A Study of ERP Implementation in Select Industries

Ph.D. Synopsis

Submitted To
Gujarat Technological University

For The Degree
Of
Doctor of Philosophy
In
Management

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1) Abstract:

Enterprise Resource Planning (ERP) systems have been implemented in most organizations for a few years. ERP solutions go through three phases of lifecycle: Selection, Implementation & Operation phase; the operation phase consists of the Stabilization stage and the Routine stage. Experience with ERP solutions in numerous organizations over the last decade indicates that successful implementation of ERP solutions does not necessarily lead to successful ERP usage. ERP systems offer benefit to organizations only to the extent that users accept and utilize them frequently and extensively. To improve the efficiency and effectiveness of ERP systems in their maturity stage of use, organizations need to understand the factors that impact user satisfaction.

Technology Acceptance Model (TAM) proposed by Davis (1989) has been widely used and it is well known that it can enhance understanding of the influences that increase the efficiency and effectiveness of ERP system in use. The literature shows that few published studies have examined users' adoption of ERP systems through a Technology Acceptance Model or examined external factors that have influence on the intention to use an ERP system, or ERP use in the stabilization stage. The purpose of this PhD research is to expose and research external factors which have influence on ERP users in the operation phase of ERP lifecycle and to investigate the impact of those factors on the use of ERP system. Total 5 industries have been taken and in each industry two Companies have been studied. Also, results have been compared for these 5 industries. Finally, interviews of CIO of some companies were also conducted and their views have been quoted in this research.

2) Brief description on the state of the art of the research topic:

Most literature on ERP solutions is focused on either evaluating the appropriateness of the ERP system vis-à-vis software, vendors, or consultants, or identifying Critical Success Factors (CSFs) affecting ERP selection and implementation (Yu, 2005), but less effort is given to identifying potential post-implementation impact (Gattiker and Goodhue, 2005). CSFs are not equally important in all phases of the ERP lifecycle, however (Bobek and Sternad, 2010); some influence operational effectiveness as well as implementation (Gattiker and Goodhue, 2005).

Much of the success of ERP implementation resides in the operational phase (Bradford, 2008; Motiwalla and Thompson, 2009). In the stabilization stage, ERP systems go through a post-implementation breaking-in period in which performance may not be typical of the long-term effects an organization might experience (Gattiker and Goodhue, 2005). In the routine stage, ERP systems might be implemented successfully from a technical perspective, but success depends on ERP users' attitudes toward and actual use of the system (Boudreau, 2002; Kwahk and Lee, 2008). To improve the efficiency and effectiveness of ERP systems in the operation phase, organizations need to research the factors that impact user satisfaction. In this area, the Technology Acceptance Model (TAM) is widely used for explaining behavioral intent and usage; it can enhance the understanding of influences that increase the efficiency and effectiveness of ERP system in use (Shih and Huang, 2009).

Several theories have been used to explain the acceptance and use of information technology (IT), including, reasoned action (TRA; Fishbein and Ajzen, 1975), planned behaviour (TPB; Ajzen, 1991), and the TAM (Davis et al., 1989). Compared to other theories, TAM is believed to be highly parsimonious, predicative and robust (Venkatesh and Davis, 2000; Lu et al., 2003; Liu and Ma, 2006), thus, it is commonly employed by IS/IT researchers (Davis, 1989; Davis et al., 1989; Amoako-Gyampah and Salam, 2004; Lee et al., 2010).

Several researchers have applied TAM to examine ERP system use (Calisir *et al.*, 2009; Shih and Huang, 2009; Sun *et al.*, 2009; Youngberg *et al.*, 2009; Lee *et al.*, 2010), but few scholars have examined multiple external factors that influence intent to use an ERP system or ERP system usage in the stabilization stage. Although a small number of external factors fail to illuminate user opinions about specific systems (Agarwal and Prasad, 1999; Lu *et al.*, 2003; Sun *et al.*, 2009), most studies address only a small number of external factors.

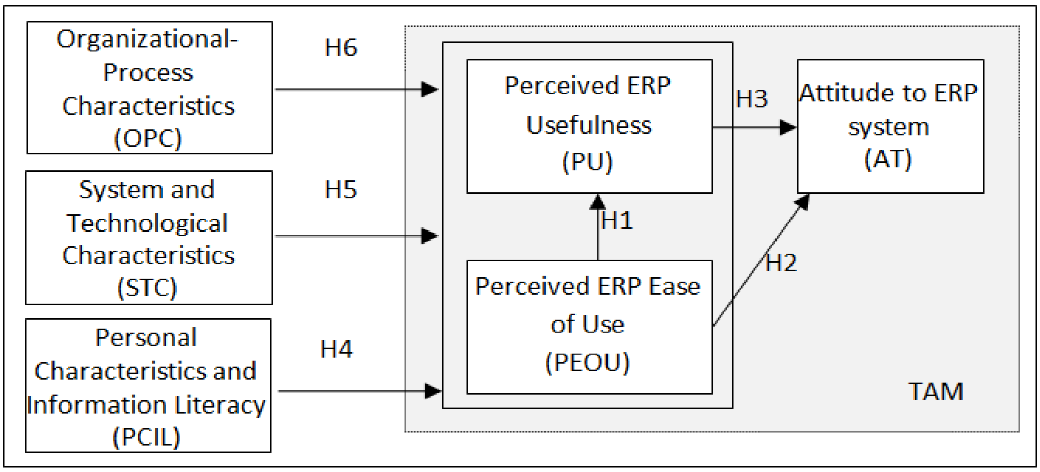


Figure-1: Technology Acceptance Model

Synthesizing prior research on TAM and research on ERP systems, a conceptual model that represents the cumulative body of knowledge from TAM and ERP research over the years has been developed (see Figure 1). The grey area within the dotted line denotes the original TAM. Because our research is focused on a group of external factors which influence the current usage of ERP system in the routine stage, there is no need to examine the behavioral intention on use and actual use; thus, behavioral intention and actual use were dropped from purposed research model.

TAM posits that two beliefs - Perceived Usefulness (PU) and Perceived Ease Of Use (PEOU) - are of primary relevance for acceptance behaviour (Davis et al., 1989). PU is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320). PEOU refers to “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989, p. 320). The two central hypotheses in TAM state that PU and PEOU positively influence an individual’s attitude about a technology which in turn influences his or her intent and actual use of the technology. TAM also predicts that PEOU positively influences PU, as Davis et al. (1989, p. 987) put it: “effort saved due to the improved PEOU may be redeployed, enabling a person to accomplish more work for the same effort.” The key purpose of TAM is to provide a basis for measuring the impact of external factors on internal beliefs, attitudes and intentions (Davis et al., 1989). The original TAM is well established and tested and a variety of extensions regarding external factors have been developed.

Because ERP systems are complex and complex systems decrease usefulness and ease of use (Momoh *et al.*, 2010), a better understanding of the factors influencing user acceptance of ERP systems is necessary to facilitate successful ERP system usage (Nah *et al.*, 2004). The goal of this research study is to explore a large number of external factors which potentially influence attitudes and behaviour regarding ERP use in the operational phase of the ERP lifecycle. Because of the large sample size required to apply TAM to multiple individual variables, the external factors have been divided into three groups: 1) Personal Characteristics and Information Literacy (PCIL); System and Technological Characteristics (STC), and; Organizational Process Characteristics (OPC) (Figure-1).

The constructs of the purposed model—perceived ERP usefulness, perceived ERP ease of use, and attitude toward ERP use for basic TAM of ERP systems—are influenced by constructs of external variables. The constructs of external variables are distributed among three second-level constructs: personal characteristics and information literacy (PCIL), system and technological characteristics (STC), and organizational-process characteristics (OPC). PCIL includes 4 factors i.e. experience with computer, computer self-efficiency, personal innovativeness toward IT, and computer anxiety. STC includes 4 factors i.e. ERP data quality, ERP system functionality, ERP system performance, and user manuals (help). OPC includes 5 factors i.e. social influence, fit with business processes, ERP training and education, ERP support, and ERP communication. Thus, our model includes 13 first-order factors and 3 second-order factors.

3) Definition of the problem:

- ERP solutions go through three phases of lifecycle: selection, implementation and operation phase; the operation phase consists of the stabilization stage and the routine stage. To improve the efficiency and effectiveness of ERP system use in the operation phase, organizations need to research the factors that have impact on users' satisfaction. The literature shows that few published studies have examined users' adoption of ERP systems through a technological acceptance model (TAM) or examined external factors having influence on the intention to use an ERP system, or ERP use in the stabilization stage.
- The purpose of this research is to expose and research external factors which have influence on ERP users in the operation phase of ERP lifecycle and to investigate the impact of those factors on ERP system use.

4) Objectives:

1) To identify external factors which have influence on ERP users (attitude & behaviour) in operation phase of ERP lifecycle.
2) To investigate the impact of those factors on ERP system use.
3) To compare these external factors in different sectors of industry.
4) To identify BPR activities carried out within 5 identified industries.

Scope of Work:

1) Research has been confined to Gujarat state only.
2) Five industries have been identified for the purpose of this research study, i.e., Chemicals, Tyre, Pharmaceuticals, Design & Engineering.
3) The data were collected from only 2 companies for each industry.

5) Original contribution by the thesis:

The present research study attempts to identify those factors which have an impact on ERP solution and use in the routine (mature) stage of ERP lifecycle. The research has examined the users' adoption of ERP systems through the TAM and the factors that have influence on the intention to use an ERP system or on ERP use in the stabilization stage. The present research, therefore, adds to the existing literature based on previous studies.

6) Methodology of Research, Results /Comparisons:

Research Design

The research design for my study is primarily **exploratory** and **descriptive** in nature. It is exploratory because at the first stage it involved the provision of insights into the research topic and comprehension of the problem situation. This has led me to formulate the research problem, develop the objectives of the study, isolate the key parameters of the study and plan the future course of action. The descriptive research attempts to describe systematically a situation, problem, phenomenon, service or programme; it also describes the characteristics of the respondents and the degree of association or relationship between the variables being studied. It helps to make specific predictions. These two research designs were apt for the present study.

Data Collection Tool: A structured **Questionnaire** was prepared which included all the items of 16 first-order factors and 3 second-order factors. These factors were measured on a 7-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'; the scale was adopted from relevant prior research and adapted to relate to the context of ERP usage. In addition, demographic information was collected.

Universe: Employees using ERP since last 1 year.

Pilot Study: The questionnaire was pilot tested with a group of 30 ERP users in Linde Engg. India Pvt. Ltd., Vadodara. Based on the results of the pilot testing, revisions and additions were made to the questionnaire. Pilot participants were included in the main data gathering effort since they were part of the population of interest.

Sample size: 508 ERP users from Five industries.

Sampling technique: Convenience Sampling

Reliability & Validity of Questionnaire: As Cronbach Alpha is 0.902, which is more than 0.7, so the reliability of questionnaire is very high. The Construct Validity of questionnaire is reasonable as it is having value 0.349, which is less than 0.5.

Sr. No.	Name of Company	No. of responses
1.	Linde Engg. India Pvt. Ltd, Vadodara	51
2.	L&T Engg, Vadodara	51
3.	GSFC Ltd, Vadodara	51
4.	GNFC Ltd., Bharuch	49
5.	FAG Bearing, Vadodara	51
6.	ABC Bearing, Bharuch	51
7.	Aventis Sanofi, Ankleshwar	51
8.	Zydus Cadila, Ahmedabad	51
9.	CEAT Tyres, Kalol	51
10.	Apollo Tyres, Vadodara	51
	Total	508

Table-1: List of Companies and responses received

Results / Comparisons:

508 questionnaires were properly filled out by respondents from 10 organizations and the collected data were used for the analysis (average 50.8 people per company). Respondents were 77 % male and 23 % female. Most (95.1%) had a high school education or more. 36 % (183 respondents) indicated that they were workers (experts and other employees), 40,6% (206 respondents) indicated lower management (e.g. ,manager of group or organization unit), 20,5% (104 respondents) indicated middle management (e.g., CIO) and other indicated corporate government and/or top management (2.9 %). The average total working years was 7.44 years, and average working years at their current workplace was 5.66 years. The ERP system had been used for 4.91 years, on average.

Non-Parametric Tests:

Mann-Whitney U Test: The Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed.

Here, we have applied this test to study the effect of Gender on factors that affect the utilization and better use of ERP solutions.

Kruskal-Wallis Test: The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. It is considered the nonparametric alternative to the one-way ANOVA, and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups.

Here, we have applied this test to study the effect of Age, Education, Working Place, Total no. of years worked, No. of years worked in current job, No. of years worked with ERP system and Company, on factors that affect the utilization and better use of ERP solutions.

Factor Analysis:

Exploratory Factor Analysis

KMO and Bartlett's Test

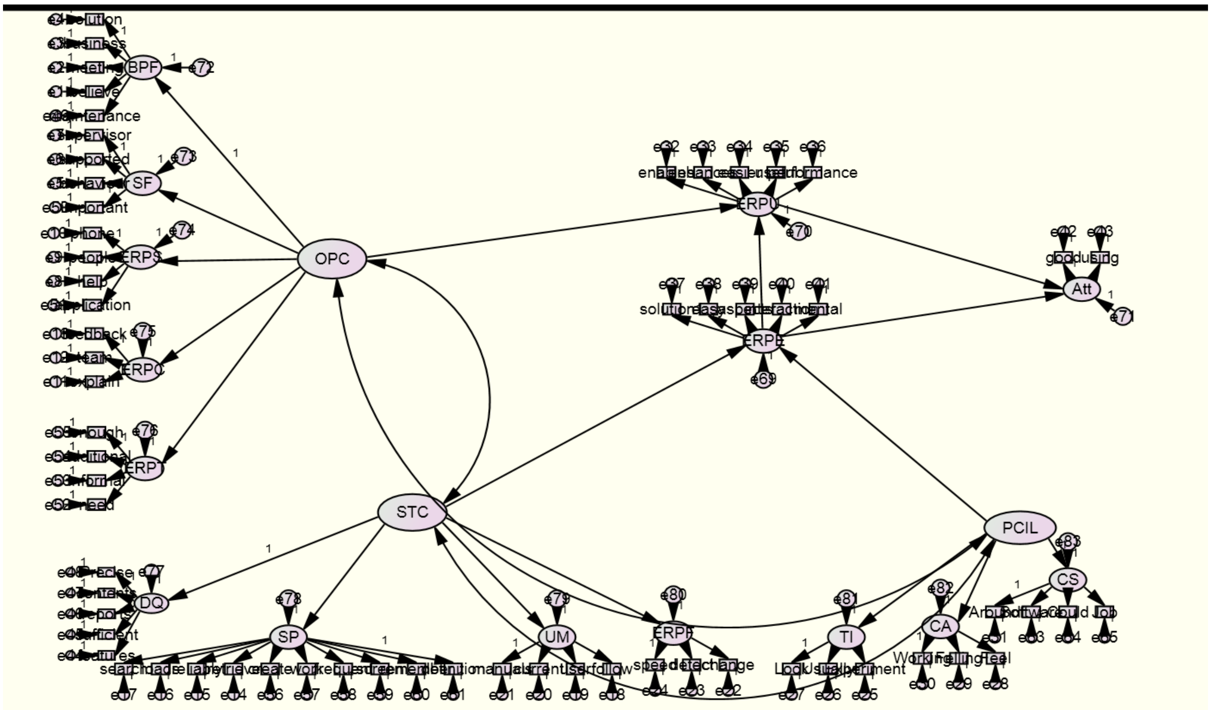
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.875
Bartlett's Test of Sphericity	Approx. Chi-Square	17655.102
	df	2415
	Sig.	.000

Kaiser-Meyer-Olkin Measure of Sampling Adequacy should be greater than .70 indicating sufficient items for each factor. Here, the results of the KMO is 0.875 is greater than 0.7. Bartlett's Test of Sphericity should be significant (less than .05), indicating that the correlation matrix is significantly different from an identity matrix, in which correlations between variables are all zero. Here, Bartlett's test of Sphericity (Significance – 0.000) indicates that factor analysis done is significant.

Industry Analysis:

Kruskal-Wallis Test was applied to study the effect of Industry on factors that affect the utilization and better use of ERP solutions. Except 5 statements (whose p value was more than 0.05), all other 62 statements were affected by Industries taken for study.

Structural Equation Modeling (SEM):



A hypothesized Technology Acceptance Model was tested using structural equation modeling using AMOS 18 software.

Our hypotheses are:

H1. ERP ease of use positively and directly affects ERP usefulness.

H2. ERP ease of use positively and directly affects attitude toward the ERP system.

H3. ERP usefulness positively and directly affects attitude toward the ERP system.

H4. ERP ease of use is affected by PCIL.

H5. ERP ease of use is affected by STC.

H6. ERP usefulness is affected by OPC.

Hypothesis	Relation Between Constructs	Estimate	P Value	Hypothesis
H1	ERP Ease of Use → ERP Usefulness	-.549	.159	Fail to Reject
H2	ERP Ease of Use → Attitude to ERP System	.620	.005	Reject
H3	ERP Usefulness → Attitude to ERP System	.378	***	Reject
H4	Personal Characteristics and Information Literacy → ERP Ease of Use	17.526	.874	Fail to Reject
H5	System Technological Characteristics → ERP Ease of Use	-11.501	.878	Fail to Reject
H6	Organizational Process Characteristics → ERP Ease of Use	1.447	***	Reject

Examination of the path coefficients and the significance level between the constructs in the model were used to test the hypotheses. The analysis in above table shows that Organizational Process Characteristics dimension has a positive significant relationship with ERP Ease of Use. ERP Usefulness has a positive significant relationship with Attitude to ERP System. ERP Ease of Use has a positive significant relationship with Attitude to ERP System. H2, H3 and H6 are supported while H1, H4 and H5 are not supported in base model.

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	148	7832.933	1932	.000	4.054
Saturated model	2080	.000	0		
Independence model	64	16099.423	2016	.000	7.986

Focusing on the first set of fit statistics, we see the labels NPAR (number of parameters), CMIN (minimum discrepancy), DF (degrees of freedom), P (probability value), and CMIN/DF. The value of **7832.933**, under CMIN, represents the discrepancy between the unrestricted sample covariance matrix S, and the restricted covariance matrix $\Sigma(\theta)$, and, in essence, represents the Likelihood Ratio Test statistic, most commonly expressed as a $\chi2$ statistic. In general, $H_0: \Sigma = \Sigma(\theta)$ is equivalent to the hypothesis that $\Sigma - \Sigma(\theta) = 0$; the $\chi2$ test, then, simultaneously tests the extent to which all residuals in $\Sigma - \Sigma(\theta)$ are zero. The test of our H_0, Technology Acceptance Model fits the data, yielded a $\chi2$ value of **7832.933**, with **1932** degrees of freedom and a probability of less than **.000** ($p < .0001$), thereby suggesting that the fit of the data to the hypothesized model is not entirely adequate. Because the $\chi2$ statistic equals (N–1) Fmin, this value tends to be substantial when the model does *not* hold and when sample size is large. Yet, the analysis of covariance structures is grounded in large sample theory. As such, large samples are critical to the obtaining of precise parameter estimates, as well as to the tenability of asymptotic distributional approximations. Thus, findings of well-fitting hypothesized models, where the $\chi2$ value approximates the degrees of freedom, have proven to be unrealistic in most SEM empirical research. One of the first fit statistics to address this problem was the $\chi2$/degrees of freedom ratio, which appears as CMIN/DF, and is presented in the first cluster of statistics which is **4.054** (Standard Recommended Value <= 5)

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.185	.646	.619	.600
Saturated model	.000	1.000		
Independence model	.431	.249	.225	.241

Turning now to the next group of statistics, we see the labels *RMR*, *GFI*, *AGFI*, and *PGFI*. The root mean square residual (RMR) represents the average residual value derived from the fitting of the variance–covariance matrix for the hypothesized model Σ(θ) to the variance–covariance matrix of the sample data (S). However, because these residuals are relative to the sizes of the observed variances and covariances, they are difficult to interpret. Thus, they are best interpreted in the metric of the correlation matrix. The standardized RMR, then, represents the average value across all standardized residuals, and ranges from zero to 1.00; in a well-fitting model, this value will be small (say, .05 or less). The value of **0.185** shown in above table represents the unstandardized residual value.

The Goodness-of-Fit Index (GFI) is a measure of the relative amount of variance and covariance in S that is jointly explained by Σ. The Adjusted Goodness-of-Fit Index (AGFI) differs from the GFI only in the fact that it adjusts for the number of degrees of freedom in the specified model. As such, it also addresses the issue of parsimony by incorporating a penalty for the inclusion of additional parameters. The GFI and AGFI can be classified as absolute indices of fit because they basically compare the hypothesized model with no model at all. Although both indices range from zero to 1.00, with values close to 1.00 being indicative of good fit. In our model GFI = **0.646** and AGFI = **0.619** which is considered to be moderate fit.

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.513	.492	.583	.563	.581
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

We turn now to the next set of goodness-of-fit statistics (baseline comparisons), which can be classified as incremental or comparative indices of fit. As with the GFI and AGFI, incremental indices of fit are based on a comparison of the hypothesized model against some standard. However, whereas this standard represents no model at all for the GFI and AGFI, it represents a baseline model typically, the independence or null model noted above for the incremental indices). We now review these incremental indices. For the better part of a decade, Bentler and Bonett's (1980) Normed Fit Index (NFI) has been the practical criterion of choice, as evidenced in large part by the current "classic" status of its original paper (see Bentler, 1992; Bentler & Bonett, 1987). However, addressing evidence that the NFI has shown a tendency to underestimate fit in small samples, Bentler (1990) revised the NFI to take sample size into account and proposed the Comparative Fit Index (CFI; see last column). Values for both the NFI and CFI range from zero to 1.00 and are derived from the comparison of a hypothesized model with the independence (or null) model, as described earlier. As such, each provides a measure of complete co-variation in the data. Although a value > .90 was originally considered representative of a well-fitting model, a revised cutoff value close to .95 has recently been advised. Based on the NFI and CFI values reported in above table (**0.513 and 0.581**, respectively), we can once again conclude that our hypothesized model fits the sample data moderately.

The Relative Fit Index represents a derivative of the NFI; as with both the NFI and CFI, the RFI coefficient values range from zero to 1.00, with values close to .95 indicating superior fit. The Incremental Index of Fit (IFI) was developed by Bollen (1989) to address the issues of parsimony and sample size which was known to be associated with the NFI. As such, its computation is basically the same as that of the NFI, with the exception that degrees of freedom are taken into account. Thus, it is not surprising that our finding of IFI of **.583** is consistent with that of the CFI in reflecting a well-fitting model. Finally, the Tucker-Lewis IndexI; Tucker & Lewis, 1973), consistent with the other indices noted here, yields values ranging from zero to 1.00, with values close to .95 (for large samples) being indicative of good fit. **Our model has RFI = 0.492, IFI = 0.583 and TLI = 0.563 which again shows that our model fits moderately.**

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.958	.492	.557
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

The next cluster of fit indices relates to the issue of model parsimony. The first fit index (PRATIO) relates to the initial parsimony ratio proposed by James et al. (1982). More appropriately, however, the index has subsequently been tied to other goodness-of-fit indices (see, e.g., the PGFI noted earlier). Here, it is computed relative to the NFI and CFI. In both cases, as was true for PGFI, the complexity of the model is taken into account in the assessment of model fit. Again, a PNFI of **0.492** and PCFI of **0.557** fall in the range of expected values

NCP

Model	NCP	LO 90	HI 90
Default model	5900.933	5631.753	6176.948
Saturated model	.000	.000	.000
Independence model	14083.423	13682.578	14490.826

The next set of fit statistics provides us with the non-centrality parameter (NCP) estimate. In our initial discussion of the $\chi 2$ statistic, we focused on the extent to which the model was tenable and could not be rejected. Now, however, let's look a little more closely at what happens when the hypothesized model is incorrect [i.e., $\Sigma \neq \Sigma(\theta)$]. In this circumstance, the $\chi 2$ statistic has a non-central $\chi 2$ distribution, with a non-centrality parameter, λ, that is a fixed parameter with associated degrees of freedom, and can be denoted as $\chi 2$ (df,λ). Turning to above table, we find that our hypothesized model yielded a non-centrality parameter of **5900.933**. This value represents the $\chi 2$ value minus its degrees of freedom **(7832.933 – 1932).** The confidence interval indicates that we can be 90% confident that the population value of the non-centrality parameter (λ) lies between **5631.753 and 6176.948**.

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	15.450	11.639	11.108	12.183
Saturated model	.000	.000	.000	.000
Independence model	31.754	27.778	26.987	28.582

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.078	.076	.079	.000
Independence model	.117	.116	.119	.000

The next set of fit statistics focuses on the root mean square error of approximation (RMSEA) also called Badness of Fit Index. Although this index, and the conceptual framework within which it is embedded, was first proposed by Steiger and Lind in 1980, it has only recently been recognized as one of the most informative criteria in covariance structure modeling. This discrepancy, as measured by the RMSEA, is expressed per degree of freedom, thus making it sensitive to the number of estimated parameters in the model (i.e., the complexity of the model); values less than .05 indicate good fit, and values as high as .08 represent reasonable errors of approximation in the population. MacCallum et al. (1996) have recently elaborated on these cutpoints and noted that RMSEA values ranging from .08 to .10 indicate mediocre fit, and those greater than .10 indicate poor fit. Although Hu and Bentler (1999) have suggested a value of .06 to be indicative of good fit between the hypothesized model and the observed data. Our model is having RMSEA is **0.078** which suggests mediocre fit. **The 90 percent confidence interval for the RMSEA is between a LO of .076 and a HI of 0.079. Thus, even the upper bound is close to .08.** In addition to reporting a confidence interval around the RMSEA value, AMOS tests for the closeness of fit (PCLOSE). That is, it tests the hypothesis that the RMSEA is "good" in the population (specifically, that it is < .05). Joreskog and Sorbom (1996) have suggested that the p-value for this test should be > .50. In our case it is **0.000** < 0.05 which is not good.

AIC

Model	AIC	BCC	BIC	CAIC
Default model	8128.933	8172.462	8755.044	8903.044
Saturated model	4160.000	4771.765	12959.401	15039.401
Independence model	16227.423	16246.246	16498.174	16562.174

The first of these is Akaike's (1987) Information Criterion (AIC), with Bozdogan's (1987) consistent version of the AIC (CAIC) shown at the end of the row. Both criteria address the issue of parsimony in the assessment of model fit; as such, statistical goodness-of-fit as well as the number of estimated parameters are taken into account.

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	16.033	15.502	16.578	16.119
Saturated model	8.205	8.205	8.205	9.412
Independence model	32.007	31.216	32.810	32.044

The Expected Cross-Validation Index (ECVI) is central to the next cluster of fit statistics. The ECVI was proposed, initially, as a means of assessing, in a single sample, the likelihood that the model cross-validates across similar-sized samples from the same population (Browne & Cudeck, 1989).

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	132	135
Independence model	67	69

BPR carried out by different Industries:

<u>Pharma Industry</u>: The pharmaceutical industry is undergoing profound changes. New opportunities, e.g. in the field of bio-technology, price pressure from governments, insurances and through generic products have created a variety of dynamics in the industry. Today, pharma-companies are also closely monitored with regard to their R&D pipeline and their ability to execute efficient R&D projects. As a result, pharma-companies have been looking for approaches that would enable a substantial improvement of their R&D processes, among them Business Process Reengineering.

7) Achievements with respect to objectives

- Important contribution of the research is the identification of the external factors for the improvement of the efficiency and effectiveness of ERP use.
- This research enhanced the understanding of how multiple external factors can impact attitudes about ERP systems in the operational phase by incorporating three groups of external factors: PCIL, STC and OPC.
- With help of SEM, the overall model fit to verify the causal relationships between factors was moderate.
- Around 90% of statements in the questionnaire were affected by Industries taken for study.
- By collecting & studying the BPR activities done in 5 sectors of my study, I got an excellent knowledge of the same.

8) Conclusion

The most important contributions of ERP systems are that they significantly reduce the time to complete business processes and they facilitate information sharing (Olhager and Selldin, 2003; Lee et al., 2010). Although the most important contributions of ERP systems are that they significantly reduce the time to complete business processes, help organizations share information (Lee et al., 2010), and lead organizations to offer a better work environment for their employees as by providing them a more efficient system with which to work, ERP systems have been plagued with high failure rates and an inability to realize promised benefits (Kwahk and Lee, 2008) in the maturity stage of the operational phase. One of the most important reasons seems to be that ERP users do not use it properly.

The aim of this research is to improve the understanding of how the influence of 13 external factors can increase the degree of attitude of ERP users toward the ERP system. This work extended the work previous research by incorporating groups of external factors—namely, personal innovativeness, computer anxiety, self-efficacy, and computer experience for the conceptual factor personal characteristics and information literacy (PCIL); data quality, system performance, user manuals, and ERP functionality for the conceptual factor system-technological characteristics (STC); and business processes fit, organizational culture, ERP support, ERP communication, and ERP training for the conceptual factor organizational-process characteristics (OPC). These three conceptual factors influence perceived ERP ease of use (PEOU) and perceived ERP usefulness (PU), which further influence attitude towards using the ERP system (AT).

This study also employed Structural Equation Modeling to assess overall model fit to verify the causal relationships between factors. Studying the influence of more external factors on constructs and researching them in different business environments contribute to the theory development and also helps understanding potential cultural differences.

The research also included sector analysis and BPR activities done in those 5 sectors. The responses of above were positive and contributed to the body of knowledge.

9) Copies of papers published and a list of all publications arising from the thesis

Sr. No.	Title of Paper	Details of Journal / Conference Proceeding	ISSN / ISBN No.	Month & Year of Publication
1	ERP Solutions Acceptance in Different Business Environments*	International Journal of Innovative Research & Development (Vol: 5, Issue: 2)	2278-0211 (Online)	Jan-16
2	ERP Implementation in Chemical Industry: A Case Study of Micro Inks Ltd.-Vapi, Gujarat**	Journal of IMS Group: Achieving Excellence in Management & IT (Vol: 12, No: 1)	0973-824X	Jul-15
3	Ethics & ERP Implementation: Can they co-exist?**	Conference Issue of SANKALPA: Journal of Management & Research (Vol: 5, February 2015)	2231-1904	Feb-15
4	A study of issues & challenges affecting ERP Implementation in SMEs**	Management of SMEs in Global Era: Challenges, Opportunities & Perspectives and Lessons from Gujarat Model	978-93-8486-934-2	Jan-15
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* Research Paper written jointly with **Dr. Samo Bobek**, Co-Supervisor.

** Research Paper written jointly with **Dr. Rajesh Khajuria**, Supervisor.

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