STRATEGIC IMPACTS OF INFORMATION TECHNOLOGY INVESTMENTS ON BANKING INDUSTRY PERFORMANCE: EVIDENCES FROM A CROSS-COUNTRY ANALYSIS FOR BRAZIL, UNITED STATES, ARGENTINA, URUGUAY AND CHILE

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Abstract:

More and more industrial and services organizations have invested time, money and their own future in Information Technology (IT). Banks, in particular, have spent billions of dollars in IT, having their products and services basically supported by it. Identifying the IT investments and its impact is a very important point for the bank executives. This study evaluates the strategic effects of IT in Brazilian, American, Argentinean, Uruguayan and Chilean banks as perceived by their executives. The sample included 334 executives and the proposed framework evaluated ten different variables. In order to externally validate the questionnaire, results were analyzed considering, as isolated samples, (a) Brazil, (b) the United States, (c) Argentina, Uruguay and Chile, and, then, (d) as one group merging all data. The results highlight that (1) *Competition*, *Products and Services*, and *Borrowers (Customers)* are the main strategic variables affected by IT; in order to detect similar and distinct perceptions among the different countries' managers, we observed (3) Argentinean and Uruguayan, American and Uruguayan, and Brazilian and Argentinean executives have a very similar perception of IT impacts on banks; on the other hand, Brazilian and American executives present distinct perception.

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1. Introduction

More and more industrial and services organizations have invested time, money and their own future in Information Technology (IT) [1]. Citibank and Federal Express are companies that have had IT budgets around US$ 1 billion [2]. Competition and rivalry have showed up like the main reasons to justify the huge expenses in this technology – in both domestic and international markets. IT has been used as a strategic business tool and competitive weapon.

However, whether the investments done in IT actually bring real benefits to the organizations is still a matter of debate in the academy. Some recent studies about IT investments showed positive and highly expressive effects [3] [4] [5]. Researchers and practitioners have agreed in the fact that traditional analysis – focused only on financial or technological aspects – are not complete. Different alternative methods have been suggested to complement investment evaluation [6].

Banking industry, in particular, has spent billions of dollars in information technology, having its products and services basically supported by it. Between 1999 and 2002, Brazilian banks employed around US$ 3 billion in IT (hardware, software and communication devices) [7]. Banks from Latin America are intended to increase their IT investments in 60% from 1999 to 2003 [8]. Identifying the IT investments and its impact on the banking industry is a very important point for the banks. It is important that both banking managers and banking IT managers be able to deal with and justify the resources spent on this technology [6] [9].

This study evaluates the strategic impact of IT in Brazilian, American, Argentinean, Uruguayan, and Chilean banks. The central objectives are (a) propose a simple and validated framework to analyze the IT effects in the banks; (b) indicate the main strategic variables affected by IT in these banks; and (c) detect similar and distinct perceptions among the different countries' managers. The paper is organized as follows. First, we describe some constructs for measuring the potential impact of information technology in the organizational strategic variables. Then, the research method is detailed. This is followed by the presentation of the main results and the discussion about the study.

2. A comprehensive model for measuring the impact of Information Technology on strategy

This study describes the IT impacts on organizational strategic variables, more specifically on banking industry. It is an extension of Maçada and Becker's framework [10] that

is supported by two previous studies – Mahmood & Soon [11] and Palvia [12], both evaluating the IT impact on the market. The first one measures its effect on domestic markets, while the last assess global impact. The present study combines both perspectives, once banks are in a domestically and internationally competitive environment.

A comprehensive list of variables was established by reviewing some studies of previous researchers to ensure that all variables that are potentially affected by IT be identified. The choice of framework's variables reflects the present economic and competitive scenery where banks are inserted: reduction of costs, prompt utilization of new technologies, financial institutions' efforts to conquest and maintain customers, new and sophisticated products' insertion, and joints/alliances between banks. All of the framework's organizational strategic variables, which are affected by IT, are described below.

Suppliers

IT improves the power upon suppliers. Organizations can use IT to evaluate and identify resources' suppliers, besides detecting alternative sources [13] [14] [15] [16] [17].

Pricing

IT can help to change prices and improve their formation at the best moment, providing important information like cost of product, data market, etc. [18].

Borrowers

IT can support organizations' customers providing information about products and services, besides improving customer services like administrative supports [13] [14] [15] [16] [17].

Government and Country Requirements

There are some government and country requirements which can difficult or facilitate the entrance of companies in a global market. IT can be used successfully to treat these requirements [12].

Cost Structure and Capacity

Huge investments in automation (e.g. ATM's) can reduce unit cost, achieve economies of scale through better utilization of machinery, space, labor and energy, and, at the same time, reduce the cost of tailoring products/services to market segments [19] [20] [21].

Products and Services

IT can change the products and services through speeding up their life cycle, enhancing their value, improving their quality, and providing adequate responses to customers' inquiries of products/services information [15] [20] [21].

Interorganizational Co-ordination

IT helps the relationship between suppliers-buyers, producers/distributors, and distributors-buyers to benefit one another. Its evolution has contributed to facilitate the interchange of information in a competitive market [16] [20].

Interorganizational Efficiency

Different IT (e.g. videoconference, e-mail) have been used to make the interorganizational communication pattern better, faster, more convenient, and more reliable. Organizations can monitor and co-ordinate, from a closer standpoint, the activities done by their customers, their suppliers, and other firms. These companies can expand their share of market in both domestic and international markets [15] [16] [20].

Competition

IT can increase the company competitiveness in different ways as differentiating its products and services, offering products or services that its opponents cannot match, providing substitutes before them, and establishing its market shares [14] [15] [16] [17] [21].

Internal Organizational Efficiency

The decision's making process can be simplified through the IT usage (e.g. Decision Support System). IT can provide better coordination between function areas. In a service company, a simple computerized system, supported by IT, can help to diminish the delivery time and the back-log in the line. An internal efficiency can bring some benefits as increasing profit margins and market shares [13] [15] [17] [21].

Internationalization

IT permits the internationalization of the banking businesses. It improves the competitiveness of the banks, through strategic alliances in different countries. Furthermore, IT has been fundamental to push and accelerate the business internationalization [12] [23].

Collecting Costs and Switching Costs

All IT users face switching costs. If an organization is trying to get in the market or introduce a new IT (e.g. Internet, ERP) to be more competitive, it should not neglect the required costs for the customers to purchase its products, services and information. This variable includes both

time and money spent to seek new suppliers, ensure quality profits, reduce delivery time, and manage contracts [13] [15] [16].

Next section describes how the framework, developed by using the variables identified above, was empirically validated and its reliability was critically tested.

3. Research Method

We identified twelve different variables potentially affected by IT in the literature, resulting in 35 items - listed in question form. Each question asked in what extent a specific item contributed to the whole impact of the information technology, following a five point Likert-type scale where 1 = no extent, 2 = little extent, 3 = some extent, 4 = great extent and 5 = very great extent. Bank' name and executive's work section were identified to make some analysis of variance possible.

The total sample included 334 executives (141 from Brazil, 84 from the United States, 56 from Argentina, 39 from Uruguay, and 14 from Chile). From the whole sample, 155 were executives of IT and 179 were other functional executives. The data were collected from May 1998 to January 2001 (Brazil: 1998, United States: 1999, Uruguay: 2000, Argentine and Chile: 2001). The questionnaires were sent to banks which were associated to Brazilian Banks Federation (FEBRABAN), American Banks Association (ABA), Uruguayan Banks Association (ABU), Argentinean Banks Association (ABA), and Chilean Financial Institutions Association (ABIF). Executives from 68 Brazilian banks (representing 79% of all FEBRABAN banks' patrimony), 52 American banks, 15 Argentinean banks (representing more than 50% of all ABA banks' patrimony), 11 Uruguayan banks (representing about 70% of all ABU banks' patrimony), and 5 Chilean banks (representing 55% of all ABIF banks' patrimony) answered the questionnaire.

In order to externally validate the questionnaire, results were analyzed considering, as isolated samples, (a) Brazil, (b) the United States, (c) Argentina, Uruguay and Chile, and, then, (d) as one group merging all data. We made in each sample the validity of face (adapting the questionnaire's vocabulary for the measurement purpose), content (determining if the survey items are representative of the topic being measure), and construct (purposing to attach the theory with the questionnaire's items) [24]. We describe the variables validation steps above:

Brazilian Sample

The original version of the questionnaire was done in Portuguese. To validate it, the questions were first evaluated for persons with no specialized training, and then for some FEBRABAN executives. An internal consistency analysis was performed for the overall model and its twelve variables by computing the Cronbach's alpha reliability coefficients. The alpha coefficient scores for the overall model ranged from .71 to .95, and the 35-item questionnaire's alpha presented coefficient .90.

American Sample

First, the questionnaire was translated from Portuguese to English, and then it was re-translated to Portuguese (back translation process) [25]. After that, some MBA students from University of Texas evaluated the 35-item questionnaire. The alpha coefficient scores for the overall model in the American sample ranged from .61 to .83, and the 35-item questionnaire's alpha presented coefficient .95.

Argentinean, Uruguayan, and Chilean Sample

We made the back translation process with Portuguese and Spanish speakers. After that, a Spanish professor from *Universidad de la República* (Montevideo, Uruguay) looked over the questionnaire. In Argentine and Chile, the same review was done with banking executives. The internal consistency analysis presented alpha coefficient scores ranging from .44 to .76, and the 35-item questionnaire's alpha presented coefficient .92. The predefined cut-point was .50, so we eliminated two variables – *Internationalization*, and *Collecting Costs and Switching Costs* – and one item from *Interorganizational Efficiency* to get better its performance. The new alpha coefficient scores for the overall model ranged from .52 to .76, and the 29-item questionnaire's alpha presented coefficient .91.

Brazilian, American, Argentinean, Uruguayan, and Chilean Sample

Before analyzing the sample as one group merging all data, we assessed the variable *Interorganizational Efficiency* in Brazilian and American samples to assure the comparison between the five countries. In both samples, the scores were worse (decreasing from .91 to .82 in the Brazilian sample and from .78 to .62 in the American sample), although they had been superior to the established point-cut. We considered ten variables and 29 items to evaluate all samples. The variables were evaluated using Cronbach's alpha reliability coefficients (Table 1) and principal components analysis (Table 2).

Table 1- Cronbach's alpha reliability coefficients

Variables	Entire Sample	Brazil	United States	Argentina, Chile, and Uruguay
1. Suppliers	.81	.93	.84	.53
2. Pricing	.78	.90	.68	.71
3. Borrowers	.77	.80	.78	.68
4. Government and Country Requirements	.74	.72	.77	.63
5. Cost Structure and Capacity	.66	.72	.61	.63
6. Products and Services	.71	.86	.69	.52
7. Interorganizational Co-ordination	.71	.73	.77	.61
8. Interorganizational Efficiency	.71	.82	.62	.58
9. Competition	.76	.85	.78	.63
10. Internal Organizational Efficiency	.76	.78	.74	.76
11. Internationalization	---	---	---	---
12. Collecting Costs and Switching Costs	---	---	---	---
29-item-questionnaire	.91	.83	.94	.92

The alpha coefficient scores for the overall model ranged from .66 to .81, and the 29-item questionnaire's alpha presented coefficient .91. The factor analysis confirmed completeness nine from ten variables, explaining 69.88% of the original measures' variations.

Table 2 – Principal Components Analysis

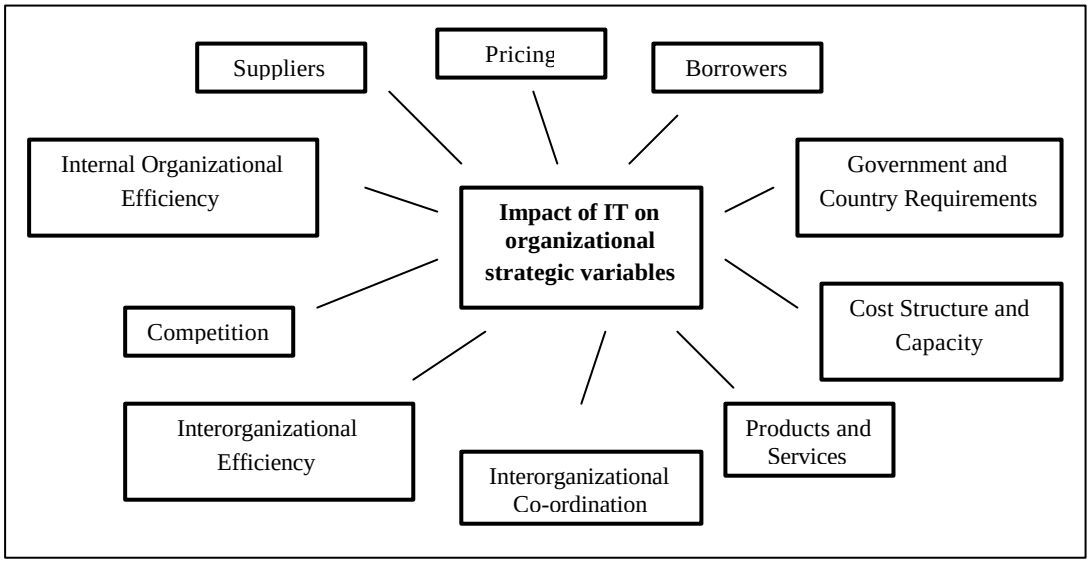
Indicadores	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Internal Organizational Efficiency (IOE)										
IOE1	.40									
IOE2	.52									
IOE3	.60									
IOE4	.60									
IOE5	.59									
SCS3	.68*									
SCS4	.70*									
Suppliers (SUP)										
SUP1		.82								
SUP2		.82								
SUP3		.72								
Government and Country Requirements (GCR)										
GCR1			.70							
GCR2			.81							
GCR3			.66							
Borrowers (BOR)										
BOR1				.85						
BOR2				.67						
BOR3				.71						
Products and Services (P&S)										
PS1					.71					
PS2					.81					
PS3					.68					
Pricing (PRI)										
PRI1						.86				
PRI2						.78				
Competition (COM)										
COM1							.84			
COM2							.81			
Interorganizational Co-ordination (ICO)										
ICO1								.52		
ICO2								.72		
Interorganizacional Efficiency (IE)										

IE1	.74
IE2	.55
Cost Structure and Capacity (CSC)	
CSC1	.68
CSC2	.78

* Items moved to *Cost Structure and Capacity (CSC)*

The validation process (validity of face, content, construct, and reliability analysis) assumed in this study attended the recommendations suggested by Straub [26] to validate questionnaires to be used in empirical surveys. After the assessments, a comprehensive model for measuring the potential effect of IT on strategic variables is suggested (see Figure 1). The framework consists of ten validated variables and 29 items (see Appendix A).

Figure 1 – Framework for measuring the impact of IT on organizational strategic variables



4. Results

The ten variables were classified according to the intensity of IT effects (see Table 3). The student *t* test (to paired samples) was accomplished to compare the means of two variables for a single group. Therefore, it was possible rank them (see Table 4). *Competition, Products and Services,* and *Borrowers (Customers)* were indicated like the main strategic variables affected by IT. The banking industry, extremely competitive, has been dependant of IT to differentiate its products and services, establish its market shares, and provide products/services before its competitors. Brazilian banks, for example, have developed a bt of automatic services like toll free-telephone line, multimedia, home banking, and ATM with more functions instead of only queries and investments [8]. IT has been used to catch and maintain customers; its huge

investments in electronic devices have tried increasing the volume of services, facilitating and providing better customer services.

Table 3 - Impact of IT in the organizational strategic variables

Variables	ALL	BRA	USA	ARG	CHI	URU
1. Competition (COM)	4,31	4,52	4,09	4,33	4,11	4,09
2. Products and Services (P&S)	4,30	4,35	4,08	4,39	4,83	4,32
3. Borrowers (BOR)	4,26	4,38	3,94	4,27	4,36	4,44
4. Suppliers (SUP)	4,06	4,15	3,85	4,19	3,95	4,00
5. Interorganizational Efficiency (IE)	4,02	4,33	3,72	3,88	4,11	3,67
6. Internal Organizational Efficiency (IOE)	4,01	4,06	3,93	3,99	4,02	4,03
7. Government and Country Requirements (GCR)	4,01	4,49	3,79	3,59	3,79	3,42
8. Interorganizational Co-ordination (ICO)	3,97	4,06	3,76	4,16	4,29	3,70
9. Pricing (PRI)	3,94	4,28	3,84	3,51	4,04	3,53
10. Cost Structure and Capacity (CSC)	3,85	3,90	3,79	3,90	3,67	3,80
Questionnaire	4,07	4,25	3,88	4,02	4,12	3,91

Pricing and *Cost Structure and Capacity* are the variables less affected by IT. It is clear that IT has helped and interfered to formulate prices and provide information about products and services which any bank commerce. A study made by American Banks Association indicated that one ATM transaction cost US$ 0.27, while the same transaction made by a clerk cost US$ 1.27 [27]. This kind of information is important and can be very useful but, often, the price of a service or product has been influenced by market or government forces, determining its fares and taxes. Regarding cost structure and capacity, although the investments in ATMs have increased in the last few years (e.g. Argentina: 53% from 1998 to 1999 [28], Brazil: 32.6% in the same period [7], and Chile: 13.6% in the same period [29]), banking executives have justified them because banking industry has showed extremely competitive.

Table 4 - Ranking of organizational strategic variables which are affected by IT

Ranking	Variables	COM	P&S	BOR	SUP	IE	IOE	GCR	ICO	PRI	CSC
1	COM	**4,31**	**NS**	**NS**	S	S	S	S	S	S	S
	P&S	**NS**	**4,30**	**NS**	S	S	S	S	S	S	S
	BOR	**NS**	**NS**	**4,26**	S	S	S	S	S	S	S
2	SUP	S	S	S	**4,06**	**NS**	**NS**	**NS**	**NS**	S	S
	IE	S	S	S	**NS**	**4,02**	**NS**	**NS**	**NS**	NS	S
	IOE	S	S	S	**NS**	**NS**	**4,01**	**NS**	**NS**	NS	S
	GCR	S	S	S	**NS**	**NS**	**NS**	**4,01**	**NS**	NS	S
	ICO	S	S	S	**NS**	**NS**	**NS**	**NS**	**3,97**	NS	S
3	PRI	S	S	S	S	NS	NS	NS	NS	**3,94**	**NS**
	CSC	S	S	S	S	S	S	S	S	**NS**	**3,85**

S: Statistic Significant ($p < .05$) NS: Non-statistic Significant ($p > .05$)

In order to detect similar and distinct perceptions among the different countries' managers (Brazilian, American, Argentinean, Uruguayan and Chilean), we considered the *t* values ($p < .05$) to compare the ten variables. An analysis of variance (ANOVA) was done and we found that only *Cost Structure and Capacity* and *Internal Organizational Efficiency* presented no different perception among the five countries' managers (Table 5).

Table 5 – Analysis of Variance among Brazilian, American, Argentinean, Uruguayan, and Chilean executives

Variable	N	F	*p*
1. Borrowers (BOR)	332	7,878	0,000
2. Competition (COM)	332	7,099	0,000
3. Suppliers (SUP)	332	2,654	0,033
4. Products and Services (P&S)	333	5,566	0,000
5. Cost Structure and Capacity (CSC)	332	0,769	0,546
6. Internal Organizational Efficiency (IOE)	333	0,635	0,638
7. Interorganizational Efficiency (IE)	332	11,398	0,000
8. Pricing (PRI)	331	12,220	0,000
9. Government and Country Requirements (GCR)	332	30,542	0,000
10. Interorganizational Co-ordination (ICO)	332	4,715	0,001

For the other eight variables we made a deeper analysis intending to find out which countries were responsible for these differences. To consider different countries with the same perception we used the *t* value ($p < .05$) between the closest countries' mean (when the *t* value was higher than .05, these countries were grouped in the same one). This procedure *post hoc* follows the same cluster analysis' logic; however, the first one considers the country as the only segmentation criteria [30]. The Table 6 presents the ten variables with their respective countries' groups.

Table 6 – Similar Perception Groups regarding the strategic impacts of IT

	SUP		COM		BOW		ICO		P&S			IE		PRI			GCR	
	Groups		Groups		Groups		Groups		Groups			Groups		Groups			Groups	
	1	2	1	2	1	2	1	2	1	2	3	1	2	1	2	3	1	2
Brazil		4,15		4,52		4,38		4,06		4,35			4,33			4,28		4,49
United States	3,85		4,09		3,94		3,76		4,08			3,72			3,84		3,79	
Argentina		4,19		4,33		4,27		4,16		4,39		3,88		3,51			3,59	
Chile	3,95		4,11			4,36		4,29			4,83		4,11		4,04		3,79	
Urugua y	4,00		4,09			4,44	3,70			4,32		3,67		3,53			3,42	
Groups	3,90	4,17	4,09	4,47	3,94	4,36	3,74	4,10	4,08	4,35	4,83	3,76	4,31	3,52	3,87	4,28	3,66	4,49
Total	4,06		4,31		4,26		3,97		4,30			4,02		3,94			4,01	

Regarding the number of similarities between samples, we observed that Argentinean and Uruguayan, American and Uruguayan, and Brazilian and Argentinean executives have a very similar perception of IT impacts on banks (7 variables with no statistic difference). The similar perception between Argentinean and Uruguayan's executives is not surprising, considering that

their capitals are geographically close, their base economies are comparable (e.g. agriculture), and their history and colonization are compatible. Concerning the United States and Uruguay, what we can conjecture is that the most important banks in Uruguay have their headquarters in the United States, and that is why they probably adopt the same management strategies [31] [32]. Montevideo is considered a very important financial center in South America, receiving a lot of foreign money from different investors. Last, concerning Brazil and Argentina, they have very similar social, politic, and economic situations (established inflation, recession period, unemployment rates, and they are the most important countries from "Mercosul" trade deal) [8] [33]. Furthermore, the biggest Brazilian and Argentinean banks have important branches operating in both countries.

On the other hand, Brazilian and American executives present distinct perception (only two variables with no statistic difference). In general, Brazilian executives perceive the strategic impacts of IT more intensively than Americans.

5. Final Remarks

IT has influenced the banking business processes, modifying and adding value to its products and services. The computer has practiced a large impact on banking operations, being one of the most automated industries in the world. However, the investments done in technology are making conventional branch structures too expensive. Thus, evaluating the real effects of IT in the corporate strategy becomes a key driver to banking executives.

We proposed and validated a framework to analyze the strategic IT effects in the banks. Besides, this study indicated and evaluated the effects of IT on banking industry, through a cross-country analysis for Brazil, United States, Argentina, Uruguay, and Chile, as perceived by their executives. We concluded that Competition, Products and Services, and Borrowers (customers) are the main strategic variables affected by IT. In this view, IT enables business strategies and allows the banks to adopt a stronger competitive posture [34]. *Pricing* and *Cost Structure and Capacity* are the strategic variables less affected by IT.

Comparing the perceptions among the different countries' managers, we found that Argentinean and Uruguayan, American and Uruguayan, and Brazilian and Argentinean executives have a very similar perception of IT impacts on banks; on the other hand, Brazilian and American executives present distinct perception.

Some cautions should accompany the conclusions of this study. First, its data were collected in different periods (started in May 1998 and finished in January 2001). This happened because Brazilian and American data had made part of a preliminary study, validating Maçada & Becker's framework. Besides, the results should be interpreted carefully because of the relatively small sample size, especially in Chile and Uruguay. We hope this study supports banking executives to plan IT strategies, their implementation and to evaluate their use.

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Appendix A

	To what extent do you think information technology does…
	I. Borrowers (Customers) – BOR
BOR1	Make the products/services data base available to borrowers.
BOR2	Help banks in negotiations with major borrowers by offering information systems about them.
BOR3	Contribute towards banks offering managerial support to borrowers (for instance, collection, account balance control, etc.).
	II. Competition – COM
COM1	Support banks make their first strike against competitors (i.e., offer products/services that their competitors cannot match).
COM2	Help banks provide products/services before their competitors do.
	III. Suppliers (Customers) – SUP
SUP1	Reduce uncertainties during the processing time of product/services.
SUP2	Reduce transaction costs of bank by making processes for resource suppliers easier.

SUP3	Reduce transaction costs of resource suppliers by making their process of financial management easier.
IV. Products and Services – P&S	
PS1	Incorporate to existing products/services, increasing their value.
PS2	Provide banks opportunities to innovate in products/services.
PS3	Allow banks add higher volume of information to their products/services.
V. Cost Structure and Capacity – CSC	
CSC1	Reduce the cost of adaptation of products/services to specific market segments.
CSC2	Provide economies of scale in the use of software.
CSC3	Reduce the cost of projects for new products and services.
CSC4	Increase financial revenues of banks.
VI. Internal Organizational Efficiency – IOE	
IOE1	Improve the decision making process.
IOE2	Provide better co-ordination among functional areas in the bank.
IOE3	Improve better evaluations for reporting annual budget.
IOE4	Improve the strategic planning of banks.
IOE5	Provide higher accuracy on sales forecasts (banks and other organizations).
VII. Interorganizational Efficiency – IE	
IE1	Allow contract/outsource activities.
IE2	Allow flexibility in locating world operations.
VIII. Pricing – PRI	
PRI1	Help in tracking the market response to promotional charges of launching products/services.
PRI2	Help in tracking how the market reacts to discounts in fees and charges.
IX. Government and Country Requirements – GCR	
GCR1	Help in dealing with different currencies and measurement systems of countries where the bank operates.
GCR2	Help in dealing with bank regulations in countries where the bank operates.
GCR3	Help achieve objectives of social policies and progress in the countries where the bank operates.
X. Interorganizational Co-ordination – ICO	
ICO1	Help banks co-ordinate with customers and suppliers.
ICO2	Help to coordinate banks activities regionally, nationally, and globally.