Contemplations on IT implementation in the Indian Higher Educational Institutions

Anchal Garg[1] and Balvinder Shukla[2]

[1] *Assistant Professor, Department of Computer Science & Engineering, Amity School of Engineering & Technology, Amity University Uttar Pradesh*
[2] *Professor, Entrepreneurship and Leadership, Amity University Uttar Pradesh*

Abstract: Indian higher educational institutions face number of operational issues and challenges. Subsequently higher educational institutions have embraced IT for effective management of their day-to-day operations. However, the manner in which IT has been implemented by the institutions and the extent to which it has proved successful has still not been discussed. This study thus conducts an in-depth investigation to identify in what spheres and to what depth and breadth IT has been implemented by the HEIs and in what ways is IT improving their operational performance.

Keywords: Levels of IT implementation, Operational Performance, Performance Indicators, Multivariate Analysis of Variance (MANOVA), Discriminant Analysis

INTRODUCTION

Education is an engine for the growth of any economy and its importance in the global knowledge-based era is well recognised nationally as well as internationally (Cheung and Chan, 2010). The demand for higher education has grown among students due to its envisioned advantages. In light of the same, the education sector has witnessed the number of Higher Education Institutions (HEIs) mushrooming to cater the increasing population of students. The growth in number of HEIs has given rise to the fierce competition amongst them to deliver the best and benchmark themselves with the top most institutions. Today, the performance of HEIs depends on the quality of systems and processes that makes them the most preferred ones. HEIs are expected to manage the diversities of students and at the same time produce globally competitive workforce. Amongst many other activities, HEIs are also facing myriad of problems to match the requirements of various national/international accreditations and rankings. Like any other organization, the institutions require sufficient funds and resources to operate effectively (Lockwood, 1985; Pollock and

Cornford, 2004; Mudalair *et al.* 2009; Seo, 2013). However, HEIs nowadays face challenges like decreasing public funding, increasing expenditure, increasing competition for quality students and faculty, pressure on funds and resources, increases in academic fees, and growing demand for affordable quality education (Bendermacher *et. al*, 2016; Shin and Harman, 2009; Tilak and Rani, 2003; Altbach, 2009; Allen and Fifield, 1999; McGorry, 2002, Garg *et al.*, 2015). Hence, there is an urgent need for the institutions to carry out their day-to-day activities in the most efficient manner in order to manage their funds, time and efforts (Cheung and Chan, 2010; Garg and Shukla, 2015). Business counterparts are known to manage their expenses and resources, handle diverse customer needs, achieve higher performance and remain competitive by leveraging on IT for operational excellence (Garg and Shukla, 2015). The effective utilization of IT is known to reduce costs, shorten execution times, improve coordination, optimize the utilization of resources (Davenport, 2013; Turban *et al.* 2008), improve operational efficiency (Bardhan *et al.* 2007), boost productivity (Brynjolfsson and Hitt, 2003), enhance performance (Melville *et al.* 2004; Duh *et al.* 2006; Mithas and Rust, 2016) and improve profitability (Hitt and Brynjolfsson, 1996; Mithas *et al.* 2012). IT usage also offers intangible benefits such as improved quality, convenience, timeliness, customer satisfaction and retention (Bharadwaj, 2000; Melville *et al.* 2004; Grover *et al.* 1998; Garg *et al.* 2015). IT implementation has also helped businesses to deal with the escalating pressure of enhancing quality coming from the stakeholders and the peer group.

Given the numerous benefits achieved by business organizations through effective implementation of IT, HEIs have also embraced IT (Garg *et al.* 2015). However, the manner in which IT has been implemented by HEIs and the extent to which it has proved successful has still not been discussed. The existing educational research is more focused on the use of IT for instruction design and delivery (Bates and Poole, 2003; Lockwood, 2013; UNESCO, 2002; Garg and Shukla, 2015). However, none have researched on the utilization of IT from the operational perspective.

This paper conducts the study for the Indian higher education sector to determine in what ways IT is being implemented for execution of day-to-day activities and whether and how IT is able to improve the operational performance of the institutions. It is important to carry out this research since, despite IT implementation, the Indian higher education sector is confronted with several operational issues such as management and regulatory controls, weak administration, poor inter and intra departmental coordination, shortage of funds, inadequate utilization of existing resources, lack of transparency and accountability, and also inflexibility as evident from obsolete programs, irrelevant curricula and poor educational resources (Agarwal, 2009; Altbach, 2005; Altbach, 2009; UGC, 2012; Carnoy and Dossani, 2013; Garg *et al.*, 2015). Therefore, it becomes essential to ascertain whether this scenario is common among all the HEIs in general or with fraction of the institutions. It is also vital to determine whether IT adoption is holistic or is limited to few functional units with automation of few activities. Whether the HEIs having a holistic IT integration have been able to overcome the educational issues and improve the institutional performance. Thus, it is vital to identify whether institutions with a more holistic IT implementation have better performance than ones with weak integration. This study thus conducts an in-depth investigation to identify in what spheres and to what depth and breadth IT has been implemented by the HEIs and in what ways is IT improving their operational performance.

The main contribution of the paper is to present the status of automation in Indian HEIs and identify how IT implementation might help HEIs to surmount the educational issues and achieve higher performance.

This study will provide roadmap to managers, administrators and policy makers of higher education sector as well as IT and Information System (IS) researchers to know how IT has been currently employed by HEIs and how IT can further be leveraged for achieving operational excellence. The study will also help them in identifying the gaps with the present IT implementation so that more productive ways of implementing IT in HEIs could be searched for.

LITERATURE REVIEW

Advantages of IT in the business sector

Frequent studies have been conducted in various sectors to demonstrate the benefits of IT usage. Several researchers have carried work in the manufacturing sector and found that IT leads to cost reduction through improved information sharing and better coordination across supply chain (Banker *et al.*, 2006; Bardhan *et al.*, 2007; Cotteleer & Bendoly, 2005; Kohli, 2007; Mukhopadhyay & Kekre, 2002; Whitaker *et al.*, 2011). A number of studies in the healthcare industry demonstrate that IT improves overall coordination, enhances communication, increases operational efficiency, reduces costs, standardizes healthcare, provides better access, offers timely information to decision makers, increases provider satisfaction, improves quality and continuity of healthcare and increases patient safety (Buntin *et al.*, 2011; Fichman *et al.*, 2011; Hoyt & Yoshihashi, 2014). The analysis of hospital data also posits that the IT usage is positively linked to performance (Devraj & Kohli, 2003). The empirical results of the retail industry depict that IT leads to sustainable advantages by using IT to leverage intangible, complementary, human and business resources such as flexible culture, strategic planning-IT integration and supplier relationships (Powell & Dent-Micallef, 1997). Brynjolfsson and Hitt (1996) analysed the data collected from 367 organizations on IS spending for 1987-1991 and the results showed that IS spending contributed substantially to the organizational output. Furthermore, a study of 370 organizations by Hitt and Brynjolfsson (1996) indicate that IT enhanced productivity and generated considerable value for customers. Brynjolfsson and Hitt (2003) reported that automation has a positive impact on productivity and output growth in a study of 527 US firms from 1987 to 1994. The empirical investigations conducted by Mithas *et al.*, (2012) on 400 international organizations from 1983-2003 suggest that there is a positive and significant impact of IT on sales and profitability. The investments in IT also enhanced revenue through value propositions, marketing and sales channels, and improved customer life cycle management. More recent research studied the impact of IT in networked environments (Liu *et al.*, 2013). Data from 26 companies across 19 industries during 1994-2008 indicate that IT directly and significantly impacts profitability. A study by Ilebrand *et al.*, (2010) reported that IT systems enhanced operational and supply chain efficiency within, and across, organizations. Several studies took up the process-oriented perspective to examine the impact of IT on business processes and found IT to have considerable positive influence (Barua *et al.*, 1995; Mooney *et al.*, 1996; Soh & Markus, 1995). There are a number of studies that shows that IT implementation leads to value creation (Aral and Weill, 2007; Barua *et al.*, 1995; Bhatt & Grover, 2005; Kohli & Melville, 2009; Mithas *et al.*, 2011). Different researchers have examined the association between IT investment and organizational performance and have found considerable positive effect (Brynjolfsson & Hitt, 1996; Powell & Dent-Micallef, 1997; Devaraj & Kohli, 2003; Duh *et al.*, 2006). Researchers have also examined the contribution of IT in formulating and implementing strategy, and its affirmative effect on financial performance (Henderson & Venkatraman, 1993; Kettinger *et al.*, 1994). A number of studies have proved that there exists a positive association

between IT investment and productivity (Brynjolfsson & Hitt, 1995, 1996, 1998; Lichtenberg, 1995). Several researchers have found evidence that IT investments produced significant returns at the organizational level (Brynjolfsson & Hitt, 1995; Lichtenberg, 1995; Malone, 1997; Dewan & Min, 1997). Similar studies have been carried out in various industries. The literature clearly reveals how different organizations have benefitted from the implementation of IT.

Advantages of IT in the Education Sector

Several researchers have described various benefits of adopting IT as a teaching learning aid in the education sector. Leidner and Jarvenpaa (1993) examined the use and outcomes of computer based instructional methodologies. The study found a positive impact of computer based teaching methods and hands on computer training over traditional methods. Similarly, a study examined the impact of the Internet on college students' academic, social and daily routines and found that it enhanced their education and improved their social life (Jones *et al.*, 2009). Neuman *et al.*, (1996) reported that students, who use technologies for learning enjoy additional benefits such as feeling more successful in school, are more motivated to learn and have increased self confidence and self esteem. Owston (1997) and Liu *et al.* (2003) reported that the use of computers and the Internet enhanced teaching and learning as well as improved communication and interface among students and teachers. Yuen *et al.* (2008) found positive and direct effects of IT use on student's 21st century skills such as information-handling skills, problem-solving skills, self-directed learning skills, collaborative skills, communication skills, IT skills and ability to learn at student's own pace. Courses that are supported via blended learning depict greater student satisfaction, improved academic achievements and significant reduction in the dropout rates (Hoic-Bozic *et al.*, 2009). A study of 6300 schools was conducted to examine the short-term and long-terms effects of changes in how IT is used and the performance of students. The findings report that a change in the manner in which IT is used is associated with enhancements in student's performance (Kobelsky *et al.*, 2014). Studies have also focused on the use of various IT tools such multimedia, internet, Web 2.0, wikis, podcasts, blogs etc in improving interaction, collaboration, communication and geographical reach to aid education. Several researchers have focused on the use of IT as an alternate teaching learning mode for distance, online and open education, blended learning, collaborative learning, networked learning, etc. (UNESCO, 2002; Chandra & Patkar, 2007; Bhattacharya & Sharma, 2007; Hattangdi & Ghosh, 2008; Hattangdi *et al.*, 2009; Dhanarajan & Porter, 2013; Kling & Hara, 2002; Garrison & Kanuka, 2004). Some studies have emphasized on the use of open source technologies to develop Open Educational Resources (OERs) for enhancing the quality of education, enabling lifelong learning and skill development free of cost. Researchers have also reported the use of the internet and mobile technologies to create Massively Open Online Courses (MOOCs) for providing education (Liyanagunawardena *et al.*, 2013; Liyanagunawardena, 2015).

The review of the existing literature apparently indicates substantial gaps. None explore on how IT has been implemented for managing institutional operations. Some report that Indian HEIs have started adopting IT for teaching and conducting administrative tasks with the purpose to enhance operational efficiency, effectiveness and performance (Bhat *et al.*, 2013; Ranjan, 2008). However, such studies do not report in what ways IT is being utilized and provide any evidences as to whether the institutions have really been able to gain such benefits through IT implementation. Even the existing literature on the implementation of IT/Information Systems such as Enterprise Resource Planning (ERP) are limited to investigating the

factors influencing ERP adoption, the issues affecting the success and failure of ERP implementation (Lawnham, 2001; Madden 2002; Parth & Gumz, 2003; Mathias *et al.*, 2014; Goel *et al.*, 2013). Scanty research has been conducted on automation at departmental level such as Admissions (Qadri, 2014), Examinations (Qadri, 2014) and Library (Singh, 2003; Matoria *et al.*, 2007; Haneefa, 2007; Kumar & Biradar, 2010). However, none of the studies discuss what activities and processes are automated at Institutional level and how IT implementation has improved the operational performance of the HEIs and whether IT implementation has really helped overcome institutional issues and challenges.

This study fills in the gap by exploring the utilization of IT by the HEIs in India from an operational point of view. In order to find the extent and effectiveness of IT implementation, this study conducts the survey of different departments of various HEIs. No studies have explored how IT is improving performance of the educational institutions. It is said that IT can help overcome educational issues and challenges, but is IT implementation really helping the institutions overcome those problems, has not been explored. This study will determine if IT facilitates surmount those issues.

RESEARCH METHODOLOGY

The research is based on the study of the Indian higher education sector. A preliminary study was conducted by interviewing Vice Chancellors and directors of ten different institutions to identify the major departments of HEIs. The study revealed that 1) Admissions, 2) Academics, 3) Finance, 4) Examinations, 5) Administration, 6) Human Resource, 7) Hostel**,** 8) Library as well as 9) Industry Interaction and Placement cell were common functional units among the institutions. For the purpose of this study only these departments were examined. Some respondents mentioned about having an IT department for managing the IT infrastructure and software for the institution.

To explore the level of IT implementation in the higher education sector, a sample of eighty six (86) institutions were taken. The study was both quantitative and qualitative and a separate questionnaire was developed for each department. The study was conducted from December 2012- July 2015 at eighty six different HEIs consisting of 38 Universities and 48 colleges. Prior permissions were taken from the competent authorities of the institutions. To get better response and avoid follow-ups, appointments were fixed beforehand and the survey was conducted personally. The data was collected from faculty members and functional heads of various departments. From each institution, eight responses from functional heads and ten from faculty members were gathered.

There were in total nine research instruments, one for each department. Before administering the questionnaire, pilot study was done to check each instrument and remove ambiguities if any.

Each research instrument consisted of seven questions. The questionnaire consisted of single-item, multiple item and five point Likert scales as well as open-ended questions. A five-point Likert scale (vaying from "strongly disagree" to "strongly agree") was used to assess the respondents' opinion on IT use. Reliability coefficient of this scale was 0.888.

Research Questions

(i)   Have all the institutions and departments adopted IT?

(ii)   What activities have been automated by HEIs?

(iii)   Are there any differences among HEIs on IT implementation? Are there any differences in the level of automation among HEIs?

(iv)   Has automation improved the operational performance of the HEIs? The following parameters have been taken as indicators of operational performance:

(a)   Speed

(b)   Cost

(c)   Coordination

(d)   Consistency

(e)   Resource Optimization

(f)   Convenience

(g)   Information sharing across the Institution

(h)   Efficient management of day-to-day activities

(i)   Transparency

(j)   Accountability

(k)   Productivity

(l)   Data analysis

(m)   Quality of services

Subsequently, the following hypotheses were developed to determine whether the institutions with better IT implementation have improved performance. Here, higher level of automation implies a more holistic IT implementation by the HEI.

Hypothesis 1: There is a significant association between the level of IT implementation and improved speed

Hypothesis 2: There is a significant association between the level of IT implementation and cost reduction

Hypothesis 3: There is a significant association between the level of IT implementation and better coordination

Hypothesis 4: There is a significant association between the level of IT implementation and improved data consistency

Hypothesis 5: There is a significant association between the level of IT implementation and resource optimization

Hypothesis 6: There is a significant association between the level of IT implementation and convenience

Hypothesis 7: There is a significant association between the level of IT implementation and information sharing

Hypothesis 8: There is a significant association between the level of IT implementation and efficient management of day-to-day activities

Hypothesis 9: There is a significant association between the level of IT implementation and improved transparency

Hypothesis 10: There is a significant association between the level of IT implementation and improved accountability

Hypothesis 11: There is a significant association between the level of IT implementation and efficiency of people (productivity)

Hypothesis 12: There is a significant association between the level of IT implementation and improved data analysis

Hypothesis 13: There is a significant association between the level of IT implementation and enhanced Quality of Service (QoS)

RESULTS

The findings from the survey conducted at various departments and institutions are as under:-

Response to Research Question 1: Have all the departments and institutions adopted IT?

The investigations on the adoption of IT by various HEIs indicate that majority of the departments and institutions have adopted IT. 97% of the HEIs are utilizing IT and just 3% of the institutions do not have a single computer. The survey at the departmental level indicate that 93% of the HEIs have automated the Finance department, 96% have done so for the Academics department, 94% of Libraries and Placement departments are computerized, 93% of Hostels and 92% of the administrative departments have adopted some form of IT. Likewise, 84% of the institutions have automation for their Admissions, Examinations and the HR departments. Thus, it is observed that there are a fraction of departments and institutions do not have a computer and all the work is carried out manually and the records are maintained in manual
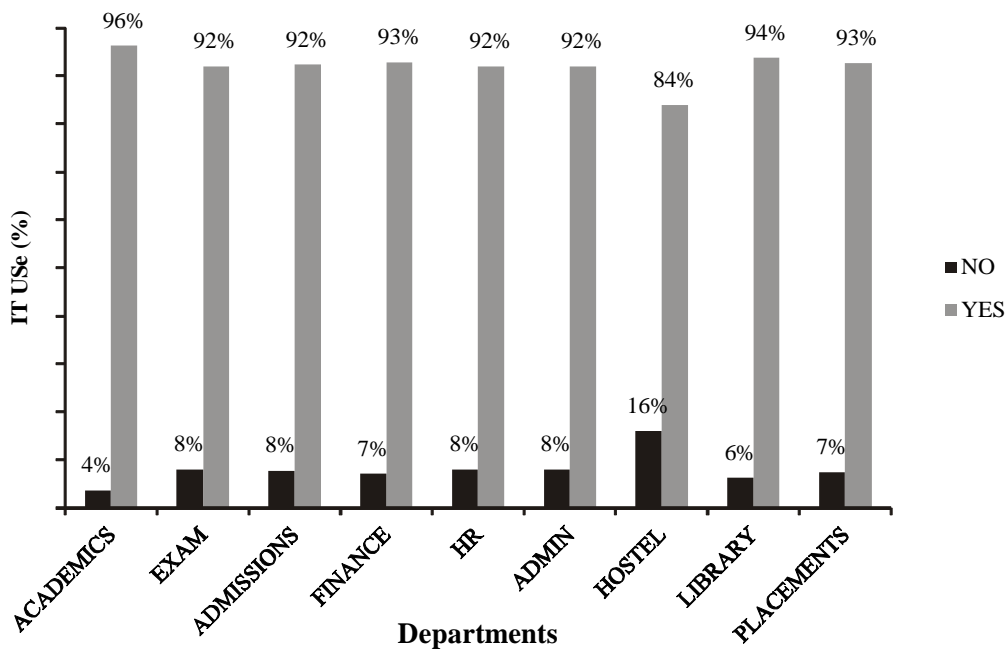

Figure 1: Use of IT in various Departments of HEIs

registers and files. It is observed that some of the institutions that have no computer facility for hostels are otherwise well-automated for other departments. The interviews with the heads of the Hostels indicate that they have never used a computer earlier nor are they willing to use it and have fear that computerization would take away their jobs. On the other hand, the interviews with the examination staff in one of the institution revealed that they were extremely enthusiastic to learn and work on the new technology and were mindful of the advantages of technology implementation, however the institution was not prepared for it and were still using the manual framework for documentation and were preparing results manually.

Response to Research Question 2: What activities have been automated by the HEIs?

The results indicate that more than 50% of the institutions are using IT for automation of the following activities: (a) Admissions Management (b) Course Planning (c) Course Management (d) Course Delivery (e) Time table Scheduling (f) Examination activities (g) Student evaluation and assessment (h) Maintaining and managing different records (i) Data Analysis (j) Accreditation activities (k) Organizing conferences (l) Financial planning and (m) Governance. While only 30-50% of the institutions, are using IT for (a) Handling student grievances (b) Placement & Industry interaction activities (c) Alumni interaction activities (d) Academic Progression/Convocation (e) Faculty & Staff recruitment and (f) Research & Development. Whilst less than 30% of the institutions implement IT for (a) Fee Payment (b) Faculty & Staff training and skill development (c) Faculty & Staff appraisals and incentives, (d) Strategy development (e) Manpower planning (f) Infrastructure planning (g) Resource Allocation (h) Organizational structuring designing (i) Process planning and design (j) Process analysis and improvement (k) Performance Management, (l) Quality Control

Thus we may conclude that the institutions first automate the activities that are directly linked to the students and then they may utilize IT at the strategic level.

Response to Research Question 3: Are there any differences among HEIs on IT implementation? Are there any differences in the level of automation among higher educational institutions (HEIs)?

To determine whether there were differences among institutions on IT implementation, it was also important to know the kind of IT tools they were utilizing for automation of various activities. Unexpectedly, some of the departments and institutions were only utilizing Microsoft Word and Microsoft Excel for managing various records. It was observed that 25% of the Academics departments, 48% of the Examinations cells, 29% of the Admissions divisions, 8% of the Finance departments, 61% of the HR departments, half of Administration departments, half of the Hostels and 52% of the Placements cells were using MS Office and Internet. Out of the aggregate sample of eighty six (86), 33% of the institutions were not actually automated and only using these basic tools for preparing documents and spreadsheets as well as sending and receiving emails.

It was also observed that some of the institutions had done automation at the departmental level only and were using tools such as student management system for managing student records, inventory management system for managing inventory, library management system were automation of the library and likewise. Separate records were maintained by each department and they were not working in an integrated manner. Thus, 13% of the Academics departments, 9% of the Examinations departments, 21% of the Admissions departments, 44% of the Finance departments, 9% of the HR departments, 5% of the

administrative departments, 6% of the Hostels, 67% of the Libraries and 8% of the Placement departments use IT solutions at the departmental level only. The interactions with the couple of librarians revealed that they themselves had taken initiatives for automation of the library and it could be done without much effort due to availability of modest readymade library solutions in the market. Therefore, 21% of HEIs are still working as functional silos where each functional division is utilizing its own particular IT solution catering to the individual departmental needs.

While 46% of the HEIs use advanced tools such as ERP for institutional management. ERP systems are either proprietary or in-house developed by the HEIs.
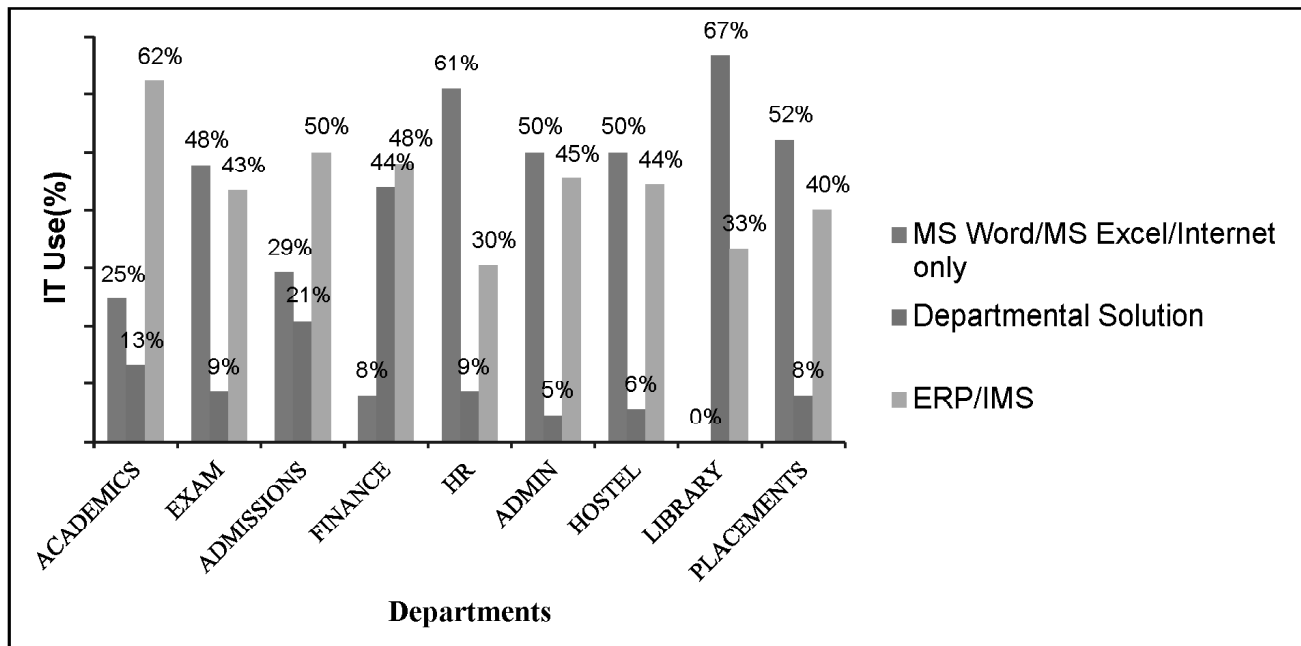

Figure 2: Use of various IT Tools Department Wise in HEIs

The meetings with the functional heads were conducted to identify the benefits of developing in-house solutions over readymade ERP solutions. They report that the readymade ERP solutions are very expensive, need customization and there are sure security and privacy concerns. The number of HEIs developing in-house solution is high (60%) contrasted to the institutions obtaining readymade solutions (40%).

It is observed that almost all the government HEIs have outsourced the ERP development to well known vendors from the business sector. However, the interviews with the functional heads revealed that the institution has spent millions on IT implementation, but the vendors have completely failed in providing the necessary benefits. 70% of the institutions opting for readymade solutions were not able to utilize the system benefits.

The common problems faced by the HEIs authorities are as under:

i)   The top management is not supportive and leaves everything to the vendor and the vendor has no understanding of the academic institution

ii) There is no IT leadership

iii) The solution is not aligned as per the institutional needs

iv) IT takes a backseat by the top management

v) The institution is completely dependent on the vendor

vi) The consultants keep on changing after few months and it becomes very difficult for a new person to understand the system and for the institutional heads to explain the system requirements.

vii) The IT solution takes much of the institutional expenditure

viii) There is a need of a Chief Information Officer or Chief Technological Officer who understands the academic fraternity and IT system.

ix) Employees are not ready to use the system.

The functional heads of these institutions shared that they were now planning to develop the solution in-house.

Comparing the Private and Government HEIs, it can be observed that private institutions have developed in-house solutions at the first go while government institutions have first tried out the readymade ERP Solutions. The study also revealed that 33% of the institutions are step ahead and have developed and are providing Mobile Apps for faculty and students.

The interviews with the respondents of HEIs institutions having successful ERP implementation indicated that their institution was well connected, sharing and exchange information across departments as well as with students, faculty and staff was easier, data was more consistent and up-to-date, timely information was available and easily accessible, paper work has lessened extensively, report generation was simpler and customized report could be generated within minutes, faster decision could be taken and there was improved accountability, transparency and inter and intra departmental coordination. However, there were some of the HEIs that were not able to utilize the ERP system for execution of the institutional activities.

For the HEIs to overcome operational issues and achieve operational excellence, it is essential that different departments work in an integrated manner and there is a seamless end-to-end flow of information across the institution. Therefore, in this study, automation refers to deployment of IT system at the institutional level for execution of day-to-day operations. Thus, based on the tools and the extent of automation, the institutions can be categorized into two broad classes-

(i) Automated institutions – The institutions having an integrated information or ERP system.

(ii) Non-automated institutions – The institutions where different departments are using different tools to cater to the departmental needs. The departments and IT systems are not integrated.

Therefore out of the total eighty six (86) HEIs 54% were non-automated while 46% were automated. Out of 46% only those institutions actually using the IT system have been taken for further research and the other have been discarded. Thus, only 34% of the institutions are taken for further study.

Are there any differences in the level of automation among the Higher Educational Institutions (HEIs)?

An in-depth analysis of the survey showed that level of automation differed among the automated HEIs. A few institutions have automated the complete process from admissions to Alumni Interaction, while the others have automated just admissions, academics and placement activities.

Based on the level of automation, the HEIs were further categorized into different stages/levels of automation –

a) Initial Stage

b) Intermediate Stage

c) Advanced Stage

Of the total sample of HEIs that were actually automated, approximately 41% of them are in the initial stages of automation, 31% are in the intermediate stages and 27% are in the advanced stages of automation.

The HEIs in the initial stages of IT implementation have about 20-40% automation with 2-4 departments automated. On the other hand, the institutions in intermediate stages have about 40-70% automation with around 5-7 departments automated. The institutions in the advanced level have about 70-95% automation with around 8-9 departments automated.

Response to Research Question 3: Has automation improved the operational performance of the HEIs?

100% of the respondents acknowledge that their department and institution has been able to improve the operational performance by leveraging on IT. They strongly feel that IT implementation enhanced their day-to-day performance through improved speed, decreased expenditure, improved information flow, better efficiency of day-to-day activities, improved staff efficiency, resource optimization, convenience and ease of report generation. We can thus infer that IT use improves the operational performance.

HYPOTHESIS TESTING & ANALYSIS

Multivariate analysis of variance (MANOVA) test was conducted to determine whether there exist performance differences among institutions at different stages of IT implementation. The operational performance was measured as a combination of the thirteen performance indicators – (i) speed (ii) cost (iii) coordination (iv) consistency (v) optimal use of resources (vi) convenience (vii) information sharing (viii) efficiency of day-to-day activities (ix) transparency (x) accountability (xi) productivity (xii) data analysis (xiii) Quality of services. SPSS 20.0 was used for conducting the test. The independent variables were different stages of automation viz: initial, intermediate and advanced. The dependent variables were the thirteen scales; the 'performance indicators'. Many of the respondents did not answer this question and the response rate for it was 80.84%. There were no rows with the missing values.

Prior to computing the MANOVA, various assumptions of normality, outliers, linearity and multicollinearlity were checked. Mahalanobis Distances satisfied the normality and the outliers test. Multicollinearity was verified with the tolerance value of all greater than 0.10, Variance Inflation Factor value was less than 10, Cook's value was less than 0.09. However, Box-M test and Levene's test for the

assumption of homogeneity of variance was significant and so to correct for these violations a relatively conservative Pillai's trace F was used for the estimation of F-statistics in our analyses (Hair *et al.*, 2010). There was a statistically significant difference between institutions at different stages of automation: $F(26, 816) = 21.98$, $p=0.000$, Pillai'sTrace= 0.824, Partial Eta-Squared = 0.412 indicating a medium to large effect. A separate univariate ANOVAs also revealed significant differences (Table 1). The results for the dependent variables when considered separately were also significant.

Table 1
ANOVA Table

Tests of Between-Subjects Effects			
	F	*Sig.*	*Partial Eta Squared*
Speed	48.404	.000	.188
Cost Reduction	73.165	.000	.259
Consistency	37.212	.000	.151
Optimal Use of Resources	75.111	.000	.264
Convenience	129.903	.000	.383
Information Sharing across the Institution	158.032	.000	.430
Efficient Management of Day-to-Day Activities	7.337	.001	.034
Transparency	70.475	.000	.252
Accountability	90.311	.000	.301
Productivity	62.084	.000	.229
Data Analysis	46.540	.000	.182
Coordination	57.918	.000	.217
Quality of Services	148.224	.000	.414

The p-values in table 1 indicate that the difference among three groups is significant for all the performance indicators.

An inspection of the mean scores indicated that institutions at advanced stages had higher score than the institutions at intermediate stage and that at initial stages. The mean scores and standard deviations are given in table 2.

Table 2 reveals that the mean score for all the parameters are higher for the institutions at the advanced stage and lower for the institutions at the initial stages of IT implementation.

We can conclude that the institutions with more integrated IT implementation have better performance than with lesser integration.

DISCRIMINANT ANALYSIS

In order to find the importance of each of the thirteen performance indicators' unique contribution to the differences between three groups (initial, intermediate and advanced) and to determine which of the variables discriminate the most, direct discriminant analysis was used with thirteen performance indicators.

Table 2
Mean Scores and Standard Deviation (SD) for various Performance Indicators

| *Levels* | *Mean* | | | | *SD* | | | |
Performance Indicators	*All*	*Initial*	*Intermediate*	*Advanced*	*All*	*Initial*	*Intermediate*	*Advanced*
Speed	4.27	4.03	4.39	4.74	.627	0.58	0.54	0.57
Cost Reduction	4.16	3.79	4.38	4.82	.801	0.79	0.64	0.42
Consistency	4.41	4.19	4.54	4.83	.647	0.68	0.55	0.41
Optimal utilization of resources	4.12	3.81	4.30	4.69	.670	0.59	0.59	0.49
Convenience	4.15	3.70	4.50	4.81	.760	0.69	0.53	0.31
Information sharing across the Institution	4.33	4.01	4.51	4.90	.527	0.36	0.50	0.31
Efficient Management of day-to-day activities	4.21	4.12	4.24	4.44	.655	0.62	0.65	0.72
Transparency	4.02	3.71	4.08	4.79	.795	0.69	0.78	0.50
Accountability	4.20	3.91	4.27	4.91	.675	0.63	0.58	0.29
Productivity	4.10	3.86	4.24	4.55	.564	0.39	0.54	0.66
Data Analysis	4.28	4.05	4.38	4.77	.635	0.57	0.63	0.48
Coordination	4.05	3.77	4.13	4.68	.726	0.72	0.56	0.55
Quality of Services	4.19	3.78	4.42	4.94	.701	0.58	0.57	0.30

Discriminant analysis revealed two discriminant functions. The discriminate function revealed a significant overall difference between the three groups. The first explained 96.78% of the variance, canonical $R^2 = 0.74$, whereas the second explained only 3.18%, canonical $R^2 = 0.09$ (Table 3).

Table 3
Eigen Values and Canonical Correlations

Function	*Eigenvalue*	*% of Variance*	*Cumulative %*	*Canonical Correlation*
1	2.818[a]	96.8	96.8	.859
2	--.094[a]	3.2	100.0	.293

a. First 2 canonical discriminant functions were used in the analysis.

Table 4 shows the significance test of the variates. Table 4 shows the significance of both variates ('1 through 2' in the table), and the significance after the first variate is removed ('2' in the table). Both the variates significantly discriminate the groups. In combination, *Wiki's* =0.24, ÷2 (26) =32.67, *p* =.000, and the second variate also significantly differentiates the groups, *Wiki's*=0.91, ÷2(12) = 3.19, p=0.000.

Table 4
Wiki's Lambda

Test of Function(s)	*Wilks' Lambda*	*Chi-square*	*Df*	*Sig.*
1 through 2	.239	590.295	26	.000
2	.914	36.984	12	.000

Table 5 shows the standardized discriminant function coefficients for the two variates. These standardized discriminant function coefficients are equivalent to the standardized betas in regression.

Table 5
Standardized Canonical Discriminant Function Coefficients

	Function	
	1	*2*
Speed	.164	.453
Cost Reduction	.235	.079
Consistency	.016	-.078
Optimal Use of Resources	.167	-.306
Convenience	.385	-.798
Information Sharing across the Institution	.466	-.320
Efficient Management of Operational Activities	.041	.050
Transparency	.258	.133
Accountability	.215	.494
Productivity	.110	.135
Data Analysis	.132	.346
Coordination	.080	.776
Quality of Services	.236	-.231

Table 6 gives the structure matrix. The values in the structure matrix represent canonical variate correlation coefficients. The dependent variables with high correlations contribute most to group separation (Bargman, 1969). As such they represent the relative contribution of each dependent variable to group separation. Table 6 lists the coefficients that signify the relative contribution of each variable to the variates.

For variate 1, information sharing, quality of services and convenience has a strong effect. All indicators have a positive relationship with varaite 1. But convenience, accountability and transparency have a greater influence in the second variate.

Table 6
Structure Matrix

Structure Matrix

	Function	
	1	*2*
Information Sharing across the Institution	.517[*]	-.065
Quality of Services	.501[*]	-.052
Optimal Use of Resources	.357[*]	-.042
Cost Reduction	.352[*]	-.087
Productivity	.324[*]	-.031

contd. table 6

Structure Matrix

	Function	
	1	*2*
Coordination	.309*	.280
Speed	.286*	.055
Data Analysis	.280*	.129
Consistency	.251*	-.011
Convenience	.460	-.490*
Accountability	.382	.450*
Transparency	.336	.435*
Efficient Management of Operational Activities	.109	.118*

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions Variables ordered by absolute size of correlation within function.

*. Largest absolute correlation between each variable and any discriminant function

Table 7 show the canonical discriminant function coefficients. These are the unstandardized versions of the standardized coefficients given in table 5.

Table 7
Canonical Discriminant Function Coefficients

Canonical Discriminant Function Coefficients

	Function	
	1	*2*
Speed	.289	.799
Cost Reduction	.340	.114
Consistency	.027	-.131
Optimal Use of Resources	.289	-.531
Convenience	.643	-1.334
Information Sharing across the Institution	1.169	-.803
Efficient Management of Operational Activities	.063	.078
Transparency	.375	.193
Accountability	.379	.873
Productivity	.222	.273
Data Analysis	.230	.601
Coordination	.123	1.204
Quality of Services	.439	-.429
(Constant)	-19.281	-3.663

Unstandardized coefficients

Higher overall scores on information sharing, quality of services and convenience are the variables on what initial, intermediate and advanced groups are differing on. The results clearly indicate that more integrated IT implementation the greater the performance is. Obviously, holistic IT implementation will lead to an institution where different departments work in an integrated manner, thus improving information sharing across the institution, will add convenience for everyone in carrying out day-to-day activities, in several ways and improve quality of services that the department and institution offers to their customers. The results of both univariate and multivariate analysis of variance indicate that the Institutions with integrated IT implementation have better operational performance as all the thirteen performance indicators differed among groups and in combined manner too. We can conclude that in long run IT can prove to be useful tool for operational excellence in education sector too.

CONCLUSION

The research study indicates that most of the academic institutions have adopted IT for performing variety of activities. However, there is a colossal contrast among the HEIs on the utilization of IT. Further, the different HEIs are at diverse stages of IT implementation research as the institutions are slow in adopting to fully fledge IT due to number of challenges. Thus, the study demonstrates that the effective implementation of IT assists in overcoming educational issues and helps achieve operational excellence in HEIs. Thus, IT has proved to be useful tool for achieving operational excellence for the university.

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