of critical importance, through making the information that is shared more accuracy, complete, consistent and valid . The system developed and implemented in this paper can be controlled more precisely, which can ultimately increase the level of satisfaction between B2B users. The concept of IQ has been described and applied through a case study of a logistics distribution company in Thailand.

Table 5: BC Quantitative analysis alone

Description of Benefits/ Costs/Risks	DB Programmers Operations	DB Users Operations	Total Operations
Current Costs	3.6 MB	2.88 MB	6.48 MB
New Improved Costs	2.4 MB	2.10 MB	4.50 MB
Benefits	1.2 MB or 33 % Savings	0.78 MB or 27 % Savings	1.98 MB or 30 % Savings

Remarks: Savings are based upon replacing staff by using new enhanced programs as in Table 1at Development Procedures (Filter).

	Risks	Before	After	Total Preventive Loss Risks
-	Loss of Current Customer	20 MB	7 MB	13 MB
-	Loss of Potential New Customer	8 MB	3 MB	5 MB

MB means Million Thai Baht, U$D 1 is approximated to 45 Thai Baht.

Another contribution is the development of a cost-benefit analysis that includes both quantitative and qualitative information, together. The advantage of this is that the usefulness of the AIS model can established, without relying entirelyon potentially misleading and inadequate quantitative data alone, as so often has been the case before (Kengpol and O'Brien, 2001). In the case of this particular company, the cost-benefit analysis suggests that the loss of current customers carries more risks than does the risk of loss of potential new customer. It is because of their reliance on current customers for income that the firm depends so much on B2B business. In Thailand, because the reputation of a business is usually just as important as the prices it can charge for its products or services, keeping its current customers satisfied is a high priority, something suggested by the results given in Table 5. The trouble is that if the company loses orders--from its current customers--it is not only a financial loss but also a blow to its reputation which has often been built up over many years.

The data in the present study comes from a logistics distribution company in the fashion retail industry. Although the specific findings may be limited to such companies, they do provide a useful test of a method for improving IQ. Perhaps engineering firms or firms in other industries may find the AIS method worth trying, always bearing in mind that they can always can customise the way they go about implementing AIS to make it appropriate for themselves, and their own products or services. In this respect, the usefulness of the Total Data Quality Management Process developed in this should be continuously reassessed to make sure it is still functioning as managers want or desire it to; positive and negative results should be recorded to provide the basis for corrections or further improvements. In the present paper, some of the results are based on estimated data, which may not be completely accurate. Current and potential new customers should benefit from being at the 'receiving end' of firms that are much more efficient and effective as a result of implementing the AIS methods developed in this paper. It is hoped that the findings from the research will help to convince firms of the benefit of sharing information as well as of constantly improving the quality of their information.

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