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Application of Structural Equation Modeling To Establish Causal Relationships among Factors Affecting Enterprise Resource Planning (Erp) Implementation

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ABSTRACT: Industries Worldwide Are Sensing The Impact Of Globalization And Liberalization From Past Two Decades Or So. As A Result They Are Getting Equipped With Different Tools And Techniques Such As JIT, KANBAN, Kaizen And Enterprise Resource Planning (ERP) Etc. To Manage Their Resources In The Best Manner Possible To Achieve The Desired Results In Terms Of Productivity And Efficiency. These Tools And Techniques Help Them To Sustain And Stay Ahead In The Global Competition. ERP Provides A Common Database Throughout The Organization And Thereby Aid In Automation And Updating Of The Data.ERP Implementation Plays A Major Role In Improving The Overall Performance Of The Organization. The Perceptions Of Factors ERP Implementation In Manufacturing And Service Industries Of North- Karnataka Is Captured Through A Questionnaire Survey, Which When Subjected To Factor Analysis Resulted In Seven Factors Representing The Variables. This Paper Focuses On Establishing The Causality Between The Factors Evolved From Factor Analysis Using Structural Equation Modeling (SEM). These Causal Relations Among The Factors And The Causal Loops Obtained From SEM May Further Help To Develop Robust Dynamic System For ERP Implementation Management.

Key Words: Automation, Causal Loops, Enterprise Resource Planning, Globalization, Structural Equation Modeling (SEM).

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I. INTRODUCTION

Enterprise Resource Planning (ERP) Is An Industry Term For Broad Set Of Activities Supported By Multi Module Application Software That Helps A Manufacturing Or Service Business Manage The Important Part Of Its Business (Zhenu And Prashant, [1]),. ERP Systems Are Basically Designed To Address The Fragmentation Issues That Exist In Legacy Systems. It Results In Streamlining And Automating The Business Processes In A Firm, Thereby Provides A Common Database From Which The Data Can Be Accessed Automatically.

ERP Systems Aid An Organization To Gain The Competitive Advantage And To Stay In Tune With The Global Competition. This System, If Implemented Judiciously Improves The Firm's Performance In Terms Of Productivity, Profit, Customer Service Etc. Which Is The Need Of The Hour.

On The Contrary, There Are Several Challenges, Problems And Risks Involved In ERP Project. Many ERP Implementations Have Reported Failure And It Is Envisaged From The Literature That The Reasons For Failure May Be Due Several Reasons To Name A Few It Might Be Due To Heavy Customization, Poor Project Management, Poor Top Management Support, Lack Of Change Management, User Resistance To Change, Hidden Cost And So On.

It Is Evident That ERP Implementation Project Is An Organization Wide Challenge And Requires Input And Co-Ordination Of All The People Concerned To The Organization At Large. Resources In The Form Of Infrastructure, Training, Budget Forms The Essential Part Of Any Project And Same Is The Case With ERP Implementation. Top Management Support And Their Willingness To Provide These Essentials In Time Ensure The Success Of The Project To A Large Extent.

II. PROBLEMS, RISKS AND ISSUES INVOLVED IN ERP IMPLEMENTATIONS

As Discussed Earlier There Are Several Risks, Challenges, Problems And Issues Involved In ERP Implementation, If These Are Not Handled In Time The Project May Lead To A Failure. Gupta And Kumar [2] Identified The Causes For Failure Of ERP Implementation And Described The Same In A

Stepwise Manner As Wrong Package Selection, Time And Schedule For Implementation, Lack Of Identification Of Objectives, Poor Quality Engineering, Lack Of Configuration, Schedule Overrun, Testing And Turnover. This Implies That Care Has To Be Taken Right From The Inception Of The Project And Continuous Monitoring Is A Must Because ERP Implementation Is Not A One Short Program. Ganesh And Arpita [3] From Their Research Identified The Factors That Led To The Failure Of ERP Implementation They Are Poor Quality Of Testing, Poor Top Management Support And Commitment, Unrealistic Expectation Of Top Management From ERP System And Also Pointed Out That Proper Knowledge Of ERP Products, Proper Budget Planning And Appropriate Training To Staff Is Essential In Order To Avoid Failure.

Neda And Govindan [4] Identified And Ranked The Factors That Result In ERP Implementation Failure And Pointed Out That Unrealistic Expectation Of Benefits, Return On Investment, Minimal Support From Vendors After Implementing, Poor Risk Management, Data Transfer Errors, Poor Project Management And Lack Of Top Management Participation Were Ranked Highest Among The Group Of Failure Factors Of ERP Implementation In Malaysian SME's. Some Of The Problems Related Encountered With ERP Implementations Are Related To Motivation For Their Adoption: Legacy Systems (Poor Data Quality, Interfacing), Understanding Business Processes, Infrastructure Requirements And Customization Of The New System. However The Main Problems Are Related To People, Changing Work Practices, Change Management, Internal Staff Adequacy, Training, Top Management Support And Consultants. The Misconception Is That ERP Is A Computer Subject, When In Reality, It Is Very Much A People Related Business Subject (Valerie And Millet, [5]). ERP Implementation Is Not Free From Risk; There Are Numerous Risks That Come In The Process Of Implementation. Amin And Hamid [6] Categorized The Risks As Organizational, Technical, Project Management System Risks, User Risks And Technology Risks, This Categorization May Help In Assessment And Minimization Of Risks. The Pertinent Issues In ERP Implementation Are Fundamental Issues (Role Of A Manager, Auditor And Top Management Commitment), Organizational Change Process (Reengineering, Training, Selection Of Right Employees Etc.), Employee Morale, Implementation Cost And Time (Chandan Et.Al., [7]). It Is Quite Evident That ERP Implementations Have Much More To Do With People Rather Than Technology, Computer Which Is Of A Secondary Concern. Amin Amid *Et.Al*., [8] Conducted A Study To Identify And Classify The Critical Failure Factors Prevalent In Iranian Industries And Classified The Critical Failure Factors As Organizational, Project Management, Human Resource, Managerial, Vendor And Consultant, Processes And Technical. As Mentioned Earlier Organization Wide Commitment Is Essential For Such Projects, Everyone Needs To Involve, Co-Operate And Contribute For The Success Of The Project. An ERP Project Involves Several Components Of Software And Business Systems, Thereby Raising Organizational Problems (D.Aloini *Et.Al.*, [9]). Yahaya Yusuf *Et.Al.*,[10]Conducted A Case Study At Rolls Royce And Identified The Risks Involved In ERP Implementation, Some Of Them Are, Inability To Align To Goals, Non-Availability Of Reliable Hardware And Software, Failing To Provide Post-Implementation Support, The Resistance To Change To The New Process, Inadequate Education On The New System Etc.

From The Above Discussions It Is Evident That Many Issues Come In The Way Of ERP Implementation. These Issues Require Major Attention For Successful Implementation Of ERP. Therefore Identification And Selection Of Issues Plays A Significant Role In Hassle Free Implementation Of ERP.

III. SELECTION OF THE ISSUES AFFECTING ERP IMPLEMENTATION

To Identify The Various Issues Affecting ERP Implementation An Extensive Literature Survey Was Carried Out. After Completion Of The Survey, A Preliminary Questionnaire Was Prepared, A Pilot Survey Was Done And The Suggestions Were Incorporated. Finally The Questionnaire Was Administered To Eminent Consultants, Vendors And Project Managers Who Had Hands On Experience ERP Projects And They Were Asked To Rectify The Questionnaire. Reliability Was Checked And Those Items Were Deleted Whose Elimination Resulted In Improving The Reliability. Finally The Revised Questionnaire Consisted Of 52 Questions Grouped Into 17 Dimensions.

3.1 Data Collection

The Questionnaires Were Administered By Post, E-Mail, Telephonic Survey And In Person By The Research Scholar. The Survey Covered The Manufacturing And Service Industries In North-Karnataka And Some Other Consultant Firms Were Included As They Were Involved In Implementing ERP In All Areas Of Karnataka. A Total Of 232 Responses Were Found Usable And Were Used For Analysis.

Factor Analysis Approach To Erp Implementation

Exploratory Factor Analysis Focuses On Underlying Constructs Of Observed Phenomenon

And Attempts To Determine The Structure Of Observed Data (Javad And Mohsen, [11]). Factor Structure Among The Variables In The Analysis, It Provides The Tools For Analyzing The Structure Of Interrelationships (Correlations) Among A Large Number Of Variables That Are Highly Interrelated Known As Factors (Hair *Et.Al*.,[12]). Factor Analysis Was Applied To 52 Items To Analysis Is An Interdependence Technique Whose Primary Purpose Is To Define The Underlying Identify Factors Affecting ERP Implementation, Which Could Be Used For Further Analysis. The Sample Size Was 232. The Tests Carried On The Data To Check Its Validity For Factor Analysis Are Given In Table-1.

Table 1: Tests For Validity Of Data For Factor Analysis

Sl..No	Test	Theoretical value	Actual (Research)Value
1	Sample Adequacy and Validity Test	SampleSize should be 100 and the minimum Saple size is to have at least five times the number of variables to be analyzed	52 variables with a sample size of 232 makes it adequate
2	The Kaiser- Meyer-Olkin test	KMO value in the range of 0.80-0.90 is considered to be meritorious and will account for substantial amount of variance	KMO value is 0.901 which indicates the sample is adequate and is appropriate for Factor analysis
3	Barlett test of sphericity	Significance level of 0.05 is acceptable	Significance level is 0.000
4	Variance explained	Variance of around 60% explained by the factors is acceptable	The seven factors explained 61.063 of the total variance
5	Releiability Test	Cronbach's alpha of > 0.6 or >0.7	The average value is 0.75 and lowest value is 0.66
6	Construct Validity	Unifactorality of the factor and factors must account for more than 50% of the variance	The average variance extracted for each factor ranges from 51% to 76% for seven factors
7	Content Validity	Success of the researches in creating and using measurement items that covered the content domain of variable being used and measured	The content validity of the variables is based on literature survey and opinions of experts in the domain such as vendors, consultants and project managers
8	Convergent Validity	The standardized loadings should be 0.5 or higher	All factor loadings are more than 0.5
9	Dicriminant Validity	Degree to which two conceptually similar measures are distinct	There is no cross loading of items on multiple factors

Exploratory Factor Analysis (EFA) Was Carried Out With Principal Component Analysis As Extraction Method And Varimax As Rotation Method, The. Scree Test Was Used To Determine The Initial Number Of Factors To Be Retained. After A Series Of Iterations, Factor Analysis Resulted In Retaining 32 Variables On 7 Dimensions. The Seven Factors Explained 61.063 % Of Total Variance Which Is Deemed To Be Sufficient In The Social Factor 7: Assessment Of Resources And ScheduleThese Seven Implementation Factors Can Be Further Used For Investigating ERP Implementation Issues In Manufacturing And Service Sciences Research. After Obtaining The Factor Solution The Next Step Is To Label Them, The Seven Factors Named Are:
Factor 1: Risk Management
Factor 2: Project Management
Factor 3: Pre-Implementation Planning
Factor 4: External Support
Factor 5:Post-Implementation Support
Factor 6: Organization Culture
Industries Of North-Karnataka Using Different Techniques And These Are Discussed In The Next Section.

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Factor 1: Risk Management(Cronbach's alpha=.92)							
Or-4 (Investment on ERP package)	0.761						
Ec-2 (Altering business processes)	0.713						
Lcm-2 (Incorporation of changes in different areas)	0.699						
Lcm-1 (Change Management)	0.688						
Cm-3 (Business process reengineering)	0.681						
Cm-2 (Total cultural change)	0.681						
Or-3 (Exposure to IT skills)	0.665						
Ea-2 (Learning abilities of the employees)	0.661						
Bpr-1 (Business process reengineering as a best practice)	0.637						
Ea-1(Positive attitude of employee)	0.624						
Pmr-1 (Budget and schedule overruns)	0.62						
Tms-2 (Top Management role)	0.582						
Or-1(user resistance to change)	0.568						
Factor2: Project Management (Cronbach's alpha=0.72)							
Te-3: (Training of the stakeholders on the new system)		0.675					
Pt-2: (Periodic monitoring of the project)		0.663					
Cis-1:(Clear scope of the project)		0.658					
Pt-3:(Project team training)		0.579					
Factor 3: Pre-implementation planning(Cronbach's aplha=0.77)							
Pl-1:(Planning on requirements definition, identification of project Manager)			0.758				
Lit-1: (Over customization, improper planning, ineffective periodic monitoring)			0.756				
Lit-2:(Consequences of schedule overruns)			0.63				
Pl-4::(Accurate requirement definition)			0.613				
Factor 4: External support(Cronbach's alpha=0.70							
Cv-2: (Competence and experience of Vendor and Consultant)				0.796			
Cv-1: (Consultant and Vendor support)				0.533			
Factor 5: Post-implementation support(Cronbach's alpha=0.78)							
Po-4: (Identification of gaps)					0.646		
Po-2:(Refresher training during the post-implementation phase)					0.634		
Po-3: (Knowledge transfer from Vendor and Consultant)					0.574		
Po-5: (Appropriate and in-time evaluation)					0.536		
Factor 6: Organization Culture (Cronbach's alpha =0.7)							
Cm-4: (Culture of the Organization conducive to change)						0.715	
Tms-4: (Top Management participation, co-operation and Co-ordination)						0.628	
Or-5:(Consequences of lack of Top Management support)						0.596	
Factor 7: Assessment of resources and schedule (Cronbach's alpha =0.66)							
Ir-1: (Resources as essentials of project)							0.698
Pt-1: (Assessment of schedule, deadlines and budget)							0.547

Table-2: Component Matrix

The Fact That ERP Implementation Issues Could Be Grouped Into Factors Or Dimensions Was Revealed By Factor Analysis. These Dimensions Can Be Further Synthesized To Arrive At A Holistic Approach To ERP Implementation By Establishing Causal Relationship Amongst Them; This Is Enabled Through Structural Equation Modeling (SEM).

Sl.No	**Latent Construct with Notation**	**Indicators**	**Notations**
		Investment on ERP package	Or-4
		Altering business processes	Ec-2
		Incorporation of changes in different areas	Lcm-2
		Change Management	Lcm-1
		Business process reengineering	Cm-3
		Total cultural change	Cm-2
		Exposure to IT skills	Or-3
1	Risk Management **(RM)**	Learning abilities of the employees	Ea-2
		Business process reengineering as a best practice)	Bpr-1
		Positive attitude of employee	Ea-1
		Budget and schedule overruns	Pmr-1
		Training of the stakeholders on the new system	Te-3
2	Project Management **(PM)**	Periodic monitoring of the project	Pt-2
		Clear scope of the project	Cis-1
		Project team training	Pt-3
		Planning on requirements definition, identification of project Manager	Pl-1
3	Pre-implementation planning (**PIP)**	Over customization, improper planning, ineffective periodic monitoring)	Lit-1
		Consequences of schedule overruns	Lit-2
		Accurate requirement definition)	Pl-4
4	External support **(ES)**	Competence and experience of Vendor and Consultant)	Cv-2
		Consultant and Vendor support	Cv-1
		Identification of gaps)	Po-4
		Refresher training during the post-implementation phase	Po-2
5	Post-implementation support **(PIS)**	Knowledge transfer from Vendor and Consultant)	Po-3
		Appropriate and in-time evaluation	Po-5
6	Organization Culture **(OC)**	Culture of the Organization conducive to change	Cm-4
		Consequences of lack of Top Management support)	Or-5
7	Assessment of resources and schedule **(ARS)**	Resources as essentials of project	Ir-1
		Assessment of schedule, deadlines and budget	Pt-1

Table 3: Constructs (Factors) And Indicators (Variables) Used In Developing Measurement Model

IV. STRUCTURAL EQUATION MODELING

Factor Analysis Captured The Perceptions About ERP Implementation Management In Manufacturing And Service Industries Of North-Karnataka Which Retained Seven Factors Representing Variables. This Section Deals With The Establishment Of Causality Between These Latent Variables And Causal Loop Analysis Using Structural Equation Modeling (SEM). These Causal Relationships Among The Latent Variables And Causal Loops Together Help In Developing Different Models Of Strategic Management ERP Implementation.

The Structural Equation Modeling Is Multivariate Techniques; It Examines A Series Of Dependence Relationships Simultaneously. It Is Particularly Useful In Testing Theories That Contain

Multiple Equations Involving Dependence Relationships. This Technique Enables To Assess, Both Measurement Properties And To Test The Key Theoretical Relationships (Hair *Et Al.*, [12).

4.1 Stages In Structural Equation Modeling

There Are Six Stages In Structural Equation Modeling, They Are:

1. Defining Individual Constructs
2. Developing The Overall Measurement Model
3. Designing A Study To Produce Empirical Results
4. Assessing The Measurement Model Validity
5. Specifying The Structural Model
6. Assessing Structural Model Validity

4.2 Measurement Model

4.2.2 *Stage II:* Developing Overall Measurement Model

Double Headed Arrows (Covariance) Were Used To Connect Each Exogenous Construct With Every Other Construct And One Headed Arrow Indicated A Causal Path From A Construct To The Respective Indicator. The Latent Constructs Are Indicated By Oval Shape And Measured Variables By Rectangle As Shown In The Figure 1. An Error Term Is Associated With Each Measured Variable. AMOS 20.0 Graphical Interface Is Used To Draw Measurement Model As Shown In The Figure 1. The Model Has 7 Latent Constructs And 29 Indicators (Observed Variables). There Was A Fit Problem With 32 Variables, So 3 Variables Were Deleted. The Model Has 348 Degrees And 87 Parameters To Be Estimated. Maximum Likelihood Method Is Used To Run The Model And The Results Are Discussed In The Next Section.

4.2.3 *Stage III:* Designing A Study To Produce Empirical Results

The Testing Of Measurement Theory Takes Place In This Stage. A Sample Size Of 232 Is Used For The Study, Which Satisfies The Conditions Of Sample Size. The Model Was Specified By AMOS.

All The Fit Indices Indicate A Reasonably A Good Fit. Ratio Of, X2 /Df = 2.050 Indicates A Reasonably Good Fit (Hayduk, [14]), Kline [15] Suggested That Ratio Of X2 (Chi-Square) To Degree Of Freedom Of Less Than Three Is Considered To Be Favourable For Fit. Scott [16]Recommended Values Of Goodness Of Fit (GFI) And Adjusted Goodness Of Fit (AGFI) Of More Than 0.80 Are Accepted As Measures Of Good Fit, The GFI Of 0.834 Is Above The Recommended Value And AGFI Of 0.792 Approaches The Recommended Value, Therefore Suggests Reasonably Good Fit . The Value Of Comparative Fit Index (CFI) Of More Than 0.8

The Portion Of The Model That Specifies How The Observed Variables Depend On The Unobserved, Or Latent, Variables Is Sometimes Called The **Measurement Model (**Bhushi And Javalagi, [13]). The Current Model Has Seven Different Measurement Sub Models. Using Validated Factor Analysis, These Relationships Were Estimated Through Stage-I To Stage-III As Explained Below And Measurement Model Validation Is Carried Out.

4.2.1 *Stage I:* Defining Individual Constructs

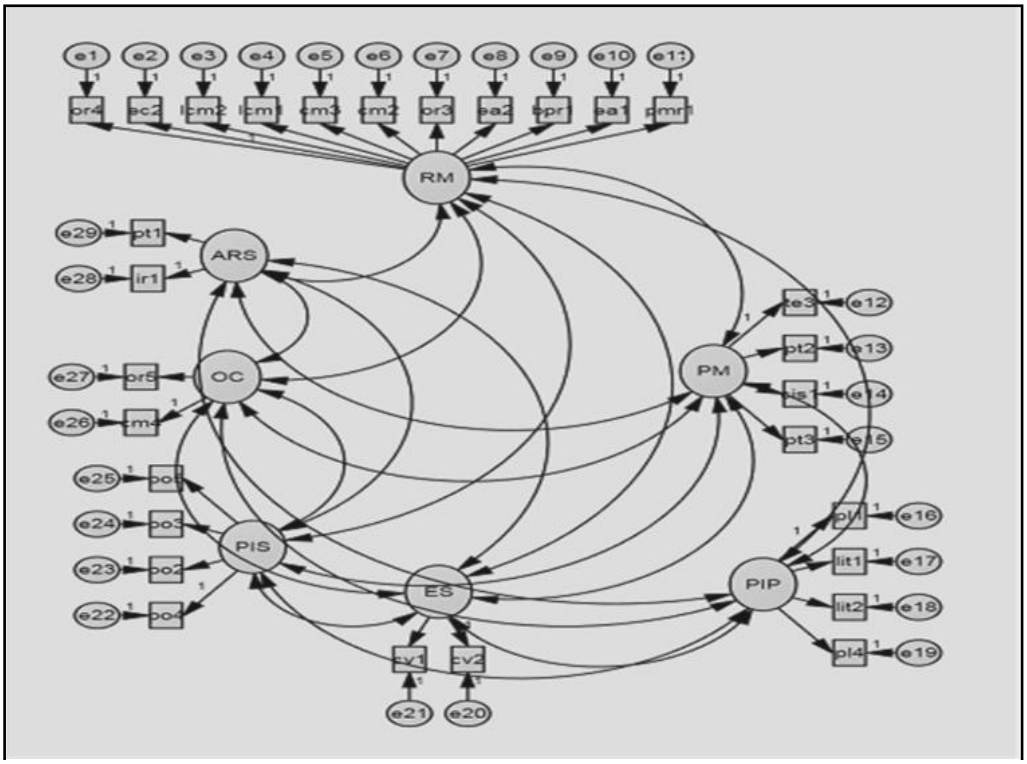
Factors Obtained From The Factor Analysis Together With The Corresponding Variables And Factor Scores Are The Basis For Constructs Used In The Measurement Model. The Study Adopted Reflective Measurement Theory.

Indicates A Good Fit (Bagozzi And Yi, [17]), The Value Of CFI Is 0.877 Which Indicates A Reasonably Good Fit. The Standardized Root Mean Square Residual (SRMR) Value Of 0.036 Indicates A Good Fit As It Is Less Than 0.1(Hu And Bentler,[18]), The Root Mean Square Of Approximation (RMSEA) Is 0.067 Which Is Less Than Recommended Value Of 0.1 (Diamantopoulos And Siguaw[19]) Which Indicates A Reasonably Good Fit. All These Measures When Taken As-A-Whole Support The Acceptance Of Model.

The Construct Validity Was Assessed By Examining The Convergent, Discriminant Validity. Table-5 Indicates Standardized Factor Loadings (Standardized Regression Weights) With Squared Multiple Correlations. All Loadings Are Found To Be Significant. The Variance Extracted (VE) Among The Set Of Construct Items Is A Summary Indicator Of Convergence (Bhushi And Javalagi, [13]). The VE Values Were Found To Be 0.5 Or Higher For All The Constructs (Except PM) Which Suggest Adequate Convergence And Are Given In Table-5. The Minimum Construct Reliability Was Found To Be 0.67 Which Is Greater Than The Recommended Value Of 0.6 (Diamantopoulos And Siguaw, [19]) Which Indicates That The Measures Consistently Represent The Same Latent Construct. The Extent To Which A Construct Is Truly Distinct From Other Is The Indicator Of Discriminant Validity (Hair *Et.Al*., [12]). The Variance Extracted (VE) Percentages Must Be Greater Than The Square Of Correlation Estimates For Any Two Constructs (Dandagi, [20]).

Correlation Estimates Between Latent Construct And Squared Correlation Are Given In Table-6, It Can Be Inferred That Variance Extracted (VE) Of Latent Constructs Are Higher Than The Squared Correlation Estimates Indicating A Good Evidence Of Discriminant Validity.

Figure 1: Measurement Model Of ERP Implementation Using AMOS



4.2.4 ***Stage IV:*** **Measurement Validity Assessment**

Results Obtained Are Used For Assessment Of Measurement Validity. The Fit Indices For The Measurement Model Are Displayed In The Table-4.

Table 4: Fit Indices For The Measurement Model

Fit Index	Model
Chi – square (χ2**)**	713.50
d.f.	348
p	0.000
Chi-square/d.f.	2.050
GFI	0.834
CFI	0.877
AGFI	0.792
SRMR	0.036
RMSEA	0.067

Table 5: Standardized Factor Loadings, Variance Extracted, And ReliabilitEstimates.
(Values In The Bracket Indicate Squared Multiple Correlations)

Variable	**PIP**	**ES**	**PIS**	**OC**	**ARS**	**PM**	**RM**
Lit-2	0.84 *(0.70)*						
Pl-4	0.81 *(0.66)*						
Lit-1	0.61 *(0.37)*						
Pl-1	0.57 *(0.33)*						
Cv-1		0.81*(0.66)*					
Cv-2		0.67*(0.44)*					
Po-2			0.77 *(0.59)*				
Po-3			0.76*(0.57*)				
Po-5			0.74 *(0.54)*				
Po-4			0.58 *(0.33)*				
Cm-4				0.79 *(0.63)*			
Or-5				0.67 *(0.45)*			
Pt-1					0.77 *(0.60)*		
Ir-1					0.65*(0.42)*		
Cis-1						0.80 *(0.63)*	
Pt-3						0.68 *(0.47)*	
Pt-2						0.60 *(0.36)*	
Te-3						0.56 *(0.31)*	
Or-4							0.78 *(0.57)*
Lcm-2							0.75 *(0.56)*
Pmr-1							0.74 *(0.54)*
Lcm-1							0.72 *(0.52)*
Cm-2							0.69 *(0.47)*
Ec-2							0.68 *(0.43)*
Or-3							0.68*(0.46)*
Bpr-1							0.68 *(0.47)*
Cm-3							0.67 *(0.45)*
Ea-2							0.67 *(0.44)*
Ea-1							0.67 *(0.45)*
Variance Extracted	**0.52**	**0.55**	**0.51**	**0.54**	**0.51**	**0.45**	**0.5**
Construct Reliability	**0.71**	**0.8**	**0.7**	**0.67**	**0.76**	**0.76**	**0.91**

Reliabilty

4.3 Structural Model

A Conceptual Representation Of The Relationships Between The Constructs Is Known As Structural Theory. The Focus Is On The Relationship Between Latent Constructs In A Structural Model. The Structural Models Are Also Known By The Name Causal Models. The Application Of Structural Theory Lies In The Transition From Measurement Model To A Structural Model In Terms Of Relation Among The Constructs. The Causal Relationships Are Established In Stages V And VI.

4.3.1 *Stage V*: Specifying The Structural Model

Table 6: Correlations And Squared Correlations Among Constructs

			Correlations	**Squared correlations**
PIP	<-->	ES	0.597	0.356
PIP	<-->	PIS	0.618	0.381
PIP	<-->	OC	0.585	0.342
PIP	<-->	ARS	0.394	0.155
PIP	<-->	PM	0.457	0.208
PIP	<-->	RM	0.547	0.299
ES	<-->	PIS	0.572	0.327
ES	<-->	OC	0.548	0.300
ES	<-->	ARS	0.515	0.265
ES	<-->	PM	0.511	0.261
ES	<-->	RM	0.551	0.303
PIS	<-->	OC	0.603	0.364
PIS	<-->	ARS	0.535	0.286
PIS	<-->	PM	0.619	0.383
PIS	<-->	RM	0.578	0.334
OC	<-->	ARS	0.590	0.348
OC	<-->	PM	0.444	0.197
OC	<-->	RM	0.561	0.315
ARS	<-->	PM	0.717	0.514
ARS	<-->	RM	0.449	0.201
PM	<-->	RM	0.547	0.299

By Determining The Unit Of Analysis And Using The Path Diagram To Represent A Theory, The Structural Model Is Specified. Figure-2 Indicates The Conceptual Interrelations Between Latent Constructs Affecting Of ERP Implementation Management In Manufacturing And Service Industries Of North- Karnataka. Relationships Shown In The Path Diagram Are Derived From Researcher's Knowledge In The Field And Experts Such As Vendors, Consultants And Project Managers. AMOS 20.0 Graphical Interface Was Used To Draw The Hypothesized Paths Shown In Figure -2. The Model Was Run After Incorporating The Data Required.

4.3.2 *Stage VI:* Assessing The Structural Model Validity

The Structural Model, Shown In Figure-3, Can Now Be Estimated. The Main Objective Here Is To Improve This Framework Through Structural Model. The Model Specification Is Process Wherein Existing Model Is Modified To Rectify Incorrect Parameters Encountered In The Process Of Estimation Or Creation Of Competing Models For The Reason Of Comparison. In The Competing Model Strategy The Proposed Model Is Compared With A Number Of Alternative Models In Order To Demonstrate That No Better-Fitting Model Exists.

Model Comparison Is The Primary Concern For Conducting Specification Search. Table-9 Indicates The Ten Models That Were Generated By AMOS 20.0. The First Model With C/D.F Equal To 2.304 Is Considered To Be The Best One. In Order To Obtain A Better Fitting, More Parsimonious Model**,** Post Hoc Modification Were Carried Where In Few Paths Were Deleted And Some Error Items Were Included Based On Modification Index (MI) And Also Theoretical Relevance In The Respecified Model

Figure: 2 Conceptual Interactions Between Factors Of ERP Implementation Management

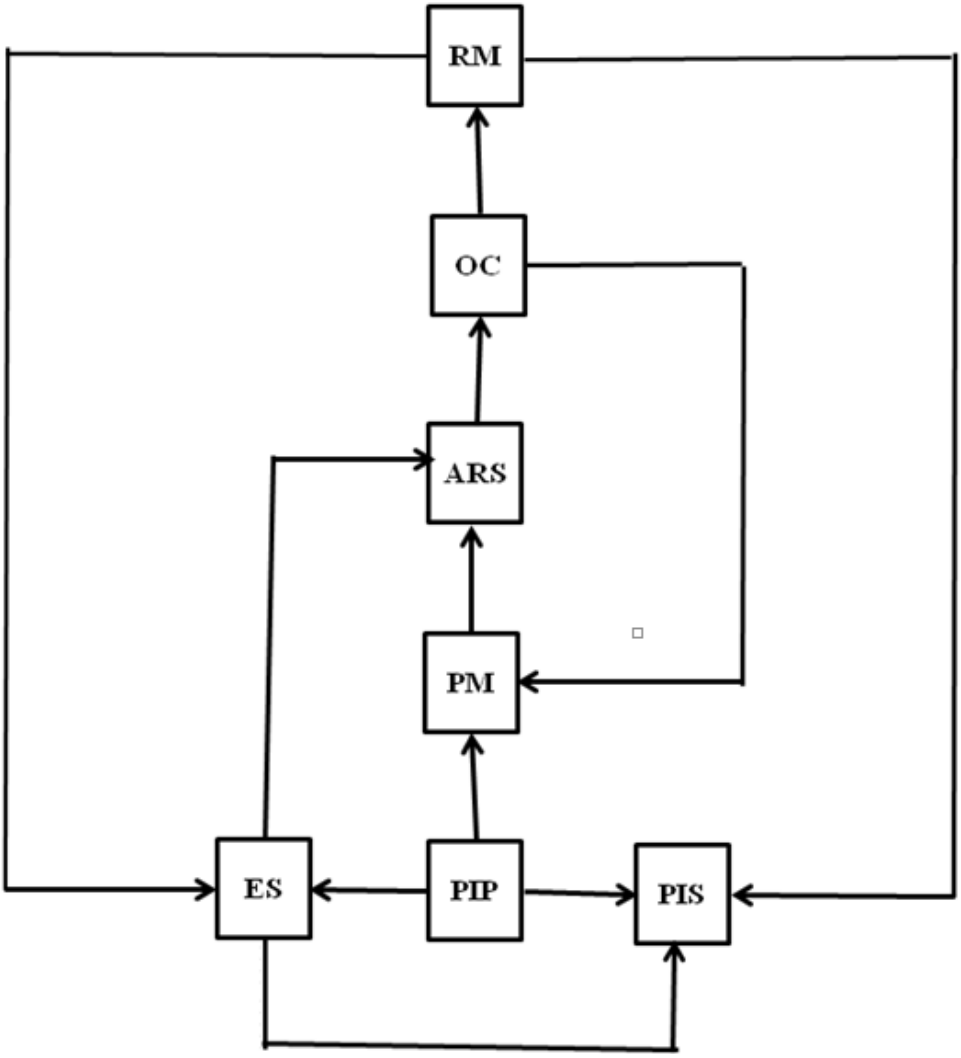


Figure 3: Structural Model Of ERP Implementation Management Using AMOS

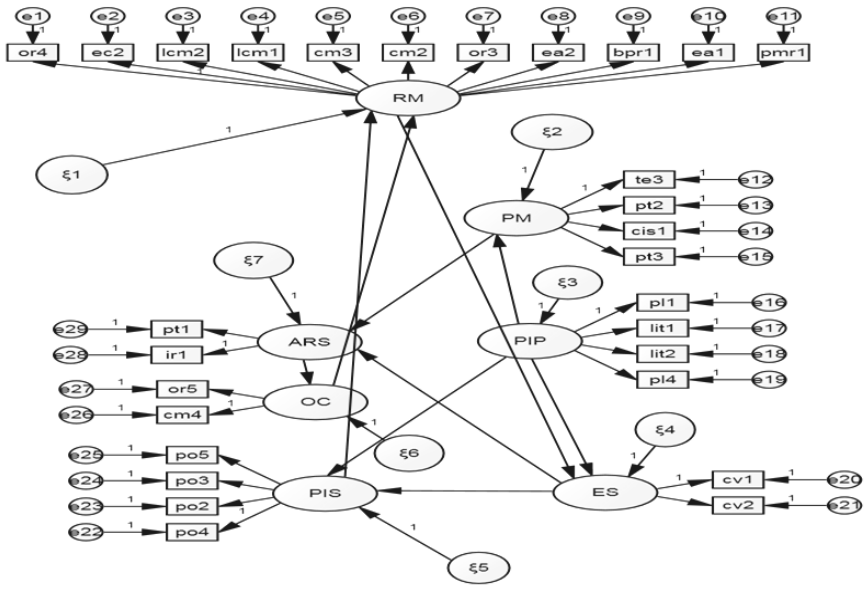
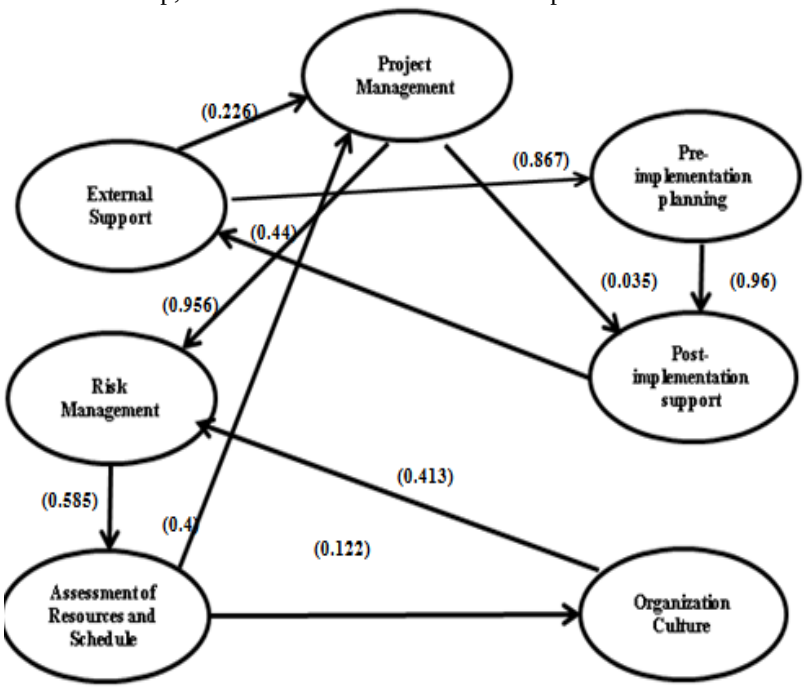


Table 8: Cause And Effect Between Dimensions With Significance

Cause	Direction of effect	Effect
ES	Positive (statistically not significant)	PM
PM	Positive (statistically not significant)	PIS
PIS	Positive (statistically significant)	ES
PIP	Positive (statistically significant)	PIS
ES	Positive (statistically significant)	PIP
PM	Positive (statistically significant)	RM
RM	Positive (statistically significant)	ARS
ARS	Positive (statistically significant)	PM
ARS	Positive (statistically not significant)	OC
OC	Positive (statistically significant)	RM

Figure 4: Structural Equation Model Of ERP Implementation Management. Arrows Depict Causal Relationship; Numbers Within The Brackets Represent Estimate



Model	Name	Parms	df	C	C-df	C/df	P
Sat	(Saturated)	435	0	0			
22	**Default model**	**79**	**356**	**820.219**	**464.219**	**2.304**	**0**
2	Default model	60	375	1256.413	881.473	3.351	0
3	Default model	61	374	1168.209	794.209	3.124	0
4	Default model	62	373	1070.123	697.023	2.869	0
5	Default model	63	372	966.636	594.043	2.597	0
6	Default model	64	371	864.404	495.404	2.335	0
7	Default model	65	370	860.373	490.377	2.325	0
8	Default model	66	369	853.281	484.281	2.312	0
9	Default model	67	368	848.825	480.285	2.307	0

Table 9: Specification Search Results

AMOS Augmented The Comprehension Of Interaction Of Parameters Affecting ERP Implementation In Manufacturing And Service Industries Of North-Karnataka. The Standardized Regression Weights And Critical Ratios Are Shown On The Holistic Structural Equation Model In Figure-4.

V. CONCLUSIONS

Running A Business On A Global Platform Is A Real Challenge For Firms Of Any Nature. Firms Around The World Are Sensing The Intensity And Pressure Of Performing Better In This Scenario. They Need To Take Care Of The Cost And Quality Of The Products Or Services And Innovate Themselves On A Continual Basis. They Can Only Be Able To Achieve This When They Adopt Tools That Gain Them Competitive Edge, So That They Can Realize The Benefits Of Profit, Sales, Customer Service, Productivity Etc. Adopting The Right ERP Package Will Help Them To Earn These Long Term Benefits, When ERP Is Implemented Judiciously And Tactfully. Focus Of The Paper Is On Developing An Empirical Framework To Assess The Causal Relationships Among The Factors That Were Obtained From Factor Analysis. This Framework Has Been Established Statistically With Respect To ERP Implementation Of Manufacturing And Service Industries Of North-Karnataka. Further The Causal Loops Obtained From SEM Can Be Used To Develop System Dynamic Model To Strategically Manage ERP Implementation In Manufacturing And Service Industries Of North-Karnataka.

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