

Measuring IT Effectiveness in Banks of India for Sustainable Development

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Submitted in May 2011; Accepted in July 2011

Abstract - Banks in India have invested heavily on deployment of information technology (IT) in the past one decade. IT over the years has become business driver rather than a business enabler. Sustainable development of banks depends heavily on effective use of IT. This calls for measuring the effectiveness of IT in these banks. This paper identifies the economic methods of measuring IT effectiveness on the basis of review of literature on the subject.

Index Terms = Information Technology (it), effectiveness, sustainable development, economic methods

1. INTRODUCTION

In the past decade banks in India have invested heavily in the information technology. Total expenditure incurred on computerization and development of communication networks by public sector banks (PSBs) alone between September 1999

and March 31, 2009 is Rs. 17897 crore. Today, information technology seems to be the prime mover of all banking transactions. Trends show that banks in India have been endeavoring to leverage technology to bring about improvements in; quality of customer services, scale and specialization in products, alternative sources of income particularly from fee-based services, geographical reach through communication networks and electronic delivery channels, risk management practices, housekeeping, internal control systems and regulatory compliance and cost efficiencies and scale economies. In other words, banks in India started perceiving IT as a tool to achieve improvement in the efficiency (more output with less input) and effectiveness (outcomes). An indication of the extent of investment and percolation of IT in different categories of banks is evident from the data presented in Table 1.

Parameter	Nationalized Banks	State Bank Group	Other Public Sector Bank	Old Private Sector Banks	New Private Sector Banks	Foreign Banks
Banks	19	07	01	15	08	31
Branches	39376	16062	510	4673	4204	293
ATMs	15938	11339	900	2674	12646	1054
Fully Computerized Branches (%)	92.9	100	100	-	100	100
IT expenditure (in crore incurred between September 1999 and March 2009)	11802	6095	-	-	3110*	-

Table 1.1: IT Percolation in Banks in India (as on March 2009) * Estimated amount

Source: RBI's Report on Trend and Progress of Banking in India, 2008-2009

It is clear from the data, shown in Table 1 that banks have invested heavily over the years in information technology systems. Looking the dependence of banks on IT, there is no doubt that, IT over the years has become business driver rather than a business enabler. This is clear that banks sustainable development depends heavily on effective usage of IT. Therefore measuring the IT effectiveness is the major concern of management today. In our paper we have identified the methods of measuring IT effectiveness by reviewing the earlier Assistant Professor, University School of Management Studies, Guru Gobind Singh Indraprastha University, New Delhi
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studies on the subjects. Earlier studies have measured the IT effectiveness using both economic as well as non economic measures. Our paper reviews only those studies which have used the economic methods for measuring the IT effectiveness.

2. REVIEW OF LITERATURE

Although banking is among the most IT-intensive industries and among those that started early to rely massively on computers for their operations, the large bulk of applied literature on bank technology includes very few studies on this topic, mainly because of the paucity of appropriate quantitative information. An analysis of earlier studies on

banking, in terms of their focus, method used as well as the main findings, is presented in Table 2.

Author(s)	Sample	Technique(s) Used	Main Findings
[Alpar and Porembski,1989]	30 German banks	DEA	Potential for cost savings from greater IT use was significant in 1989 and in 1994, the effects of IT on cost efficiency were small
[Alpar and Kim,1990]	175 U.S. banks	Translog Function	IT contributed to reduction in demand deposits and increase in time deposits. IT also helped to increase in other loans and decrease in installment loans. IT was also responsible for saving labor.
[Parsons, Gotieb and Denny,1993]	5 Canadian banks	Translog Function	There was a 17 to 23 percent increase in productivity with the use of computers. The returns were very modest compared to the levels of IT investments.
[Wang et al.,1997]	22 U.S banks	DEA	Inefficiency in IT-related value added activities always lead to overall inefficiency. Around 64 percent of units that had efficient IT- related activity also had perfect overall efficiency.
[Prasad and Harker ,1997]		Cobb-Douglas Production Function	Additional investment in IT capital had no real benefits and may be more of strategic necessity to stay within the competition. However the results indicated that there were substantially high returns when investment in IT labor was increased.
[Soteriou and Zenios,1999]	Bank branches of Cyprus	DEA	Micro-environment in the branches had an effect on their efficiency and urban branches had better efficiency than rural branches.
[Department of Banking Supervision, RBI, 2002]	All scheduled commercial banks of India	Ratios	Higher performance levels had been achieved without corresponding increase in the number of employees. Also operating expenses of the banking system had declined during the study period, indicating the positive impact of computerization.
[Takemura,2003]	Japanese banks	Cobb-Douglas Production Function	IT capital has either positive or no effect on productivity
[Rao et al.,2003]	Indian banks	Cobb-Douglas Production Function	E-business capital and e-business as well as non e-business labor made positive contributions to output. Non e-business capital has either insignificant or negative impact on productivity
[Chen and Zhu,2004]	22 banks of U.S.	DEA	Applying the developed model on the data of 22 banks for the period 1987 to 1989, they concluded that IT budget was not efficiently utilized in the study period.
[Li,2007]	All Taiwan banks	DEA and SFA	Low operational efficiencies existed in the banking industry during the study period, 1996 to 2000. These inefficiencies were in nature ascribable to a combination of both wasteful over use of information technology resources and inappropriate scale of information technology investments.

Author(s)	Sample	Technique(s) Used	Main Findings
[Beccalli,2007]	737 European banks	Ratios and SFA	Investment in IT services from external providers (consulting services, implementation services, training and education, support services) had a positive influence on accounting profits and profit efficiency, while the acquisition of hardware and software reduced banks' performance.
[Chandrasekhar and Sonar,2008]	29 Indian banks	DEA and Malmquist Index	Private sector banks had a slight edge over their industry counterparts during the study period of 2001 to 2006. Further, on the technology front as well as in exercising managerial control, substantial scope existed for improvement, across the sector.

Table 2: Analysis of the Earlier Studies on Impact of IT on Banks

3. METHODS OF MEASURING IT EFFECTIVENESS

Literature survey reveals that along with the performance ratios, econometric and linear programming approaches are available to measure the IT effectiveness. Performance ratios are widely used in all sectors of business. The best known ratios are for financial and production managers. The financial ratios regarding liquidity, capital adequacy, earnings and liability are widely used measures of organizational performance. While in banking sector intermediation cost, interest spread, operating expenditure, cost to income ratio, return on assets, return on equity, business per employee, income per employee and business per branch, among others, are some of the commonly used ratios for assessing the efficiency and productivity of a banking unit. However, they have disadvantages like (i) each single ratio must be compared with some benchmark ratio one at a time (ii) while the calculation of a set of financial ratios is relatively easy, the aggregation of those ratios can be quite complicated, which requires experienced judgment (iii) financial ratios do provide information on the overall financial performance of an organization, but provide little information about the amount by which performance could be improved or the area where the effort should be focused in order to improve performance (iv) ratio analysis also fails to consider the multiple input-output characteristics of business enterprises and cannot give an overall clear picture of organizational operations because firm performance may exhibit considerable variation, depending on the indicators selected. Looking at the disadvantages of ratios as a performance measurement technique, in the recent banking literature the attention has mostly been directed to the latter two techniques of frontier efficiency analysis, namely, econometric approach and linear programming approach, which can provide comprehensive insights beyond those available from financial ratio analysis for evaluating and improving IT effectiveness. After seminal study by [Farrell, 1957], methodological development in frontier efficiency analysis has been growing at a rapid pace. Presently, there are multitudes of techniques, parametric and nonparametric, stochastic and deterministic are available for performance measurement. The essential differences among these

techniques based on the differing assumptions used in estimating the shape of the frontier and the distributional assumptions imposed on the random error and inefficiency. There are at least five different types of approaches in the literature that have been employed in measuring IT effectiveness. Of those, three are econometric approaches i.e. stochastic frontier approach (SFA), distribution-free approach (DFA) and thick frontier approach (TFA), which are parametric, and two linear programming approaches which are nonparametric i.e. data envelopment analysis (DEA) and free disposal hull (FDH). Each of the approaches has weaknesses, as well as strengths relative to the other. The literature has not yet come to a consensus about the preferred approach for determining the best-practice frontier against which relative efficiencies are measured. In general, parametric approaches are stochastic, which distinguish the effects of inefficiency from the effects of noise. A key drawback of parametric approaches is that they usually specify a particular functional form that presupposes the shape of the frontier. If the functional form is misspecified, measured effectiveness may be confounded with the specification errors. In sharp contrast to parametric approaches, nonparametric approaches are inherently bounding techniques, and so they impose less structure on the frontier. They are deterministic and do not allow for random error owing to luck, data problems or other measurement errors. If random errors do exist, measured effectiveness may be confounded with these random deviations from the true efficiency frontier. Most of studies on banking have used either SFA or DEA approach to calculate the effectiveness. Both the DEA and SFA approaches have their individual strengths and weaknesses. The SFA approach has the advantage of allowing for random shocks and measurement errors. Another advantage of the SFA approach is that it is possible to analyze the structure, and investigate the determinants of, producer performance. Therefore, it has a more solid grounding in economic theory. On the other hand, weaknesses with the whole family of econometric approaches to efficiency measurement (to which SFA belongs) are (i) It is risky to impose a priori assumptions on the production

technology by choosing a functional form (e.g. Cobb–Douglas, translog, etc.), given that most of the distributional characteristics of the production technology are a priori unknown (ii) The precise specification of the error structure is difficult (sometimes even impossible) to ascertain. In addition, such specification is likely to introduce another potential source of error (iii) The continuity presumed in this approach may lead to approximation errors.

Compared with the stochastic parametric frontier approach, DEA has advantages in measuring the relative efficiency of banks. First, DEA is non-parametric frontier approach and does not require, rigid assumptions regarding production technology and specific statistical distribution of the error terms. Second, DEA is amenable for small sample studies. Third, as a non-parametric frontier technique, DEA identifies the inefficiency in a particular bank by comparing it to similar banks regarding as efficient. Other DEA advantages are [Banker and Morey, 1986, Sengupta, 1988] identification of bad from good performers by generating an overall, easy to interpret efficiency score; independent measurement units (giving great flexibility in selecting outputs/inputs); and manipulation of uncontrollable, environmental factors, e.g. competition. However, the DEA model does not allow for measurement error or random shocks. Instead, all these factors are attributed to (in) efficiency, a characteristic that inevitably leads to potential estimation errors.

4. CONCLUSION

In this paper author on the basis of review of literature has identified methods of measuring IT effectiveness in banks of India. There are at least five different types of approaches in the literature that have been employed in measuring IT effectiveness. Of those, three are econometric approaches i.e. stochastic frontier approach (SFA), distribution-free approach (DFA) and thick frontier approach (TFA), which are parametric, and two linear programming approaches which are nonparametric i.e. data envelopment analysis (DEA) and free disposal hull (FDH). Most of studies on banking have used either SFA or DEA approach to calculate the effectiveness. Advantages and disadvantages of each method are also discussed in the paper.

REFERENCES

- [1]. Alpar P. and Porembski M. (1989), "Impact of IT on cost efficiency of German banks", Marburg University Working Paper.
- [2]. Alpar P. and Kim M. (1990), "A microeconomic approach to the measurement of information technology value", *Journal of Management Information Systems*, Vol. 7, No. 2, pp. 55-69.
- [3]. Banker R.D. and Morey R.C.(1986), "Efficiency analysis for exogenously fixed inputs and outputs", *Operations Research*, Vol. 34, pp. 513-521.
- [4]. Beccalli E. (2007), "Does IT investment improve bank performance? Evidence from Europe", *Journal of Banking and Finance*, Vol. 31, pp. 2205-2230.
- [5]. Chadrasekhar M. and Sonar R. M. (2008), "Impact of information technology on the efficiency and total factor productivity of Indian banks", *South Asian Journal of Management*, Vol. 15, No. 3, pp. 74-99.
- [6]. Chen Y. and Zhu J. (2004), "Measuring information technology's indirect impact on firm performance", *Information Technology and Management*, Vol. 5, pp. 9-22.
- [7]. Farrel M. J. (1957), "The measurement of productive efficiency", *Journal of Royal statistical Society*, Vol. 120, pp. 253-281.
- [8]. Li C. F. (2007), "The role of information technology in operating cost and operational efficiency of banks: An application of frontier efficiency analysis", *Asian Journal of Management and Humanity Sciences*, Vol. 2, Nos. (1-4), pp. 36-56.
- [9]. Off-site Monitoring & Surveillance division, RBI (2002, December), "Expenditure pattern and IT initiatives of banks", *RBI Bulletin*, pp. 849-867.
- [10]. Parsons D., Gotlieb C. C. and Denny M. (1993), "Productivity and computers in Canadian Banking", *Journal of Productivity Analysis*, Vol. 4, pp. 95-114.
- [11]. Prasad B. and Harker P. (1997), "Examining the contribution of information technology towards productivity and profitability in U.S. retail banking", Working Paper No. 09, Wharton Financial Institutions Center, Wharton School, University of Pennsylvania.
- [12]. Rao N. V., Singh P., and Maheshwari, N. (2003), "A framework for evaluating e-business models and productivity analysis for banking sector in India", Retrieved from <http://www.arraydev.com/commerce/JIBC/2005-08/maheshwari.htm>.
- [13]. Sengupta J.K.(1988), "A robust approach to the measurement of Farrell efficiency", *Applied Economics*, Vol. 20, pp. 273-283.
- [14]. Soteriou A. and Zenios S. A. (1999), "Operations, quality, and profitability in the provision of banking services", *Management Science*, Vol. 45, No.9, pp. 1221– 1238.
- [15]. Takemura T. (2003), "Information system investment, productivity and efficiency in Japanese banking industry", Working Paper of the Graduate School of Economics, Osaka University.
- [16]. Wang C. H., Gopal R. and Zions S. (1997), "Use of data envelopment analysis in assessing information technology impact on firm performance", *Annals of Operations Research*, Vol. 73, No. 1-4, pp. 191-213.