

## Research

# Strategic information technology plan: A vital component in the corporate strategies of banks

Thow-Yick Liang \* and Chin-Keon Tan

*Department of Decision Sciences, Faculty of Business Administration, National University of Singapore, 10 Kent Ridge Crescent, Singapore 0511, Republic of Singapore*

The traditional areas of commercial banks, such as consumer banking, corporate banking, and treasury operations of investment banking have been computerized. Decision support systems have been used extensively in areas such as consumer account analysis, customer profitability analysis, and calculation of the cost of funds and bond yield. In addition, expert systems are gradually being used on an irregular basis in banks. Despite the fairly high level of information technology (IT) utilization, the present information systems of the banks are in management and operation decisional areas, rather than in strategic applications. A proper plan for strategic utilization of IT is missing. This study explores the areas in which banks can use IT strategically to emerge as winners in the highly competitive banking industry. Several Management Information Systems frameworks, such as Porter's competitive framework is adapted to examine such strategic impact.

**Keywords:** Information technology; Decision support systems; Expert systems; Management information systems frameworks; Strategic utilization

## 1. Introduction

An understanding of the Management Information Systems (MIS) framework provides a better perspective for information systems (IS) planning and utilization. A clear perception of the roles and functions of IS is essential for mapping out an effective IS strategic plan. And matching this plan with that of the corporate is a key to sustaining an organization's competitiveness.

A traditional MIS framework is based on the three managerial functions associated with the different levels of a typical organizational hierar-



**Liang Thow-Yick** is a Senior Lecturer in the Department of Decision Sciences at the National University of Singapore. He received his BSc (Mathematics, 1977, external) from the University of London; BSc (Physics, 1977), BSc (1st Class Hons, Physics, 1978), and MSc (Computer Image Processing, 1980) from the University of Singapore; and PhD (Particle Physics, 1985) from the National University of Singapore. He has had articles published in the *Journal of Mathematical Physics*, *Physical Review D*, *Nuovo Cimento*, *Information and Management*, *Behaviour and Information Technology*, *International Business Schools Computing Quarterly*, and *Singapore Management Review*. His current research interest is in the areas of Information Theory, Management Information Systems, Expert Systems, and Information Technology Policy.



**Tan Chin Keon** is currently a liner executive at the Neptune Orient Lines of Singapore. He received his BBA (Hons, 1992) from the National University of Singapore. His research interests include financial Decision Support Systems and Office Automation.

\* Corresponding author.

chy (strategic planning, management control, and operational control (Anthony, 1965)), coupled with a classification of decision making: structured and unstructured decisions (Simon, 1960). Such a model provides a convenient two-dimensional approach to classifying and analyzing IS (Gorry and Scott Morton, 1971).

Two variations on this theme involve: (i) a conceptual model that has been applied specifically to the computerization of banks. It has three levels of computer usage (Yavitz, 1967). At level I, information technology (IT) has the capability of improving existing services. It is used to lower costs, raise revenues, achieve greater accuracy, and reduce response time. At level II, IT makes it possible to innovate and introduce new products and services. Finally, at level III, IT has the capability of simulating management decision making processes. (ii) the concept of three different levels of IS use (Johnson and Carrico, 1988). The first level occurs when organizations use IS primarily as production tools. Such applications are common in most organizations. The second is for the use of IS to support corporate strategies without explicitly considering the strategic potential of the IS themselves. The third happens if IS is used to influence the organizations' competitive strategy. It is here where the organizations integrate IS strategy with the corporate strategy.

Perhaps the most frequently cited framework today is Porter's Competitive Framework (Porter, 1980). He views business as being surrounded by five competitive forces: the threat of new entrants, the intensity of rivalry among existing firms, the pressures from substitute products, the bargaining power of buyers, and the bargaining power of suppliers. He pointed out that a good strategy for an organization is to pursue one or more of the following activities: (i) erect barriers against potential new entrants, (ii) change the balance of power in supplier relationship in favour of the firm, (iii) increase switching costs for customers, and (iv) change the basis of competition among rivals in the firm's favour. With this in mind, IT can be used to enhance one of the three generic competitive strategies that concentrate on product differentiation, lower operation cost, and market segment specialization.

Porter's framework has been used to assess the strategic importance of IT (Parsons, 1983). In that study, it was found that firms which develop

strategic IT systems must analyze its impact simultaneously at the industry, firm, and strategy levels. Based on the anticipated impact at both the industry and firm levels, future strategies can then be selected to ensure competitive advantage. Because of the success of that study, we used Porter's framework to analyze the data collected here.

## **2. IT and banks in Singapore**

Information Technology is not new to banks in Singapore (Liang and Ta, 1988 and 1991). Over the past one and one-half decades, computers have been used to process cheques and transfer funds. Indeed, the rapid growth of the banking business in recent years could not have been achieved without computers. In Singapore, banks were among the first organizations to use computers on a large scale and they have remained in the forefront of IT usage. Thus, banks are now totally dependent on the technology to function competitively and it is hard to imagine a bank operating without IT.

In general, banks spend more on technology than any other types of organization. According to a survey, U.S. banks invest more than twice the national average spending on information systems (Ko and Koh, 1987). In Singapore, an IT survey conducted by the National Computer Board in 1987 showed that 86% of the firms in the financial services sector were computerized, as opposed to the national average of 59% for all others.

Historically, banks used IT to improve their operations and contain costs in the back room operations (Friedman, 1986). Today, banks are gradually shifting from using IT for rationalizing operations to using IT for strategic applications: to improve customer services and to achieve competitive advantage.

## **3. Objectives and scope**

The rapid development of Singapore into a regional financial centre and growing foreign competition makes it necessary to have good insight into the competitiveness of the full license banks. This is a dynamic environment where banks

that have already positioned themselves should be able to do better in the changing technological environment through strategic utilization of IT.

There are 35 full license banks in Singapore, comprising 13 local and 22 foreign banks. The full license banks are authorized to engage in a full range of banking activities, varying from the traditional banking activities (loans and deposits), to sophisticated forms of financial services (such as specialized fee-based financial services, and trading and investment in both the local and international financial markets). The full license banks are the most influential group in Singapore's banking and financial industry, as they have the greatest ability to raise and deploy funds in the domestic market. They have played a significant role in the economic growth of Singapore and contributed about 7.7% to the GDP in 1987. Hence, the performance of the banking sector is vital to the local economy and its development will determine the status of Singapore as a major international financial centre.

This study is designed to encompass the following objectives:

- a. To examine the level of IT and the spread of the use of the technology in the full license banks;
- b. To examine the impact of IT on the banks and the strategies that these banks can use to position themselves, based on Porter's MIS frameworks;
- c. To analyze the key issues such as economic benefits, customer services, and competitive

advantages while using IT as a strategic tool, and

- d. To identify the barriers faced by IS executives during IS planning.

The data for the study were collected through a survey based on all the 35 full license banks, and from secondary sources, such as annual reports of banks, published literature, conference papers, and bank brochures. The survey return was 52%. The majority of the respondents were the most senior IS members of the banks, such as Vice-Presidents (29%) and IS Managers (64%). A five point Likert-scale was adopted in the questionnaire.

#### 4. Level and spread of IT

The traditional activities of the banks, such as consumer banking, corporate banking, and treasury operations of investment banking, are highly automated. These areas have rather well-structured decision-making processes. Besides high volume, the repetitive nature of transactions, the need for accuracy and validity of data, the necessity of quick turnarounds, and well-understood processing logic are reasons for the banking systems to be highly automated. On the other hand, the automation level for corporate financial services is low, because the nature of its activities tends to be unstructured (see Table 1).

The result also showed that about 75% of the respondent banks used some form of Decision Support Systems (DSS). Consumer and investment banking were the heaviest DSS users. Commercial and consumer account analysis, customer profitability analysis, and calculation of the cost of funds and bond yield were also among the most common application areas (see Table 2).

Apparently, the DSS are used mainly in management and operational decisions rather than strategic applications. However, with growing and intense competition in the deregulated financial market, together with an increasing diffusion of education in strategic DSS, it is expected that a higher percentage of banks will use strategic DSS in the near future. This is supported by a sizable percentage of non-users indicating plans for future use of DSS (see Table 3).

In addition, about 14.3% of the respondents indicated that they have used expert systems (ES)

Table 1  
Level of automation in the different aspects of banking

Level of Automation	Departments
High Automation	Consumer Banking Treasury Finance
Average Automation	Corporate Banking Investment Banking International Banking Correspondent Banking Administration Human Resource Management
Low Automation	Corporate Finance

Note: Automation level: Low: 0-1.7, Moderate: 1.8-3.4, and High: 3.4-5, in the 5 points Likert-scale.

(see Table 4). The small number of users was partly due to the conservatism of the banking sector in using what may be considered an immature technology. However, there is a strong indication that ES will be used in future.

## 5. Impact of IT and IT planning

Despite a growing awareness of the strategic impact of IT and the many conceptual frameworks that have been developed to assist practi-

Table 2  
Decision support systems applications in functional management areas

Functional Applications	Current	Anticipated	Desired	No Plan
<b>Deposit Account Management</b>				
Deposit account pricing	35.7	–	42.9	21.4
Deposit account analysis and forecast	35.7	–	42.9	21.4
<b>Loan Portfolio Management</b>				
Commercial account credit analysis	42.9	14.3	42.9	–
Consumer account credit analysis	42.9	7.1	35.7	7.1
Commercial account loan pricing	21.4	7.1	57.2	14.3
Consumer account loan pricing	21.4	7.1	50.0	14.3
Customer profitability analysis	42.9	7.1	42.9	7.1
Calculation of cost of funds	50.0	–	42.9	7.1
Default account collection	14.3	7.1	28.6	50.0
Performance evaluation	28.6	7.1	50.0	14.3
<b>Investment Portfolio Management</b>				
<b>Bond buying, selling and holding</b>				
strategy using simulation	14.3	7.1	35.7	35.7
Bond yield calculation	35.7	7.1	28.6	28.6
Bond swap strategy	14.3	7.1	50.0	28.6
Bond coupon tabulation and clipping	14.3	7.1	50.0	28.6
Repurchase agreement securities monitoring	28.6	14.3	28.6	28.6
Identification of arbitrage opportunities	21.4	7.1	35.7	35.7
<b>Bank Operations</b>				
Scheduling cheques pick ups from branches	7.1	14.3	14.3	42.9
Employee work scheduling	7.1	7.1	28.6	57.2
<b>Bank Consulting Services</b>				
Cash management	42.9	14.3	28.6	7.1
Financial planning for businesses	28.6	14.3	28.6	21.4
Financial planning for consumers	7.1	14.3	50.0	21.4
Investment and financial advice	7.1	7.1	50.0	28.6
Trust services and estate planning	7.1	7.1	35.7	42.9

Note: a. "Anticipated" represented those applications that the bank has planned to use DSS within the next six months.

b. "Desired" represented those applications that the bank would like to have DSS in the future.

c. All numbers are expressed as percentages of the respondent banks.

d. Missing observations are left out in the computation, as such the row totals do not add up to 100%.

Table 3  
Decision support systems applications in strategic management areas

Strategic Management	Current	Anticipated	Desired	No Plan
Asset-liability management; financial statement projections and analysis	21.4	14.3	64.3	–
Interest rate sensitivity, including gapping analysis	35.7	7.1	57.2	–
Tax planning for bank management	–	7.1	42.9	50.0
Cash flow analysis for liquidity and reserve management	35.7	14.3	50.0	–
Optimization approach using mathematical programming techniques	–	–	57.2	42.9
Hedging strategy using options and financial futures	21.4	21.4	35.7	21.4

tioners in evaluating the potential of IT, only 14.3% of those who responded to the survey indicated that they were using some form of model to evaluate the contribution of IT to their strategic plan.

A means for banks to achieve strategic advantage is through examining Porter's generic strategies: to provide low cost products or services, to practice product differentiation, and to focus on a market niche. From the analysis, together with their present practices, strengths, and weaknesses, a strategic plan can be developed.

Banks can adopt a low cost strategy by offering products and services at prices lower than those of their competitors. To do this profitably, they have to strive for high standards of productivity and efficiency so that the cost of doing business is low.

IT has made a low cost strategy possible; e.g., Automated Teller Machines (ATM) have reduced the number of tellers and have promoted operational efficiency by cutting personnel costs and even reducing the number of branches. Sophisticated on-line systems are making branch employees more productive and effective. In back offices, sophisticated computer programs are making customer service representatives, researchers, and collectors more efficient. New electronic payment technologies, such as the automated clearing house, point-of-sale networks, and wholesale electronic fund networks are grad-

ually replacing paper-based payment methods, such as cheques, telexes, or money orders. New computer models can control credit transactions better and extend credit faster. New software can also process applications, track loans, and reconcile accounts more quickly and accurately.

It is evident that IT has reduced cost and increased productivity. However, the low marginal cost in producing an additional unit of product with full automation has resulted in intense price competition. Pricing for mature products has become very low, as competitors seeking economies of scale reduce prices to gain market share. In this situation, it is relative efficiency that will dictate the survivors. Furthermore, banks that adopt this strategy must continually monitor changes in technology, as innovations enable competitors to leapfrog each other as cost leader. Therefore, banks must always maintain a technological lead and be ready to implement change when necessary, if they are to adopt the low cost strategy.

Instead of competing in terms of price, banks can choose to differentiate their products and services from those of their competitors. They can incorporate unique features in their products, and constantly invent ideas and features ahead of their competitors in order to maintain their market share.

IT offers opportunities for a vast array of financial products to be customized to the needs

Table 4  
Expert systems applications in banking

Application Areas	Current	Anticipated	Desired	No Plan
Risk Management	14.3	-	71.4	14.3
Foreign Operations	7.1	-	57.2	35.7
Mergers and Acquisitions	-	-	50.0	50.0
Portfolio Management	7.1	-	78.6	14.3
Balance Sheet Management	14.3	-	71.4	14.3
Tax Advising	-	-	50.0	50.0
Treasury Operations	-	7.1	71.4	21.4
Credit Approval	-	7.1	78.6	14.3
Data Processing Operations	14.3	7.1	57.2	21.4
Financial Planning	7.1	-	64.3	28.6
Regulatory Compliance	14.3	-	50.0	35.7
Trading Strategy Analysis	-	-	64.3	35.7
Loan Underwriting	-	-	57.2	42.9
Processing of Trade related documentation e.g. letter of credit	-	7.1	78.6	14.2
Insurance Policy Evaluation	8.3	-	-	-
Housing Loan Evaluation	8.3	-	-	-

of customers, such as allowing customers' purchasing information to be tracked and creating electronic linkages with buyers; for example, the cash and treasury management services that allow corporate treasurers to have real-time access to global money markets are tailored to the needs of corporate customers, and this is only made possible by IT. As competition in the industry is growing and the cost saving aspects of IT are becoming limited, differentiation will be a significant strategy for banks.

The next approach, niche identification, prescribes that banks have to compete in certain focus areas; for example, foreign banks are well known for curtailing retail banking, and focusing on merchant banking, investment banking, securities processing, and international banking. On the other hand, local banks focus more on retail banking.

However, the impact of IT makes it more difficult to find a niche or develop a focused strategy. As computer systems replace manual and paper-based work, the fixed cost component rises and the initial start-up cost is high. By practising a focused strategy, banks with considerably fewer products and business lines will sacrifice the synergistic effect of cost sharing.

In general, banks tend to have higher shared cost structures than do other types of companies. Synergy can be derived from the sharing of common distribution channels. According to Stainer (1990), 50% to 80% of the total cost of a banking product comes from shared cost structures; 15% to 20% is in the real overhead such as personnel and administration, 20% to 40% is in the distribution system and centralized operations, and 15% to 20% is in the cost of data processing. Thus, the high shared costs through the use of IT has created a significant problem for undertaking a niche strategy.

## 6. Strategic IT issues

It is interesting to examine how banks in Singapore have and can position themselves through the strategic use of IT. The contribution of IT was evaluated using certain identified criteria based on relative importance on a 5 point Likert-type scale. The average importance of the various criteria is listed in Table 5.

Table 5  
The importance of each evaluation criteria

Evaluation Criteria	Average Importance
Customer satisfaction	4.5
Contribution to achievement of goals and missions	4.4
Improvement in data integrity	4.2
Support of product lines/services	4.2
Contribution to competitive advantage	4.1
Contribution to innovation and improvement in services offered	4.1
Increased productivity of operational units	4.1
Effective use of human resources	4.1
Integration/coordination of activities	3.9
Cost cutting/cost savings	3.8
Contribution to planning	3.3
Facilitation of internal communication	3.1

Note: 1-Not Important, 2-Slightly Important, 3-Moderately Important, 4-Very Important, 5-Extremely Important.

The contribution of IT as a means of attaining competitive advantage appears to be considerable. It ranked fifth among all criteria. This is consistent with a survey of key IS issues which showed that competitive advantage advanced from nowhere in 1983 to be ranked second in importance in 1986 (Brancheau and Wetherbe, 1987). The overriding concern for customer satisfaction (ranked first), contribution to the achievement of goals and missions (ranked second), and innovation and improvements in services offered (ranked six) give further support to the current emphasis on the strategic role of IT in banking.

Other criteria considered were the improvement of data integrity, support of product lines or services, effective use of human resources, cost savings, and increased productivity of the operational units. Surprisingly, cost savings is low on the list. One possible explanation is that banks are gradually moving from the traditional perspective that views IS as a vehicle to cut costs to the strategic perspective that views IT as a vehicle for supporting or shaping the organization's competitive strategy. This observation tallied with the second level of Johnson and Carrico's model.

Setting the objectives of IT and ascertaining the extent to which these objectives are satisfied is an important phase in strategic IS planning, as this helps to determine the current status of the long-range IS plan and under-performing areas.

Table 6  
Attainment of objectives and under-performing areas

Objectives	Importance	Performance	Gap	Gap Important
Customer satisfaction	4.5	4.1	0.4	1.80
Cost cutting/savings	3.8	3.4	0.4	1.52
Contribution to better achievement of goals and missions	4.4	4.1	0.3	1.32
Making effective use of human resources	4.1	3.8	0.3	1.23
Improvement in data integrity	4.2	4.4	0.2	0.84
Contribution to competitive advantage	4.1	3.9	0.2	0.82
Support of product lines/services	4.2	4.1	0.1	0.42
Contribution to innovation and improvement in services offered	4.1	4.0	0.1	0.41
Integration/coordination of activities	3.9	3.8	0.1	0.39
Increased productivity of operational units	4.1	4.1	0.0	0.00
Facilitating internal communication	3.1	3.1	0.0	0.00
Contribution to planning	3.3	3.3	0.0	0.00

The various objectives that are of average importance and performance are analyzed, and the gap between importance and performance is calculated and listed in column 3 of Table 6. This gap is a measurement of the difference between the evaluation and the actual performance of the objectives; it is then weighted by multiplying it by the importance of the objectives (see column 4). A large value indicates that that area is a critical issue. Based on this information, the critical issues facing IS executives are how to improve customer service, cut costs, and achieve corporate goals and objectives.

## 7. Current barriers to the strategic use of IT

Is executives must recognize the problems or barriers that are detrimental to their ability to exploit it strategically. Competitive advantage is only made possible when the "inhibitors" are explicitly identified and considered in the planning process.

Ten possible inhibitors were identified and respondents were asked to rate each one on a five-point scale. A summary of these ratings is shown in Table 7. The problem areas are listed in the order of their importance, as determined by the average of all respondents. The three top rated barriers are the inflexibility of IS, rapid changes in technology, and expensive hardware and software.

IS has been known as the "limiting" item in implementing change. The lack of flexibility of old IS can severely retard a bank's potential to respond to change. Considerable time and resources are required to redesign major systems, and this often slows down the development of new strategic IS in the drive to gain competitive advantage.

Technology changes rapidly and, as a result, obsolescence is a constant threat. New systems are always a little outdated as soon as they are built, and old systems, some only implemented a few years ago, can be totally obsolete. These may put an organization at a competitive disadvantage. The cost of hardware and software is an-

Table 7  
Perceived problems to strategic use of IT

Problem experienced	Mean
Inflexibility of information system	3.6
Technology is changing very rapidly	3.4
The cost of hardware, software, etc. is expensive	3.3
Long term benefits of IT as an instrument for managerial and strategic decision making are not well understood	3.1
Top management perceive IT as a cost component	3.1
Lack of economies of scale	3.1
Budget constraints	3.0
Lack of sufficiently competent IT personnel	2.9
Organisational and cultural constraints	2.8
System vulnerability	2.7

Note: 1 = No Extent, 5 = Great Extent.

other limiting factor to the strategic use of IT. A strategic information system is expensive and the justification for its investment is usually uncertain.

The next two barriers, namely, that top management perceive IT investment as a cost component, and that there are long term benefits of IT as an instrument for managerial and strategic decision making are not well understood. However, these barriers were perceived as being only moderately important. This observation is in contrast with the findings of King et al. (1987), and Lederer and Mendelow (1988), which indicated that the lack of top management support and the difficulty in convincing top management of the potential strategic impact of IS were the major inhibitors. The implication could be that there is an awareness among Singapore's bankers of the strategic effect of IT, and that they support its use as a strategic weapon. This awareness has probably only occurred recently.

## 8. Conclusion

Traditionally, IS applications were exclusive to the internal functions of organizations. As management became more aware of the strategic effect of IT, applications in areas such as customer needs and competitors' activities have become important. However, to achieve maximum results from IT utilization, a systematic approach is essential. The study observed that such an attempt is still lacking. In order to handle IT more effectively, management can use some of the methodologies or frameworks constructed by academics to help identify strategic opportunities from IT. Simultaneously, important criteria or issues for determining the contribution of IT to strategic planning will have to be identified and included in corporate plans. A macro approach is important during the construction of the strategic IS plan.

## References

- [1] Anthony, R.N., *Planning and Control Systems: A Framework for Analysis*, Harvard University Press, Boston (1965).
- [2] Brancheu, J.C. and Wetherbe, J.C., Key Issues in Information Systems Management, *MIS Quarterly*, 11, pp. 23–45 (1987).
- [3] Friedman, P.J., Information Technology: The Path to Competitive Advantage, *Bank Administration*, 62, pp. 39–43 (1986).
- [4] Gorry G.A. and Scott Morton, M.S., A Framework for Management Information Systems, *Sloan Management Review*, 13(1), pp. 55–70 (1971).
- [5] Johnson, H.R. and Carrio, S.R., Developing Capabilities to Use Information Technology Strategically, *MIS Quarterly*, 12(1), pp. 37–48 (1988).
- [6] King, W.R., Hufnagel, E., and Grover, V., Using Information and Information Technology for sustainable competitive advantage: Some Empirical Evidence, *Information and Management*, 17, pp. 87–93 (1987).
- [7] Ko, K.H. and Koh, S.H., Information Technology and the Financial Services Industry, Finance Industry in Singapore, pp. 28–30 (1987).
- [8] Lederer, A.I. and Mendelow, A.L., Convincing Top Management of the Strategic Potential of Information Systems, *MIS Quarterly*, 12, pp. 525–534 (1988).
- [9] Liang, T.Y. and Ta, H.P., Information Technology in the Banking Sector, *BankFin Journal* 1988/89, pp. 37–39 (1988).
- [10] Liang, T.Y. and Ta, H.P., Information Resources Management: A Significant Activity in Banking and Finance, *BankFin Journal* 1991/92, pp. 43–44 (1991).
- [11] Parsons, G.L., Information Technology: A New Competitive Weapon, *Sloan Management Review*, 25(1), pp. 3–14, (1983).
- [12] Porter, M.E., *Competitive Strategy*, Free Press, New York, 1980.
- [13] Porter, M.E. and Millar, V.E., How Information gives you Competitive Advantage, *Harvard Business Review*, 65(3), pp. 149–160 (1985).
- [14] Simon, H.A., *The New Science of Management Decision*, Harper and Brothers, New York (1960).
- [15] Stainer, T.H. and Teixeira, D.B., *Technology in Banking*, McKinsey and Company, Inc. (1990).
- [16] Yavitz, B., *Automation in Commercial Banking – Its Process and Impact*, The Graduate School of Business, Columbia University, and the Free Press (1967).