Implementation of Hybrid Cloud Enterprise Systems for Organizations - Scale Development

Anvarali Shahul Hameed[1*], R.Baskaran[2]
[1, 2] Department of Industrial Engineering, College of Engineering, Anna University, Chennai, India
[1] anwar@annauniv.edu.in, [2] baskishree@gmail.com,

Abstract

This paper develops four scales to implement hybrid cloud enterprise systems which measure the following: On-premise ERP conditions, cloud ERP conditions, adoption of hybrid cloud ERP processes and execution of ERP, by employing Podsakoff's scale development process. The literature review accompanied by the expert's opinion from practitioners and academia helped to develop the items for the four scales. Further, a survey was performed with 137 senior managers as respondents who are domain experts in the implementation of ERP systems in various multi-national organizations. An exploratory factor analysis was performed to extract the factors and further confirmatory factor analysis was also performed to test the consistency of the constructs. The results show that all four constructs possess psychometric properties which further helps to develop a conceptual framework for implementing hybrid enterprise systems.

Keywords: *Enterprise Resource Planning, Hybrid Cloud ERP, Scale Development, Cloud Computing, CFA*

1. Introduction

The advent of Enterprise Resource Planning is the most significant and it is better in today's world of cloud computing. For the past thirty years, ERP has been a research topic.[1-7]. Most research in the area of ERP implementation was focused on surveying the literature of ERP systems[8] and how to improve systems implementation by identifying the critical success factors.[9-15].Hybrid Enterprise Resource Planning is used to describe best of breed applications, which include IT deployment in a combination of on-premise and cloud computing applications. The hybrid cloud is the most popular cloud configuration (82% adoption) [16]. It is well known that ERP has many benefits such as the integration of data across the company,hat helps to reduce the dependence on expensive hardware. This type of infrastructure is designed to be so flexible and scalable as business demands. Hybrid cloud combines the benefits of both private and public cloud infrastructures. Hybrid cloud gaining momentum from 2012 with enterprises leveraging their existing infrastructure coupled with the advantages of cloud computing. Since 2015, trends like complete automation, Industry 4.0, Internet of Things combined with artificial intelligence (AI) and deep learning in the cloud through a hybrid cloud model starts getting prominence. Companies using a hybrid cloud moving to next-generation initiatives such as the Internet of Things, machine learning and cognitive computing, aiming to disrupt and capture new markets[17].No technology operates continually and completely in isolation, without ever needing some degree of human intervention[18]. Information systems are working systems in which human beings or machines performing work using information, technology or other resources to produce specific products or services for specific customers[19].It is necessary for ERP implementations to embrace human intelligence, so as to mitigate the inflexibility of the ERP system.[18.20].Thus a hybrid ERP system is one the combines the formal system and that is an ERP and the informal enterprise social software

2. Features of Hybrid Enterprise Systems:

1) Disaster Recovery or Archiving: Usage of hybrid clouds promotes high availability and disaster recovery. Creating an effective disaster recovery plan is possible only in a hybrid model. On any disaster, administrators can quickly start the application in the public cloud, since the data is already present there. When a disaster happens this configuration results in data availability and it significantly reduces cost.
2) Development/ QA/Testing: Developers testing a beta version in sandbox need an agile, flexible, dynamic environment for developing and testing software applications. Moving application development and testing to the cloud with seamless interoperability gives the developer the freedom to quickly deploy develop or test workloads to the cloud
3) Cloud bursting: It is the deployment model where an application usually runs in an on-premise cloud or data-centre, when the situation arises where the application needs additional resource demand for computing it bursts into a public cloud. The idea is that a given application normally runs in a private cloud or a local computing environment. The advantage of such a hybrid cloud deployment is that an organization pays only for what they use. Even though there is complexity in this application design the advantage of cloud bursting worth it.
4) Migrate Packaged Application: Enterprises migrate standard packaged applications such as CRM,(Salesforce), SharePoint, Email, messaging (Twilio)and collaboration software to a hybrid cloud, freeing up hardware resources on-premise.
5) A hybrid ERP system is able to increase collaboration within an organization since it provides opportunities for employees to interact with others and enhance social relationships.
6) A hybrid ERP system allows for the continued use of informal processes that cannot be incorporated into the ERP system. However, it was seen that within the case study companies that to implement the hybrid ERP system successfully required that informal activities were undertaken under the guidance of managers.[21]

3. Need for A Scale:

The demand for hybrid cloud ERP is increasing exponentially, most companies are more concerned in using a hybrid cloud approach. Fig 1 shows the recent research with 786 technical professionals from cross-section organizations shows there is 69% of adopting hybrid cloud. There is no instrument for measuring the execution of ERP implementation in Organizations demands a unique scale to be developed. The necessity leads to a detailed scale development process with four constructs identified.

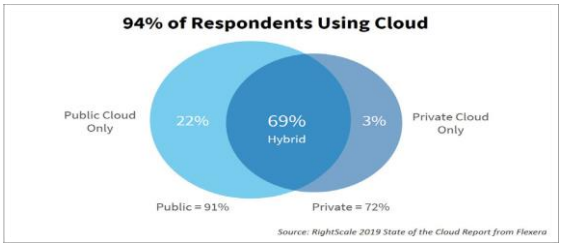

Fig 1: State of cloud 2019 report showing 69% of Hybrid cloud usage

4. Scale Development:

The scale development process starts with naming the constructs and defining each construct conceptually followed by developing tentative measures.[22]

4.1 Conceptualization:

Construct 1: On-premise ERP conditions.

Definition: On-premise ERP conditions within the organizations is the process which are basic internal conditions for originating ERP related process and its execution.

Construct 2: Cloud ERP conditions

Definition: Cloud ERP conditions of an organization is the process of integrating the entire business process through internet externally.

Construct 3: Hybrid cloud ERP processes.

Definition: The hybrid cloud ERP processes is the organization's practices that comprises of both private cloud and public cloud processes which integrate every business areas within and between the organization's service provider and clients.

Construct 4: Execution of ERP within Organizations

Definition: The execution of ERP within the organizations is both internal and external integration of the entire business process of the organizations with the service provider and clients in order to improve the value and level of the entire business process.

4.2 Development of Measures:

Development of measure is the process of generating items to measure each construct and assess the content validity of each construct.

4.2.1 Critical Success Factors obtained from Literature:

Table 1: Critical Success Factors for implementation of ERP shortlisted from Literature.

S.no	ERP CSFs	Authors & Year
1	Top Management support	[2,23,24]
2	Project Management	[2,24,25]
3	Business Process Reengineering	[11,24,26]
4	User Training & Education	[27,11]
5	User Involvement	[30]
6	Business Plan & Vision	[32]
7	Careful Package Selection	[34]
8	Change Readiness & Culture	[11]
9	Clear Goals & Objectives	[24,25]
10	Learning Competency	[30]
11	Minimal Customization	[35]
12	Monitoring & Evaluation Of	[9]
13	Project Champion	[12]
14	Strategic IT Planning	[35]
15	Teamwork & Composition	[36,37]
16	Vendor Support	[38,24]
17	Application and legacy systems	[9]
18	Data Analysis & Conversion	[30]
19	Education on new	[39]
20	Partnership with Vendor	[35]
21	Technological infrastructure	[40,32]
22	Departments(Stakeholder)	[31,41]
23	Change Management	[42,40]

24	Communication	[43,40,32]
25	Interdepartmental cooperation	[35]
26	Management of expectations	[35]
27	Dedicated resources	[35]
28	Use of steering committee	[35]
29	Use of vendors' tools	[35]
30	Use of consultants	[35]
31	Architecture choices	[35]
32	Cultural and structural changes	[44]
33	Training Employees	[44,45]
34	System quality	[44,46]
35	Charismatic leadership	[47]
36	Fit between ERP	[48]
37	Implementation strategy & time	[45]
38	Vanilla ERP	[45]
39	Build a business case	[45]
40	Consultant Selection	[9]
41	Data Privacy	[48]
42	Change management process	[32]
43	Formal project plan	[45]

4.2.2 Factors shortlisted after Brainstorming with ERP Experts:

Table 2 Factors obtained from Brainstorming with Experts

S.no	**Cloud and Hybrid Critical Factors**
1	Scalability of the system
2	Technological Infrastructure
3	Integration of different systems
4	Data Exchange from On-premise to Cloud ERP
5	The elasticity of the system
6	Cost Efficiency
7	Asset Utilization
8	Balance Isolation
9	Disaster Recovery
10	Data Security
11	Cloud Bursting
12	Data Integrity
13	Data Security
14	Integrating ERP functional modules with Service provider
15	Integrating ERP functional modules with clients

4.3 Methodology:

The design of the questionnaire for this research required a variety of measures and items. The items have been collected and adapted from different sources. The study used a variety of measurements to measure each factor hypothesized the CSFs in ERP implementation. The CSFs measure contained 58 items from Table 1 and Table 2 that were distributed across the three constructs. On the other hand, the

fourth construct the Execution of ERP implementation included 3 items. A 0 to 100 slider-scale type rating from 0=minimum to 100=maximum was used for all the mentioned items.

4.4 Empirical Study:

The data were collected through an online survey portal (SurveyGizmo) from 137 senior managers from manufacturing, IT and ITES companies as respondents. As all the primary responses collected were identified to be genuine no response was removed for further analysis. (Tool used: IBM SPSS24) For factor analysis, initially, principal component analysis (PCA) was carried out. This helps us to identify the factors contributing to the execution of ERP implementation. The varimax rotation method was used to observe the rotated factor loadings. Subsequently, Confirmatory Factor analysis was carried to test how well the measured items represent the constructs.

5 Results:

5.1 Reliability:

Table 3: Reliability of factors

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.924	.928	58

The obtained alpha value greater than 0.7 is considered excellent, the Cronbach's alpha value obtained with respect to the list of factors from Table 3 is 0.924 which says that the factors are reliable to conduct further analysis for obtaining the objective.

5.2 Adequacy sampling test

Kaiser-Meyer-Olkin (KMO) is a test of how suited the data is for factor analysis. The test measures sampling adequacy for each variable in the model and for the complete model. The lower the variance the more suited the data is for Factor Analysis.

Table 4: Showing the KMO test and Barlett's test of Sphericity value

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.753
Bartlett's Test of Sphericity	Approx. Chi-Square	3621.405
	df	1653
	Sig.	.000

The KMO value is 0.753, which indicated that the sample is adequate and Factor analysis can be proceeded with using the available data. large. Hence the appropriate technique for further analysis of data is considered to be Factor Analysis. The results (Table 4) confirmed that the data analyzed were adequate enough for carrying the principal component analysis(PCA)[49].

5.3 Exploratory Factor Analysis:

Exploratory Factor Analysis is a technique within factor analysis is to identify the underlying relationships between a large set of measured variables[50].In the present research, the 26 factors explained 70.53% of the total variance are considered for CFA. Those 26 factors are grouped under three constructs namely On-premise ERP conditions, Cloud ERP conditions and Adoption of Hybrid cloud ERP processes. The relationship between the construct and the factor items which are grouped in Table 5 have factor loadings higher than 0.7 and no major cross-loadings.

5.4 Focus Groups:

Three focus group interviews of each 45 minutes were carried out with ERP implementation and cloud experts through Google cloud community-India meetups where the first author acted as a moderator for all the focus groups. The questions used during the focus group interviews primarily focused on grouping the obtained ERP critical factors. Through the focus group interviews, 10,7 and 9 factors were grouped and identified as on-premise, Cloud and Hybrid ERP factors respectively as outlined in Table 5 and for the construct "Execution of ERP" 3 factors were finalized. The construct "Execution of ERP" has the following items shortlisted.

Items: 1. Integrating all the functional modules with your service provider.
2. Integrating all the functional modules with your clients.
3. Internally integrating all the functional modules.

Table 5: Factor items listed with their respective construct.

Items	**On-premise ERP conditions(C1)**	**Items**	**Cloud ERP Conditions(C2)**	**Items**	**Hybrid Cloud ERP processes(C3)**
OP10	Top management	CERP20	Scalability .	HERP30	Asset Utilization.
OP11	User training and education	CERP21	Technological infrastructure.	HERP31	Balance isolation.
OP12	User involvement	CERP22	System quality	HERP32	Disaster recovery.
OP13	Selection of the consultant	CERP23	Integrate different ERP cloud systems.	HERP33	Data security.
OP14	Dedicated resources for ERP adoption.	CERP24	Exchanging data between on-premise to cloud ERP.	HERP34	Cloud bursting.
0P15	Data entering ERP systems.	CERP25	Cloud elasticity.	HERP35	Network latency.
0P16	Objectives and clear goals	CERP26	Data analysis and conversion through ERP.	HERP36	Data Integrity
OP17	Capable of working as a team on ERP projects.			HERP37	Data privacy
OP18	Interdepartmental operations.			HERP38	Cost Efficiency
OP19	Business Process Re-engineering in ERP projects				

5.5 Confirmatory Factor Analysis:

CFA is a one form of factor analysis used to test whether the construct is consistent and the fitness of the hypothesized model. The measurement model fit was checked using the covariance-based structural equation Modeling.

5.5.1 Model Fit Summary:

Table 6: Chained Multilateral Index Number (CMIN).

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	58	1280.996	293	.000	**4.372**
Saturated model	351	.000	0		

Chained Multilateral Index Number **(**CMIN) value in Table 6 is 4.372 which (below 5) shows a good fit.[51,52]

Table 7: Goodness of fit (GFI)

Model	GFI	AGFI	PGFI
Default model	**.985**	.883	.505
Saturated model	1.000		

The goodness of fit (GFI) value found to be above 0.9 as per Table 7 considered to be a good fit**.**

Table 8 : Baseline Comparisons-Comparitive Fit index

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.724	.750	.785	.836	**0.928**
Saturated model	1.000		1.000		1.000

Table 8 clearly shows the Comparative fit index (CFI) is above 0.9 considered to be a good fit.[51, 52]

Table 9: Root mean square RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.910	0.832	.781	**0.050**

5.5 Scale Validity:

The confirmatory factor analysis showed an excellent fit As the values GFI greater than 0.90, CFI greater than 0.90 (Table 7,8) there is an absolute fit. PCLOSE value less than or equal to 0.5 (Table 9) is a sign of absolute fit [51, 52](Hair et al. (1995, 2010) and Holmes-Smith (2006). All the items for the factors have the standardized values more than 0.60 so it confirms content validity [53]. The fit indices and the content validity results confirm the scale can be replicated anywhere for future research in this field. The average variance extracted (AVE) of each factor (K^2/n where K= Factor loading, n-the number of the item), the average variance extracted values were above 0.5 which confirms the requirements of convergent validity of the scale[54]. Based on the corrected correlations from the Confirmatory Factor Analysis, the AVE of each of the latent constructs found to be more than the

highest squared correlation with other latent variables (Fornell Larcker criterion). This confirms the discriminant validity of the construct. In Fig 2 the confirmatory factor analysis clearly states that the four constructs loading and their factor items possess good fit.So the measurement model developed is statistically a fit model thereby a new psychometric scale is developed for implementing a hybrid cloud enterprise systems.

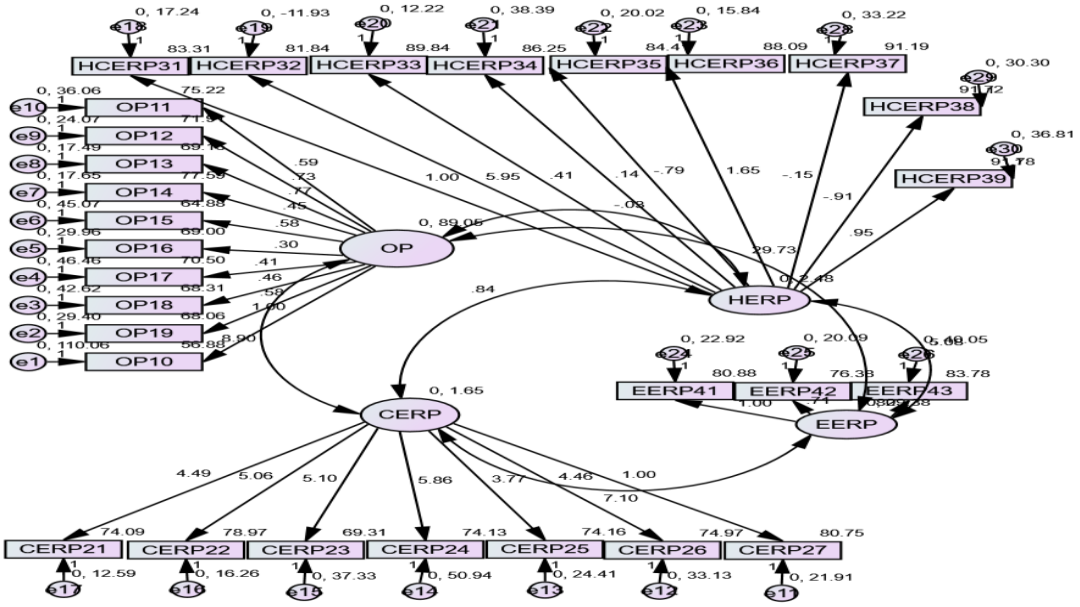

Fig:2 Confirmatory Factor Analysis using SPSS-AMOS

6. Summary and Conclusion:

Hybrid Cloud has quickly emerged as a cloud of all needs, organizations have been more open to adopting hybrid cloud as a part of their IT strategy as they see advantages like reduction in total cost, enhanced performance, enhanced data security, greater availability and resiliency, and increased flexibility among others. Many organizations adapting Industry 4.0 consider the hybrid cloud as easy and economic. Certain industries like telecom, retail have seen a high rate of adoption, whereas industries like manufacturing and core banking are staggering. It is found that the proposed scale and the measurement model was fit. The scale developed will contribute IT managers to adopt and execute the hybrid Enterprise systems (ERP) in their organizations in an easier way. It is a unique scale only to address the execution of Enterprise systems. This paper outline an updated psychometric scale development that incorporates a more validated methodological development known as confirmatory factor analysis (CFA). The four constructs developed and their respective factors got a high validity and good fit. Enterprises with a hybrid strategy grow from 51 percent to 58 percent in 2019 clearly shows most organizations concern over the hybrid cloud adoption. Business analytics, internet of things (IoT) and artificial intelligence will further propel the adoption of hybrid cloud in the future and help the enterprises to improve customer centricity and experience through the same. The supply side is becoming so competitive, with giant companies like AWS, VMware, Microsoft, IBM providing a complete and a total hybrid cloud solution.

Appendix

Factor Item : ("To what degree……")

Construct C1: On-Premise ERP Conditions

X10 …does the top management of your company support in ERP adoption?
X11… the user training and education given to the employees contribute to ERP projects?
X12…the user involvement of the employees working with ERP related projects?
X13…the selection of the consultant plays a vital role in ERP adoption?
X14…your company capable of providing dedicated resources for ERP adoption?
X15…your company trained to manage data entering ERP systems?
X16…your company set Objectives and clear goals before ERP projects were launched?
X17…your company capable of working as a team on ERP projects?
X18…is there the interdepartmental operations work in your company?
X19….is your company willing to have Business Process Re-engineering in ERP projects?

Construct C2: Cloud ERP conditions

X20…your company ERP software is scalable?
X21…your company capable of providing technological infrastructure?
X22…your company ERP System quality helping in cloud-based ERP projects?
X23…is your company willing to integrate different ERP cloud systems?
X24…is your company capable of exchanging data between on-premise to cloud ERP?
X25…is your company ERP system adapts cloud elasticity?
X26…is your company depends on data analysis and conversion through ERP?

Construct C3: Adoption of hybrid cloud ERP processes

X30…is your company capable of Asset Utilization?
X31…is your company capable of maintaining balance isolation?
X32…is your company capable of any disaster recovery?
X33…is your company capable to provide data security?
X34…is you're capable of reducing network latency?
X35…is your company capable to meet the demand for computing capacity spikes (cloud bursting)?
X36…is your company to maintain Data Integrity?
X37…is your company need data security?
X38…is your company needs data privacy?

Construct C4: Execution of ERP

X40…has your company integrating all the functional modules with your service provider?
X41…has your company integrating all the functional modules with your clients?
X42…has your company internally integrating all the functional modules?

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References

[1] DAVENPORT, T. H. *Putting the enterprise into the enterprise system*. Harvard business review, 1998, pp. ***76***(4).

[2] AL-MASHARI, M., AL-MUDIMIGH, A., & ZAIRI, M. *Enterprise resource planning: A taxonomy of critical factors*.European Journal of Operational Research, 146, 2003, pp. 352-364.

[3] DEZDAR, S., & AININ, S. *The influence of organizational factors on successful ERP implementation*. Management Decision, 2011, **49**(6), pp. 911-926.

[4] SEETHAMRAJU, R. *Adoption of software as a service (SaaS) enterprise resource planning (ERP) systems in small and medium-sized enterprises (SMEs).* Information systems frontiers, 2015, ***17***(3), pp. 475-492.

[5] ALMAJALI, D. A., MASA'DEH, R. E., & TARHINI, A. *Antecedents of ERP systems implementation success: a study on Jordanian healthcare sector*. Journal of Enterprise Information Management, 2016, ***29***(4), pp. 549-565.

[6] LIAN, J. W. *Establishing a cloud computing success model for hospitals in Taiwan.* INQUIRY: The Journal of Health Care Organization, Provision, and Financing, **54**, 2017

[7] JAGODA, K., & SAMARANAYAKE, P. *An integrated framework for ERP system Implementation*. International Journal of Accounting & Information Management, 2017, ***25***(1), pp. 91-109.

[8] HUANG, T., & YASUDA, K. *Comprehensive review of literature survey articles on ERP*. Business Process Management Journal, 2016, ***22***(1)pp. 2-32.

[9] HOLLAND, C. R., & LIGHT, B. *A critical success factors model for ERP implementation*. IEEE software, 1999,***16***(3), pp. 30-36.

[10] BINGI, P., SHARMA, M., & GODLA, J. *Critical Issues Affecting an ERP Implementation*. Information Systems Management, 1999,**16**(3), pp. 7–14.

[11] HONG, S. G., HONG, S. G., SIAU, K., SIAU, K., KIM, J. W., & KIM, J. W. *The impact of ISP, BPR, and customization on ERP performance in manufacturing SMEs of Korea*. Asia Pacific Journal of Innovation and Entrepreneurship, 2016,**10**(1), pp. 39-54.

[12] AKKERMANS, H., & VAN HELDEN, K. *Vicious and virtuous cycles in ERP implementation*: *a case study of interrelations between critical success factors*. European journal of information systems, 2002,***11***(1), pp. 35-46.

[13] FINNEY, S., & CORBETT, M. ERP implementation: a compilation and analysis of critical success factors. Business Process Management Journal, 2007,**13**(3), pp. 329-347.

[14] ALADWANI, A. M. *Change management strategies for successful ERP implementation.* Business Process management journal, 2001,***7***(3), pp. 266-275.

[15] TARHINI, A., AMMAR, H., &TARHINI, T. *Analysis of the critical success factors for enterprise resource planning implementation from stakeholders' perspective*: A systematic review. International Business Research, 2015, **8**(4), pp. 25.

[16] RIGHTSCALE *Summary* RightScale Cloud report (2016,2017,2018,2019)

[17] KARPOVICH, B., & SANDERS, L. *Growing up hybrid: Accelerating digital transformation*. *IBM Center for Applied Insights, 2016.*

[18] SLACK, N. AND LEWIS, M. *Operations strategy, 3 rd ed*, Pearson Education Limited, Harlow, 2011.

[19] ALTER, S. (2008), *Defining information systems as work systems: implications for the IS field*, European Journal of Information Systems, **17** (5), pp. 448-469

[20] S. NEWELL, J.C. HUANG, R.D. GALLIERS, S.L. PAN, *Implementing enterprise resource planning and knowledge management systems in tandem*: fostering efficiency and innovation complementarity, Inf. Org.2003, **13**, pp. 25–52

[21] ANDREW GREASLEY YUCATAN WANG, *Integrating ERP and enterprise social software "*, Business Process Management Journal, 2017, 23, **1** pp. 2 – 15

[22] MACKENZIE, S. B., PODSAKOFF, P. M., PODSAKOFF, N. P., & MACKENZIE, S. B., *Construct Measurement and Validation Procedures in MIS and Behavioral Research* : Integrating New and Existing Techniques1, 2011,**35**(2), pp. 293–334.

[23] ANG, J.S.K., SUM, C.C., YEO, L.N, *A multiple-case design methodology for studying MRP success and CSFs.* Information and Management,2002,**39**, pp. 271–281.

[24] YUSUF, Y., GUNASEKARAN, A., AND ABTHORPE, *M. S. Enterprise information systems project implementation:* A case study of ERP in Rolls-Royce. International Journal of Production Economics,2004,**87**, pp. 251–266.

[25] UMBLE, E. J., AND UMBLE, M. M. "*Avoiding ERP Implementation Failure*." Industrial Management, Industrial Management Society, 2002,**44**(1), pp. 25-33.

[26] MALBERT, V.A., SONI, A., VENKATARAMANAN, M.A. *Enterprise resource planning: Managing the implementation process.* European Journal of Operational Research2003, **146**, pp. 302–314.

[27] MANDAL, P., GUNASEKARAN, A. *Application of SAP R/3 in on-line inventory control*. International Journal of Production Economics,2002, **75**, pp. 47–55.

[28] BURNS, O.M., TURNIPSEED, D. *CSFs in manufacturing resource planning implementation*. International Journal of Operations and Production Management,1991, **11**, pp. 5–19.

[29] COX, J.F., CLARK, *S.J., Problems in implementing and operating a manufacturing resource planning information system*. Journal of Management Information Systems **1**,1983, pp. 81–101.

[30] ZHANG, L., LEE, M. K.O., ZHANG, Z., AND BANERJEE, P. *CSF of Enterprise Resource Planning Systems Implementation Success in China*. Proceedings of the 36th Hawaii International Conference on System Sciences, **5**(3),2002, pp. 7695- 1874, IEEE.

[31] ALDAYEL, A. I., ALDAYEL, M. S., & AL-MUDIMIGH, A. S. *The Critical Success Factors of ERP implementation in Higher Education in Saudi Arabia*: A Case Study. Journal of Information Technology and Economic Development, **2**(2),2011, pp. 1–16.

[32] GANESH AND MEHTA, ARPITA, *Critical success factors for successful enterprise resource planning implementation at Indian SMEs*, International Journal of Business, Management and Social Sciences **1**(1),2010, pp.65-78.

[32] FRIMPON, MICHAELF, *A re-structuring of the enterprise resource planning implementation process*, International Journal of Business and Social Science, **3**(1),2012, pp.231-243.

[33] SHEHAB, E., SHARP, M., SUPRAMANIAM, L. AND SPEDDING, T. '*Enterprise resource planning: An integrative review'*. Business Process Management Journal, **10** (4),2004, pp. 359-386.

[34] WEI, C. AND WANG, M. '*A comprehensive framework for selecting an ERP system*'. International Journal of Project Management, **22**,2004, pp. 161–169.

[35] SOMERS T.M. AND NELSON K.G. '*A taxonomy of players and activities across the ERP project life cycle*', Information and Management, **41**(3),2004, pp. 257–278.

[36] LOH T. C. AND KOH S. C. *Critical elements for a successful enterprise resource planning implementation in small- and medium-sized enterprise*, International Journal of Production Research, **42**(17),2004, pp. 3433–3455.

[37] REMUS U. '*CSFs of Implementing Enterprise Portals'*. Proceedings of the 39th Hawaii International Conference on System Sciences,2006.

[38] MOTWANI, J., MIRCHANDANI, D., MADAN, M., GUNASEKARAN, *A. Successful implementation of ERP projects:* Evidence from two case studies. International Journal of Production Economics **75**, 2002, pp. 83–96.

[39] WOO H, *CSFs for implementing ERP: the case of a Chinese electronics' manufacturer*, Journal of Manufacturing Technology Management **18** (4), 2007, pp. 431-442.

[40] BHATTI, T.R., *Critical Success factors for implementation OF Enterprise Resource Planning (ERP): empirical validation*, The Second International Conference on Innovation in Information Technology, UAE, 2002.

[41] FRIMPON, MICHAELF, *A re-structuring of the enterprise resource planning implementation process*, International Journal of Business and Social Science,**3**(1),pp. 231-243.

[42] PLANT, ROBERT AND WILLCICKS , LESLIE,*Critical success factors in international ERP implementation*: a case research approach, Journal of Computer Information Systems, 2007, pp. 60-70.

[43] JAFARI, OSMAN, YUSUFF AND TANG, *ERP systems implementation in Malaysia: the importance of critical success factors,* International Journal of Engineering and Technology, **3**(1) 2006, pp. 125-131.

[44] DEZDAR, S., SULAIMAN, *A. Successful enterprise resource planning implementation: Taxonomy of critical factors*. Industrial Management & Data Systems **109** (8),2009, pp. 1037–1052.

[45] S. FINNEY, AND M. CORBETT, "*ERP Implementation: A Compilation and Analysis of Critical Success Factors*, Business Process Management Journal, **13**(3), 2007, pp. 329-347.

[46] RAM, J., CORKINDALE, D., & WU, M. L. *Implementation critical success factors (CSFs) for ERP: Do they contribute to implementation success and post-implementation performance?* International Journal of Production Economics, **144**(1),2013, pp. 157–174.

[47] WANG, E., CHOU, H.W., JIANG, J. *The impacts of charismatic leadership style on team cohesiveness and overall performance during ERP implementation*. International Journal of Project Management **23** (3), 2015, pp. 173–180

[48] ELRAGAL, A. ERP and Big Data : *The Inept Couple. Procedia Technology*, **16**, 2014, pp. 242–249.

[49] SCHUMACKER, R. E., & LOMAX, R. G. *A beginner's guide to structural equation modeling*. Mahwah, NJ: L. L. Erlbaum Associates,1996.

[50] NORRIS, M., & LECAVALIER, L. Evaluating the use of exploratory factor analysis in developmental disability psychological research. Journal of autism and developmental disorders, **40**(1), 2010. pp. 8-20.

[51] HAIR, J., ANDERSON, R., TATHAM, R. L., & BLACK, W. C. (1995). *Multivariate data analysis with readings.* Englewood Cliffs: Prentice-Hall

[52] CUNNINGHAM, E., HOLMES-SMITH, P., & COOTE, L. *Structural equation modelling: From the fundamentals to advanced topics.* Streams Statsline, Melbourne.2006

[53] NUNNALLY, J. C. *Psychometric theory (2nd ed.).* New York: McGraw-Hill.,1978

[54] FORNELL, C., & LARCKER, D. F. (1981). *Evaluating structural equation models with unobservable variables and measurement error*. Journal of marketing research, ***18***(1), pp. 39-50.

[55] BASKARAN, R. (2018). *An Empirical Study on determining the critical success factors for the implementation of the Hybrid Cloud ERP system in IT Organizations*,**14**, pp. 2505-2528

[56] HAIR, J., ANDERSON, R., TATHAM, R., & BLACK, W. *Multivariate Data Analysis: A Global Perspective (7th ed.)*. Upper Saddle River, NJ: Pearson Prentice-Hall, 2010.