DEVELOPMENT OF A MODEL TO EVALUATE INFORMATION SYSTEMS IN BANKING SECTOR IN INDIA

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Abstract

The banking industry in India has been one of the early adopters of technology wherein the processes are standardized and mature. In view of the increasing competitive pressures from many private and multinational banks, the Information Systems (ISs) in these banks needs to effective and must be aligned to the goals and strategies of the banks, and thus must be monitored holistically and continuously so as to keep the systems updated which in turn help the banks gain strategic and competitive advantage. A review of literature indicates a clear research gap in IS in general and evaluation of IS in Indian banks in particular. Keeping in mind the importance of the subject and research gaps therein, this study has been conducted to propose a model to evaluate the IS effectiveness in banking sector in India. The proposed model proposes to evaluate the IS effectiveness from Strategic, Functional, and Technical perspectives that provides a modular, flexible and scalable approach to assess IS effectiveness using measures for partial and complete evaluation. The model has been tested using the sample data for validity of scale and further applied on banks under study.

Introduction

In today's information age, Information systems (ISs) play a significant role not only in achieving the efficiency in business operations rather in making effective decisions and helping the organizations achieving competitive advantage. The banking industry in India has been one of the early adopters of technology wherein the processes are standardized and mature. The effectiveness of ISs is of paramount importance that needs to be monitored holistically and on a continuous basis.

There have been a few studies on the evaluation of ISs that have highlighted the importance of IS evaluation. **Kamna & Goyal (2003)** suggested an ACE Model a 3 ring model comprising of three components namely (A)dapt, (C)ollaborate and (E)valuate, to establish and evaluate organizational effectiveness for improved IS effectiveness in automobile industry in India. Similarly **Rishi and Goyal (2009)** observed that a rapidly changing business environment requires firms to develop IS that are more flexible, responsive, integrative and information rich. At the same time, it is also important to align the IS with their core business processes. One of the most enduring research topics in the field of IS is IS's success (Markus and Tanis, 2000). Delone and McLean (1992) argued that if IS research is to contribute to the actual practical aspects, a well-defined outcome measure is essential. A detailed review of literature indicates that there have been several studies on evaluation of ISs, however there have not been much work done on the integrated view of evaluation model.

Review of Literature

Nanda Mohan & Ajayakumar (2005) has developed a model for the IT enabling process. This study proposed a specific order for the events related to IT enabled activities. The paper by Hitt et al (2002) discussed that information systems integrate key business and management processes within and beyond a firm's boundary. The study focused on the cost-benefit analysis of IS implementation. Thatcher and Oliver (2002), examining the contribution of IT to productivity studied the impact of technology investments on product based industry.

Au et al (2002) presented a critical review of research on End-User Information System Satisfaction (EUISS) that focused on End-user satisfaction from information system. A model was proposed on equity and needs theory. Delone and Mclean (2002) proposed a Model of Information Systems Success for measuring the complex-dependent variable in IS research. The study was focused on measuring e-commerce system success through a proposed model.

Technology Acceptance Model (TAM) was proposed by Davis (1986) to examine the mediating role of perceived ease of use and perceived usefulness in their relation between systems characteristics (external variables) and the probability of system use (an indicator of system success). The paper on "Information Technology Usage: an Indian experience" presented by Gupta and Kumar (2004) devised phases of IT usage in Indian organizations. The researchers stressed that KPIs linked to the goals and objectives of the organization need to be clearly identified and incorporated into the IS so as to monitor the health of the organization at all times. The purpose of the paper named "Impact of Information Technology management practices on customer service" by Karimi et al (2002) was to gauge whether IT management practices differ among firms where IT has a major role in transforming marketing, operations, or both, which gave the firms advantage by affecting customer service.

From a survey of literature, it is observed that research gaps exist in evaluating the effectiveness of Information in general; and with special reference to its applications in banking organization in India in particular. Further evaluation studies exist on multiple fronts but an integrated view is missing. The review also revealed that the research lacks an integrated approach to IS evaluation that is based on functional integration, technological integration, and strategic integration. Also there is a need to identify Key Performance Indicators for measuring effectiveness of IS. In view of this, the study has been undertaken with the following objectives:

Objectives of the Study

The study has the following two broad objectives:

i) To propose an integrated model to evaluate IS effectiveness in the selected banks in India
ii) To validate and apply the proposed model in Indian Banking Industry

Research Methodology

The present study has been conducted in banks located in Chandigarh region in northern part of India.165 respondents from 28 banks participated in the study. Data was collected from a specially designed and pre-tested questionnaire which was codified, tabulated and analysed applying various statistical techniques like correlation and factor analysis. The performance of IS in banks was measured by using 40 assertive statements measured on Likert scale. These statements represented 40 variables for evaluating the performance of IS in Indian banks. The research work conducted measures the IS effectiveness as Strategic, Functional, and Technical integration of IS with processes of banks. A model was proposed to evaluate the IS effectiveness. The model represented the various dimensions of effectiveness that further make the whole IS effective. Various instruments have been designed to record the perceptions of the users of IS in the selected banks. The evaluation was done by converting the subjective scale of perceptions to a distinct objective score on a 5-point Likert scale.

Model to Evaluate Effectiveness of ISs

A model comprising 12 components has been proposed to evaluate IS effectiveness. Factor analysis using Principal Component Analysis was applied for data classification and reduction, selecting 12 components with factor loading greater than or equal to 0.5 in the rotated matrix. These 12 components explained a cumulative of 64.9% of variance. The data reduction through factor analysis grouped variables

into 12 components. These 12 KPIs were listed in the rank of their importance as mentioned below:

1. Data Integrity & Network Security
2. Long Term Planning
3. Transactional Effectiveness
4. Resource Utilization
5. Data Management
6. Flexibility for Data Handling
7. Cost Control Management
8. Flow of Information
9. E-Documentation
10. Information System Efficiency
11. Backup Policy
12. Customer Satisfaction Level

Name and Scope of the Model

The model has been named as SFTI Model (Strategic-Functional-Technical Integration Model). It helps in evaluation of Information System in an organization and providing an integrated approach for evaluation of IS.

The scope of the model is limited to post implementation scenario only. This model is proposed for facilitating continuous and regular monitoring. It will also help to study the factors of success and failures of IS in an organization in general, and a bank in particular.

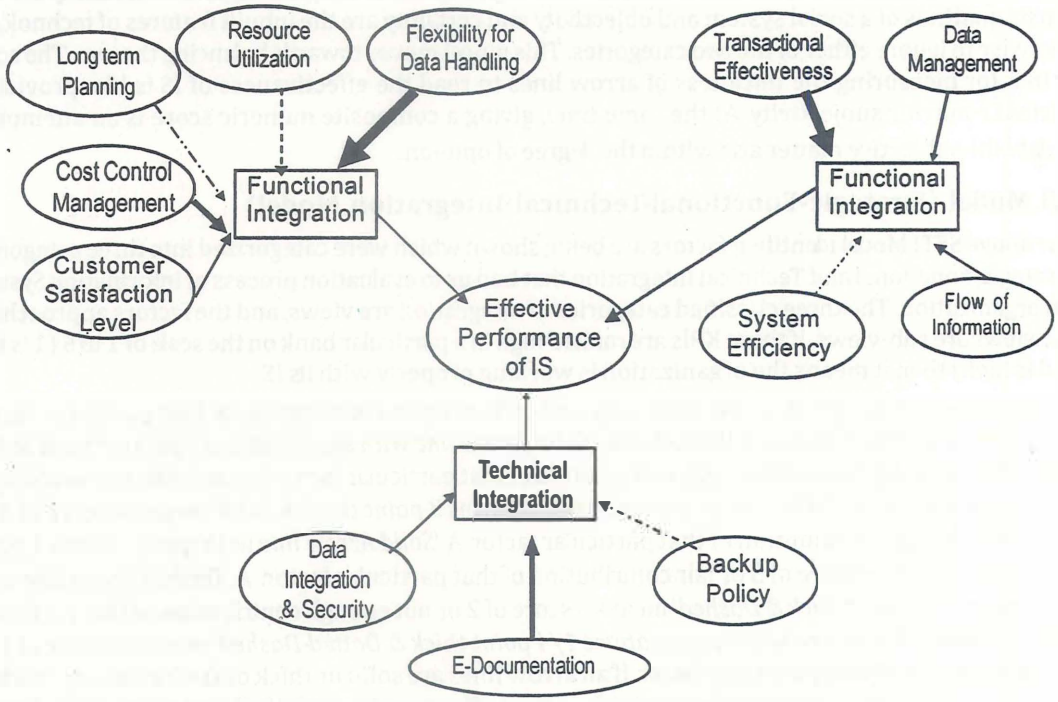


Figure 1: SFTI Model (Strategic-Functional-Technical Integration Model)

(Thickness and design of arrow lines depicts the degree of contribution of factors towards the effective performance of Information System in a bank)

Features of the Model

- ***Integrated:*** The model is designed in an integrated manner by taking a comprehensive view of multiple factors contributing to the IS effectiveness and consolidating them further.
- ***Flexible:*** The model framework is flexible and it could be applied in a customized manner to take care of organizational preferences.
- ***Modular:*** As the evaluation of IS effectiveness is a continuous process, it is possible that after evaluation, one or more factors or parameters need to be enhanced and re-evaluated. The model is so designed that it allows its use as a whole or partially, depending on what area is the focus of the improvement in the organization at a particular instance.
- ***Generic:*** Although the model is developed after interactions with the respondents from banking industry and also testing on the same set of respondents, the model is flexible and could be customized as per need of any organization in any segment.
- ***Easy to use:*** The structure of the model correlates well with the questionnaire, involves only simple mathematical calculations and the complete visuals to highlight the comparative views of strengths and weaknesses of the IS in the organization.

Controlled Subjectivity

An Information System is a social as well as technical system. Since subjectivity and uncertainty are the intrinsic qualities of a social system and objectivity and certainty are the inbuilt features of technology, it is unwise to ignore either of the two categories. This model moves towards balancing the two. The scale of 1 to 5 for measuring the thickness of arrow lines to read the effectiveness of IS is like providing sufficient room for subjectivity. At the same time, giving a composite numeric score is an attempt to calculate the subjective matter also within the degree of opinion.

SFTI Model (Strategic-Functional-Technical Integration Model)

In the above SFTI Model identified factors are being shown which were categorized into three categories of Strategic, Functional and Technical Integration that lead us to evaluation process of Information System in an organization. The three classified categories of integration are views, and the factors approaching these views are sub-views. If these KPIs are ranked high in a particular bank on the scale of 1 to 5 (1 is low and 5 is high) then it means the organization is working properly with its IS.

The thickness and design of arrow lines vary and reflects upon contribution of that particular factor toward effective performance of IS in a bank. *'Solid Arrow line with specifications 6 point thick & Solid"* mark indicate strong score of 5 or high contribution of that particular factor toward effective working of IS in a particular bank. *'Solid Arrow line with specifications 3 point thick & Solid'* means a score of 4 or comparatively high contribution of that particular factor. A *'Solid Arrow line with specifications 1 point thick & Solid'* means a score of 3 or fair contribution of that particular factor. A *'Dashed Arrow line with specifications 1/2 point thick & Dashed'* means a score of 2 or not enough contribution of that particular factor. A *'Dashed Arrow line with specifications 1/4 point thick & Dotted-Dashed'* means a score of 1 or poor contribution of that particular factor. If all arrow lines are solid or thick or doubled arrow marked then it means all factors are contributing fairly high in effectiveness of IS. If all arrow lines are of same design and thickness then it means all factors have equal contribution to the effectiveness of IS.

The validity and applicability of the proposed model need to be evaluated. The proposed model provided a modular, flexible and scalable approach to assess IS effectiveness using measures for partial and complete evaluation. The model also indicated the scope for improvement. The model was tested using the sample data for validity of scale and further applied on banks under study.

Validity of the Instrument

The proposed model has been tested for validity in three ways as explained below:

Measure of Goodness

- *Scale Reliability:* Reliability of the scale has been studied for questionnaire using method of scale reliability. Cronbach's Alpha reliability of the scale was .910 i.e. more than 0.7 in the questionnaire thus illustrating the goodness of the scale measurements.
- *Content Validity:* The factors or variables for building the questionnaire were identified based on the study of available literature by various researchers and authors. The appropriate literature has been briefly summarized in the chapter 2, along with the synthesis. The managers practicing at higher level and also the academicians were consulted before finalizing the design. Informal discussion with the respondents also revealed that the questionnaire was quite comprehensive and gave due coverage to their concerns regarding Information System evaluation.
- *Sensitivity:* Likert scale of 5-point was being applied on the questionnaire, taking into account the highest level of accuracy, and properly blending desired subjectivity and objectivity. It was testified by end users in the pilot survey.

Analysis & Findings

Table 2 summarizes the various factors within the questionnaire and their significance. An analysis of table 2 indicates that these factors were consistent across the banking industry. It might have been due to standards followed in banking as well as ISs

Table 2: Proposed Model: Correlation between factors

S.No	Factor	Correlation within	Correlation with Factor Independent Variables
1	Data Integrity & Network Security	Significant at 0.01 Level	No Significance
2	Long Term Planning	Significant at 0.01 Level	No Significance
3	Transactional Effectiveness	Significant at 0.01 Level	Significant for some variables
4	Resource Utilization	Significant at 0.01 Level	No Significance
5	Data Management	Significant at 0.01 Level	No Significance
6	Flexibility for Data Handling	Significant at 0.01 Level	Significant for some variables
7	Cost Control Management	Significant at 0.01 Level	No Significance
8	Flow of Information	Significant at 0.05 Level	No Significance

9	E-Documentation	Significant at 0.01 Level	Significant for some variables
10	System Efficiency	Significant for some variables	Significant for some variables
11	Backup Policy	Significant at 0.01 Level	No Significance
12	Customer Satisfaction Level	Significant at 0.01 Level	No Significance

It is found that the variables in a particular factor are correlated with each other at 0.01 or 0.05 level of significance. It applies to all the 12 factors taken in the study. Table clearly reveals that there is no significant correlation among variables considered in the study with the independent variables. It could be concluded from the above discussion that the proposed model could be used for evaluating IS effectiveness in the banks.

Applicability of SFTI Model

At this stage the SFTI model could be applied for evaluation of Key Performance Indicators or factors contributing to effective performance of IS in banks. The score or contribution of each factor is calculated on the basis of formula devised, and applied as shown below in Table 3.

Table 3: Score of each factor after applying SFTI Model for Total Banking Industry

S. No	View of IS Effectiveness	Effectiveness Score (1-5)
1	Strategic Integration	4.10
1.1	Long Term Planning	4.17
1.2	Resource Utilization	4.19
1.3	Flexibility for Data Handling	4.12
1.4	Cost Control Management	4.13
1.5	Customer Satisfaction Level	4.02
2	Functional Integration	4.30
2.1	Transactional Effectiveness	4.39
2.2	Data Management	4.30
2.3	Flow of Information	4.22
2.4	System Efficiency	4.25
3	Technical Integration	4.30
3.1	Data Integrity & Network Security	4.30
3.2	E-Documentation	4.28
3.3	Backup Policy	4.38
	Total IS Effectiveness	4.25

As it could be seen from the data above, all the factors are contributing significantly for the performance of banks. Major scorers are factors of 'Data Integrity and Network security', 'Transactional Effectiveness', 'Data Management' and 'Backup Policy'. The factors contributing comparatively less are 'Flexibility of Data Handling', 'Cost Control Management', and 'Customer Satisfaction Level'.

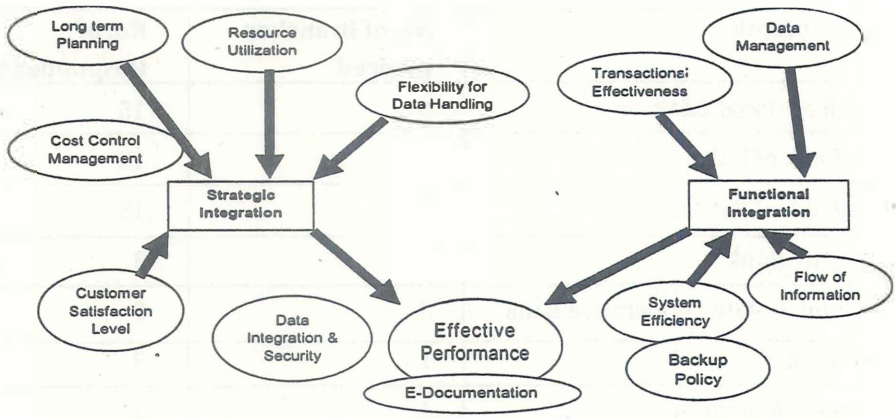


Figure 2: Applicability of SFTI Model on Total Banking Industry
(Thickness and design of arrow lines depicts the degree of contribution of a particular factor towards the effective performance of Information System in the bank)

So as per the model description, all the factors or KPIs are represented by solid arrow of 6 point thickness in fig 2 for their contribution in effective performance of banks.

Applicability of SFTI Model on Public Sector Banks

The SFTI model could be applied for evaluation of Key Performance Indicators or factors contributing to effective performance of IS in public sector banks. Twenty public sector banks in the region participated in this study. The banks participating in the research with number of branches and respondents are shown in Table 4 below.

Table 4: Detail of respondents of Public Sector Banks

Name of Bank	No. of Branches covered	No. of Respondents
Allahabad Bank	1	3
Andhra Bank	1	3
Bank of Baroda	1	3
Bank of India	1	3
Bank of Maharashtra	1	3
Canara Bank	2	6
Central Bank of India	2	6
Corporation Bank	1	3
Indian Bank	1	3
Indian Overseas Bank	1	3
Oriental Bank of Commerce	2	6
Punjab & Sind Bank	4	12

Name of Bank	No. of Branches covered	No. of Respondents
Punjab National Bank	5	15
State Bank of India	4	12
State Bank of Patiala	5	15
Syndicate Bank	1	3
The Punjab State Cooperative Bank	3	9
UCO Bank	1	3
Union Bank of India	1	3
Vijaya Bank	1	3

The score or contribution of each factor is calculated on the basis of formula devised earlier, and applied as shown below in Table 5 below.

Table 5 : Score of each factor after applying SFTI Model for Public Sector Banks

S. No	View of IS Effectiveness	Effectiveness Score (1-5)
1	Strategic Integration	4.12
1.1	Long Term Planning	4.19
1.2	Resource Utilization	4.10
1.3	Flexibility for Data Handling	4.15
1.4	Cost Control Management	4.07
1.5	Customer Satisfaction Level	4.09
2	Functional Integration	4.26
2.1	Transactional Effectiveness	4.26
2.2	Data Management	4.31
2.3	Flow of Information	4.15
2.4	System Efficiency	4.30
3	Technical Integration	4.35
3.1	Data Integrity & Network Security	4.40
3.2	E-Documentation	4.28
3.3	Backup Policy	4.38
	Total IS Effectiveness	4.24

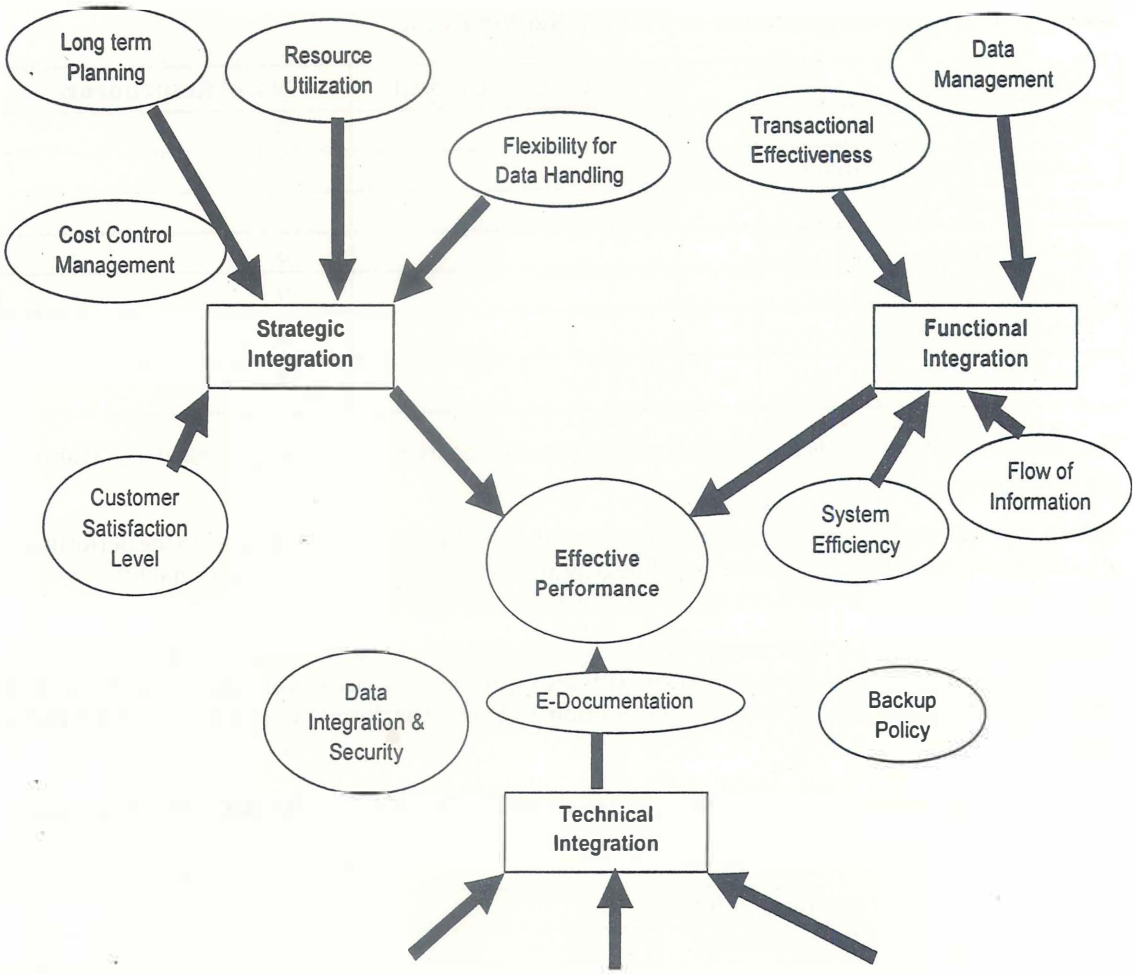


Figure 3: Applicability of SFTI Model on Public Sector Banks

(Thickness and design of arrow lines depicts the degree of contribution of a particular factor towards the effective performance of Information System in the bank)

As the above data illustrated, there is small variation in contribution of factors in the performance of banks. Major scorers are factors of 'Data Integrity and Network security', 'Data Management', 'System Efficiency' and 'Back-up Policy'. The factors contributing comparatively less are 'Resource Utilization', 'Cost Control Management' and 'Customer Satisfaction Level'. So as per the model description, all the factors or KPIs are represented by arrows of same thickness (6-point thickness and solid) in figure 3 for their contribution in effective performance of Public sector banks in totality.

Applicability of SFTI Model on Private Sector Banks

For evaluation of Key Performance Indicators or factors contributing to effective performance of IS in private sector banks, the SFTI model could be applied again. Only seven private banks in the region participated in this study. The banks participating in the research with number of branches and respondents are shown in Table 6.

Table 6 : Detail of respondents of Private Sector Banks

Name of Bank	No. of Branches covered	No. of Respondents
Axis Bank	1	3
Centurian Bank of Punjab	4	12
HDFC Bank	3	9
ICICI Bank	2	6
IDBI Bank	3	9
Kotak Mahindra Bank	1	3
Yes Bank	1	3

The score or contribution of each factor is calculated on the basis of formula devised earlier, and applied as shown below in Table 7.

As the below data shows, there is no significant variation in contribution score of factors in the performance of banks. Major scorers are factors of 'Data Integrity and Network security', 'Transactional Effectiveness', 'Data Management', 'Flow of Information', 'E-Documentation' and 'Back-up Policy'.

The factors contributing comparatively less are 'System Efficiency' and 'Customer Satisfaction Level'. So as per the model description, all the factors or KPIs are represented by arrows of same thickness (6-point thickness and solid) in figure 4 for their contribution in effective performance of private sector banks in totality.

Table 7 : Score of each factor after applying SFTI Model for Private Sector Banks

S. No	View of IS Effectiveness	Effectiveness Score (1-5)
1	Strategic Integration	4.18
1.1	Long Term Planning	4.19
1.2	Resource Utilization	4.27
1.3	Flexibility for Data Handling	4.21
1.4	Cost Control Management	4.22
1.5	Customer Satisfaction Level	4.02
2	Functional Integration	4.33
2.1	Transactional Effectiveness	4.45
2.2	Data Management	4.33
2.3	Flow of Information	4.36
2.4	System Efficiency	4.17
3	Technical Integration	4.36
3.1	Data Integrity & Network Security	4.31
3.2	E-Documentation	4.33
3.3	Backup Policy	4.44
	Total IS Effectiveness	4.29

Applicability of SFTI Model on Foreign Bank(s)

At this stage the SFTI model could be applied for evaluation of Key Performance Indicators or factors contributing to effective performance of IS in Foreign sector banks. Only One foreign sector bank in the region i.e. HSBC participated in this study.
The score or contribution of each factor was calculated on the basis of formula devised earlier, and applied as shown below in Table 8.

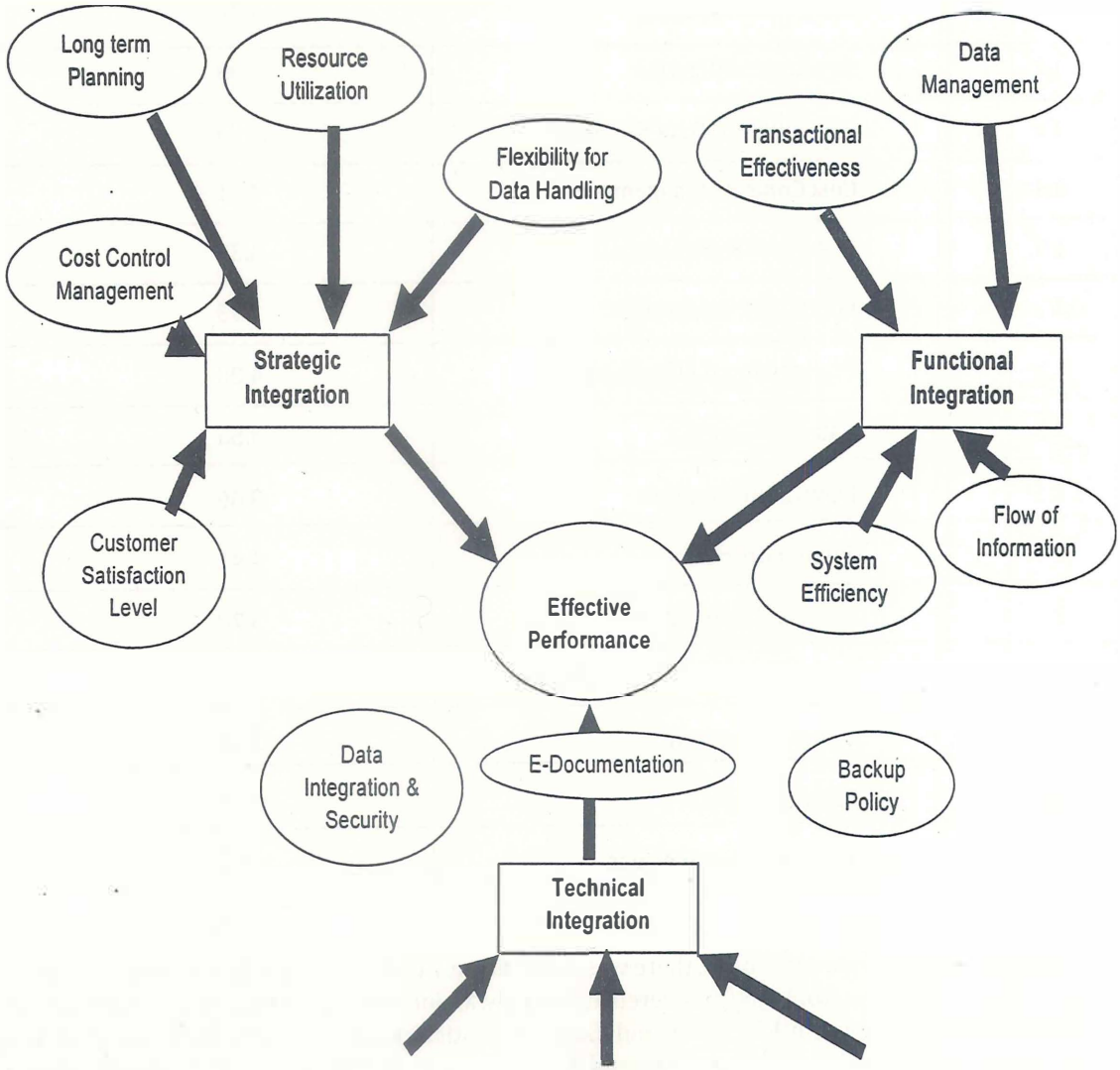


Figure 4: Applicability of SFTI Model on Private Sector Banks

(Thickness and design of arrow lines depicts the degree of contribution of a particular factor towards the effective performance of Information System in the bank)

Table No. 8 : Score of each factor after applying SFTI Model for Foreign Sector Bank(s)

S.No	View of IS Effectiveness	Effectiveness Score (1-5)
1	Strategic Integration	4.06
1.1	Long Term Planning	4.22
1.2	Resource Utilization	3.83
1.3	Flexibility for Data Handling	3.83
1.4	Cost Control Management	4.11
1.5	Customer Satisfaction Level	4.33
2	Functional Integration	3.93
2.1	Transactional Effectiveness	4.08
2.2	Data Management	3.55
2.3	Flow of Information	3.66
2.4	System Efficiency	4.41
3	Technical Integration	3.78
3.1	Data Integrity & Network Security	4.33
3.2	E-Documentation	3.33
3.3	Backup Policy	3.67
	Total IS Effectiveness	3.92

As it could be seen from the data above, there was a significant variation in contribution of factors in the performance of foreign sector bank(s) covered in the study. Major scorers were factors of 'Data Integrity and Network Security', 'System Efficiency' and 'Customer Satisfaction Level'. The factors contributing comparatively less were 'Data Management' and 'E-Documentation'. The factor of 'E-Documentation' was having lowest effectiveness score comparatively.

Diagrammatically, the factors contributing well and getting the score above 4.00 were represented by arrows with thickness of 6-points and factors getting score less than 4.00 were represented by arrows with thickness of 3-points. So as per the model description, all the factors or KPIs were represented by arrows of varied thickness in figure 5 for their contribution in effective performance of foreign banks.

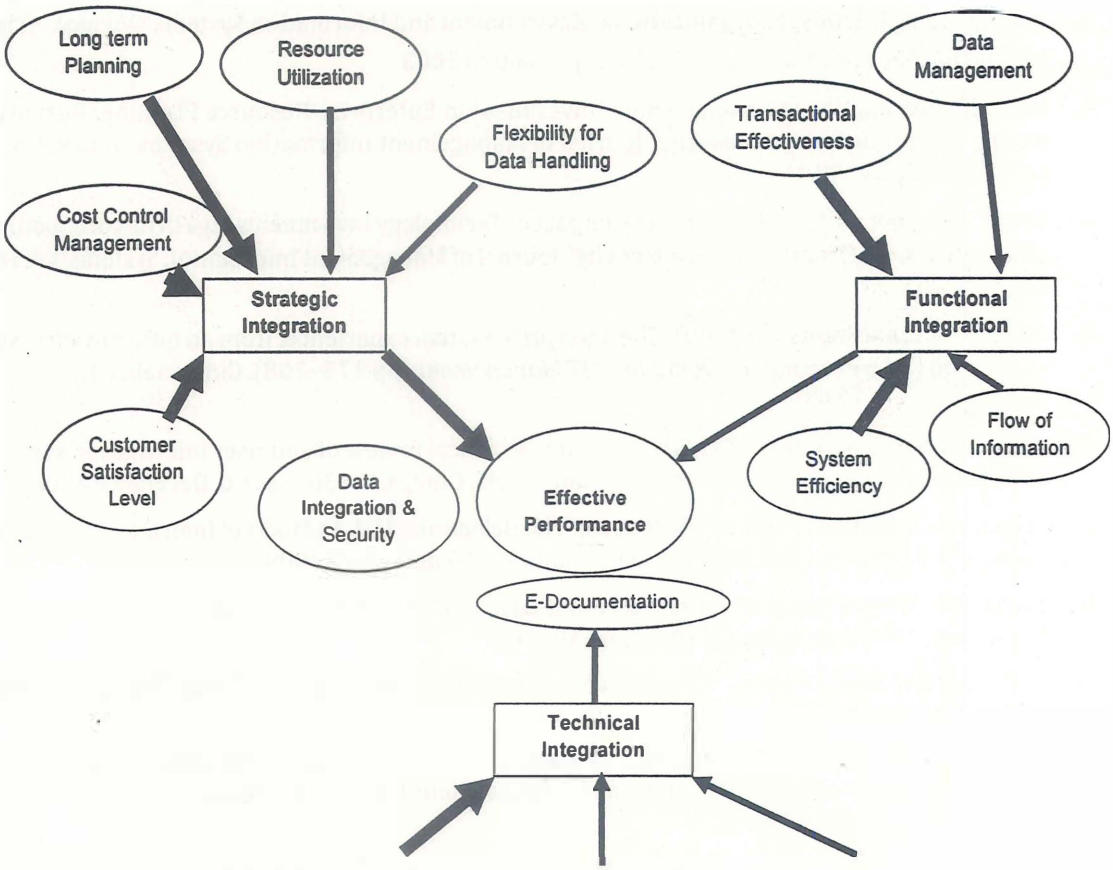


Figure 5: Applicability of SFTI Model on Foreign Sector Banks
(Thickness and design of arrow lines depicts the degree of contribution of a particular factor towards the effective performance of Information System in the bank)

Conclusion & Contribution of study

The proposed model representing 12 KPIs and their influence on working of banks provides a general framework that can be applied in evaluating the effectiveness of ISs in banks. The banking industry in India thus can apply this model for evaluating their respective ISs and find out the effectiveness index of IS. On the basis of this evaluation, the banks can improve the areas where the IS is found deficient. The model also emphasizes on the significance of the integration of various aspects, which provides a holistic picture. Academia will also get benefit from this study, as they would get a general framework for evaluating ISs.

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