USE OF INFORMATION TECHNOLOGY IN BUSINESS PROCESS IN PAKISTANI AND MULTINATIONAL PHARMACEUTICALS IN KORANGI

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Abstract

This study presents an analysis of IT use and Business Processes (BP) in Korangi pharmas.

Information system usage and manufacturing performance are moderately associated within the sample. There is little difference in the utilization of IT between the multinational and Pakistani firms. The main deficiency of utilization are in decision support systems and external integration functions. Suggestions are presented for increasing effectiveness of IT use in business process.

Introduction

In a previous study (Kamal,et al.2006) we conclude that the acid test to determine the impact of IT usage on organizational performance rests on the application of this sophisticated tool in its business processes. This research is an extension of the previous study. It attempts to measure Information System (IS) usage in business processes (BP) in the same nineteen pharmaceutical companies of Korangi Industrial Area (KIA) which formed part of the first study.

The previous study was based on the premise that information technology's full potential can only be realized if the competence level of users is adequate. (Kamal 2006) attempted to measure the degree of competence of the users of IT in a sample of 19 pharmaceutical firms. The major findings of the study are:-

- The IT competence of users were evaluated through two validated measuring tools; (a) Information Management Awareness Index, (b) MIS Style of 190 respondents of 3 MNCs and 15 national companies within Korangi Industrial Area (KIA).
- No major difference in competence level was found to exist on the measured scales between MNC and local firm IT users.
- Users who had more hands-on experience had a better score on the Awareness Index and the MIS Scale.
- Generally, the competence of the users is below the international benchmarked scoring level on the survey instruments chosen for this research.
- There is a need to impart extensive training to upgrade the technical skills of senior managers and other line managers working on computers. It was also recommended that tendency on the part of line manager to rely on IT specialists for decision support should be avoided and the user requirement should be spelt out by line managers to the technical staff.
- The MNCs control 55% of the major market share in term of revenue till 2004 (Kamal,et al 2006) although their numbers are restricted to only 29; This reflects that better management and marketing practices results into competitive advantage; This coincides with Dorgan's (2004) view that managerial skills in business organization are the major factors rather than mere computing power in determining performance differential.
- The companies which scored high on the MIS Style scale are also found to be amongst the top 50 pharma companies in Pakistan by market share and growth rate. This substantiates the view that better utilization of IT is dependent upon general employee skills.

The issues which were not explored in the first study were-:

- Usage of IT in business processes within the pharmaceutical sector and its impact on manufacturing performance.
- The impact of investment in IT on the productivity of the firms.
- Changes in Management practices necessary as a result of proliferation of IT in the manufacturing industry.

The objective of the present study is to identify the extent of usage of information technology in the business processes of MNCs and national pharmaceuticals. The 19 companies in Korangi Karachi, have again facilitated this study. This paper is divided into five sections. Section I reviews the relevant literature, section II presents the methodology of research, section III analyses the findings, section IV makes some recommendations and concludes.

Sec I. Literature Survey

Management has been focusing on improving effectiveness and efficiency in manufacturing processes. Work in this area began as early as the mid 1940's when efforts

were made to improve business processes (Davenport and Stoddard, 1994). The focus of these efforts was directed to process control and process techniques in a bid to improve quality (Juran, 1964; Garvin, 1988). Thereafter, process skills and process consultancy was improved to bring change management (Schein, 1969). Finally operations management focused on management of processes, people, technology, and other resources in the production of goods and services (Armistead et al 1995).

During the 1990's information technology application to upgrade business processes and the term business process reengineering (BPR) came into the lime light. (Davenport, 1993, Hammer and Champy, 1993, Kettinger et al., 1997). IT is considered to be one of the most important enablers of process change. In one of the first papers about BPR, Davenport and Short (1990) argue that in the future processes and information technology together could be seen as the new industrial reengineering process which may revolutionize manufacturing operations. This could lead to better efficiency and effectiveness.

The major contribution of Davenport's paper in 1993 was to coordinate business processes with IT design. It identified different ways in which IT could be used to improve process performance. He argued that the techniques necessary for achieving process improvement are distinct in use from those for developing information systems (IS). He advocated that IS requirements and data structures should mesh with corresponding business processes. However the study does not supply information that indicates the impact of IT on BP.

The role of information systems in enabling change is pursued in more detail in the System Analysis (S-A) framework in Kettinger et al. (1997). The S-A framework specifies the system analysis and designs its implementation. It focuses almost exclusively on identifying techniques that can be used in analysis and design but does not discuss how the co-ordination between process and information systems can be achieved.

One of the few papers that address the integration of BP and IT modeling is presented in Painter et al.'s work (1996). One of the major contributions of his paper is that it recognizes the need to integrate process and information technology design and identifies an intermediate layer, information systems, as the link between process and computer networks.

The earlier empirical studies of IS usage were characterized by a rather narrow and eventually quantitative conceptualization of usage, such as hours of usage (Ettema, 1985) and frequency of usage (Benbasnat, 1981). However it emerged that more use does not necessarily mean better use. Therefore later studies conducted in the 1990's and onwards shifted to more qualitative variables of IS usage. One of the most well-known research streams is that of the Technology Acceptance Models. However their definition of information security is mostly at the individual level emphasizing user satisfaction and individual performance.

These issues are beyond the scope of this study. Doll and Torkzadeh (1995) were the first to develop an instrument which quantitatively measured usage of IT and identified five dimensions where IT should be utilized, i.e. problem solving, customer service, decision rationalization, vertical integration and horizontal integration.

The model chosen for this research is based on the study conducted by Qiang Tu (2001) where linkage has been established between IT and manufacturing performance (MP) through a quantitative statistical tool LISREL[1]. Qiang Tu argues that unless the impact of IT usage is translated into manufacturing excellence, competitive advantage cannot accrue to the firm. The validity and reliability of this study has been found to be high since it was piloted and the instrument rigorously tailored before testing. The study suggests that the IS usage concept has not been adequately linked to manufacturing processes.

The study identified the following four major dimensions where usage IS should be applied by firms in order to gain a competitive advantage -:

- **O**perational Decision Support (ODS). This assesses how the firm use IS to monitor and improve daily operational decision processes (Doll and Torkzadeh, 1995 and Boynton, 1994).

- **S**trategic Planning Support (SPS). The extent to which the information system is used by the firm to help formulate and improve long term planning processes (Boynton, 1994).

- **I**nternal integration (II). The extent to which information system is used by the firm to facilitate information sharing and coordinate work activities within the organization. (Doll and Torkzadeh, 1995).

- **E**xternal integration (EI). The extent to which information system is being used to service and communicate with external constituencies such as suppliers and customers.

At the manufacturing performance level Qiang Tu (2001) identified five dimensions (1) cost reduction (2) quality performance (3) delivery performance (4) flexibility performance (5) innovation performance. These are regarded as “criteria of excellence”. Qiang Tu developed a valid and reliable instrument for assessing organizational level IS usage through a large-scale questionnaire survey of senior manufacturing managers. The linkage between IS usage and manufacturing performance was then examined using structural equation modeling analysis.

FOOTNOTE

1. **L**inear Structural Relationships (LISREL) is a type of structural equation modeling program. (Joreskog & Sorbom, 1986). Structural Equation Modeling (SEM) is an extension of standard statistical testing techniques such as regression and factor analysis. This statistical methodology takes a confirmatory (hypothesis-testing) approach to the analysis of a structural theory based on any phenomenon. SEM confirms relationships and explains complex models having interdependent multiple variables. It not only tests hypotheses to verify how variables affect each other but also to the extent the variables are inter-related (Bentler, 1988). The model determines the goodness of fit between a hypothesized model and the sample data.

The IS usage (ISU) construct represented the first four dimensions mentioned above, i.e., operation decision support, strategic planning support, internal integration and external integration in concurrence with manufacturing performance.. To test the relationships between IS and manufacturing performance LISREL equations were used. Qiang Tu also used statistics like root mean square residual (RMSR), goodness-of fit index (GFI) etc. The results of the structural equation model showed that organizations with high levels of information system usage have high levels of manufacturing performance.

Though Qiang Tu's sample covered the manufacturing concerns in general however it is thought that this model can be applied usefully in the analysis of the pharmaceutical industry in Pakistan. Within this industry, IT is being aggressively applied in several business processes. However a recent study carried out by the London School of Economics points out that it is not merely adding more computing power that adds to productivity; this should be accompanied by better management practices (Dorgan and Dowdy, 2004). It is important to analyze the impact of IT applications on business processes to determine whether it serves as a factor of competitive advantage.

Another important consideration is to understand how IT should be integrated in business processes. This particular aspect has been well covered in the research carried out by Levitt and Duhl (2004) who conducted a series of interviews with leading organizations which had implemented IT solutions. This study lays down the principles for the induction of IT into business processes and summarizes a sequence in which business processes should be aligned with computer technology.

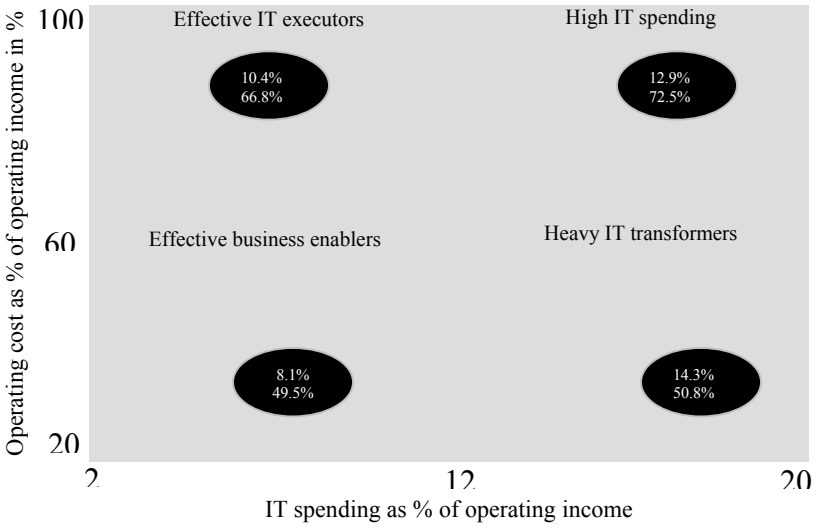
Levitt and Duhl (2004) recommend that the automation system usage should commence from functions which usually require tedious manual effort like book keeping, inventory control and salary rolls to save on cost and effort. Similarly easy operations should be automated first. Our research will explore whether the pharmaceutical firms have adopted any uniform sequence of automation.

Hyder and Zaheer (1997) have attempted to quantify the usage of IT in functional areas such as accounting, manufacturing, marketing and human resources whilst at the same time assessing IT utilization at different management hierarchical levels. Their findings were that IT is mainly being utilized for accounting processes and to generate reports and returns, and not for problem solving. There is a need to measure changes if any in utilizations of IT during the last two decades.

The research conducted by Kamal (2006) had highlighted that induction or utilization of IT will not enhance productivity unless accompanied by better management practices. This particular aspect was also investigated by Bahadur, Desmet and Bommel (2006) who pointed out that expenditure in IT should be related to operating income. These researchers categorized several European surveyed banks along two dimensions i.e. budgets for IT and operating costs as related to operating income and then placed each bank on a matrix on the basis of value added to companies. The banks were categorized according to the following classifications:-

Figure 1

Categorization of Banks on IT Usage



Source: Bahadur, Desmet and Bommel. McKinsey 2005 survey of IT cost in 32 European banks

Spanish banks were found to be the best users of IT. They maintained extraordinary discipline over IT costs and effectively used the technology in servicing, transactional products like ATMs, wire transfers and direct debits and finally in back-office operations. We shall also attempt to classify the pharmaceutical firms along these

dimensions to examine the difference of IT spending between the MNC's and the NC's. Each of the above quadrants in Figure 1 is explained in detail above.

- "Effective business enablers" who achieve the greatest business efficiency and effectiveness, from a relatively low level of IT(less than 12% expenditure on IT out of the total operating income).
- "High IT spenders" would be the firms which spend a higher percentage of their operating income on IT(12 to 20 percent) but have not yet achieved a major impact on business efficiency and effectiveness.
- "Heavy IT transformers" who spend a relatively higher percentage of their operating income in shape of one time investment in order to support business expansion like new products and markets.
- "Efficient IT executors" who just spend around 10% of their operating income on IT but haven't achieved a high level of operating effectiveness.

Sec II. Rationale and Methodology

This research is exploratory in nature since no earlier study of usage of IT in the pharmaceutical sector could be found in Pakistan (i.e. before Kamal,2006). Our main concern was to determine (a) the impact of IT in the business processes leading to productivity growth; (b) whether a sequential order of induction of IT enhances smooth transition towards automation; (c) whether changes in usage of IT have taken place over time and (d) level of investment in IT necessary to enhance efficiency.

The variables for ISU and MP have been derived from the bench-marked study of Qiang Tu (2001) for evaluating the usage of IT in manufacturing concerns. There are, however, some differences in our methodology. These are as follows:-

- Qiang Tu meshed the sub variables of ISU and MP directly whereas we have introduced "business processes" as an intervening variable. The relationship between MP (dependent variable) with ISU (independent variable) becomes more evident by this procedure.
- Our aim is also to determine if difference exists in usage of IT in business processes amongst MNCs and national companies.
- A pilot study was conducted to improve content validity of the questionnaire by involving six professionals from IT and production department in 3 firms. An option was given to these experts to recommend "Keep" "Drop" "Modify" and "Add" to a preliminary questionnaire. .After the finalization of the instrument it was administered in one of the pharmaceutical companies to establish further authenticity and test the usefulness of the LISREL equation.

  ISU is measured in terms of integral integration within the organizations, external integration with suppliers and customers, facilitation in strategic planning support and

operational decision support through IT. The following questions included in the questionnaire related to ISU:-

1. What type of software applications do you use in your company?

2. What is the medium used in collecting data from vendors, sales force, customers and institutional organizations?
3. What is the frequency of obtaining data?
4. What is the level of integration amongst the different departments?
5. How does your existing business process structure help in justifying and formulating long-term business plans?
6. Does your existing application system help in analyzing and monitoring daily operations?
7. Does your IT system provide batch tracking function to heads of the departments?
8. How is the business process information circulated among departments in your company?
9. What kind of information related to competitors is collected?
10. To what extent do different levels of management obtain reports and query database?

Cost reduction, quality improvement, delivery performance, flexibility and innovation were the sub dimensions of MP which were measured by the following questions:-

TABLE 1

The following statements describe typical **manufacturing objectives** of a firm. Please circle the appropriate number that best indicates the **ideal level of attainment through IT** (column 1) against **actual level of attainment through IT in 2006** (column 2) as applicable to your organization. **Please answer both columns**. The measurement scales to be used are explained below.

1 - Very Low, **2** - Low, **3** - Moderate, **4** - High, **5** - Very High, **NA** - Not Applicable or Do Not Know

Item Descriptions	Ideal level of attainment	Actual level of attainment through IT in my company in 2006
1 Reduce material costs …....	1 1 2 3 4 5 NA	1 2 3 4 5 NA
2 Develop new forms of shop floor management	1 1 2 3 4 5 NA	1 2 3 4 5 NA
3 Increase labor productivity ..	1 1 2 3 4 5 NA	1 2 3 4 5 NA

4 Reduce wastages	1	1	2	3	4	5	NA	1	2	3	4	5	NA
5 Provide faster delivery …	1	1	2	3	4	5	NA	1	2	3	4	5	NA
6 Process both large and and small orders	1	1	2	3	4	5	NA	1	2	3	4	5	NA
7 Develop new ways of customer service ……...	1	1	2	3	4	5	NA	1	2	3	4	5	NA
8 Make rapid changeover between product lines ……	1	1	2	3	4	5	NA	1	2	3	4	5	NA
9 Increase capacity utilization …..……	1	1	2	3	4	5	NA	1	2	3	4	5	NA
10 Develop new ways of supply chain management.	1	1	2	3	4	5	NA	1	2	3	4	5	NA

LISREL structural equation modeling method was used to test the relationship between ISU and MP. The advantage of this model is that it allows the testing of several variables simultaneously which is not possible within regression analysis. Several statistics are used to assess the model fit. The evaluation of the model fit derives from a variety of sources and is based on several criterions assessing the model fit. (Byrne 1998).Each statistic must fall within a minimum range to qualify for a reasonable good fit.

1. **S**tatistical testing determines the goodness of fit between a hypothesized model and the sample data. It is sometime unlikely that there will be a perfect fit of the model to the data. This differential is called RESIDUAL. Mean Square Residual (RMSR) and Root mean Square Error of Approximation (RMSEA). It incorporates no penalty for model complexity and tends to favor models with many parameters. Values less than 0.05 indicate good fit while values ranging from 0.08 to 0.10 indicate mediocre fit.

2. **G**oodness of Fit (GFI) is analogous to the squared correlation and it indicates the proportion of the observed co-variances. Adjusted Goodness of Fit (AGFI) differs from the GFI only in the fact that it adjusts for the number of degrees of freedom in the specified model (Byrne, 1998). Both indices range from zero to 1.00, with value close to 1.00 being indicative of good fit.

3. **T**he Chi-square is the likelihood ratio test that has been the traditional measure used to test the closeness of fit between the unrestricted sample covariance matrix S, and the restricted covariance matrix $\Sigma(\theta)$ (Byme, 1998). The ratio of chi-square to the degrees of freedom provides information on the relative efficiency of alternative

models in accounting for the data. Researchers have recommended using ratios lower than 5.0 to suggest a reasonable fit.

Table-2

Indices calculated values

Name of the Test	**Indices**	**Recommended Value**
Root Mean Square Residual	RMSR	Maximum 0.10
Goodness of Fit	GFI	Minimum 0.90 for good fit
Adjusted Goodness of Fit	AGFI	Minimum 0.90 for good fit
	CFI	Minimum 0.90 for good fit
T Chi-Square	Ratio of Chi Square of Df	Less than 3.0 for reasonable fit

The induction of IT in a sequential order is expected to bring about smooth transition in the automation process. However since there is no internationally established sequence of functions of business processes or empirical model relevant to the pharmaceutical industry therefore opinions were sought from the respondents and recommendations made to the industry. The respondents were asked to provide information as to the sequence adopted for automation in their firms. Questions included in this respect are:-

1. What should be the sequential order in induction of IT in the different departments?
2. While inducting IT in different departments, what should be the sequence adhered to for different activities?

The usage of IT is most wide spread in Pakistan in the pharmaceutical industry however no empirical record exists about its intensity. There is a need to update IT usage between the period 1999 and 2006. Data reflects the progress made in the usage in elements like databases, applications and medium of exchange within the organization and outside forces. The following questions were included in the questionnaire to make this comparison.

1. Express in % the extent of usage of information technology in business processes in 1990 and 2006?
2. What is the percentage use of Information Technology in Business Processes in the different departments ?

Budgets allocated to IT by the firms were also studied. The information collected highlighted the priority attached by management in allocating budgets to IT infrastructure. Under-mentioned questions were included:-

1. Express in % the ratio of investment in IT against total Sales?
2. Express in % IT spending as related to Operating Income?
3. Express in % operating cost as related to operating income?

Overall the questionnaire contains ten items related to relationship between ISU and BP factors; four items related to induction of IT in sequential order; two items related to differential in usage between 1990's and 2006 and four items related to investment in IT by the firms. There were twenty items related to manufacturing performance (MP).

The present study is based on a sample obtained from 16 pharmaceutical companies which were also part of the earlier study (Kamal,2006). Three companies did not give complete data. A non- random sample of one representative from each of the pharmaceutical companies was taken who received inputs from finance and production heads. The criterion for limiting the survey to one participant (IT specialist) from each company was based on the premise that information being sought related to sensitive data about the company and is not in the common knowledge of all employees. However to avoid sampling error, respondents not meeting the following criteria were omitted at the time of analysis.

- ☐ Refused to fill the questionnaire.
- ☐ Not submitted the questionnaire in time.
- ☐ Companies could not be contacted.
- ☐ Incorrect data was provided.

Data was collected in August and September 2006. Informal consent was taken verbally from the participants and the survey was administered in person in the company premises. The survey result for sixteen companies is considered adequate for analysis; the remaining companies did not meet the criteria mentioned in the previous paragraph. The data was transcribed and later open coded for ease of tabulation. The data worksheets are not being attached to this study but are available to the respondent companies on request.

Section III - Results

We tested for relationship between ISU factors and Manufacturing Performance (MP) through the LISREL structural equation modeling method. (See Section II). The sub dimensions of ISU and MP provided by all sixteen pharmaceutical companies were averaged. The result displays a reasonable fit between the ISU factors and the MP dimensions according to LISREL. The result of the survey and the profile of the firms are presented in Table -3 below. Organizations with high-level of information system usage are predicted to have high-levels of manufacturing performance.

Table -3

Surveyed Companies and their Profile

S.#	Company	Type	Ranking	MKT Share %	Growth Rate %	Firm Value Rs million	# of Product	ISU score	MP score
1	BRISTOL	MNC	TOP 50	2.20%	18	1.4b	34	3.56	3.27
2	ROCHE	MNC	TOP 50	2.30%	18.3	1.47b	46	3.75	3.79
3	J&J	MNC						3.037	1.97
4	NABI	NC	TOP 50	0.80%	8.7	5.07	47	3.8	3.75
5	GETZ	NC						3.39	3.7
6	BROOKES	NC						3.47	3.23
7	HILTON	NC						3.37	3.11
8	HINOVEX	NC						3.37	3.11
9	ADAMJEE	NC						3.13	3.071
10	INDUS	NC	TOP 50	0.70%	15.8	4.46	33	2.26	2.88
11	GEOFMAN	NC		0.15%	-19.2	88	65	1.61	2.75
12	BOSCH	NC	TOP 50	0.86%	12.6	555	51	3.17	2.71
13	EFROZE	NC		0.34%	-3.9	215	36	3.49	2
14	EROS	NC		0.01%	-0.9	4.2	23	1.95	2
15	UNI FROZE	NC					2	1.97	
16	Chaz Mendoza	NC		0.25%	-0.1	1.72	33	2.66	1
Companies				**Average of All the Companies**				**3.0**	**2.8**

- Three companies namely Bristol, Nabi Qasim and Roche have a mean ISU and MP measurement greater than 3.5. These companies are amongst the top 50 companies and their market share is well above 5% (Survey Report, Apr2005).

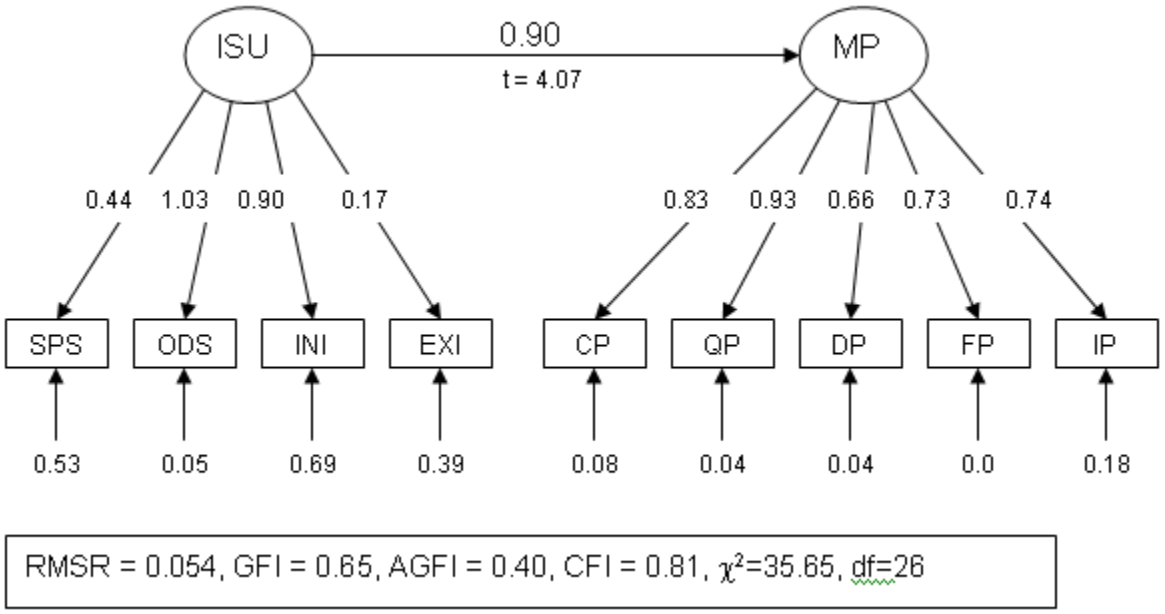
- There is no significant difference of association between ISU and MP between MNCs and the national firms. It is not the case that MNCs demonstrate a more effective use of IT as reflected in their manufacturing performance.

- There were 8 companies whose mean ISU readings were between 3.0 to 3.5 and out of these 5 companies have acceptable MP rating as well.

The results of the LISREL modeling test is presented in Figure 2 below:-

Figure –2

LISREL Structural Equation Model



The LISREL path coefficient is 0.69. The t value indicates that the result is significant. This shows that ISU and MP have the expected hypothesized positive relationship amongst themselves within our sample of firms. We consider this a "reasonable fit". However some of the other statistical tests GFI and AGFI do not meet the recommended criterion as given in Table-4. Qiang Tu's value as indicated in Table 4 indicates a much better "Fit". The above findings reflect that the usage of IT is not fully exploited in Pakistani (both MNCs and national) firms. The data also highlights that the deficiency exists in the utilization in operational decision support (ODS) and strategic planning support (SPS).

Table - 4

Indices calculated values

Indices	**Recommanded Values**	**Calculated Values**	**Qiang Tu's Result**	**Our Result**	**Qiang Tu's**
RMSR	Maximum 0.10	0.054	0.047	FIT	FIT
GFI	Minimum 0.90 for good fit	0.65	.95	NOT FIT	FIT
AGFI	Minimum 0.90 for good fit	0.40	.95	NOT FIT	FIT

CFI FIT	Minimum 0.90 for good fit	0.81	.95	FIT
Ratio of FIT	Less than 3.0 for	1.35	2.30	FIT
Square	reasonable fit			

All firms are strongly poised in the utilization of IT in the dimensions of internal and external integration with the exception of marketing and human resource functions. None of the firms carry out any surveillance of competitors. A cursory examination of the data also shows that companies are well integrated internally and communicate using sophisticated mediums as shown in Table-5:-

Activities	Nabi	Roche	Bristol	Efroze	Brookes	Getz	Hilton	Hinovex	Bosch	Adamjee	J & J	Chaz	Indus	Uniferoz	Eroz	Geofman
Software Alerts			✓		✓											
Emailing or Message Server	✓		✓	✓		✓	✓	✓	✓	✓	✓			✓		
Telephone													✓			✓
Internal hard copy	✓	✓											✓		✓	
Face to Face												✓			✓	
We based Application			✓			✓	✓	✓								✓
Client Server Based applications	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Stand alone applica	✓		✓												✓	

tion																

- Communication networking between the managers through emails and client server based applications is similar within the MNCs and national companies. However most of the MNCs are now using web based applications and software alerts which is a superior technology providing faster access and flexibility. The vendors and customers presently are not well integrated in this networking by either MNCs or national firms.

An important aspect which emerged from the literature survey was that the induction of IT in any industry should be in a sequential order. Respondents recommended the following order of sequence for the induction of IT in functional departments-

Table –6

Departments Automation Order

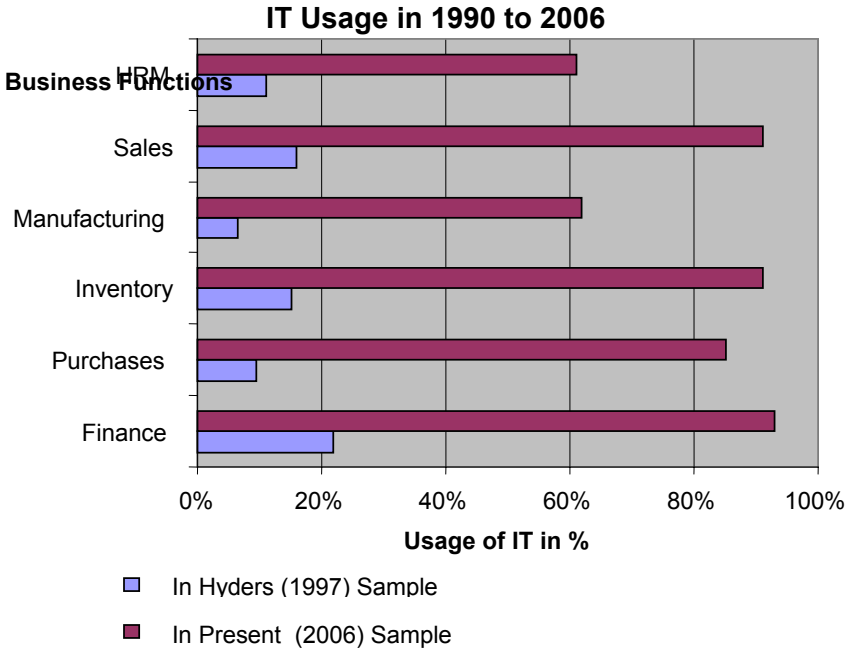
Department	Sequence Order	Consensus amongst the sample %
Finance	1	66%
Sales	2	46%
Inventory	3	46%
Purchase	4	40%
Manufacturing	5	100%
Marketing	6	73%
HRM	7	86%

There is over 90% consensus within the sample that sequential activities in departments should commence from record-keeping, moving on to functions like decision making and forecasting. Our results showed that the sequential pattern of IT induction is broadly appropriate and in line with consensual recommendations.

. **O**ur survey shows that there is higher intensity of computer usage in the pharmaceutical industry in 2006 as compared to the earlier study carried out by Hyder (1997). Graph-1 portrays the differential between 1990 and 2006.

Graph –1

Usage of IT in 1990 and 2006



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a) In the 1990's most companies used stand-alone application and there was no integration within the departments except in the case of a few MNC's. Today there has been a lot of forward movement in the utilization of information technology and now IT is better integrated with the business processes and users have easy options to share online data within the departments and with external business partners. Most national companies are still using client server based applications which facilitate internal integration but for external integration they have to move on to web based applications which will boost real time exchange of information which most of the MNC's are using. Presently only Bristol, Getz, Hilton, Hinovex and Goefman are on web based applications.

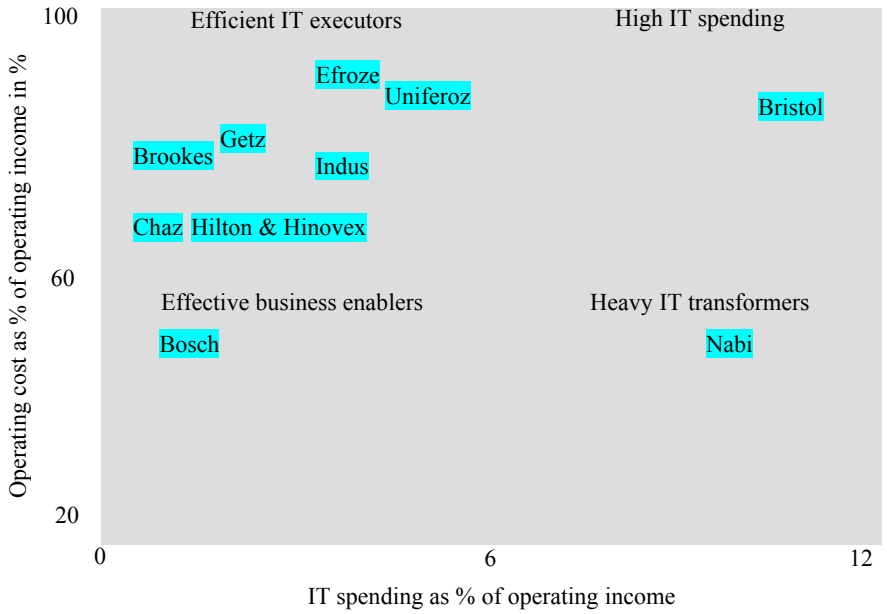
b) In Hyder's study (1997) Decision Support System (DSS) was not found to be used by the managers in the development of business plans; this deficiency still persists. Most of the firms pointed out that the usage of IT is deficient in the marketing and manufacturing functions. There is a need to explore why the companies are reluctant to exploit DSS in generation of business decisions?

c) Hyder's study (1997) also pointed out that the databases were upgraded to third generation languages whereas now most of the companies have switched to fourth generation languages like Rational Database and Web application which facilitate the business processes in term of speed, number of users and user friendliness (Bristol, Getz, Hilton).

Our literature survey suggests that companies which combine superior IT management with tighter control on IT expenditures reap better dividends. The survey found that IT spending varied widely from 5% to 20% of operating income. A higher level of IT spending does not necessarily increase the effectiveness or efficiency of the business. This particular question received mixed response from the organizations. Only 11 firms disclosed their operating cost and IT spending. Each firm was positioned on the ratio of spending in IT and their respective operating income in the graph below. Each firm is placed in one of the quadrant as per its characteristics explained in the graph.

Graph - 2

IT spending verses Operating Income



The above finding is consistent with the model developed by Bahadur, Desmet and Bommel 2005 who carried out a similar categorization of IT spending in European banks. Using the same dimensions surveyed companies have been positioned. The implication of the positioning is as follows-:

☐ **"E**ffective business enablers" achieved the greatest efficiency and effectiveness from a relatively low level of IT spending. Bosch spends less than 6% on IT spending, while their operating cost is limited to 40% of operating income. Incidentally this company is amongst the top 50 companies in the pharmaceutical industry. Bosch has a more centralized and consolidated application portfolio than the typical high IT spenders since most of the applications have been developed in house. It also has 100% integration within the departments.

☐ **O**n the other end "High IT spenders" payout almost 16% of their operating income on IT but have not yet seen the desired impact on business efficiency and effectiveness. Bristol is categorized as high IT spender. However this could be a one time major IT expenditure to support business expansion.

☐ **"H**eavy IT transformers" spend almost 12% of operating income on IT largely for specific business transformations projects. Nabi Qasim falls in this category.

☐ **L**astly most of the companies spend up to 6% of their operating income on IT but their operating cost fall between 60 to 95 % of their operating income. These companies are dubbed as "efficient IT executors" who have not yet realized effectiveness in their operations. Most of the national companies fall in this quadrant.

Section IV – Conclusion

The major conclusions are:-

a) Information system usage and manufacturing performance are moderately associated related within the pharmaceutical firms. There is however a good deal of room for improvement. Overall there is little difference in the utilization of IT between the MNCs and the national firms. However the MNCs have somewhat superior IT applications which allow them speedier operations and controls.

b) The usage of IT commenced in all pharmaceutical firms from the finance department like payroll accounting, cash flow statements and trend analysis reports followed by sales function being a critical indicator for strategic business planning and production schedules. Decision making and forecasting remains a neglected area though plays a crucial part in strategic planning.

c) Investment in IT infrastructure must be balanced against competence of users and benefits in terms of speed and expanded networking. Investment in training will also ensure better exploitation of this sophisticated tool.

d) The research could not identify " better management practices" during this study as a result of induction of Information technology in the business processes; maybe the focus of future studies should be directed in this direction.

Appendix- 1. Questionnaire

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Appendix–I
SURVEY QUESTIONNAIRE

The objective of this survey is purely academic. This questionnaire has been refined through IT experts.

1. What type software applications do you used in your company? (Tick as many as you like)

- In House
- Off the shelf
- ERP Solutions,
- Others_____

2. What should be the sequential order in induction of IT in the Pharmaceutical Industries?

Departments	Order of Sequence
Finance	
Purchases	
Manufacturing	
Inventory	
Sales	
Marketing	
HCM	

3. While inducting IT in different departments, what should be the sequence adhered to for following activities?

Departments	Sequence of Activity
Record Keeping	
Reporting	
Controlling	
Analysis	
Decision Making	
Forecasting	

4. What is the percentage of Information Technology in Business Processes in the following departments:

Departments	Record Keeping	Reporting	Controlling	Analysis	Decision	Forecasting

Finance Purchases
ing HCM

5. What is the medium used in collecting data from the following? (Express in %)

Medium	Institutional Sales Customers	Vendors	Sales Force Visit
report			
Online Line			
Email			
Fax			
Telephone			
Courier			

6. What is the frequency of obtaining data from following?

Frequency	Institutional Sales Customers	Vendors	Sales Force Visit
report			
Daily			
Weekly			
Fortnightly			
Monthly			

7. How is the business process information circulated between the departments in your company?

- Software Alerts
- Emailing or Message Server
- Telephone
- Internal hard copy mail
- Face to Face

8. What is type of business application used in your organization?

- We based Application
- Client Server Based applications
- Stand alone applications
- Others

9. Does your IT Provide Batch Tracking function, If yes can you identify the following;

- Component Batches
- Supplier
- QA Manager
- Production In charge
- Production Date

 None of the above.

10. What is level of integration in the departments?

Departments	In %
Purchases	
Sales	
Manufacturing	
Inventory	
Marketing	
HCM	

11. Express in % the extent of usage of information technology in business processes?

Business Function	**Year 1990**	**Year 2006**
Finance	%	%
Purchases	%	%
Inventory	%	%
Manufacturing	%	%
Sales	%	%
HR	%	%

12. How does your existing business process help in justifying and formulating long-term business plans?

1 - Very Low, **2** - Low, **3** - Moderate, **4** - High, **5** - Very High, 6 - **NA** - Not Applicable or Do Not Know

13. Does your existing application help in analyzing and monitoring daily operations?

1 - Very Low, **2** - Low, **3** - Moderate, **4** - High, **5** - Very High, **NA** - Not Applicable or Do Not Know

14. What kind of information related to competitors is collected?

Type of Data	Low	Moderate	High	Very High
Sales data				
Product data				
Marketing				
Doctor prescriptions				

Others, _____

15. Does your IT business application effectively support your company business objectives and strategies?

1 - Very Low, **2** - Low, **3** - Moderate, **4** - High, **5** - Very High, **NA** - Not Applicable or Do Not Know

16. To what extent the following users obtain reports and query database:

☐ Senior Executives % ☐ Middle Manager % ☐ Supervisors %

☐ IT employees % ☐ Others specify %

17. What is the ratio of investment in IT against total Sales?

In Percentage: _____%

18. Express in % IT spending as related to Operating Income?

In Percentage: _____%

19. Express in % operating cost as related to operating income?

In Percentage: _____ %

20. What are your annual sales?

In Rupees _____

The following statements describe typical **manufacturing objectives** of a firm. Please circle the appropriate number that best indicates the **ideal level of attainment through IT in developed companies** (column 1) against **actual level of attainment through IT in 2006** (column 2) as applicable to your organization. **Please answer both columns**. The measurement scales to be used are explained below.

1 - Very Low, **2** - Low, **3** - Moderate, **4** - High, **5** - Very High, **NA** - Not Applicable or Do Not Know

	Item Descriptions	**Ideal level of attainment through developed companies in 2006**					**Actual level of attainment through IT in my company in 2006**					
1	Reduce material costs ……...	2	3	4	5	NA	1	2	3	4	5	NA

2	Develop new forms of shop floor management …..	2	3	4	5	NA	1	2	3	4	5	NA
3	Increase labor productivity …..……...	2	3	4	5	NA	1	2	3	4	5	NA
4	Reduce wastages	2	3	4	5	NA	1	2	3	4	5	NA
5	Provide faster delivery …… ……	2	3	4	5	NA	1	2	3	4	5	NA
6	Process both large and small orders ……...	2	3	4	5	NA	1	2	3	4	5	NA
7	Develop new ways of customer service …….....	2	3	4	5	NA	1	2	3	4	5	NA
8	Make rapid changeover between product lines …….	2	3	4	5	NA	1	2	3	4	5	NA
9	Increase capacity utilization …..…….	2	3	4	5	NA	1	2	3	4	5	NA
10	Develop new ways of supply chain management …..	2	3	4	5	NA	1	2	3	4	5	NA
11	Reduce unit cost ……..….	2	3	4	5	NA	1	2	3	4	5	NA
12	Track your delivery status……	2	3	4	5	NA	1	2	3	4	5	NA
13	Better product performance ……	2	3	4	5	NA	1	2	3	4	5	NA
14	Make rapid production volume changes ……..…	2	3	4	5	NA	1	2	3	4	5	NA
15	Develop new products and features ……	2	3	4	5	NA	1	2	3	4	5	NA
16	Improved product durability ……...	2	3	4	5	NA	1	2	3	4	5	NA
17	Develop new process technologies …….	2	3	4	5	NA	1	2	3	4	5	NA
18	Reduce defective rate ……..……	2	3	4	5	NA	1	2	3	4	5	NA
19	Decrease manufacturing lead time …….....	2	3	4	5	NA	1	2	3	4	5	NA
20	Make rapid design changes …….	2	3	4	5	NA	1	2	3	4	5	NA