A COMPARATIVE STUDY ON THE CONCEPTUAL AND CONTEXTUAL PERCEPTION ABOUT CSF FOR ERP ADOPTION IN THE SMES

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ABSTRACT

This paper presents the approach, analysis and findings of a pilot study conducted for ERP Adoption in select Small and Medium Enterprises (SMEs) in India. A set of CSFs that were identified from previous research studies conducted all over the world on ERP for SMEs were categorized into different phases of ERP Adoption viz., planning, acquisition, implementation, usage and percolation and extension. These were ranked by the authors in their previous study. This conceptual ranking was then compared in a real-life context in India. Five SMEs were selected as a pilot study wherein the respondents' ranking on the same CSFs was compared with the authors' ranking to bring out the similarities and differences in the perceptions. The five SMEs were operating in the automobile-component industry in India and is a pilot project conducted as a part of the on-going research.

Keyword: ERP, SMEs, CSFs, Perception, planning, acquisition, implementation, usage & percolation, extension

INTRODUCTION:

Over the last 15 years firms irrespective of their size have shown keen interest in implementing enterprise solutions primarily to achieve central creation and common sharing of commercial data. The need for integrating core business processes have become imperative in today's competitive business which calls for more emphasis on standardization of core functional processes. The degree of interoperability one can achieve using enterprise systems is high when compared to a set of isolated and fragmented software applications. It was nearly impossible to extract uniform or standardized data from such application which lack an integrated central system. It was also quite capital intensive to invest in such integration of disparate systems (Wheatley 2000, Stewart et al., 2000). ERP systems can ensure communication flow seamlessly across organization's functional departments at a competitive cost perspective. In other words the cost per unit of transaction comes down with increasing usage of ERP in transactions processed. ERP implementation was believed as a very capital intensive investment for which there was no certain return on investment. Even many large global companies have had bitter experiences in implementing and using ERP systems and some extreme cases of bankruptcy were also heard after they implemented ERP (Davenport, 1998). A study pointed that the probability of ERP failure ranged from 40 to 60 percent and another study still higher at 60 to 90 percent (Langernwalter 2000, Ptak and Schragenheim 2000). Many researchers in the past have also analyzed that ERP implementation could fail due to various internal and external factors affecting the organization's very existence (Ribbers and Schoo, 2002; Soh et al., 2000; Willis and Willis-Brown, 2002). Some have found that ERP implementations were abandoned completely resulting in heavy financial losses to the organization (Davenport, 1998; Jesitus, 1997). Hence, over the last 15 years researcher have been exploring and defining factors that could significantly impact the success of ERP adoption. These factors are named as critical success factors (CSFs), (Al-Mashari et al., 2003; Bingi et al., 1999; Bharathi, Parikh, 2009; Esteves-Sousa and Pastor-Collado, 2000; Hong and Kim, 2002; Ribbers and Schoo, 2002; Soh et al., 2000; Scheer and Habermann, 2000; Somers and Nelson, 2001; Umble et al., 2003). Though over the last 10 years newer and lighter ERP deployment models have arrived, still the old perception of ERP as a strategic cost absorber persists predominantly in Small and Medium Enterprises (SMEs) that are limited by capital resources.

As a strategic initiative ERP adoption is also believed to be well-thought out involving a very high degree of planning, foresightedness from the top management since such decisions are irrevocable and can topple the very survival of the organization. Hence it becomes imperative to define success factor that create significant impact in the adoption of ERP by organization particularly the SMEs. The factors also known as Critical Success Factors (CSFs) are to be well-thought out and should be measurable objectively. Many academic researchers in the past have pondered upon CSFs by defining and formulating various frameworks and ranked and prioritized such CSFs for ERP adoption. However, it becomes necessary to apply these CSFs from time to time to test their relevance in practice. This paper presents the approach, analysis and findings on the application of conceptual perception.

This research paper is divided into five sections. The next section i.e., Section Two discusses the relevant literature review. Section Three explains the objectives and methodology of the research study and its relevance to the previous studies and justifies the need of the current study. Section Four presents the comparative analysis and the resultant finding out the perceptual ranking of CSFs between the authors and SMEs. Section Five concludes the paper and presents the scope for future work in this direction.

Literature Review:

The term Critical Success Factor in Enterprise System parlance can be said as a factor which can significantly enhance the success probability of ERP implementation (Sherer, Alter, 2004). An organization expects that ERP system should address the problem of business process integration and enable information to flow seamlessly across organizational functions. ERP systems are also expected to streamline functional processes with the organization as part of integration (Koch et. al, 1999). For ERP implementation success a clear understanding of the CSFs by the entire stakeholder group (Top Management, Process Owners and Users) is imperative. This will enhance the success probability of ERP initiative in the organization. It is also important to include and involve those sections of the stakeholders who are pessimistic on ERP success (Welti, 1999). ERP is expected to be perceived by stakeholders group differently, for instance top management perceives clarity, real-time information flow, support decision making, while users perceive it to ease and improvise their operational routine so as to enhance competitiveness (Chung et al., 1993, Chung, 2001). The result of a study of 53 Australian organizations suggested and validated seven dimension of ERP implementation (Bhatti 2005). A study empirically tested a multidimensional view of IS project performance and confirmed that an information systems project like ERP should have important parameters to function effectively (Aladwani, 2002). 78 CSFs

for ERP-Project Success were identified and were aggregated to 15 CSFs for further analysis (Kronbichler, Ostermann, Staudinger, 2009). Their work was a research on the review of the already available literature on CSFs for ERP projects from the works of Sumner, 1999; Esteves, Pastor 2000; Al-Mashari, Ghani, Al-Rashid 2006; Jarrar, AL-Mudimigh, Zairi, 2000; Nah, Delgado 2006; Ranzhe, Xun 2007; Holland, Light 1999; Zhang, Mathew, Zhang, Banerjee 2003; Somers, Nelson 2001; Markus, Axline, Petrie, Tanis 2000; Parr Shanks 2000, Ross 1999; Shanks et.al 2000; Francalanci 2001. Another study on the review of literature on CSFs found that factors like Top Management Support, Clear Objectives and Goals, Team Composition, Implementation Approach, End-user attitude on ERP as high impact factors (Bahmanziari, 2004). Based on various research works done earlier, it was significantly found that there is still need for research focusing on the identification of CSFs from the key stakeholders' perspective. It was further found that future research efforts on the study of CSFs should consider the perspectives of key stakeholders and to ensure that this stakeholder approach is also comprehensive in its coverage of CSFs (Finney, Corbert, 2007). An empirical study on the ERP implementation in Greek SMEs identified that SME's lack the required knowledge, regarding the identification of information system needs and how they can choose appropriate software vendors and products for one of their most significant areas of operation. The study also suggested that expenses have a negative effect on the usage of the ERP system, but implementation of the ERP system does present positive overall effects on the SME if done correctly (Mullins, Christos, Iannacci, 2011). An investigative study was conducted to find the motivations, concerns and strategies across select Canadian organizations on the critical management issues of ERP projects. The study analyzed factors like selection of ERP vendor, project manager, and implementation partners; constitution of project team; project planning, training, infrastructure development, on-going project management; quality assurance and stabilization of ERP (Kumar, Maheshwari, Kumar, 2003)

After a comprehensive compilation and analysis of the existing literature, 30 CSFs were identified from earlier studies and were grouped under five sequential decision stages of ERP Adoption namely Planning, Acquisition, Implementation, Usage and Percolation and Extension. These were then ranked and prioritized using AHP by the authors in their earlier work, based on the popularity of these CSFs in the existing literature (Bharathi, Vaidya, Parikh, 2012). To test their practical validity, the conceptual ranking and prioritizing of the CSFs were applied to a sample of SMEs. This paper will bring out the similarities and differences between the conceptual and contextual perception of CSFs. This paper is a part of an on-going research on the assessment of decision areas for ERP Adoption by SMEs.

Objective and Methodology of the Study:

The objective of the study is to compare the conceptual perception of authors and the contextual perception of respondents on the CSFs of ERP adoption.

For the purpose of accomplishing these objectives five small and medium enterprises engaged in the business of automotive ancillaries were chosen as sample units for the study. All these units were situated in Pune which is one of the major automobile hubs in India. These units supplied a variety of automobile components to the various OEMs (Original Equipments Manufacturers) situated mostly in and around Pune. This research paper is conceptual as well as empirical. For the concept building, the authors extensively relied on secondary data that contained tested and proven knowledge in this area from already conducted and published research studies from all over the world. Using the conceptual understanding the empirical study was conducted on these five SMEs based on a structured questionnaire.

The questionnaire was circulated to certain key process owners of these units namely the departmental heads of Information Technology, Production Planning and Finance. The questionnaire contained a set of 30 CSFs segmented into five phases of ERP adoption apart from some general questions relating to type and nature of the enterprise, business operations, business age, type and age of ERP, number of users etc. These CSFs were identified from various research studies from India and rest of the world. The respondents were solicited to rank the CSFs in each of the phases of ERP adoption based on their experiential perception. Then the ranking of CSFs were compared with the rankings already done by the authors as part of a previous study, wherein they had ranked and prioritized the same set of CSFs based on research studies worldwide.

The limitations of the study could be the less number of samples units chosen as the results or outcome may not be eligible for generalization of the whole population. Moreover, though responses were solicited from multiple process owners, the analysis of their perception was done collectively and the differences between them were not studied due to lack of responses and data completeness.

Analysis and Findings:

The profile and relevant basic details of the sample units are presented in the table below.

Table-1

Basic Details	SME 1	SME 2	SME 3	SME 4	SME 5
Type of the organization	Medium	Medium	Medium	Small	Medium
No. of Years in Business	>20	>15	>20	>10	>20
No. of Employees	100-150	100-150	150-200	50-100	100-150
ERP in place currently	Yes	Yes	Yes	Yes	Yes
No. of Years since ERP	6	1	4	3	7
Implementation Time (in months)	7	12	5	5	6
Core Functions targeted in ERP	Inventory, Production, Procurement	Production, Procurement, Sales, HR	Inventory, Production, Procurement & Sales, Logistics	Accounts, Production, Procurement	Inventory, Production, Procurement
Nature of Business	Manufacturing, Subcontracting	Manufacturing	Manufacturing, Subcontracting	Manufacturing	Manufacturing
Systems in place before ERP	Yes (Tally)	Yes (Tally)	Yes (Tally)	Yes (Tally)	Yes (Tally)
Type of ERP Product used	Branded	Branded	Branded	Un-Branded	Branded
Functions in Use in ERP	Inventory, Production, Procurement	Billing & Production Planning	Inventory, Production, Procurement, Sales, Logistics	Production, Procurement	Inventory, Production, Procurement
Type of ERP	On-Premise	On-Premise	On-Premise	On-Premise	On-Premise
ERP Investment (Millions of Rs.)	NA	1.5(approx)	NA	NA	NA
No. of daily routine Users	20-25	10-15	20-25	10-15	10-15

The following section will present the analysis to justify the objective of this paper. The authors' rankings and the SMEs ranking were taken as variables and they were tested to assess how well they are related to each other. Spearman's Rank Correlation was used to test the relationship between the authors' ranking and SMEs ranking of CSFs. The authors' rankings were compared individually with each of the SMEs for analysis and interpretation.

Null Hypothesis: There is no significant relationship between the researcher's ranking and the SME's ranking.

Planning Phase:

Success Factors	Authors	SME1	SME2	SME3	SME4	SME5
Goal and Scope of ERP	5	3	5	5	4	4
Owner's (Proprietor/Partners/ Director) commitment	1	1	1	2	3	1
SME culture (maturity) in terms of receptiveness to change	2	4	2	1	1	2
SME Vision and growth perspective	4	2	3	3	2	5
Project Planning and Scheduling	3	5	4	4	4	3

	Authors & SME 1	Authors & SME 2	Authors & SME 3	Authors & SME 4	Authors & SME 5
r value	0.2	0.9	0.8	0.45	0.9
Critical rs	0.3464	1.558846	1.385641	0.779423	1.558846
Null Hyp	Accept	Reject	Reject	Reject	Reject

Sig	n	df (n-2)	Table Value
0.05	5	3	0.9

In the planning phase, the rankings of 4 out of 5 respondents had significant relationship with the ranking of the

authors. In other words except the perception of SME 1 all other units' perception matched with those of the authors which reinforces the alignment of priority on certain CSFs like Owner's/Partner's Commitment, SME Culture in terms of receptiveness to change, Vision and Growth perspective of SME etc between the authors and the SMEs. So we can infer that the conceptual rankings can be justified to that of the actual rankings with regard to the CSFs ranked in the planning phase of ERP adoption by these units.

Acquisition Phase:

Success Factors	Authors	SME1	SME2	SME3	SME4	SME5
Existing IT compatibility of the SMEs	1	1	1	1	3	2
Software package selection, evaluation	4	4	2	3	2	1
Implementation Vendor Analysis	3	5	4	5	4	6
Cost Benefit Analysis	2	3	3	2	1	4
Role of consultant	5	6	5	4	6	3
SMEs Process Owners' interaction	6	2	6	6	5	5

	Authors & SME 1	Authors & SME 2	Authors & SME 3	Authors & SME 4	Authors & SME 5
r value	0.3714	0.828571	0.828571	0.657143	0.2
Critical rs	0.7429	1.657143	1.657143	1.314286	0.4
Null Hyp	Accept	Reject	Reject	Reject	Accept

sig	n	df (n-2)	Table Value
0.05	6	4	0.8286

In the acquisition phase, the rankings of 3 out 5 respondents had significant relationship with the ranking of the authors. The perceptions of SMEs 2, 3 & 4 matched with the perceptual rankings of the authors. The CSFs like Existing IT compatibility, Role of Consultants, Cost Benefit Analysis had fewer differences in perceptions. Hence we can infer that the conceptual rankings can be justified to some extent with that of the actual rankings.

Implementation Phase:

Success Factors	Authors	SME1	SME2	SME3	SME4	SME5
Implementation road map & Methodology	3	3	6	5	5	4
Project Management	2	1	3	6	4	3
Identification of mission critical functions/processes	4	4	2	4	3	2
Configuration vs Customization & Gap Analysis	1	5	4	2	2	5
Involvement of Process Owners	5	2	1	1	1	1
Functional Testing	6	7	7	7	6	6
Training needs identification	7	6	5	3	7	7

	Authors & SME 1	Authors & SME 2	Authors & SME 3	Authors & SME 4	Authors & SME 5
r value	0.5	0.214286	0.035714	0.535714	0.321429
Critical rs	1.118	0.479157	0.07986	1.197894	0.718736
Null Hyp	Reject	Accept	Accept	Reject	Accept

sig	n	df (n-2)	Table Value
0.05	7	5	0.745

In the implementation phase, the rankings of 2 out of 5 respondents had significant relationship with the ranking of the authors. The perceptions of SMEs 1 and 4 matched with the perceptual rankings of the authors. It was

found that the difference in perceptions was high in certain CSFs like Involvement of Process Owners; Configuration vs. Customization Issues, Implementation Methodology, Project Management etc which contributed to the overall difference in perception of authors with SME 2, 3 & 5. Hence we can infer that there is a considerable gap about the conceptual rankings and actual rankings.

Usage and Percolation Phase:

Success Factors	Authors	SME1	SME2	SME3	SME4	SME5
Gap Analysis before and after training	2	2	3	4	4	5
Periodical and timely communication	1	3	2	3	1	1
Percolation of owner's commitment	5	1	1	1	2	2
Mandatory ERP environment	6	6	4	5	6	6
Feedback on user satisfaction	3	4	5	2	4	3
Periodical review on implications on time, cost and benefits	4	5	6	6	3	4

	Authors & SME 1	Authors & SME 2	Authors & SME 3	Authors & SME 4	Authors & SME 5
r value	0.3714	0.142857	0.142857	0.571429	0.485714
Critical rs	0.7429	0.285714	0.285714	1.142857	0.971429
Null Hyp	Accept	Accept	Accept	Reject	Reject

sig	n	df (n-2)	Table Value
0.05	6	4	0.8286

In the usage and percolation phase, the rankings of 2 out 5 respondents had significant relationship with the ranking of the authors. Factors like Mandatory ERP working environment, Feedback on user satisfaction, periodical review had less differences in perceptions while percolation of owners' commitment had clear difference of perception because all the SMEs ranked it higher than what the authors' had ranked. Overall, the perceptions of SMEs 4 and 5 matched with the perceptual rankings of the authors. Hence we can infer that there is a gap about the conceptual rankings and the actual rankings.

Extension Phase:

Success Factors	Authors	SME1	SME2	SME3	SME4	SME5
Identification of processes extended interface	6	4	6	5	6	5
Business relationship with OEM	3	2	4	2	3	2
Role in demand and material planning	5	5	3	3	4	4
ERP working culture in the SME	1	1	2	1	2	3
Extent of process standardization	4	3	1	4	1	1
Analysis of additional IT infrastructure	2	6	5	6	5	6

	Authors & SME 1	Authors & SME 2	Authors & SME 3	Authors & SME 4	Authors & SME 5
r value	0.3714	0.314286	0.371429	0.428571	0.085714
Critical rs	0.7429	0.628571	0.742857	0.857143	0.171429
Null Hyp	Accept	Accept	Accept	Reject	Accept

sig	n	df (n-2)	Table Value
0.05	6	4	0.8286

In the final phase of ERP adoption that is extension phase the rankings of only 1 out 5 respondents had significant relationship with the ranking of the authors. The perceptions of only SME 4 matched with the perceptual rankings of the authors. Amongst the CSFs the need for an ERP working culture was ranked high by all the respondents or in other words the perception was unanimous. All other factors had varying differences

of perception with that of the authors. Hence we can infer that there is considerable gap about the conceptual rankings and the actual rankings.

Overall, there exists a lot of difference in the perception of authors and the SMEs. In each phase of ERP Adoption it could be found that there is varying degrees of perceptual differences. The perceptual differences between the authors and SMEs increased over the five phases of ERP Adoption. For instance in the planning phase, the ranking of 4 out of 5 respondents matched with that of the authors. It could be because most of the CSFs listed in the planning phase impacted to a large extent by the top management and moreover, these CSFs had a long-term perspective of ERP adoption. In SMEs the top management comprises of either an owner or a small number of partners as a result of which decision making is centralized and also very conservative. Since all the samples belonged to the same strata there was less difference in the rankings. In the acquisition phase of ERP adoption, the perceptual difference was mixed in the sense that 3 out of 5 respondents agreed to that of the authors'. Apparent similarities in perception could be found in certain CSFs like Existing IT Compatibility, Role of Consultants, and Process Owners' Interaction etc. Certain factors like Software Package Selection and Evaluation, Implementation Vendor Analysis had differences in perceptions. Interestingly the CSF called Implementation Vendor Analysis was not given a high rank due to the reason that these SMEs did not have the adequate resources to conduct a formal in-depth analysis of the implementation vendor, instead the implementation vendor was recommended by the consultant. In the Implementation Phase of ERP Adoption the overall rank perception of 3 SMEs were complimentary, to that of the authors'. However it can be found that the relationship was weak. The SMEs felt that Process Owner's Involvement is critical to get the initial buy-in from the ERP system and it would also sensitize the expectation of the ERP working environment to the larger user-group after implementation. Though Project Management was ranked high by the authors, in reality it was found that as such SMEs do not employ formal project management techniques to implement ERP. The sample units had implemented on a phased manner by configuring certain key departmental functions like procurement, finance, production, sales etc., hence there was quite a difference in their ranking perception on this CSF.

The ranking perception of 3 SMEs were different from that of the authors on the CSFs relating to Usage and Percolation phase of ERP Adoption. However, the perception relating to Mandatory ERP Working Environment was ranked quite lower in the order by the SMEs as well as the authors. The SMEs believed that sufficient time should be given to allow the users to percolate into the ERP working environment and if such an environment is made mandatory it may create a sense of compulsion and insecurity in the minds of the users which might also impact their operational efficiency. The perceptions of authors had little relevance to that of SMEs in the Extension Phase of ERP Adoption. Only 1 out of the five SMEs studied has positive relationship in the perception with the authors. Amongst the various CSFs ranked in this phase, it was found that enabling an ERP Working Culture was ranked as top or amongst the top by the SMEs and it matched with that of the authors'. However, the authors' ranked lower in the order, the CSF relating to process standardization while the respondents ranked it higher, because all these SMEs supply their products to customers (OEMs) who are much larger in terms of size, IT enablement and compatibility. It was also believed the OEMs have higher degree of standardization in their business process since they were all IT systems driven. Hence SMEs felt that information flow integration with their larger counter parts could be improvised through process standardization from ERP environment. The CSF relating to Analysis of additional IT infrastructure was ranked high by the authors, while it was not so by the SMEs, the main reason being most of the SMEs use the web portals of their larger counterparts to connect and conduct transactions, hence as such no additional IT infrastructure was required specifically to extend and integrate the information between the SMEs and their larger customers.

Conclusion and Future Scope of Work:

The above paper has presented the application of the conceptual ranks of the authors in a practical context to a set of SMEs. The similarities and differences bring out clarity and direction for further research in this area. The researchers found that there is lot of perceptual differences in the later stages of ERP Adoption, namely implementation, usage and percolation and extension. It may be noted that though the authors' rankings may be arrived through referring extensively the already available research in this area, the SMEs perception on CSFs in all the adoption phases appears to be considerably different. This enables further research in this direction broadening its scope to larger sample size and also categorizing SMEs based on their ERP age (number of years since ERP implemented). Also analyzing the perception of a mix of stakeholders namely decision-makers, process-owners and users will draw more extensive and healthier analysis and findings into this comparative study.

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