

# Exploring Enterprise Resource Planning (ERP) System Outcomes in Indian Small and Medium Enterprises (SME's)

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## Abstract

*To improve productivity and overall business performance, Enterprise Resource Planning (ERP) is one of the solutions for the small and medium scale enterprises (SMEs) in order to face the global challenges. The purpose of this paper is to investigate Enterprise Resource Planning (ERP) system outcomes in the context of Indian Small & Medium-sized Enterprises. Most of the former research on ERP outcomes or benefits is based on data from large enterprises. In this paper, we discover and classify ERP system outcomes in Indian Small & Medium size Enterprises (SMEs). An extensive literature review was carried out for identification of various attributes which grouped in various ERP system outcomes or benefits. The instrument consisting of 25 variables was identified after literature review. A 24 item questionnaire was developed from the relevant literature and distributed to 863 SME's. Data from 219 Indian SMEs were collected for the measurement of effectiveness of critical success factors. Through the study, five factors were identified that attempts to explain 77.349 % of variances. The factors are found to be reliable and valid.*

**Keywords** – Enterprise Resource Planning (ERP), Critical Success Factors (CSFs), Small and Medium Size Enterprises (SMEs), ERP system outcomes

## 1. Introduction

Enterprise Resource Planning (ERP) system implementations are substantial and long-term investments, expected to yield significant positive outcomes or benefits for organizations undertaking this earnest attempt. Organizations hence need to assess whether they have achieved the intended contribution from their investment, and the ERP literature includes several studies investigating ERP system outcomes in organizations [32]. While it

could be argued that return on investment is even more critical for small and medium-sized enterprises (SMEs), for whom ERP system implementations constitute a comparatively larger investment than for large enterprises [18], there has yet been limited focus on ERP outcomes in the SME context.

The majority of existing measurement frameworks has been developed based on data from the large enterprises. Only few studies have tried to attempt within the SME context. Large enterprises have been reported to receive more benefits as compared to small and medium-sized enterprises [31]. Compared to large enterprises SMEs have been reported to be constrained by limited resources and limited IT competence [17]. The organizations which have successfully implemented the ERP systems are reaping the benefits of having integrating working environment, standardized processes and operational benefits to the organization. The objective of this paper is to contribute to the scarce literature on evaluation of ERP system outcomes in SMEs and to develop an instrument for measuring ERP system outcomes or benefits. In this paper, first, we review the literature mainly to identify ERP outcomes in general organizations. Next, we describe the data collection, then we present and discuss the factors that emerged and finally, we present the study contribution and conclusion. The study reveals that about 77.349 % of the variances in ERP system outcomes were explained by the ERP benefits identified in the study.

## 2. Literature Review:

Over the years, various approaches to ex-post evaluation of ERP system outcomes have been developed. A significant contribution in this area is the multidimensional model for Enterprise systems success (ESS) measurement developed by Gable [10]. Former research has recognized the effect of organizational size on ERP outcomes. A study conducted by Esteves [9] identified organizational size as a moderator of ERP impact on productivity in

SMEs. A limited number of studies have focused on ERP system outcomes in SMEs. Esteves [9] conducted a survey to investigate ERP benefits realization in SMEs. Kale [17] investigated performance evaluation of ERP implementation in Indian SMEs. The study employed a survey of 130 SMEs. The ERP performance was studied through a list of 19 ERP benefits. Extensive literature review was carried out for identification of various attributes of ERP outcomes which were grouped into the performance outcomes. Table 1 presents a list of variables selected by author from the literature review.

### 3. Research Methodology:

The purpose of this research is to identify ERP outcomes within the SME context. This research was a cross sectional field study that involved the use of survey methodology to obtain data from small & medium scale industries across a variety of

production environments. A model was developed to include key variables and their relationships in the implementation of ERP system. A questionnaire was developed to collect data from Indian SMEs, for testing these relationships. The survey was implemented using a mixed – mode method wherein postal mail procedures were mixed with email delivery.

### 4. Scale Development for ERP System Outcomes:

Design of multi-item scales employed to measure the constructs are very vital to empirical research [11]. Establishing the validity of the scales is dependent first upon establishing that they are reliable measures [13]. One of the major goals of this research study is to create reliable and valid multi – item scales for measuring the 25 constructs.

### 5. Survey Methodology:

Invitations to participate in the survey requested responses from implementers of ERP packages who have basically worked for small & medium scale enterprises based in India and have been associated with the implementation process for their respective organization. Questionnaire survey method was selected and used five point multi-items, liker-type scales for each item where ‘1’ meant ‘not important’, ‘2’ meant ‘somewhat important’, ‘3’ meant ‘neutral’, ‘4’ meant ‘important’ and ‘5’ meant ‘most important’. The questionnaire is focused on the ERP system outcomes or benefits that clarified from literature review. It identifies the respondent’s perception of the importance of ERP system outcomes.

### 6. Findings and Analysis:

An analysis is conducted to defect weaknesses in design and instrumentation and to provide proxy data for selection of a probability data. By carrying out the extensive literature review total 25 variables were framed in the research instrument (questionnaire). The main objective of this study is to identify the current ERP scenario in small and medium scale enterprise. Accordingly, to draw meaningful conclusion, sample frame & sample size were decided based on review. Sample frame consist of the all type of small and medium scale enterprises. The questionnaire was sent to 863 organizations & 219 usable surveys were received making the response rate to be around 25.37%. The respondents came from manufacturing, financial services, healthcare, Insurance, process oriented, unit oriented,

**Table 1: List of variables selected from review.**

1. Work Simplification	2. Data Integration
3. Administration Expenses Reduces	4. Better Inventory Outflow
5. Increased Work Efficiency	6. Data Transparency
7. Information Accuracy	8. Business Process Improvements & Increased Capacity
9. Overall Productivity	10. Substitutability
11. Data Analysis	12. Information Availability
13. Data Import / Export	14. Information Timeliness
15. Production Planning Improvements	16. Enhances Quality of Decision Making
17. Data Security	18. Up-to-date Data Base Contents
19. System Extensions / Changes	20. Improves organization wide Communication & Departmental Cooperation
21. Staff Requirements Reduction	22. System Quality
23. Information Back Tracking	24. User Interface Flexibility
25. Improves Workers Participation in the Organization.	

public service, telecommunication, utility & a variety of other industries.

### 6.1 Reliability of Instrument:

Reliability is one of the most critical elements in assessing the quality of the construct measures [9], and it is necessary condition for scale validity. A statistically reliable scale provides consistent and stable measures of a construct. There are four methods to measure the reliability of empirical model out of these four, internal consistency method is easy and works effectively in the field studies.

The internal consistency of a set of measurement variables is to the degree to which items in the set are homogeneous. Internal consistency can be estimated using reliability coefficient such as Cronbach's alpha. With the objective of establishing the reliability of the data collected and that of the study. Cronbach's alpha of the data pertaining to the factors was calculated. Nunnally (1971) suggests that a Cronbach's alpha value larger than 0.7 suggests good internal consistency. The overall Cronbach's alpha for independent variable was found to be 0.964 indicates that the developed model was found to be reliable. Table 2 shows the reliability statistics of output variables, whereas Table 3 shows the reliability for five ERP system outcomes.

**Table 2: Reliability Statistics (output Variables)**  
**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.964	.964	25

**Table 3: Internal Consistency - Reliability for five ERP system outcomes. (Output Factors)**

Sr.No	Factor Name	Cronbach Alpha	No. of Items
1	System Quality	0.959	8
2	Organizational Impact	0.909	6
3	Information Quality	0.925	5
4	Individual Impact	0.905	4
5	Workgroup Impact	0.915	2

### 6.2 Descriptive Statistics for Variables:

The primary data analysis involved the use of descriptive statistical tools such as mean and standard deviation. These measures were utilized to know the data quality. The mean and standard deviation associated with each scale used to measure the ERP system outcomes facilitating ERP system deployment

are shown in table 4. All the 25 variables showing minimum mean value of 3.44 & a maximum mean value of 4.09, which means that five of the mean values are more than 4 and others are nearer to 4. It shows the perception of Indian small & medium ERP firms towards these 25 factors that means these variables were the performance measures of the successful ERP implementation.

**Table 4: Descriptive Statistics of Responses of Performance Measures**

Descriptive Statistics			
	N	Mean	Std. Deviation
Increased Work Efficiency	219	4.09	.985
Enhances Quality of Decision Making	219	4.08	.967
Data Integration	219	4.04	1.022
User Interface Flexibility	219	4.03	1.108
System Extensions / Changes	219	4.02	1.045
System Stability	219	3.99	1.084
Data Security	219	3.99	1.075
Substitutability	219	3.99	1.056
Data Analysis	219	3.97	1.004
Data Transparency	219	3.97	.943
Data Import / Export	219	3.96	1.068
Work Simplification	219	3.94	1.012
Production Planning Improvements	219	3.90	.951
Administration Expenses Reduces	219	3.88	.926
Business Process Improvements & Increased Capacity	219	3.85	.932
Better Inventory Outflow	219	3.84	.837
Up-to-date Data Base Contents	219	3.81	1.014
Information Back Tracking	219	3.80	.984
Information Accuracy	219	3.79	.882
Information Timeliness	219	3.78	.958
Staff Requirements Reduction	219	3.77	1.030
Information Availability	219	3.75	.917
Overall Productivity	219	3.75	.984
Improves Organization Wide Communication & Departmental Cooperation	219	3.50	.955

Improves Workers Participation In The Organization	219	3.44	.962
Valid N (listwise)	219		

**6.3 Factor Analysis:**

An exploratory factor analysis was conducted on the different measures to purify the model. Factor analysis is most frequently used to identify a small number of factors, which may be used to represent relationship among sets of interrelated variables. Factor analysis is frequently used to develop questionnaires. In this study, factor extraction principal components method was used with original 25 dependent variables.

The first step is to decide which factors you wish to retain in the analysis. The common sense criterion for retaining factors is that each retains factors must have some sort of face validity or theoretical validity. The SPSS V 18 default is to keep any factor with an Eigen value larger than 1.0. If a factor less than 1.0, it explains less variance than an original variables and usually for only a few of the factors will the Eigen value be larger than 1.0 there are other criteria for selection such as Scree plot or conceptual reasons that may be used. The Scree plot sometimes used to select how many factors to rotate to a final solution. The traditional construct for interpretation is that the Scree should be ignored and that only factors on the steep portion of the graph should be selected and rotated. We have selected 5 output factors (dependent) based on the observation of the Scree plot (Fig 2). Also, the Eigen value of these variables are lower than 0.4.

After factor extraction and the rotation, loading of the variables in respective factor was noted down and the naming was done. Table 3 shows the reliability of (internal consistency) co- efficient of input factor which ranged from 0.905 to 0.959. Table 5 shows the rotated component matrix.

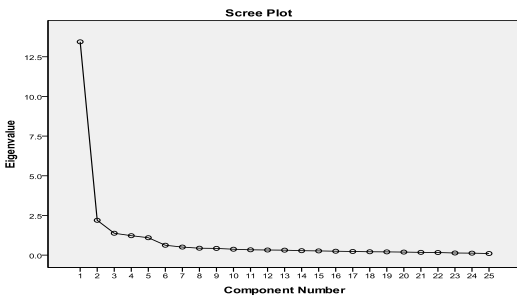


Fig. 2 Scree Plot.

Table 5: Rotated Component Matrix for ERP system outcomes (Dependent Factors).

	Component				
	1	2	3	4	5
24-User Interface Flexibility	.838				
17-Data Security	.822				
19-System Extensions / Changes	.820				
2-Data Integration	.802				
11-Data Analysis	.788				
22-System Stability	.785				
6-Data Transparency	.780				
13-Data Import / Export	.768				
4-Better Inventory Outflow		.758			
3-Administration Expenses Reduces		.724			
8-Business Process Improvements & Increased Capacity		.711			
15-Production Planning Improvements		.693			
9-Overall Productivity		.648			
21-Staff Requirements reduction	.405	.602			
7-Information Accuracy			.806		
18-Up-to-date Data Base Contents			.756		
12-Information Availability			.749		
23-Information Back Tracking			.672		
14-Information Timeliness			.668		
5-Increased Work Efficiency				.811	
16-Enhances Quality Of Decision Making				.791	
10-Substitutability				.788	
1-Work Simplification				.738	
25-Improves Workers Participation In The Organization					.885
20-Improves Organization Wide Communication & Departmental Cooperation					.838

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization.  
 a. Rotation converged in 6 iterations.

**6.4 Interpretation of Output from the Factor Analysis of ERP System Outcomes or Factor Naming:**

After factor analysis five factors were extracted, this explained total 77.329% of variances which were named as shown in table 6 as per the variables content within that component.

**Table 6: Interpretation of Output from the Factor Analysis of Performance Measures.**

Categorization of Performance Measures in terms of Component	TVE	List of CSFs for Indian SMEs	RCMV
Component 1: Named as "System Quality "	53.762	24-User Interface Flexibility 17-Data Security 19-System Extensions / Changes 2-Data Integration 11-Data Analysis 22-System Stability 6-Data Transparency 13-Data Import / Export	.838 .822 .820 .802 .788 .785 .780 .768
Component 2: Named as "Organizational Impact "	8.780	4-Better Inventory Outflow 3-Administration Expenses Reduces 8-Business Process Improvements & Increased Capacity 15-Production Planning Improvements 9-Overall Productivity 21-Staff Requirements reduction	.758 .724 .711 .693 .648 .602

Component 3: Named as "Information Quality "	5.517	7-Information Accuracy 18-Up-to-date Data Base Contents 12-Information Availability 23-Information Back Tracking 14-Information Timeliness	.806 .756 .749 .672 .668
Component 4: Named as "Individual Impact "	4.901	5-Increased Work Efficiency 16-Enhances Quality Of Decision Making 10-Substitutability 1-Work Simplification	.811 .791 .788 .738
Component 5: Named as "Workgroup Impact "	4.389	25-Improves Workers Participation In The Organization 20-Improves Organization Wide Communication & Departmental Cooperation	.885 .838

## 6.5 Detailed Item Analysis:

This method is used to evaluate the assignment of variables to scales as per Nunnally's method (1971). As per this method variable should have high correlation with the scale in which the variable is placed than other scales. As seen in table 7, all the variables have high co-relations with the scales to which they had been assigned relative to all others. Therefore it was concluded that all the variables in this instrument had been correctly assigned to respective scale.

**Table 7: Detail factor analysis.**

	OU_SCORE1 _ System Quality	OU_SCORE2 Organizational Impact	OU_SCORE3_ Information Quality	OU_SCORE4 _ Individual Impact	OU_SCORE5 _ Workgroup Impact
24_User Interface Flexibility	.922**	.596**	.614**	.504**	.468**
17_Data Security	.893**	.570**	.593**	.499**	.441**
19_System Extensions / Changes	.881**	.561**	.569**	.510**	.470**
2_Data Integration	.861**	.550**	.565**	.473**	.424**
11_Data Analysis	.823**	.475**	.538**	.474**	.443**
22_System Stability	.876**	.590**	.628**	.540**	.501**
6_Data Transparency	.810**	.468**	.553**	.508**	.360**
13_Data Import / Export	.831**	.563**	.580**	.499**	.430**

4_Better Inventory Outflow	.434**	.776**	.516**	.451**	.347**
3_Adminstration Expenses Reduces	.539**	.847**	.626**	.557**	.439**
8_Business Process Improvements & Increased Capacity	.563**	.834**	.594**	.580**	.411**
15_Production Planning Improvements	.578**	.824**	.625**	.575**	.446**
9_Overall Productivity	.595**	.785**	.623**	.525**	.457**
21_Staff Requirements reduction	.655**	.808**	.683**	.564**	.466**
7_Information Accuracy	.506**	.552**	.852**	.537**	.382**
18_Up-to-date Data Base Contents	.572**	.613**	.887**	.565**	.497**
12_Information Availability	.567**	.608**	.869**	.590**	.470**
23_Information Back Tracking	.553**	.624**	.843**	.584**	.537**
14_Information Timeliness	.530**	.589**	.831**	.608**	.546**
5_Increased Work Efficiency	.495**	.534**	.560**	.897**	.439**
16_Enhances Quality Of Decision Making	.557**	.560**	.583**	.898**	.508**
10_Substitutability	.431**	.482**	.562**	.844**	.397**
1_Work Simplification	.459**	.467**	.527**	.800**	.445**
25_Improves Workers Participation In The Organization	.416**	.422**	.448**	.443**	.942**
20_Improves Organization Wide Communication & Departmental Cooperation	.509**	.462**	.548**	.495**	.937**

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## 7. Validity:

The validity of a measure refers to the extent to which it measures what is intended to be measured. There are two different types of validity generally considered.

- a. **Content Validity:** Content validity was subjectively judged by the researchers [30] contents of this instrument was selected based on the extensive literature reviews and discussed with experts and with recent literature regarding the performance measures of ERP system in SME'S. Thus we said that this study have content validity.
- b. **Construct Validity:** The construct validity of each measure was evaluated by factor analyzing the measurement items of each of the factors. A measure has construct validity if it the theoretical construct that it has design to measure. The factor matrices (Table 8) showed that all the output factors were unifactorial with Eigen values greater than the accepted criteria of 1. The result of this study indicated good construct validity for the developed scales.

**Table 8: Summary of Separate factor matrices for each constructs (output Factors)**

No.	Factor	KMO	% Variance	Eigen Value	Factor Extracted
1	Factor 1	0.957	77.760	6.221	01
2	Factor 2	0.898	68.839	4.130	01
3	Factor 3	0.886	76.944	3.847	01
4	Factor 4	0.838	78.076	3.123	01
5	Factor 5	0.500	92.126	1.843	01

## 8. Conclusion :

The study has identified 25 major ERP system outcomes in the SME context and thus contributes to the research on ERP system implementation projects in small & medium-sized enterprises. The main basic contributions of this paper are the definition of new constructs associated with the ERP system outcomes and the development of new multi-item measurement scales for measuring these constructs. The model which

proposed was evaluated empirically and was found to be of acceptable reliability and validity. By factor analysis, five ERP system outcomes were identified after grouping and they are System Quality, Organizational Impact, Information Quality, Individual Impact and Workgroup Impact which covers total 25 variables contributing 77.329% of total variances.

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