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Impact of IT on the Performance of Indian Service Industries

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ABSTRACT
This research develops principles for an evaluation criterion of the performance of service firm. The aim of this paper is to provide an analysis on the relationship between Information Technology (IT) adoption and its usage and firm performance (banking and software firm) in India. Firm performance was measured with the help of three important variables: efficiency, effectiveness and profitability. Each one of the above has been described with a set of pretested questionnaires. Banks in India, in particular are geared for comprehensive banking solutions with extensive branch networks. Empirical data was collected in the year 2013. A scientific sampling scheme was implemented using the non-probability sampling technique. Perceptions of branch managers, staff members and customers were collected using survey methodology. Structured questionnaires were designed for the respondents in the selected firm.

Data analysis was carried using statistical tools. The relationship between variables was checked by using Pearson's correlation coefficient. The analysis suggested that IT usage has a positive linear relationship with financial performance. Firm performance was found to have a positive correlation with factors such as staff attitude towards IT usage, IT literacy level thereby increasing efficiency, effectiveness as well as profitability of service firm. In specific terms, tenure of IT adoption and utility of IT contributes much towards increase in performance of firms. Result from statistical analysis was validated with that achieved from ANN modeling.

Keywords: Information technology usage, firm performance, IT literacy level, financial performance, Artificial neural network modeling.

1. INTRODUCTION

Information Technology (IT) is fast becoming a dynamic channel that drives the Indian economy. IT is a means to communicate data and valuable information that is used in organizational processes for crucial decision making and becoming increasingly important for the growth of the economy as a whole. The availability and usage of adequate IT skills are important factors, which influence the competitiveness among the service firms in this era of e-Economy.

There are multiple factors which govern the performance of an organization **Rock man et al**. **[1].** Of those, IT has a significant positive impact on the organizational performance. Growth and competitiveness of banks are dependent on the successful application of new technologies. Availability of skilled labor is a questionable resource requirement. There is a qualitative and quantitative imbalance in the supply of skilled labor **Calabrese et al**. **[2].** It depends on the demographic factors, business cycles and rapid technological advancements taking place around us. Due to the vast development in the area of e-Banking it is essential that the policy makers should focus on the growing demand in IT skills and take corrective steps to prepare the required numbers and quality beforehand Cheng **et al.[3].** E-Banking enables to conduct service business electronically over the Internet where the costs are minimal and it is no longer bound by time or geographical boundary. How can the Indian service firms keep abreast of these changes? How can the service firms stay ahead and introduce next generation of service products? The answers to these questions would be to have employees fluent in digital language and people who are innovative and creative. **Cheng, et al**. **[4].** They should be capable in introducing new service products and understanding the future service needs of our society. This research provides information to the stakeholders of service industries commercial banks to allocate required funds for the much-needed IT training on employees. Further, IT literacy level of the decision makers has a huge impact on the total customer satisfaction and thereby achieving growth in performance. **Nudurupati et al, [5].**

There were many constraints and hardships experienced by service firms in the era of pre-IT usage **Bergendahl et al**, [**6].** Banking, in particular, the total number of accounts handled manually by branches with the allocated staff members was limited.

Opening of new accounts was restricted. Follow up of past records was a task of searching through huge paper files and documents. Customer advices and statements were type written. There were no cashless shopping, marketing or holidaying. People had to carry cash with them. Credit cards and debit cards were not available **Nik et al [7].**Banks were spending huge sums of money in acquiring IT competence. They were expending huge money in foreign currency for acquiring hardware, software and soft skills, investing money to train bank staff and maintain and retain the group of knowledge **workers Shaik, et al, [8].** Still, banks were not getting the expected return on expenditure, unable to achieve the maximum value for the money spent. They were not having a specific plan for return. Banks were unable to generate its entire staff to accept IT challenges and innovations ahead **Steigenberger et al**, **[9].**Presently, banks have overcome the above difficulties due to its online transactions and flexibility in nature.

It was investigated that the impacts of specific risk management strategies and residual performance risk on objective performance measures such as cost and schedule overrun. It also indicated that, unlike subjective performance measures, cost and schedule overrun performance measures are positively associated with residual performance risk in Korea. It was also investigated about the impact of two alternative conceptualization of software development risk on both objective performance and subjective performance **Na et al,[10].**

The main objective of this research is to find out the impact of IT usage on service performance. With respect to a leading service firms in India, this study attempts to measure the impact of IT usage on service performance. It also tries to find out the level of IT usage at branches. Further the study attempts to explore the IT literacy level of service firm's staff.

2. REVIEW OF LITERATURE

There are many factors governing the overall performance of service firms. It is necessary to study all the factors and their effectiveness on the performance. Lima et al, **[11].** In the era of e-Banking, IT definitely plays a major role in performance. Almost all the service firms in India geared with complex IT systems to handle core-banking functionalities. This will also create awareness in the general public that it is important to acquire basic IT skills before seeking employment Chan et al, **[12].** Finally, it can contribute in turn to improve the IT literacy level of the general public. However, the usage of IT at the branch, other than the core banking application has not been studied Chen, **et al, [13].**

Presently, banks are willing to include IT literacy skills in the performance evaluation and promotion criteria for motivating the existing bank staff to acquire required IT skills. **Lepmets et al**, **[14].** When the branch staff is IT literate, they can propose and suggest innovative banking products that align with banking business. It will be easy for the specialized IT staff to have fruitful discussions during policy reforms **Dewhurst et al, [15**].

IT mainly influences globalization. Various companies from different countries with different cultural values and ideas tend to converge together. **Grigoroudis et al**, **[16].** Business and society as a whole rely heavily on IT. With the development of the Internet there is an increased opportunity enabling organizations to succeed financially. **Schmidberger et al**, [**17]**. IT has become an essential resource to business activities due to the development of high bandwidth telecommunications networking, integrated distribution systems, and database systems that allow businesses to operate in a global way **Adriaanetal [18].** IT enables communication between different companies via state-of-the-art technology, consisting of telecommunications equipments such as high-tech web cameras and ultra-fast networks, resulting in high-speed data transmission **Ojha, et al (19).**

Assessment of IT literacy means not just knowledge of technology, but the ability to apply technology to solve problems. **Needle et al**, **[20]**. Findings of an e-skill study of IT user in workplace at UK demonstrated very bad gaps for employees. The study has found that many employees lacked sufficient IT user skills to perform effectively in their day-to-day roles thus impacting negative business productivity **Nudurupati, et al**, [**21]**.

State Bank of India introduces Supply Chain Finance by leveraging its state of the art technology for the convenience of the customers. SCF will strengthen the relationship of SBI with the Corporate World by financing their supply chain partners **Trachta et al**, **[22].** Under Supply Chain Finance Unit online platform for financing the Supply Chain partners of various reputed Corporate has been established Cho et al, **[23].**

Dramatic changes are happening in financial products and services. Other than the traditional banking business of liquidity provision, banks have acquired competencies to perform variety of other financial and non-financial activities. **Lee et al, [24].**Customer Relationship Management **(CRM)** produces Customer Equity. Three major drivers of customer equity are: 1. Value Equity 2. Brand Equity 3.Relationship Equity. **Hussain et al, [25].**Deregulation and innovation have opened up the financial sector. It has been ensured that the Bankers are ready for the technological change **Rockman et al,** [**1**].

The drive towards self-service and automated customer care has allowed organizations to reduce costs and handle an ever-increasing number of consumer transactions efficiently. **Therrien, et al, [26].** However, the profile of end customer is ever changing. They are becoming mobile and not relying on a single communication device. Companies should grasp this and maintain a competitive edge. They should recognize the growing user-centricity of consumer communications Ojha, et al, [**19]**.

In the shifting paradigm, organizations move quickly to respond the change to gain a bigger market share and reduce customer churn purely by enhancing the experience of customers who now expect anytime, anywhere access to services. Grigoroudis et al, [**16]**. A research carried out in the UK has used the "Growth Accounting Approach" to multi factor productivity estimation to estimate the impact of IT on productivity. **Robinson et al**, **[27]**. Identification of suitable metrics to assess IT impact on business performance is a difficult task Chan et al, **[28].** Further work to be carried out to determine the measures such as IT usage, user satisfaction, and the indicators of business performance attributed to the use of IT in a competent and innovative way **Robinson et al**, (**27**).

There are many factors governing the performance of decision-making units considered in benchmarking **Robinson et al** [**27]**. Some of them can be listed as customer attitude towards IT usage, scope of IT applications used, level of IT service quality, IT security level, complexity of IT, unreliability of IT, job satisfaction of the staff, profitability, considering IT as a strategic tool, level of customer relationship management, customer satisfaction, cost reduction, operational efficiency and operating efficiency **Braz**, **et al,[29].** A study done on comparison of service quality states that the IT usage on branch performance can be measured using the use of the Internet as a marketing intelligence tool, perceived usefulness and perceived ease of use, system quality (information quality), attitudes towards web retailing, compatibility, personality, working experience, educational level, Internet access availability, training received and frequency of use and trust **Goo et al**, [**30]**.

In a research done by **Davis et al**, **[31]** in 1989 using the Technology Acceptance Model (TAM) as a basis, a questionnaire was completed by employees. Structural Equation Modeling (SEM) was used to analyze the data, and this confirmed the relationships proposed by the TAM**ArasliH** [**32]**. In that research, the TAM was modified and applied to bank customers in Estonia, because Estonia, a country with a developing economy, has focused on Internet banking as an important distribution channel. A total of 268 commercial bank customers responded to a Greek and Turkish translated version of the SERVQUAL (a multiple-item scale for measuring perceptions of service quality instrument) **ArasliH** [**32]**.

3. METHODOLOGY

This research developed a survey method. The total design method (Larso and Doolen, 2009) was used to develop survey items and the survey administration. Survey items were adapted from previously published studies, wherever available. Multiple item measures were developed for each construct (IT Adoption and performance measures) included in the research work **Wainwright et al. [35]**

Survey instrument was pilot tested. The pilot survey was administered to 20 randomly selected Indian service firms, whose Standard Industrial Classification codes were 6021 (Nationalized commercial Banks) and 7371 (software firms). A 50% response rate was received. Internal reliability using Cronbach's alpha was carried out for the entire set of responses from the pilot study. In addition, qualitative follow up from respondents was done. Unreliable items were deleted and modifications wherever necessary were made. **Hussain et al**, [**25**].

4. SURVEY ITEMS

Items for three performance dimensions (effectiveness, efficiency and profitability) were adopted from **Davis F. D,**[31]. The initial number of items identified and developed for each performance dimension ranged from 10 to 15. A Q-sort analysis was conducted by ten subject matter experts for the newly developed survey items for IT adoption (Table 1) and performance due to IT adoption (Table 2). About 95 percent of the items were matched to the intended performance dimension (**Wainwright and Yarrow, 2005**[(**35**]. For each of the items of IT adoption a tick mark against the appropriate item was asked.

Table 1: Variables used to measure Information Technology usage at organizations

Tenure of IT adoption in organization	
i	less than 2 years
ii	between 3 and 5 years
iii	between 6 and 10 years
iv	more than 10 years
Percentage of service facility using IT adoption	
i	users with less than 25 % utilization
ii	users with 26-50 % utilization
iii	users with 51-75 % utilization
iv	users with 76-90 % utilization
v	users with more than 91 % utilization
Percentage of IT adoption developed by vendors	
i	Less than 25%

ii	26-50%
iii	51-75%
iv	76-90 %
v	more than 91%

Firm performance was measured from two aspects such as quality performance and financial performance. Based on the previous literature, those two performances were measured using multiple sets of variables as explained in Table 2.

Table 2: Variables used to measure organizational performance

Effectiveness	
i	Ease of installation of the software
ii	Completeness and accuracy of installation instructions
iii	Ability of the initially delivered software to function without errors or problems
iv	Ability of the initially delivered software to function without crashes or service interruptions
v	Long term ability of the software to function without errors or problems
vi	Long term ability of the software to function without crashes or service interruptions
Efficiency	
i	Ability of the user to easily perform required tasks using the software
ii	Completeness of the software in providing all of the functions I need to do my job
iii	Availability of the technical support
iv	Completeness of the user documentation
v	Completeness of the training
vi	Overall, how satisfied are you with the own software product?
Profitability	
i	User friendliness of the software
ii	Technical leadership of the functionality of this product compared to other similar products
iii	Ability of technical support to solve my problems
iv	Usefulness of the user documentation
v	Usefulness of the training
vi	Overall, how useful are the own software products support services?

Performance was evaluated using a mix of items related to internal and external performance. In order to measure the branch performance, the following sources were used to acquire data: customer views, interview with veteran bankers, interviews with bank staff and results from the questionnaire. **Yee et al**. [**36**]

Various items were developed to measure internal performance as well as external performance as a result of the IT introduction. For each of these items, a seven-point Likert scale was used. Respondents were asked to evaluate the relative performance of the firm against the objectives set at the start of the IT adoption effort (1 - strongly disagree; 7 - strongly agree).

5. SURVEY ADMINISTRATION

Indian service firm (Bank and IT firm) was selected as the target population for this research. **Droge et al**,[**39]** reported that IT innovation and adaptation to changes were the two most compelling factors in the Indian service industry (SIC code 6021 and 7371). The survey was administered in 2013. The unit of analysis for this research was a single branch or unit. Since the goal of this study was to evaluate the impact of IT on performance for a specific new product, it was determined that single plants were an appropriate unit of analysis. The target respondents were individuals familiar with IT related activities. Respondent titles included general manager, branch manager, operations manager, customer relationship manager. The research was carried out on quantitative terms to measure IT usage level at individual units. Interviews were carried out to collect data from key stakeholders in the banking sector with IT expertise. Functionalities that the branch staff can perform using IT skills in order to increase the bank performance were analyzed by conducting interviews with industry experts. A sample set of branches along with leading IT firms were selected for the survey.

The sample size for this study was determined using response rates obtained in previous studies and taking into account sampling error**. Arasli** (2005)[**37**] predicted a sampling error rate between 5 and 10 percent with a 95 percent confidence level with a sample size of at least 200 for a population of approximately 5,000. Considering the above, a random sample of 500 banker and IT personnel were selected from various authentic sources.

6. RESPONDENT DEMOGRAPHICS

Of the 500 surveys that were mailed, 125 completed surveys were returned, corresponding to a response rate of 25 percent, which was slightly greater than previous studies (**Arasli, 2005**). [**37**] Approximately, 55 percent of respondents were from units with 51 to 100 employees. The overall size of the firms responding to the survey indicated that 40 percent had 100 or so employees, 30 percent had between 101 and 200 employees, and 30 percent had more than 200 employees. Respondent job titles indicated high-level positions with average experience in their position of

over five years and total experience of around 10 years and more.

The major percentage of respondents within the sample (52 percent) was from IT firms and the rest (48 percent) banking. Firms in this sector develop and maintain software packages. Non-response bias was assessed by comparing general characteristics of non-responding firms to the respondents, by comparing characteristics of early responders and late responders, and by completing an analysis of variance across the two service sectors (**Hair et al.,** 2009)[**38**]. No differences were detected.

7. RESULTS

7.1 Relationship with Efficiency

Data presented in descriptive and narrative forms has been analyzed using statistical methods and SPSS software. The impact of IT usage on performance of service firms was checked. The respondents' opinion are analyzed for identifying the factors significantly affecting the performance measures. The analysis (ANOVA) was carried out for significance level of α=0.05, i.e. for a confidence level of 95%. Table 3 shows the P-values, i.e. the realized significance levels, associated with the F-tests for each source of variation. The sources with a P-value less than 0.05 are considered to have a statistically significant contribution to the performance measures. The last column in Table provides the percent contribution of significant source out of total variation, indicating the degree of influence on the result. Table 1 indicates that the effect of tenure, utility and the interactions tenure-utility are the largest statistically significant and the best firm performance (efficiency) results, as their P-value is less than 0.05. Among all the factors the significance of effect of utility is the most predominant (F=14.93) followed by tenure (F=13.09), the interactions between tenure-utility (F=9.40). The percent contribution gives a better understanding for the interpretation on the results which shows that the contribution due to the interaction of tenure*utility, utility and tenure are 34.15%, 18.75% and 12.21%. However, the effect of vendor on efficiency is not statistically significant, contributions being 2.09%.

Table 3: Generalized Linear Model for Efficiency versus Tenure, Utility and Vendor

Source	DF	SS	Adj SS	Adj MS	F	P	C(%)
Tenure	3	0.47825	0.47825	0.15942	13.09	0.000	12.21
Utility	4	0.72728	0.72728	0.18182	14.93	0.000	18.75
Vendor	4	0.08186	0.08186	0.02047	1.68	0.170	2.09
Tenure* Utility	12	1.37399	1.37399	0.11450	9.40	0.000	34.15
Tenure* Vendor	12	0.23303	0.23303	0.01942	1.59	0.125	5.95
Utility* Vendor	16	0.43633	0.43633	0.02727	2.24	0.016	11.14
Error	48	0.58458	0.58458	0.01218			14.9
Total	99	3.91533					100%

S = 0.110357 R-Sq = 85.07% R-Sq(adj) = 69.21%

Figures relating various measures have been described to get an in depth understanding between the factors. The main effects plot for efficiency is shown in Figure 1(a, b & c). The efficiency appears to be an almost linear increasing function of tenure (1-a) and utility (1-b). However vendor does not play vital role for increasing the efficiency /performance of service.

The diagnostic checking of the model was carried out and presented in Figs. 2(a) and 2(b). Normal probability plot was drawn for residuals and shown in Fig. 2(a). Linearity of this normal plot confirms the normal distribution of the data. Fig. 2(b) shows the relationship between standardized residuals and the predicted values. The residuals do not show any obvious pattern and are distributed in both positive and negative directions. This implies that the model is adequate and there is no reason to suspect about violation of the independence or constant variance assumption.

7.2 Relationship with Effectiveness

In Table- 4 it can be seen that the factor tenure, utility, vendor and the interactions tenure-utility, tenure-vendor, utility-vendor are significant sources of conformance, as their P-value is less than 0.05. Among all the factors the significance of factor utility is the most predominant (F=14.84) followed by tenure (F=8.32), the interactions between tenure- utility (F=7.11) and tenure-vendor (F=5.43). The percent contribution gives a better understanding for the interpretation on the results which shows that the contribution due to the interaction of tenure* utility, tenure*vendor, utility and utility*vendor are 23.94%, 18.3%, 16.6% and 15.4% respectively. However, the effect of vendor on effectiveness is not statistically significant and the contributions being 5.19% .The respondents' opinion are analyzed with analysis of variance (ANOVA) that is used for identifying the factors significantly affecting the performance measures. The analysis was carried out for significance level of α=0.05, i.e. for a confidence level of 95%.

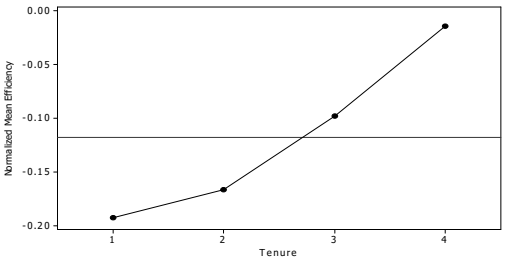

Fig-1(a): Tenure vs. Efficiency

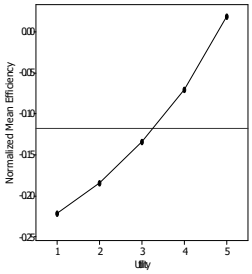

Fig-1(b): Utility vs. Efficiency

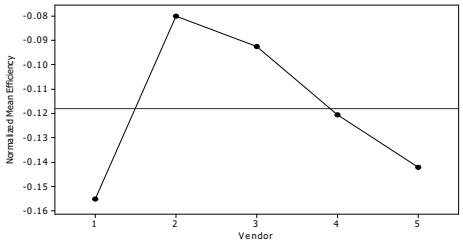

Fig-1(c): Vendor vs. Efficiency

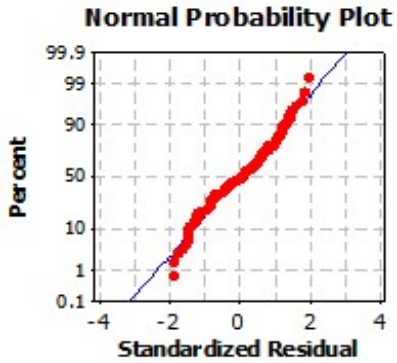

Fig.-2(a): Residual vs. Percent

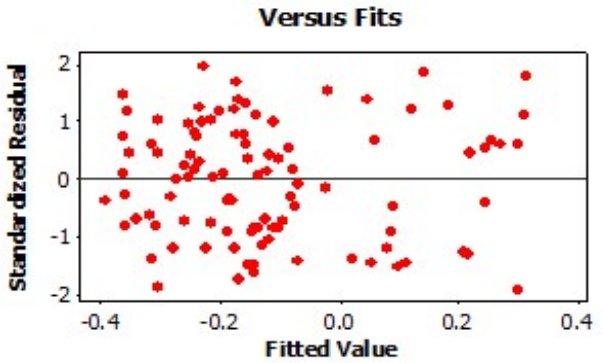

Fig.-2(b): Fitted value vs. Residual

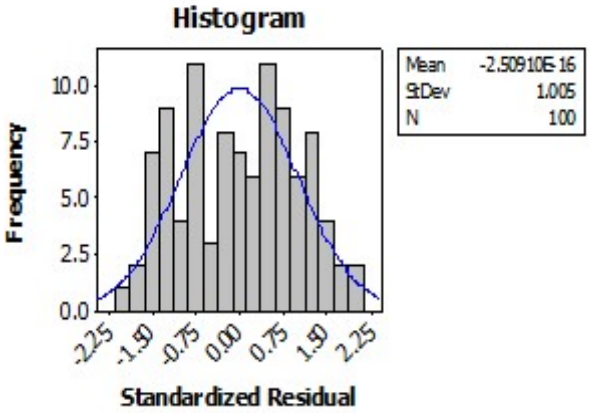

Fig.-3(a): Residual vs. Frequency

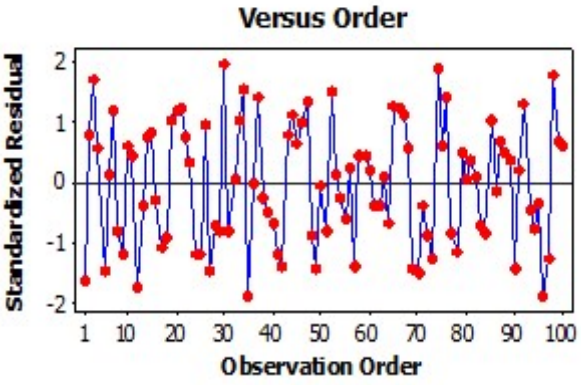

Fig.-3(b): Observation order vs. Residual

Table 4: Generalized Linear Model for Effectiveness versus Tenure, Utility and Vendor

Source	DF	SS	Adj SS	Adj MS	F	P	C (%)
Tenure	3	0.137622	0.137622	0.045874	8.32	0.000	7
Utility	4	0.327440	0.327440	0.081860	14.84	0.000	16.6
Vendor	4	0.102112	0.102112	0.025528	4.63	0.000	5.19
Tenure*Utility	12	0.470483	0.470483	0.039207	7.11	0.000	23.94
Tenure*Vendor	12	0.359515	0.359515	0.029960	5.43	0.000	18.3
Utility*Vendor	16	0.302729	0.302729	0.018921	3.43	0.000	15.40
Error	48	0.264707	0.264707	0.005515			13.47
Total	99	1.964610					100%

S = 0.0742612 R-Sq = 86.53% R-Sq(adj) = 72.2

Table 4 shows the P-values (realized significance levels) associated with the F-tests for each source of variation. The sources with a P-value less than 0.05 are considered to have a statistically significant contribution to the performance measures. The last column in the above table provides the percent contribution of significant source out of total variation, indicating the degree of influence on the result.

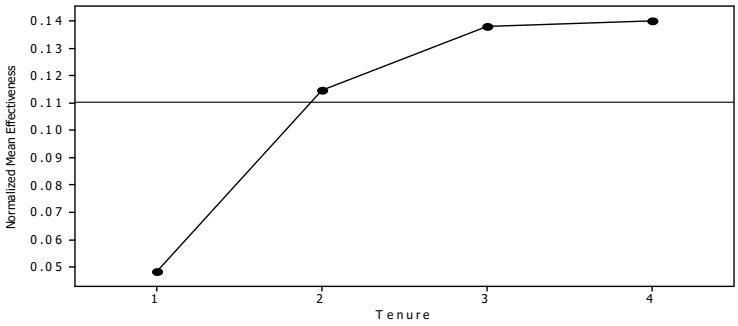

Fig.-4(a): Tenure vs. Effectiveness

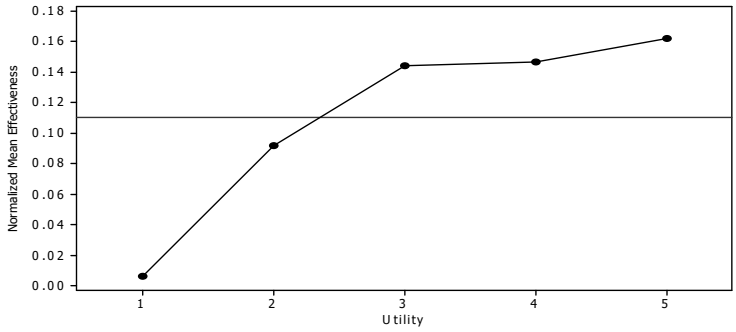

Fig.-4(b): Utility vs. Effectiveness

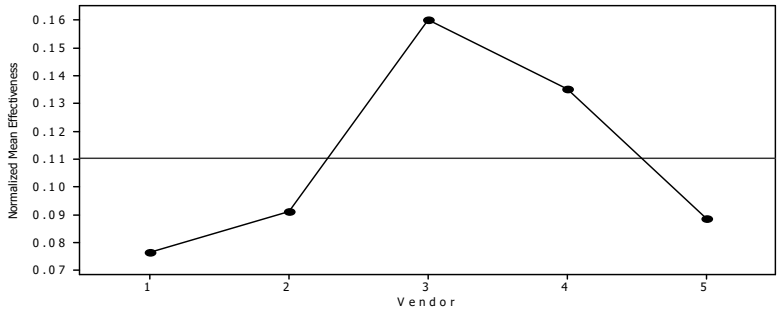

Fig.-4(c): Vendor vs. Effectiveness

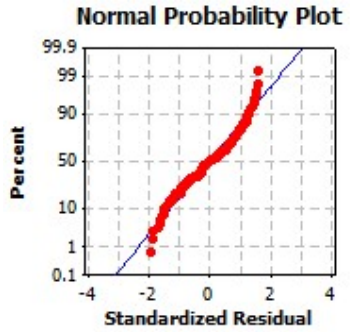

Fig.-5(a) : Residual vs. Percent

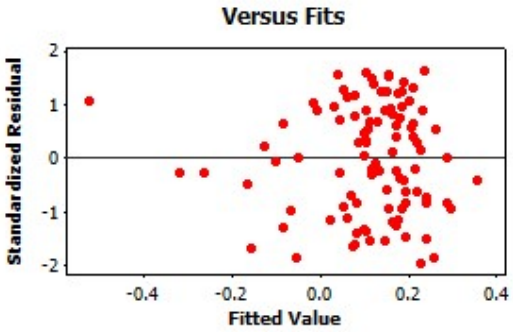

Fig.-5(b): Fitted value vs. Residual

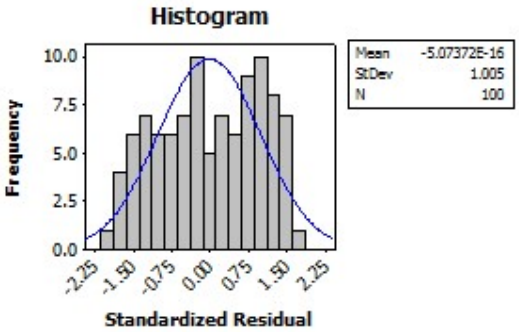

Fig.-6(a): Residual vs. Frequency

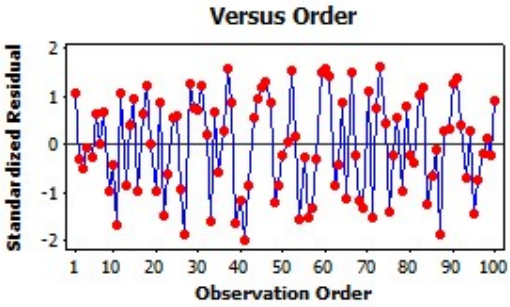

Fig.-6(b): Observation order vs. Residual

The main effects plot for effectiveness is shown in Figure 4 (a, b& c). The effectiveness appears to be an almost linear increasing function of tenure (4-a) and utility (4-b). However vendor does not play vital role for increasing the effectiveness/performance of service. The diagnostic checking of the model was carried out and presented in Figs. 5(a) and 5(b).

Normal probability plot was drawn for residuals and shown in Fig. 5(a). Linearity of this normal plot confirms the normal distribution of the data. Fig. 5(b) shows the relationship between standardized residuals and the predicted values. The residuals do not show any obvious pattern and are distributed in both positive and negative directions. This implies that the model is adequate and there is no reason to suspect about violation of the independence or constant variance assumption. Histogram of all the observed values has been made in fig. 6(a) that shows the uniform distribution around '0' (mean value). Fig. 6(b) residual plots the relationship between observation order &standard residual to confirm the constant variance of the entire data.

Relationship with Profitability

ANOVA identifies the factors significantly affecting the performance measures for a confidence level of 95%.

Table 5 shows the P-values associated with the F-tests for each source of variation. Last column in the table provides the percent contribution of significant source out of total variation, indicating the degree of influence on the result.

Table-5: Generalized Linear Model for Profitability versus Tenure, Utility and Vendor

Source	DF	SS	Adj SS	Adj MS	F	P	C(%)
Tenure	3	0.050873	0.050873	0.016958	15.00	0.000	6.15
Utility	4	0.172705	0.172705	0.043176	38.19	0.000	20.88
Vendor	4	0.030725	0.030725	0.007681	6.79	0.000	3.71
Tenure*Utility	12	0.225807	0.225807	0.018817	16.64	0.000	27.31
Tenure*Vendor	12	0.134080	0.134080	0.011173	9.88	0.000	16.21
Utility*Vendor	16	0.158334	0.158334	0.009896	8.75	0.000	19.15
Error	48	0.054266	0.054266	0.001131			6.56
Total	99	0.826789					100%

S = 0.0336235 R-Sq = 93.44% R-Sq(adj) = 86.46%

The above Table shows that the factor tenure, utility, vendor and the interactions tenure-utility, tenure-vendor, utility-vendor are significant sources of profitability, as their P-value is less than 0.05. Among all the factors the significance of utility is the most predominant (F=38.19) followed by tenure*utility (F=16.64), tenure (F=15.00) the interactions between tenure-vendor (F=9.88) and utility-vendor (F=8.75). The percent contribution gives a better understanding for the interpretation on the results which shows that the contribution due to the interaction of tenure*utility, utility, utility*vendor and tenure*vendor are 27.31%, 20.88%, 19.15% and 16.21% respectively. However, the effect of vendor on profitability is not statistically significant and the contributions being 3.71%.

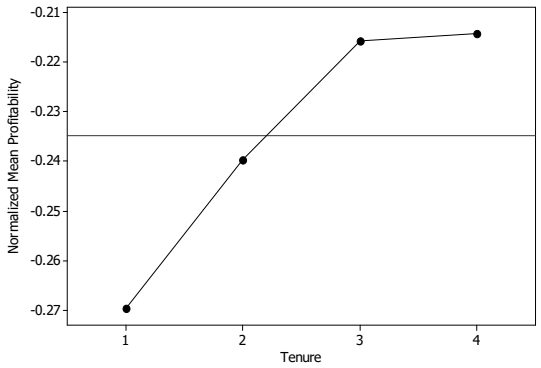

Fig-7(a): Tenure vs. Profitability

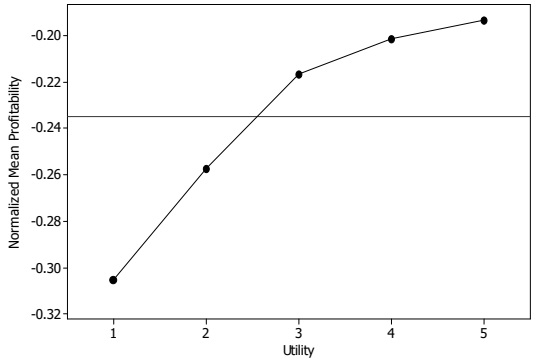

Fig-7(b): Utility vs. Profitability

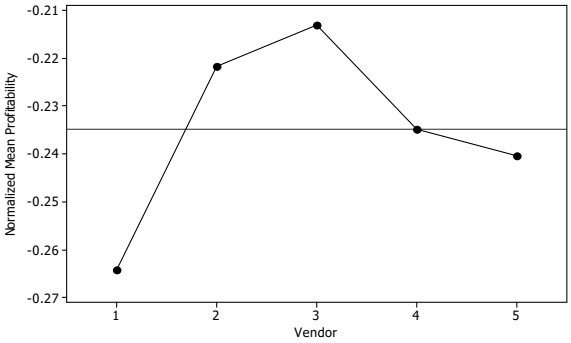

Fig-7(c): Vendor vs. Profitability

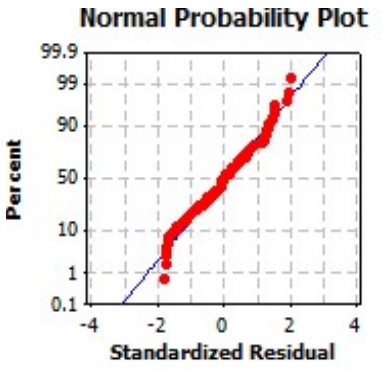

Fig.-8(a): Residual vs. Percent

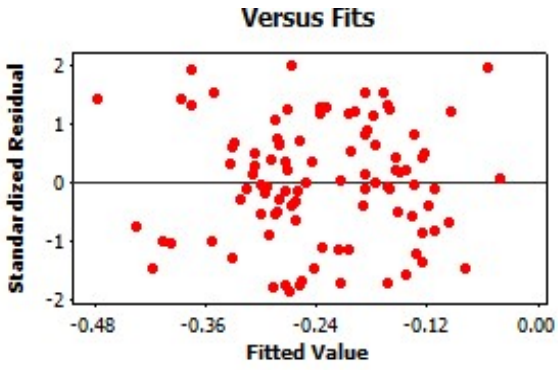

Fig.-8(b): Fitted value vs. Residual

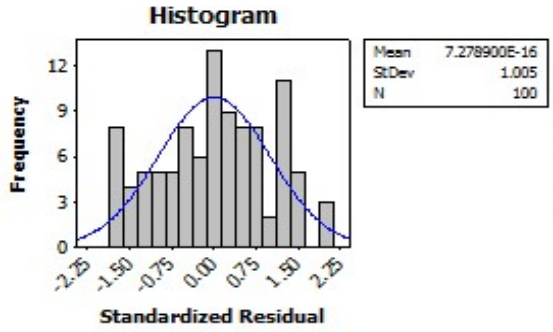

Fig.-9(a): Residual vs. Frequency

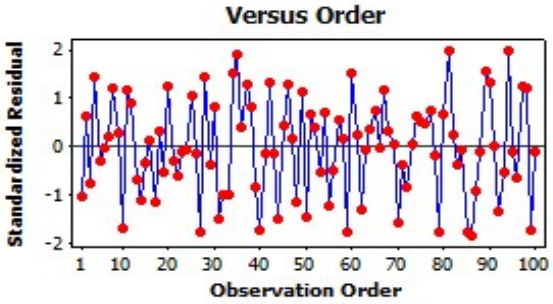

Fig.-9(b): Observation order vs. Residual

The main effects plot for profitability is shown in Figure 7(a ,b& c). The profitability appears to be an almost linear increasing function of tenure (7-a) and utility (7-b). However vendor does not play vital role for increasing the profitability /performance of service. The diagnostic checking of the model was carried out and presented in Figs. 8(a) and 8(b). Normal probability plot was drawn for residuals and shown in Fig. 8(a).
Linearity of this normal plot confirms the normal distribution of the data. Fig. 8(b) shows the relationship between standardized residuals and the predicted values. The residuals do not show any obvious pattern and are distributed in both positive and negative directions. This implies that the model is adequate and there is no reason to suspect about violation of the independence or constant variance assumption. Histogram of all the observed values has been made in fig.9(a) that shows the uniform distribution around '0' (mean value).Fig.9(b) residual plots the relationship between observation order & standard residual to confirm the constant variance of the entire data.

8. DISCUSSION

There is a significant positive relationship between the tenure of IT adoption and increase in firm performance. There is a positive relationship between the IT application and the increase in effectiveness of the services provided. Again, IT application level in the firm and the efficiency of internal resources is positively related. It is also noted that tenure is significant positively related with profitability of the service firms.

It is noted that utility is significant positively related with profitability of the service firms. There is a significant positive relationship between the utility of IT adoption and increase in firm performance. There is a positive relationship between the IT application and the increase in effectiveness of the services provided. Again, IT application level in the firm and the efficiency of internal resources is positively related.

In certain situations, vendor support has become essential for installation as well as updation of the IT tools in a timely manner. Firm has benefited in the least possible time. However, vendor has no such positive effect on increasing overall performance of service firm.

All the independent variables such as tenure of IT adoption, utility of IT tools have strong relationships with the dependent variable named as increase in firm performance. The relationship with attitude towards IT and IT literacy level is stronger. It is seen that the relationship between IT usage and quality as well as performance of a firm is also significant. Staff members are able to attend to customer needs in a better way as they could access customer information online. They could interact with end users online. Total customer profile could be viewed with a single key stroke. IT has made the work easier and faster.

Validation of Statistical results with ANN model results Efficiency

Results obtained from statistical analysis (ANOVA) have been verified with that of Artificial Neural Network model using MATLAB-11b. Fig 10 (a) represents correlation plot between training data and questionnaire data, Fig. 10(b) represents correlation plot between validation data and questionnaire data and Fig. 10(c) represents Mean Square Error vs. Epoch. Fig. 10(d) is the snap shot of the model building and analysis for obtaining the relationship between tenure of IT adoption, utility of IT and vendor's contribution for improving the efficiency of firm performance. Results of ANN model closely confirms that of the statistical results obtained in section.

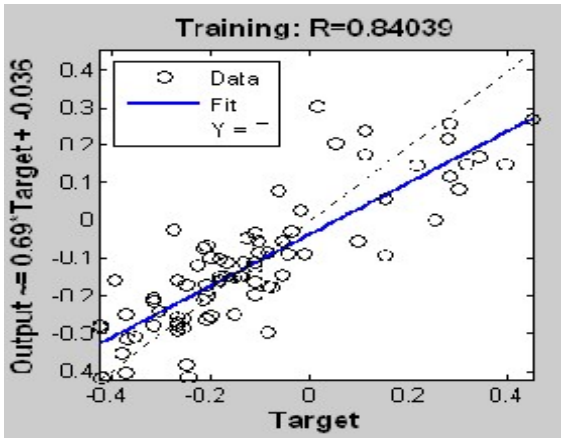

Fig. 10(a): Correlation plot between Training data and Questionnaire data

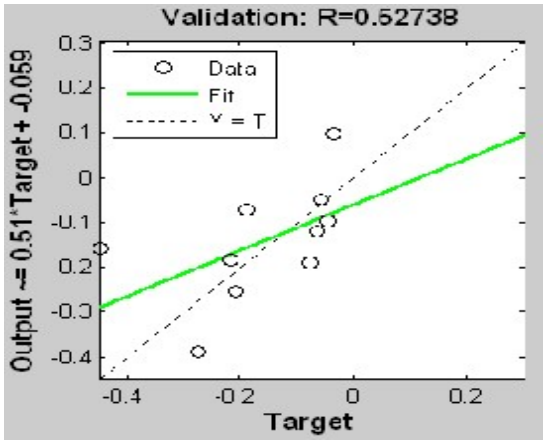

Fig.10 (b): Correlation plot between validation data and Questionnaire data

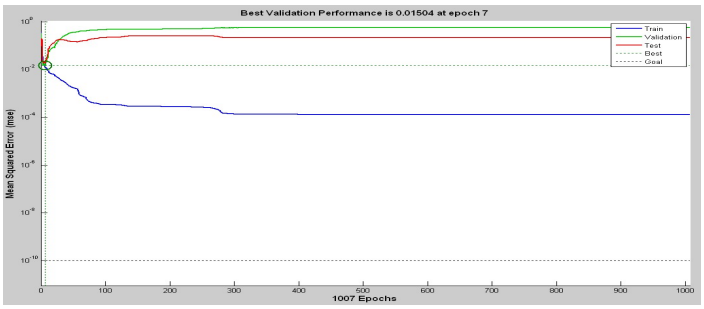

Fig. 10(c): Mean Square Error vs. Epochs

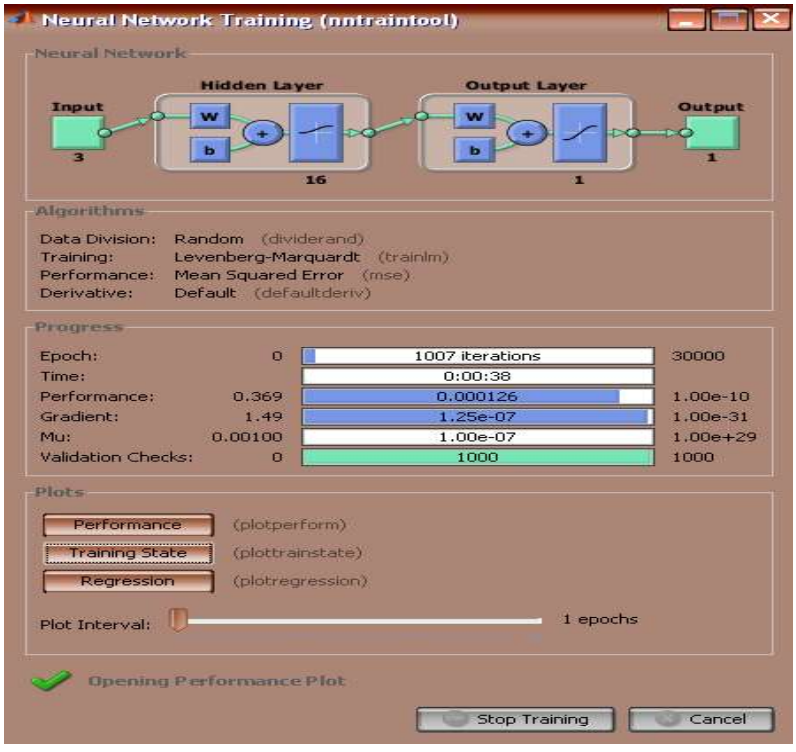

Fig. 10(d) Snap shot of ANN analysis using MATLAB-11b

Effectiveness

Fig. 11 (a) represents correlation plot between training data and field data, Fig. 10(b) represents correlation plot between validation data and field data and Fig. 10(c) represents Mean Square Error vs. Epoch to check the relationship between tenure of IT adoption, utility of IT and vendor's contribution for improving the effectiveness of firm performance. Results of ANN model closely confirms that of the statistical results obtained in section .

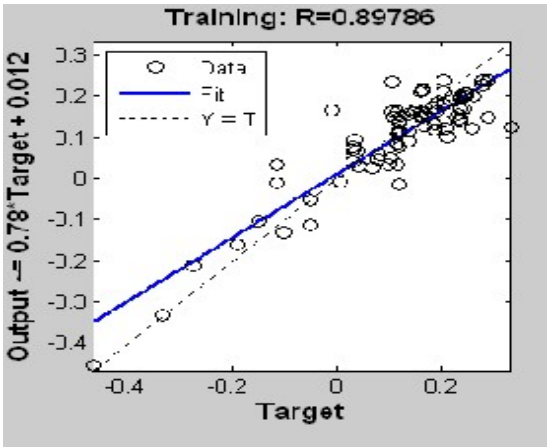

Fig. 11(a): Correlation plot between Training data and Questionnaire data

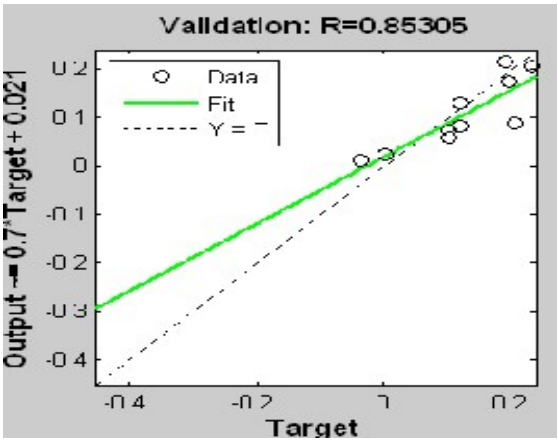

Fig. 11(b): Correlation plot between validation data and Questionnaire data

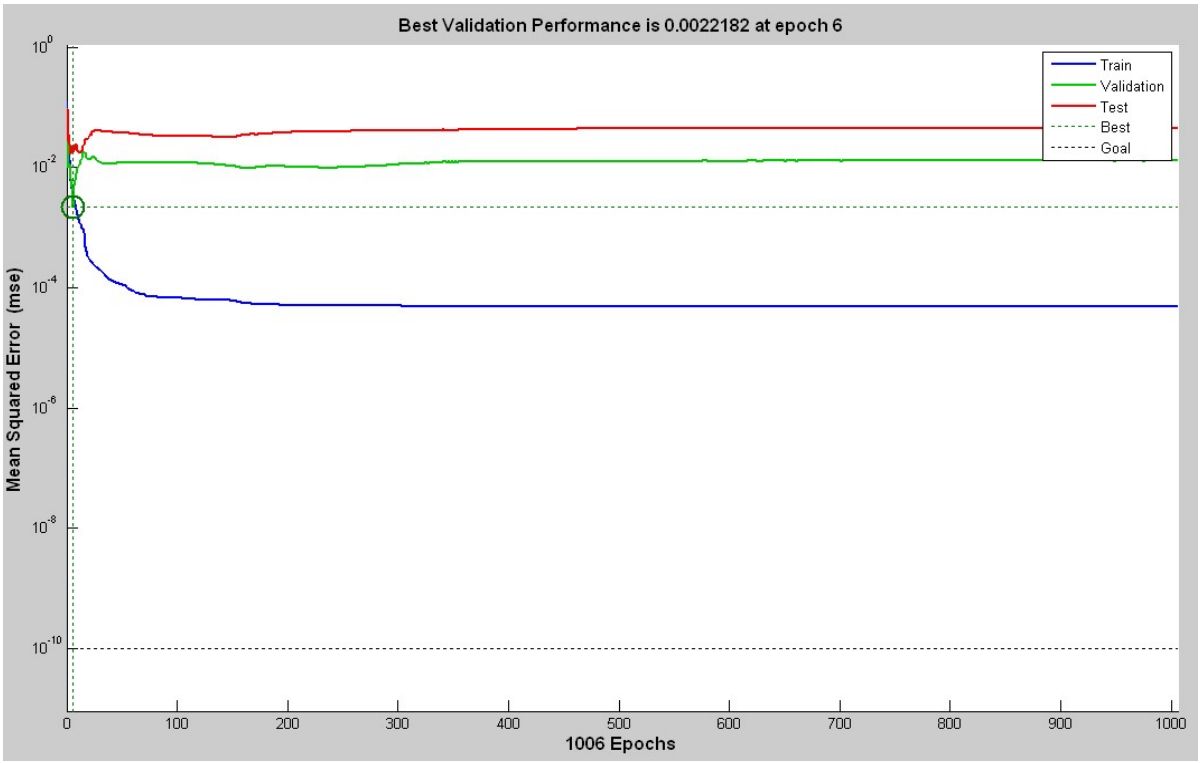

Fig. 11(c): Mean Square Error vs. Epochs *Profitability*

Fig. 12 (a) represents correlation plot between training data and field data, Fig. 12(b) represents correlation plot between validation data and field data and Fig. 12(c) represents Mean Square Error vs. Epoch to check the relationship between tenure of IT adoption, utility of IT and vendor's contribution for improving the profitability of firm performance. Statistical results obtained in section closely confirms that of the ANN model results.

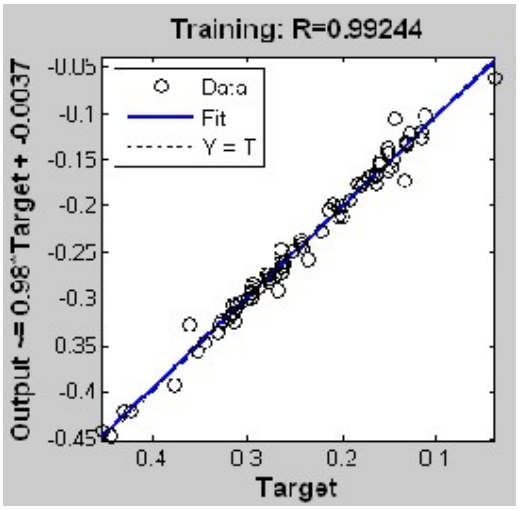

Fig.12(a): Correlation plot between Training data and validation data and Questionnaire data

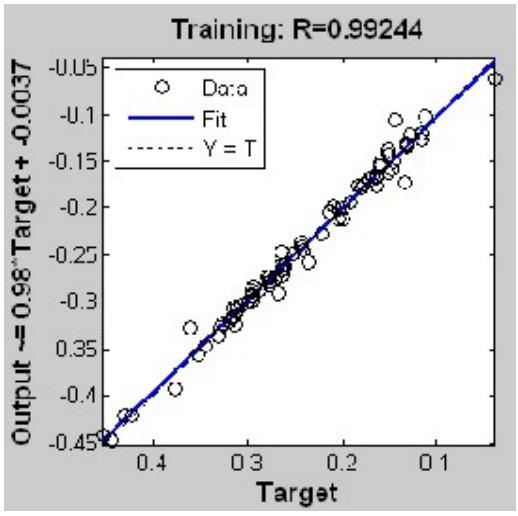

Fig.12(b): Correlation plot between Questionnaire data

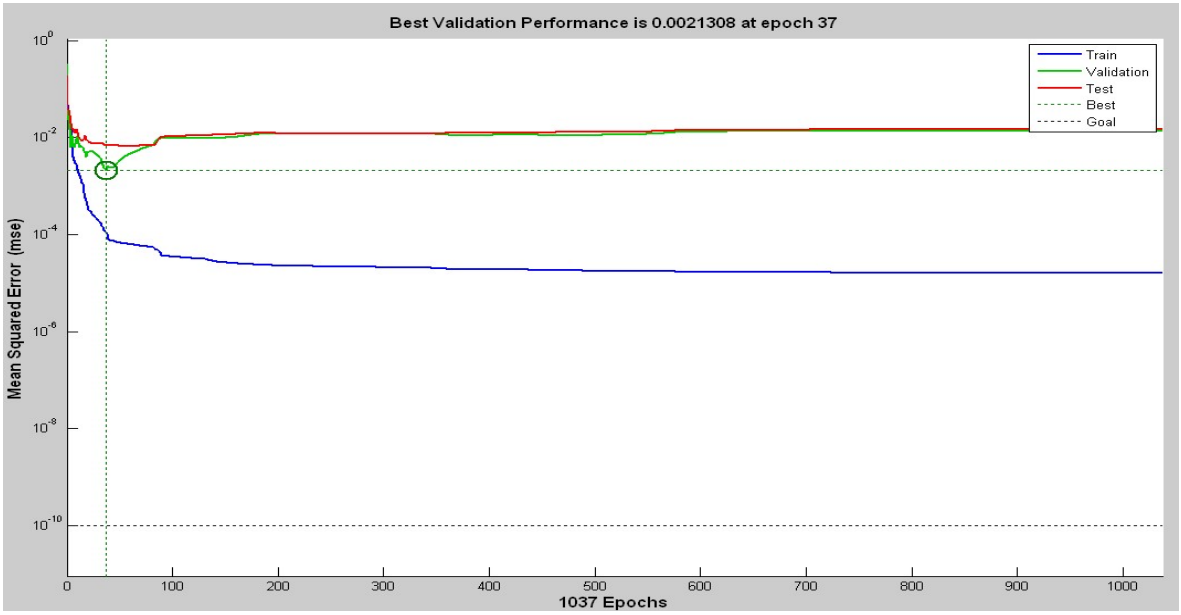

Fig. 12(c): Mean Square Error vs. Epochs

9. CONCLUSION AND IMPLICATIONS

The research finds two important results with respect to IT adoption and firm performance. The first result is that service firms who implemented IT tools and techniques early achieved more turnover thereby grater market share from innovation/adoption (world-first and, to some extent India-first). These firms are able to better commercialize their service even if their most important innovations/adoptions supported by vendor's to some extent. The second result is that service firms, which introduce new services, even if the service is already on the national or International front, derived more commercial sales from innovation, thus achieving more firm performance. Therefore, late followers (firm-first) would have higher sales from innovation by introducing services with high original content.

It is observed that the presence of skilled workers is highly linked with higher sales from innovation. This is because of a skilled, educated and talented workforce to increase the firms' performance. It is apprehended that both well- educated workers (university degree holders in banking) and specialized skilled workers (R&D workers in software firms) are important assets to increase efficiency, effectiveness as well as profitability of the firm achieving higher sales through innovation. While R&D- related workers might be better able to understand the technological advancements, skilled workers might be better able to recognize the market opportunities in other service firms.

Our research provides practitioners with managerial insights in the following aspects.
(1) Its greatest value is that it can help service managers to view and assess the design and management of service supply processes in a different way as opposed to the traditional management system.
(2) It is expected that this research will further motivate researchers to work in this area. This service performance measurement framework will be beneficial to researchers and practicing managers in identification of opportunities for improvements in service firms.

As further research, the validity of the framework in other service industries (hotel, hospital, and travel) needs to be examined. Moreover, with both academic research and practitioner-driven initiatives creative efforts are required to develop new measures and new programs for evaluating the performance of the service firm as a whole as well as the performance of each organization that is a part of the service industry.

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