Exploring interrelationship between three performance indicators with PMI's Nine Knowledge Areas for successful Project Management

Krishnaswamy N.[#1], Selvarasu A.[#2],

[#] *Department of Business Administration, Annamalai University*
Annamalai University, India

[1]iyernataraj@yahoo.co.in

[2]selvarasu.a.03989@annamalaiuniversity.ac.in

Abstract **- The performance output of software project management is an essential area of study as reflected in the earlier literatures of Management and organizational behaviour related studies. As a continuous improvement to the earlier existing knowledge contributed by Donna G. Thomas (2009), the present study has been attempted from mere identification of relationship between the performance indicators to project knowledge area of PMBOK®, to the exploration of the strength of relationship between and beyond the PI-KA, the input artifacts and performance output deliverable. A conceptual model has been proposed as Artifact (input)-Process-knowledge area-Performance indicator-Performance deliverable (Output) model (Krishnaswamy N. & Selvarasu A., 2014) for further exploration in the present study. The study has been designed with triangulation of researcher-respondent interactions among FSEs, Senior Project Managers (SPM) and Project Managers (PM) with focused discussion, experience survey and personal/online survey, respectively. The PLS-Regression and PLS-SEM data modelling tool has been employed to find the total effect of hypothetically proposed paths from Artifact-PKA-PI-Performance with and without moderators. The focus of the study is aimed at identifying the top three performance indicators and its interrelationship between PMI's nine knowledge areas.**

Keywords *- Artifact, Knowledge area, Performance indicator, Performance report, Performance acceptance, Mediator*

1. Introduction

The Project Management Professional (PMP) is the one who is able to accept a project or program or portfolio by applying their knowledge and processing from initiating, planning, executing, monitoring and closing successfully. The classical Project Manager gains the skill sets of managing a project through advisors and their own experiences. In a standardised business operations, *PMPs* have qualified themselves from Project Management Institute (PMI) with Project Management Body of Knowledge (PMBOK) and process groups (MM Carvalho & Rabechini Jr. 2011) with a PMP ID number for practice for instance the PMP ID number of the researcher is 505255 (2008). Senior Project Managers have been identified with very limited relationship with their PMI competence and their performances (Crawford, L., 2005). Project Managers have been deployed in a hierarchical structure, matrix structure and hybrid structure with advisor and advisee network of human resources. There are vertical and horizontal project managers groups in project management. In a matrix organizational structure, Project Managers are independent to apply changes. Project manager are encouraged to control over the change management processes. Project Manager has the complete control over the resources.

The Project Management Institute (PMI), was founded in 1969 as a non-profit association. The mission of the PMI involves the development of Standards and scientific improvement in relation to the project management area (Archibald & Prado, 2011). The Knowledge Areas defined by the PMBOK are: 1) Scope Management (SM) (5 process), 2) Time Management (TM) (6 process), 3) Cost Management (CoM) (3 process), 4) Quality Management (QM) (3 process); 5) Human Resource Management (HRM) (4 process), 6) Communication Management (CM) (5 process), 7) Risk Management (RM) (6 process); 8) Acquisition/Procurement Management (PM) (4 process), and 9) Project Management Integration (IM) (6 process). These areas of knowledge provide the base to the processes execution as verified in PMI (2008). The performance of Procurement Management has also been approached with Contract Maturity Management

Model (CMMM) as special tools to measure projects in public sector organization (Rendon, R. G., 2008). The process groups defined by PMBOK are: 1) Initiating (2 process), 2) Planning (20 process), 3) Executing (8 process), 4) Monitoring & controlling (10 process), and 5) Closing (2 process). These process groups are responsible for the grouping of forty-two processes established in the framework. In a cyclic approach, keeping the integration management knowledge area and other knowledge areas to support the Project Management theory, there emerges a Model Strategic Project Management (MEGP). The MEGP is divided into three parts: *Structure, Maturity and Competencies*. For Structure, divisions are considered as the Knowledge Areas viz., Procurement, Human Resources and Scope; for Maturity divisions are considered as the Knowledge Areas like Time, Risk & Communication, and, finally, for the Competencies division, the model is considered for the Knowledge Areas of Cost and Quality (MM Carvalho & Rabechini Jr., 2011).

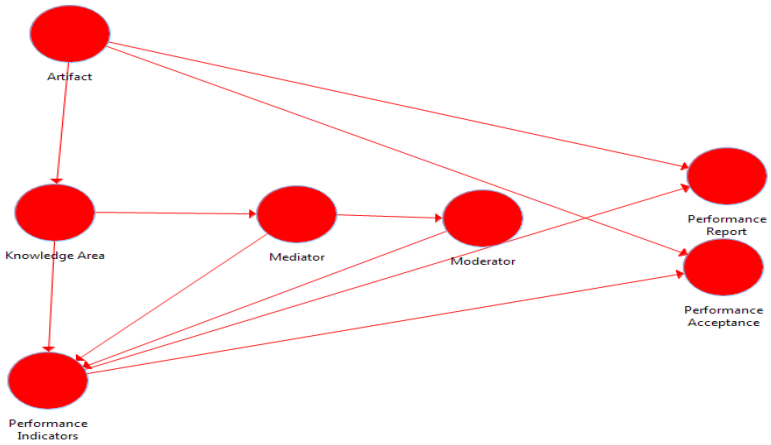
1.1 Theoretical framework and APPP-SEM conceptual map

The projects have been experienced by the researcher and his peers over a decade are, document manager, trade TI, Infomall, Web Bank, STS, B2BX, SCI, Wal-Green (retail), Wal-mart, Ac Nielsen, AT&T from the leading software companies viz., Scope International, Tata Consultancy Services, IBM, HP, etc. The performance review of the software projects have been done in a simple way to a complex procedure. The earlier research has shown that an attempt has been made to indicate the performance using indicator with respective knowledge areas. The initiation of software projects has been normally done with customer requirements as inputs in the form of artifact that has an influence upon the PMP's Process groups based knowledge areas (KA). The application of the expertise in the KAs have an influence on the project manager's' performance through performance indicators (PI) (Figure 1). It is true that the project managers have the highest drives from KAs through the mediators like of the project managers' PMP accreditation, age & experience as mediator1 that lead to further salary and time zone to performance. The possibilities to observe performance have four paths by starting directly from artifact to (A→P) as one possibility, Artifact→IM-KA→PIs to Performance (A→KA→PI→P) as another possibility, next jointly through Artifact→HRM-KA→Mediator1→PIs→Performance (A→HRM-KA→Mediator1→PIs→P) as third possibility, and Artifact→HRM-KA→Mediator1→Moderated Mediator2 as fourth possibility upon the performance (A→HRM-KA→Mediator1→Mediator2→PIs→P). As the researcher was able to distinguish the performance deliverable as status report and acceptance, there were eight paths established for the study.

The operational definition of the latent variables and constructs have been done for artifact, project charter, project plan, PMP, age, experience, accreditation, salary and time zone of PMP, in addition to the performance indicators like customer satisfaction, scope, schedule, within budget and traceability. The other operational definitions of PMI's knowledge areas such as integration, communication, human resource, scope, time, quality, procurement, cost and risk management along with performance deliverables such as performance reports/documents and plan acceptance for better understanding.

Donna G. (2009) has found out the corresponding knowledge areas for Scope-PI as SM, IM and HRM. In the present study for the same, there were three knowledge areas SM, CM and PM identified based on the opinion of FSEs. SM-KA was carried on par with the previous study. The earlier researcher has explored five KAs for Schedule-PI viz., IM, CM, RM and CoM. In the present study, the researcher has identified only one TM-KA for Schedule-PI. In the same way, for Traceability PI, in place of QM, SM has been included for the study and there was no common KA. Similarly for Within Budget-PI, in the earlier study, the corresponding KAs were CoM and PM. In the present study, CoM and HRM have been identified for WB-KPI and HRM-KA has replaced the PM-KA.

Figure 1. Theoretical Framework of Proposed APPP-SEM



1.2 Purpose of the study

The PMBOK has established standards and guidelines for project management in the possible ways of Knowledge Areas with ITTOs. There are several performance indicators laid down at every stage of input, tools & techniques and output. In order to achieve the desirable output of the project tasks, several performance indicators have also been introduced by PMI. However, all the measures of standards have not been adopted in a given project by successful managers. And, there are very limited performance measures and their tasks related to KAs have drawn upon the attention of the researcher to study the interrelationships between PIs and KAs in first place, artifacts, and performance deliverable in the second place. It is essential to understand the status of the studies in the earlier research reports in the following section.

2. Literature Review

The search words like software project, artifacts, knowledge areas, performance indicators, and deliverable performance in the search of the JSTOR, ProQuest, and Emerald electronic databases for standard journal have resulted to 1410 articles. About 173 articles have been chosen to the context and relevance of the proposed area of study and the results of the studies have been reviewed in this section. The uses of visual artifacts to represent time like "Gantt charts," that are widely used for scheduling, budgeting, and project management, are woven into the fabric of organizational life (Yakura, E., 2002). Revels, Ira. (2010) has emphasised that projects are temporal in nature with a start -to-end flow but at the end, products and services exist whereas the project team dismantled. Among the theories viz., self-justification theory, prospect theory, agency theory, and approach avoidance theory, the fourth theory provided the best classification of projects, correctly classifying over 70% of both escalated and non-escalated projects.

There are 52 factors found that are common for performance of the projects (composite factors, 11) to USA (17), Finland (21) and Hong Kong (14) cross cultural settings (Schmidt, R., Lyytinen, K., Keil, M., & Cule, P., 2001). The top three factors reported were (1) lack of top management commitment, (2) failure to gain user commitment, and (3) misunderstanding the requirements of the software projects using Delphi method among 41 panellists (19 USA; 9 Hongkong; 13 Finland). There exists support for the contingency model focusing a project's risk management profile that vary according to the project's risk exposure (Barki, H., Rivard, S., & Talbot, J., 2001). It was reported for the project budgets as the performance criterion, successful high-risk projects had high levels of internal integration, as well as high levels of formal planning and as quality as the performance criterion, successful high-risk projects had high levels of user participation (Barki, H., Rivard, S., & Talbot, J., 2001).

It has been confirmed that the association between notable practices of project planning and cross-functional teams consistently with project outcomes in terms of product quality, productivity, time to market, and customer satisfaction (Deephouse, C., Mukhopadhyay, T., Goldenson, D., & Kellner, M., 1995). The model has also been reported with rework as mediator of process, project characteristics upon performance. A matrix of four models viz., standardization of methods, standardization of performance criteria, decentralization of methods, and

decentralization of performance criteria based on the process and structure approaches of software project performance management have been established (Nidumolu, S., & Subramani, M., 2003). The staffing and cost/schedule trade-off choices of successor project managers, and comparison of them with the choices made by managers who run their projects from start to finish without interruption (Abdel-Hamid, T., Sengupta, K., & Swett, C., 1999) explained the scope of Project Management Professionals (PMP®). The outsourced projects began with relatively simple controls but often required significant additional controls after experiencing performance problems (Choudhury, V., & Sabherwal, R., 2003).

3. Methodology

The PMI's PMBOK® has established universally accepted standards and guidelines for individuals to become Project Management Professionals (PMP). Their certification has equipped them to practice professional competence in the initiation, planning, execution, monitoring & control and closing of a project in association with knowledge areas toward the performance of a successful project. It is evident that all the processes and tools & techniques have not been deployed in the process of completing the project. There is a behavioural change in the adoption of the expertise to practice project management depending on the nature of the project. There is a perceptual difference in the adoption of the project knowledge expertise therefore; a qualitative study has been adopted in the present study. The perceptual study in the form of exploratory research design with a mixed model approach has been adopted.

3.1 Research Gap

The performance of projects depends on the Project Management Team lead by Project Management Professionals. The Professionals are of two major categories viz., Classical Project Manager and PMI accredited Project Manager especially in software projects. The basic structure of Projects have been promised with certain specific performance indicators (PIs) that set the project deliverable. The PMBOK provides the process functions spread across the Knowledge areas (KAs). The performance of deliverable is certain and it is possible to satisfy the customer only when the process is structured with an existing relationship between PIs and KAs. It has been established by Donna G.T. (2009) as an exploratory study outcome. The present study has been attempted to explore the strength of interrelationship between PIs and KAs. As the previous study focused on the process aspects of project, the present study has been also attempted to connect the artifacts and deliverables that are part and parcel of the process outcome.

3.2 Research Questions

The responses have been recorded as weak, moderate to substantially strong relations between artifacts-process-indicators-deliverables in finding answers to the following research questions:

1. *How do successful Project Managers perceive as the relatedness of the artifacts, mediators and moderators as the process flow for IM and HRM Knowledge Areas?*
2. *How do Project Managers rank the top three performance indicators from five PIs identified by field status experts?*
3. *How do the top three performance indicators relate to PMI's nine knowledge areas when it comes to successful completion of the project?*
4. *How do the top three PIs influence the performance deliverable for the successful project management?*

3.3 Objectives of the study

The following four objectives proposed for the study to find answers to the research question and hypothesis emerged out of the study.

1. *To study the perception of successful Project Managers in relation to artefacts, mediators and moderators as the process flow for IM and HRM Knowledge Areas.*
2. *To ascertain the top three performance indicators from five PIs established by field status experts of projects.*
3. *To establish the strength of relationship between the top three performance measures and the PMI's nine knowledge areas for successful completion of the project.*
4. *To propose the mixed model of Artifact-process-performance indicator-performance deliverable (APPP) towards promotion of successful project management.*

3.4 Propositions

There are about four path structures of variances from artifacts through knowledge areas, moderator, mediator and performance indicators to each of the performance deliverable like status report and

acceptance. In addition, there are other ***18 relational hypotheses*** have been proposed in line with the research questions that are tested for its strength of relationships between variables.

$1H_0$: There is statistically significant total effect relationship between KA-CM endogenous and CS performance indicator (CM→CS)

$2H_0$: There is statistically significant total effect relationship between KA-CoM, endogenous and Within Budget Performance indicator (CoM→WB)

$3H_0$: There is statistically significant total effect relationship between KA-HRM endogenous and CS performance indicator (HRM→CS)

$4H_0$: There is statistically significant total effect relationship between Mediator endogenous and HRM-KA (HRM →Mediator1)

$5H_0$: There is statistically significant total effect relationship between Mediator endogenous and Scope performance indicator (Mediator1→Scope)

$6H_0$: There is statistically significant total effect relationship between Moderator exogenous and mediator endogenous constructs (Moderated Mediator→Mediator1)

$7H_0$: There is statistically significant total effect relationship moderator exogenous and HRM-KA (HRM→Moderated Mediator)

$8H_0$: There is statistically significant total effect relationship between moderated mediator endogenous and Scope performance indicator (Moderated Mediator→Scope)

$9H_0$: There is statistically significant total effect relationship between PM-KA and CS endogenous PI (PM→CS)

$10H_0$: There is statistically significant total effect relationship between RM-KA and scope PI (RM→Scope)

$11H_0$: There is statistically significant total effect relationship between SM-KA and P2 Acceptance of performance deliverable (SM→P2 Acceptance)

$12H_0$: There is statistically significant total effect relationship between SM-KA and Scope PI (SM→Scope)

$13H_0$: There is statistically significant total effect relationship between SM-KA and Traceability PI (SM→Traceability)

$14H_0$: There is statistically significant total effect relationship between Schedule PI and P1 Reports (Schedule→P1 Reports)

$15H_0$: There is statistically significant total effect relationship between Scope PI and P2 Acceptance (Scope→P2 Acceptance)

$16H_0$: There is statistically significant total effect relationship between TM-KA and P1 Reports (TM→P1 Reports)

$17H_0$: There is statistically significant total effect relationship between TM-KA and Schedule PI (TM→Schedule)

$18H_0$: There is statistically significant total effect relationship between Traceability and P2 Acceptance (Traceability→P2 Acceptance)

3.5 Research Design

The exploratory design of research in the form of experience survey and focused interview with Field Status Experts in addition to field survey among practicing Project Managers has been adopted as *triangulation* in the research study. In order to keep control over the *biased* opinion of the FSE, the researcher has included five men and four women on one side and classical and accredited project managers on the other from three different Indian religions prevailing in the workplace. Three different *instruments* have been prepared and administered for the purpose of data collection. The research is a continuation of work from Donna G. T. (2009) to an advancement of finding the interrelationships between the key variables. Based on the outcome of the excerpts, the study has advanced from the previous study in the form of value addition with artifacts and deliverable as part of input-process-performance indicators-performance. There are 23 variables that have interrelationship among PGs, KAs and PIs termed as processes. In addition to this, there are two input variable and five outputs included in the study as artifacts and deliverables, respectively.

3.6 Research Approach

A mixed model approach of combining reflective and formative model has been done. Initially the model has been tested for formative approach and the constructs have been formed in the relative structure. In the second stage, the Knowledge area constructs have been formatted as absolute constructs to reflect the project manager's' perception. As in the second stage there was a combined form of constructs used also for performance deliverable, the study has been confirmed as mixed approach though exploratory research.

The model has been maintained in the form of *formative*, with arrows going from the indicators to the latent variable, measurement path weights are based on *regression* of the latent variable on its indicator. On the response side, PLS has been applied to the set of metric independent variables such as two artifacts, nine knowledge areas, five performance indicators to three metric dependent (response) performance deliverable with three mediators (age, experience and accreditation) and two moderated mediator (salary and time zones). PLS has been employed as a technique most suitable

where the research purpose is exploratory modelling. Hinseler, Ringle, and Sinkovics (2009: 282) thus stated, "PLS path modelling is recommended in an early stage of theoretical development in order to test and validate exploratory models." Albers, 2009, cites PLS as the method of choice in success factors marketing research), and the social sciences (ex., Jacobs et al., 2011). The arrows connecting the components to their indicators have been maintained as formative modelling as the study is exploratory in nature. Partial least squares (PLS) analysis is an alternative to OLS regression, canonical correlation, or covariance-based structural equation modelling (SEM) of systems of independent and response variables. In fact, PLS is sometimes called "composite-based SEM", "component-based SEM", or "variance-based SEM", in contrast to "covariance-based SEM," which is the usual type (e.g., implemented by Amos, SAS, Stata, MPlus, LISREL, EQS and other major software packages).

3.7 Target Population

PMI Chennai chapter has three executive members and 15 special privileged distinguished members across in and around among nine chapters in India. There are about 67 corporate members, 1310 individual members. In addition there are two State and Central Government members from Ministry of Shipping and Road Transports. These members have both classical and PMP accreditation. There is an exclusive PMI certified PMP members represented association to cater to the needs of academic, training and special event for the benefit of members. The total population of the study include both classical and PMP accredited project managers in one of the chapters in India, the Chennai zone.

3.8 Sampling procedure

The size of the sample of nine Field Status Experts has been planned for the purpose of conducting focused Interviews. In the second stage, 36 Senior Project Managers at the level of Vice President from Software companies with PMP Accreditation and PMs with Classical exposure have been included. There were about 360 Junior Project Managers have been planned for the purpose of personal field survey and online survey. In the case of Senior Project Managers, 43 of them have responded in place of our required number of 36 and 302 Project Managers have been approached in place of 360 planned, and in the final stage the researcher has managed to impute to a total of 674 from 354 Project Managers for the purpose of obtaining the goodness of fit of the model and in total the sample size of all the Project Managers put together was 674 including the FSEs and SPMs.

3.9 Description of the measuring instruments

The study has been done by conducting interview with field study expert (FSE), and experience survey have been done with open ended questions in addition to field survey both online and face to face semi-structured instrument for practicing successful Project Managers. The opinion of the FSE have been sought to identify the Process Groups, Knowledge Areas and Key Performance Indicators, in addition to the input and output variables as per PMBOK 4th Edition Guideline. Demographics and reflections on the knowledge areas and performance indicators as process have also been included in the scale of measurement. The instrument has been constructed with two artifacts such as Project charter (A1) and Project plan (A2) with two mediators (age, experience and accreditation) and mediator2 (Salary and Time zone) as input independent variables.

As part of the process, five performance latent variables with number of constructs in bracket are given viz., customer satisfaction (CS-5), scope (S-5), schedule (Sc-5), within budget (WB-6)) and traceability (T-2) on one side and knowledge areas viz., integration, (IM-2), communication (CM-2), human relation (HRM-2), procurement (PM-1), quality (QM-1), scope (SM-3), risk (RM-3), cost (CoM-4) and time (TM-5) management have been included. There are two performance output variables constructed as report documents (P1-2) and acceptance plan (P2-3). The measure has been done with the interrelation of variables on the successful performance of the software project management from weak (1) to strong (10) at ten points scale. The constructs has been maintained with two dimensions as performance indicator of project management and knowledge areas as grouping and regrouping for the purpose of data analysis by indicating the codes of indicator number and knowledge area number of constructs. The face validity, criterion validity, discriminant validity have been tested at the pilot study along with composite validity using PLS-SEM analysis tool.

3.10 Data collection Procedure

The Field Status Experts (FSEs) have been contacted in person in the places of the senior retired Vice-President of Projects with a view to understand the flow of a successful project management. The confirmation on the variables identified and the research proposal has been confirmed from nine FSEs in the Chennai region of software projects. In the

second stage the experience survey has been conducted among 43 Senior Project Managers spread across religion, gender diversity and experiences with ten set of open ended questions covering the artifacts, age, experience, salary, accreditation, time zone in addition to the scope of the probable knowledge areas, performance indicators with performance output.

As a last stage of data collections for about 354 Junior Project Manager have been chosen from PMI chapter membership for the purpose of data collection. The personal field survey and online survey has been done with Google form and Surveymonkey.com. Among the respondents who are contacted, about 5 percent of the respondents have been found with incomplete responses. In order to treat the data with missing value analysis has been done to replace few of the unfilled columns in the data instruments. It is about 302 Project Managers data in addition to 9 FSEs and 43 SPMs have been considered for further data screening and analysis.

3.11 Limitations of the study

The Project management domain as such is a global phenomena and the present study is done at the destination known for outsourcing for specific advantage. The coverage of the target population has limited to the volunteer PMPs and Project managing professionals. The challenge is to get the data in a formal way rather researcher has tried their best to approach data in both online and personal front. The data handling has become more mechanical than a smooth process. As the present study is again exploratory in nature and therefore it gives lot of room for standardization of the research components.

Table 1. Mapping of Artifacts -Process KPI - Process KA -Performance (APPP) constructs

ARTEFACT	PROCESS			PERFORMANCE DELIVERABLE
	KPI	Construct of Measuring Scale	KA	
A1. Project Charter *A2. Project Plan* *Mediators* Me1. Age Me2. Experience Me3. Accreditation *Moderators* Mo1. Salary Mo2. Time zone	CS	CS1IM1: Change control	IM1	*P1CM3: Status Report* *P1TM6: WBS* P2CM4: Performance Report P2CM5: Acceptance Plan P2SM4: Business Test case
		CS2CM1: Information distribution	CM1	
		CS3HRM1: Carrying out corrections	HR M1	
		CS4PM1: Settling project and contract	PM1	
		CS5QM1: Complying with quality standards	QM1	
	S	*S1SM1: Control over the new changes*	*SM1*	
		S2CM2: Confirming the acceptance	*CM2*	
		S3RM1: Decision on feasible approach	*RM1*	
		S4RM2: Determining the project risk	*RM2*	
		S5RM3: Tracking the identified risk	*RM3*	
	WB	WB1IM2: Updating project plan	IM2	
		WB2CoM1: Resource Estimating cost	CoM 1	
		WB3CoM2: Establishing a cost baseline	CoM 2	
		WB4CoM3: Maintaining a cost control	CoM 3	
		WB5CoM4: Cost variances and change controls	CoM 4	
		WB6HRM2: Enhancing the project performance	HR M2	

	Sc	*Sc1TM1: Type and quantities of resources*	*TM1*	
		Sc2TM2: Schedule Performance	*TM2*	
		Sc3TM3: Activity scheduling	*TM3*	
		Sc4TM4: Duration of Schedule	*TM4*	
		Sc5TM5: Cost variances and change controls	*TM5*	
	T	T1SM2: Project scope statement	SM2	
		T2SM3: Validating the traceability matrix	SM3	

3.12 Pilot Study

Field Status Experts (FSE) verification has been done to explore the relationship between KPI and KAs in line with previous study. There are observed differences in the knowledge areas with respect to Performance indicators. The study has started by studying the effects of knowledge areas, process groups and process according to PMBOK prescribed by PMI. In the earlier literature, the identification of the KPIs and KAs has been done. Subsequently, the interrelationship between KPIs and the KAs in accordance with the Process groups has been included for the present study. By eliminating, the process which is not highly correlated with KPIs and KAs as per FSEs, the research study has been conducted by exploring the strength of relationship as weak to strong. The initial output of PLS-SEM for 43 respondents has been verified for the preliminary understanding. The thickness of the line of paths indicated relative strength of relationship between the latent variables.

Preliminary to applying the PLS algorithm, the measured indicator variables are normalized to have a mean of 0 and a standard deviation of 1. The checking for convergence has reached at 74th iteration for the coefficients in performance output. Among the three performance outputs, production of performance reports has the highest r^2 value of 0.818 with a path closest to relative 1 being the strongest, for the second performance output of accepting plan of confirmation has r2 value of 0.536. The second level of independent endogenous variable of customer satisfaction has the highest r^2 value of 0.983; the scope has the r2 of 0.922 and the schedule as well as within budget performance indicators has almost negligible r^2 values. The first level of independent endogenous variable of PMI's knowledge areas (KA), HRM has the highest r2 value of 0.596, IM has the r2 value of 0.536 and other seven KAs have been observed with less significant r2 values. Similarly the mediator as endogenous variable has the r2 value of 0.662.

The path from customer satisfaction performance indicator to the performance acceptance latent variable has the regression coefficient weights of 0.517 and the path from schedule to the performance report has regression weight of 0.578 with value middle to relative 1 reflected the moderate strong paths. Similarly, the path from IM-KA to within-budget performance indicator has been observed with the regression weight of 0.756 and the path from RM-KA to scope-PI has the weight of 0.701 showing the relative reference value 1 reflecting the strongest paths.

The path from artifacts of exogenous variable that has been observed with r^2 value of 0.535, have been identified with a path regression weight of 0.700 to IM-KA. In the same way, considering the path from artifact to the performance output of business test case (r^2=0.251) has been observed to have very less regression weights. The path regression weight between the mediator1 to mediator2 is 0.813 and the extended path from HRM-KA to mediator is 0.690.

In this study, only the producing status report as an endogenous variable the R-square value is 0.816, meaning that about 81.6% of the variance in the performance output of reports is explained by the model (that is, jointly by artifacts, KAs and PIs). Similarly, confirming the performance acceptance has been observed with its variance explained by about 50% and the extent of variance explained for the performance of business test case is only about 6%.

3.13 Data screening

Data screening has been done for the sample with representation of location as first priority and industry sector based software project at the second level (Mac Jackson McMullen, 2015). 9 FSEs, have been contacted in person, and out of 43 Senior Managers 27 of them have been contacted in person and others have been

contacted firstly over telecom and the data collected by mail and email. In addition, 302 Managers have been contacted both partially, telecom, mail and online. In almost all the cases the missing data have been transformed with the median value of the responses. The sectors included in the proportion of banking (48%), financial services 26.9% and others like retailing, capital market, education, insurance, airlines and telecom are well <10% with a missing value of 3%. This has been maintained as more number of projects is with banking and financial services as more peers of the researchers have been included in the study. The study has been ensured with equal participation in three age groups from <34 years to >45 years with experiences of within <8 year. It has been attempted to maintain at least one third of them from PMP accreditation as they are reluctant to participate in the survey due to the policy of Human Resource Department of Multinational companies and the sensitivity of the type of the projects handled by them. The time zone indicated by the respondents has shown that almost co-located and both virtual-colocated have equal proportions than mere virtual projects.

4. Data Analysis

PLS-SEM has been adopted to explore from the formative model to mixed model of APPP-SEM to study the interrelationships between KAs and PIs by involving artifacts and performance deliverable. Face validity and convergent validity have been verified with the standardized path loading coefficient for the structural arrow from the factors (Chin, 1998) against the suggested cut-off of .90 or at least .80. This implies that the R-squared value for the formative factor remained within 0.81 or at least 0.64.

4.1 First stage of analysis of FSE's Data

Results were presented based on the confirmation of indicators by Field status Experts who represent the software industry. There were about nine FSEs identified at the regional level (Chennai &Bangalore) from India. The constructs rated from the collection of PMBOK standard process, 23 indicators relating to the performance indicators and equally 23 indicators relating to knowledge areas have been analyzed. In addition, from the bank of ITTOs collection, two artifacts and five performance deliverable have been identified by the experts. The choices of measuring scale have been provided to them from Likert scale of agreement, importance, weak-strong, rating, and semantic scale. The attitudinal strength of the measuring scale has been introduced with a range of 1 through 10, bearing the perceptual difference of weak through strong.

The initial result of the data analysis have indicated that the relationships at varying degree between indicators. PLS-Regression has been used to verify the strength of the relationship and it is noted that there is observable results of regression weights and outer loadings. The goodness of fit was not available as there are very few cases to test the fitness of the model. In the first stage of analysis, there were only two exogenous variable maintained to find out the other possible variables in the model.

4.2 Second stage of Data analysis among Senior Project Managers

There were only 36 Senior Manager were originally planned to approach and the researcher has made it possible to reach 43 respondents for the experience survey excluding the opinion of the FSEs. The data has been screened to test the good of fit of the model. The results indicated that there are five exogenous variables found which were initially endogenous based on the fitting of the proposed model. However the goodness of fit was not available for the model at this stage of analysis.

4.3 Third stage of Data analysis

There were about 360 Project Managers planned for the purpose of approaching on the field and online survey. There were about 302 responded to the study with positive responses. However the goodness of fit of the model was not available. Further, the researcher has imputed the data to 674 for the purpose of verifying the fit of the model and the NFI has been obtained as above 0.254.

4.4 Normality assessment

The measurement scale used as similar to Likert scale as weak to strong measure of relationship for the successful project management. Applying the interval scale procedure is appropriate when the focus is on the interval less than the labels (Allen & Seaman, 2007). As establishing the normality for interval points, have been done even though it is meant for continuous variables. Using PLS-SEM, the Indicator reliability is interpreted as the square of the measurement loading (Hair et al., 2014: 103). The square of the measurement loadings of project charter (0.497) and project plan (0.466) on artifact has been recorded at n=674 and the outer eight of project plan on artifact was 0.738 but for project charter was only 0.149. The age has the loadings measurement square of 0.591 on the mediator, the

construct confirm-acceptance on communication has the square of loadings 0.619, the experience construct on the mediator has the square of loadings 0.834, the granulation on project reports was 0.821, validating WBS on scope management was 0.564, salary on moderator was 0.931, performance-schedule on schedule was 0.771, optimizing-duration on schedule was 0.852, validating WBS on traceability was 0.604 and optimizing duration on time management was 0.869. All the above 11 constructs viz., project-charter, project-plan, age, confirm-acceptance, experience, change-control, status-report, granulation-wbs, validating-wbs, salary, perform-schedule, optimization-duration, on the respective nine (9) latent variables such as artifact, CM, IM, , SM, TM, mediator, moderator, Schedule, Traceability and P1-reports have been found reliable as per the square measurement of loadings. However, the deal of fit of the measurement (outer) model when factors are modelled formatively, the composite reliability varies from 0 to 1, with 1 being perfect estimated reliability. There were *six latent variables have been identified as fit with the composite reliability viz., the mediator, SM, TM, CS, Traceability, P1-reports and P2-acceptance.* Even then, the CS at the sample size of 674 and SM at the size of 43 have been found the p values that are not significant and as a result there are only four latent variables found reliability test passed.

Table 2. Composite Reliability

Composite Reliability	**T Statistics (|O/STDEV|)**	**P Values**
CS	0.503	0.615
Mediator	107.270	0.000
P1 Reports	64.005	0.000
P2 Acceptance	83.371	0.000
SM	188.592	0.000
TM	345.387	0.000
Traceability	189.899	0.000

Figure 2. Composite Reliability

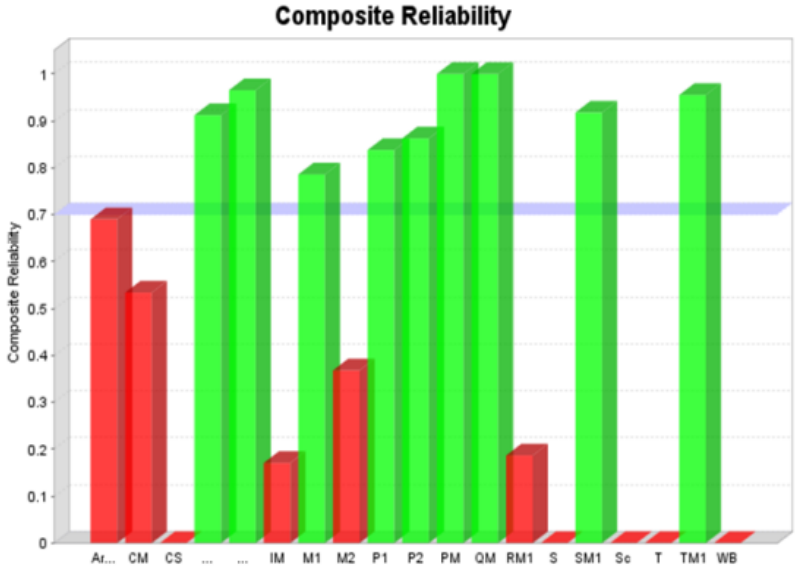
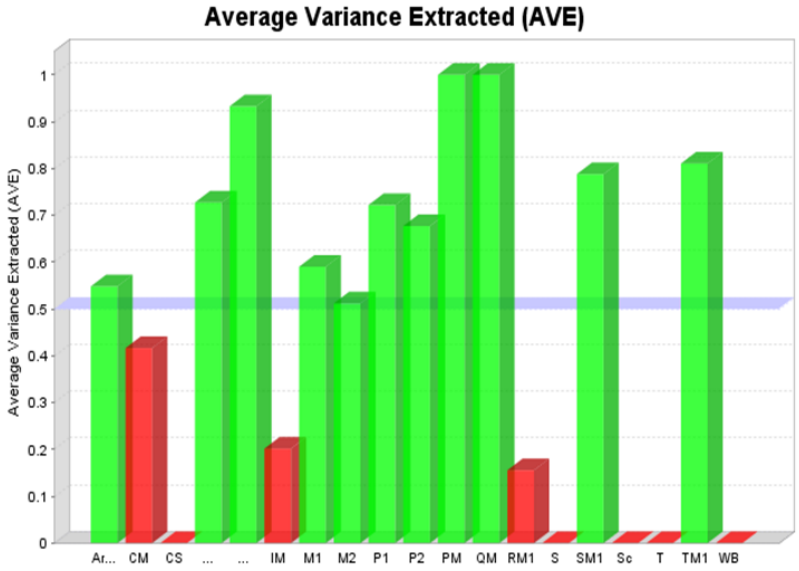


Figure 3. Average Variance Extracted (AVE)



The Average variance extracted (AVE) AVE has been used as a test of both convergent and divergent validity. In an adequate model, *AVE should be greater than .5* (Chin, 1998; Höck & Ringle, 2006: 15) as well as greater than the cross-loadings, which means factors explain at least half the variance of their respective indicators. AVE below .50 means error variance exceeds explained variance. At the level of sample size n=674, the latent variables viz., mediator (0.588 >0.50 for age, experience, accreditation), moderator (0.506 >0.50 for salary and time zone), Performance reports (0.720>0.50) (Status report and granulation of work breakdown structure), Performance acceptance (0.675>0.50), Scope Management (0.787>0.50), Time Management (0.810>0.50) and Traceability (0.880>0.50) have been identified with adequate AVE. The same variable at the pilot study (n=43), has resulted with four similar latent variables, mediator (0.580 >0.50 for age, experience, accreditation), moderator (0.545 >0.50 for salary and time zone), Performance reports (0.656>0.50) (Status report and granulation of work breakdown structure), Scope Management (0.497<0.50), and Traceability (0.584>0.50).

The standardized root mean square residual (SRMR) SRMR is a measure of approximate fit of the researcher's model. It measures the difference between the observed correlation matrix and the model-implied correlation matrix. By convention, a model has good fit when SRMR is less than .08 (Hu & Bentler, 1998). The present APPP model study has indicated SRMR of 0.062<0.08 (Saturated) and 0.067<0.08 (Estimated) sample mean value with significant p value of 0.000, therefore the approximate fit of the model has been established with the normality assessment.

Table 3. Average Variance Extracted (AVE)

Average Variance Extracted (AVE)	T Statistics (|O/STDEV|)	P Value N=674	T Statistics (|O/STDEV|)	P Values N=43
>0.50, Adequate				
Artifact				
CS	23.676	0.000	6.817	0.000
Mediator	96.915	0.000	14.255	0.000
Moderator	73.402	0.000	10.102	0.000
P1 Reports	38.680	0.000	9.064	0.000
P2 Acceptance	36.018	0.000	4.988	0.000
SM	74.320	0.000	7.579	0.000
Schedule	9.958	0.000	12.951	0.000
Scope	13.168	0.000	5.572	0.000
TM	82.311	0.000	11.398	0.000
Traceability	101.124	0.000	8.754	0.000
WB	26.171	0.000	9.505	0.000

Table 4. Standardized Root Mean square Residual (SRMR)

SRMR n=674	T Statistics (|O/STDEV|)	P Values
Saturated Model	55.244	0.000
Estimated Model	65.023	0.000

4.5 Multicollinearity assessment

Multicollinearity may be a problem if tolerance is less than 0.20 or if the variance inflation factor (VIF) exceeds 5. Some researchers used the more stringent cut-off values of 0.25 and 4, respectively. VIF is the inverse of tolerance and contains the same information (tolerance < 0.20 corresponds to VIF > 5), so only one of these tests is applied. The factors that are having tolerance limit of <0.25 and VIF <5 are, traceability, schedule and mediator, the next tolerance limit of <0.3 and VIF <5 are, customer satisfaction, scope and

Performance report. The other factors that are found to have tolerance >3.0 are, Communication Management, Integration Management, Human Resource Management, Performance-Acceptance, Risk Management and Scope Management.

4.6 Indicator collinearity assessment

The Cronbach's alpha has been computed in addition to the AVE measure of the indicators. The Performance report, performance acceptance, traceability, Time management, and Scope management have been identified with alpha value of above 0.60 and all other indicators have alpha value less than the desired value. Further, cross-loadings are a good for a model when indicators load well on their intended factors and also cross-loadings with other factors. The cross loadings have also been verified for 0.3 and loading on the same factor at 0.60 for all the 19 latent variables included in the APPP model. It has been found that for 18 variables the cross loadings have been extracted except TM. The artifact has the cross loadings above 0.30 with complying-quality, experience, PMP-Accreditation, confirm-acceptance, salary, perform-schedule, optimize-duration, estimate cost, limit-cost-variance, and enhancing performance. Likewise, all the other latent variables have been verified for the cross loadings value of 0.30 and presented in the table (Henseler, Ringle & Sarstedt, 2015). In a APPP-fitting model, 60 heterotrait correlations found smaller than monotrait correlations.

Figure 4. Cronbach's Alpha

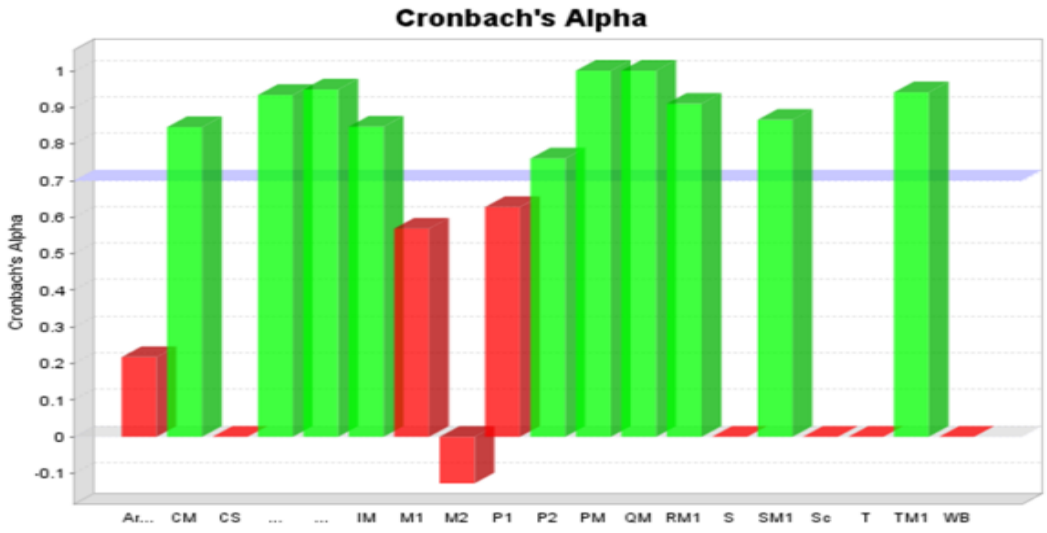
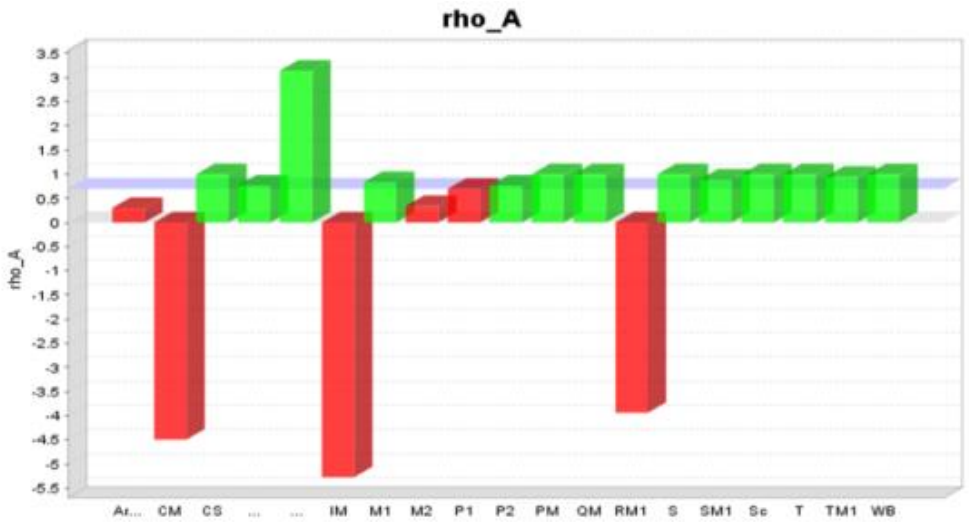


Figure 5. rho_A



4.7 Test of hypothesis total effect due to interrelationships

The study on the APPP model testing has been measured from substantive strength through moderate strength and to weak relationship between the desired variable of measures. In order to test the hypothetical relationships, bootstrapping has been done for the model. The results of the interrelationship with the test of significance have been reported for the purpose of better understanding. The test of multicollinearity has been observed in order to verify the relative strength of the indicators and predictors.

Figure 6. R Square Adjusted

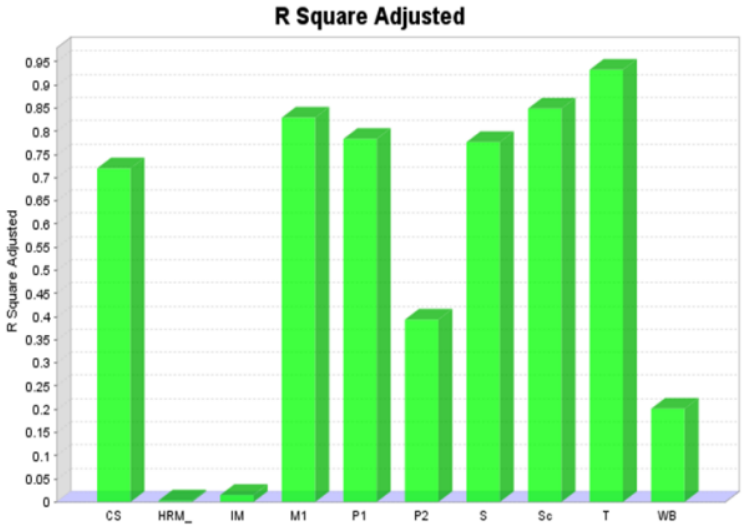
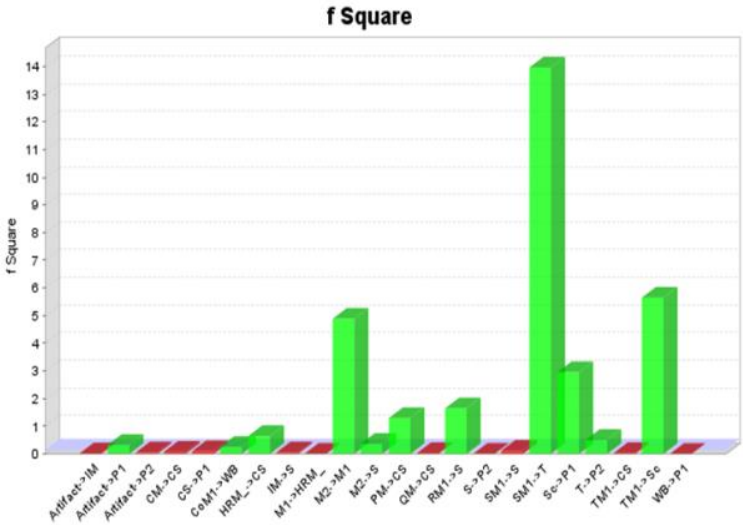


Figure 7. f Square

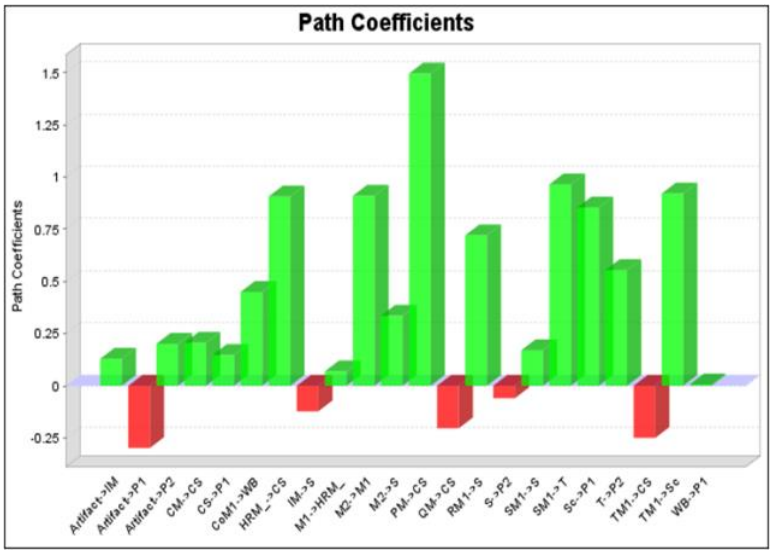


The relationship between the performance deliverable and performance indicators

The relationship between schedule and performance status report (Sc→PSR) has been observed with a strong results whereas the traceability to performance acceptance (T→PA) has been noted as having strong relationships. The performance indicators have viz., customer satisfaction, schedule on performance status report (CS→PSR; Sc→PSR) have shown good results as that of scope to acceptance (S→PA) almost equal strength of relationships.

It was found that among 22 different combinations of path relationships, 17 paths have reflected positive relationship at varied strengths. There are about five interrelationships have also found with negative effect from A→P1, IM→S, QM→CS; S→P2; TM→CS.

Figure 8. Path Coefficients



The interrelationship between HRM-KA to mediator1 was weaker than the relationship between mediator 1 and mediator 2 which was stronger. Similarly the relationship of communication and Human resource management-KA has thinner relationships. It was found that the path emanating from artifact to IM, Performance acceptance, traceability and within budget are having significant total effect statistically at 95% level of confidence and also at 5% level of significance. Similarly the path emanating from mediator 1 & 2 have significant relationships between variables HRM, IM, Performance report, WB, CM and IM latent variables. The CM, PM, QM and IM have positive significant relationship with customer satisfaction and performance report. Similarly, SM, RM and TM were found to have relationship significantly with scope, WB and schedule, respectively.

5. Results and Discussion

The results of the study have been presented as discussion with the perspectives of the objectives of the study.

5.1 Objective#1: Relationships of the artifact, IM and HRM-KA, Mediators with Top three PIs

The results of the study indicated that traceability, schedule and scope have been found as top three performance indicators. It was further confirmed that the relationship between artifact→IM-KA→SCPE-PI have positive relationship. It was further inferred that the introduction of mediator as an indirect effect have also proved to be having positive relationship from artifact to performance indicator through the mediators.

5.2 Objective#2: Top three performance indicators

As the study is aimed at identifying the top three performance indications based on the responses of projects managers, customer satisfaction (Rank I) has been ranked as the top indicator among 44.2% of the responses, whereas the second best indicators were within budget and scope (Rank II) equally at 25.6% each. The third indicator has been ranked by 41.9% of the responses for Schedule (Rank III). Similarly, it has been drawn from the model fit with R square, Adjusted R Square and F square values that were due to the interrelationship Traceability (1^{st}) placed as top indicator, Schedule (2^{nd}) have been found as the second priority as well as the scope (3^{rd}) has been placed at the third indicator of performance.

There is observable difference in the identification of the top three indicators based on the ranking of the responses and the ranking based on the fit of the model. The results are found to vary due to the interrelationship between endogenous and exogenous variables. It has also been tested for the influence and effect of moderators and mediators along with artifacts.

5.3 Objective#3: Identification of the key Knowledge areas (KA)

The Integration Management-KA, Human Resource Management-KA, Scope Management-KA and Communication Management-KA have been traced based on the regression weights. The performance deliverable has been identified with a regression value of R^2=0.396 for performance acceptance and R^2=0.783 for performance status report as deliverable twice as that of performance acceptance. In other words, 39.6% of the variances are due to the influence of the performance indicators have been reported for performance acceptance it was 78.3% for performance status report as deliverable. The procurement management (PM-KA) to customer satisfaction-PI line of the PM→CS path is thicker than any other relationships in the model. Scope Management to Traceability (SM→T), Risk Management to scope (RM→S), Time Management to Schedule (TM→Sc) and communication management to within budget (CM→WB) has an observable strength of relationships by the indication of the thickness of the line of the paths in the model.

5.4 Objective#4: Effect of APPP-SEM Paths on performance status report &acceptance

The results of the four paths ideally reflecting the strength of relationships have been presented as; (i) Artifact-PI (A→P): The artifact project charter has half of its strength of relationship when compared to the Project plan. Further, the direct effect of Artifact on the performance acceptance was higher than the performance report deliverable; (ii) Artifact→IM KA→upon PIs (A→IM-KA→Scope-PI→P2): Among the three parts of the path relationships, the first part of the path from artifact to IM-KA has significant relationship but the other two parts of the path are found to not have significant relationships; (iii) Artifact→IM-KA→Mediator1→PI→P (A→IM-HRM-KA→Mediator1→Schedule-PI→P): It was found that the relationship between the path emanating from artifact to IM-KA, and the path from PI schedule to performance has positive significant relationship; (iv) A→IM-KA→HRM-KA→Mediator1→Mediator2→Scope-PI→P). Among six paths of relationships, only one path at the end scope→performance acceptance has no significant relationship and all other paths have positive relationships.

5.5 Managerial Implications of the APPP-SEM

The emphasis is always given more to the knowledge area and the process in the PMBOK throughout the projects. The requirements are always presented in the project management plan which is artifact of the business process and there is proven connectivity with KAs. The relationship is not with all KAs but it is with Integration management and Human Resource Management. In other context, the other seven KAs certainly play a vital role independently or exogenously in the performance. In addition, the age, experience, accreditation, salary and time zone have a notable expiation of its variances. The performance itself can be of two forms as deliverable and acceptance. This importance given to the status report is almost double than the acceptance which means the documentations have been explained in the project management than the formalisation of acceptance of deliverable. The focus of the direction in the project management emerged with the utility and standardization of the APPP-SEM model.

5.6 Scope for future research

The interrelationship is looking highly a challenging area to handle all the constructs and its path of relationships. The methodology has been verified in terms of formative and mixed method of research approach. All the four components of research such as artifact, process-KA, performance indicator and performance deliverable in the form of formative in the study as it is exploratory in nature. It is an interesting area of study to change the research model for few components as formative and few as reflective to see the effect of all the paths of latent variable. However, the researcher had attempted in the form of keeping knowledge area as reflective and performance indicator as formative to see the effect of performance deliverable. The results of the future studies add value to the PMBOK certainly.

5.7 Conclusion

The study has been considered as continuation of earlier study by Donna G.T. (2009) from the point of identification of relatedness between knowledge area and performance indicators. The attempt to establish the strength of the relationship between the KA and PI has drawn also the attention of researcher to introduce the artifact as input and performance deliverable as output. Using formative model approach throughout the study and also attempted the mixed model in the last face of assessing the managerial implication of research added value to the PMBOK of project management professionals to meet future career challenges.

Table 5. Bootstrapping Results of the path Relationships

Total Effects of Interrelationship of paths	T Statistics (|O/STDEV|) (<1.96)	P Values
Artifacts→IM;	11.28	0.00
Artifacts →Performance _Acceptance	6.77	0.00
Artifacts → Traceability	10.76	0.00
Artifacts → WB	5.77	0.00
CM → Customer satisfaction	2.16	0.03
CoM →Performance Report	7.90	0.00
CoM→WB	48.76	0.00
IM → Performance Report	4.82	0.00
IM → WB	5.12	0.00
Mediator AA Exp → HRM	11.23	0.00
Mediator AA Exp → IM	8.28	0.00
Mediator AA Exp → Performance Report	3.49	0.00
Mediator AA Exp → WB	3.75	0.00
Moderator ST →CM	4.21	0.00
Moderator ST→ HRM	11.78	0.00
Moderator ST → IM	8.64	0.00
Moderator ST→ Mediator AA Exp	95.34	0.00
Moderator ST→ Performance Report	3.22	0.00
Moderator ST → WB	3.81	0.00
PM → Customer satisfaction	4.79	0.00
QM → Customer satisfaction	7.19	0.00
RM → Scope	77.48	0.00
RM → WB	1.92	0.05
SM → Performance _Acceptance	6.31	0.00
SM→ Traceability	140.55	0.00
Schedule → Performance Report	9.31	0.00
TM → Performance Report	9.31	0.00
TM -> Schedule		0.00
Traceability → Performance _Acceptance	6.30	0.00
WB → Performance Report	8.39	0.00
Propositions showing not significant results		
QM → Performance Report	1.83	0.07
RM → Performance Report	1.79	0.07
Artifacts→ Customer satisfaction	0.81	0.42
Artifacts → Performance Report	1.56	0.12
Artifacts → Scope	0.10	0.92
CM →Performance Report	1.09	0.28
Customer satisfaction → Performance Report	1.66	0.10
HRM → Customer satisfaction	0.36	0.72
HRM → Performance Report	1.06	0.29
HRM → WB	0.91	0.36
IM → Customer satisfaction	0.81	0.42
Moderator ST → Customer satisfaction	1.62	0.11
PM → Performance Report	1.55	0.12
Mediator AA Exp → Customer satisfaction	0.65	0.52
QM → Schedule	0.14	0.89
RM → Schedule	0.11	0.92
RM → Performance _Acceptance	0.85	0.40
Scope → Performance _Acceptance	0.84	0.40
SM → Scope	0.10	0.92

References

[1] Abdel-Hamid, T. (1989), A Study of Staff Turnover, Acquisition, and Assimilation and Their Impact on Software Development Cost and Schedule, Journal of Management Information Systems, Vol 6, No.1, pp. 21-40.

[2] Abdel-Hamid, T. (1992), Investigating the Impacts of Managerial Turnover/Succession on Software Project Performance, Journal of Management Information Systems, Vol 9, No. 2, pp. 127-144.

[3] Aladwani, A. (2002), An Integrated Performance Model of Information Systems Projects, Journal of Management Information Systems, Vol 19, No. 1, pp. 185-210.

[4] Andres, H., & Zmud, R. (2001), A Contingency Approach to Software Project Coordination, Journal of Management Information Systems, Vol 18, No. 3, pp. 41-70.

[5] Banker, R., & Slaughter, S. (1997), A Field Study of Scale Economies in Software Maintenance, Management Science, Vol 43, No.12, pp. 1709-1725.

[6] Banker, R., Davis, G., & Slaughter, S. (1998), Software Development Practices, Software Complexity, and Software Maintenance Performance: A Field Study, Management Science, Vol 44, No. 4, pp. 433-450.

[7] Barki, H., Rivard, S., & Talbot, J. (2001), An Integrative Contingency Model of Software Project Risk Management, Journal of Management Information Systems, Vol 17, No. 4, pp. 37-69.

[8] Barki, H., Rivard, S., & Talbot, J. (2001), An Integrative Contingency Model of Software Project Risk Management, Journal of Management Information Systems, Vol 17, No. 4, pp. 37-69.

[9] Barley, S., & Kunda, G. (2006), Contracting: A New Form of Professional Practice, Academy of Management Perspectives, Vol 20, No.1, pp. 45-66.

[10] Carvalho, M. D., & Rabechini Jr, R. (2011), Foundations in project management: building skills to manage projects, São Paulo: Editora Atlas, (3rd Edition).

[11] Chin, W. W. (1998), The partial least squares approach to structural equation modeling, Modern methods for business research, Vol 295, No. 2, pp. 295-336.

[12] Choudhury, V., & Sabherwal, R. (2003), Portfolios of Control in Outsourced Software Development Projects, Information Systems Research, Vol 14, No. 3, pp. 291-314.

[13] Crawford, L. (2005), Senior management perceptions of project management competence. International Journal of Project Management, Vol 23, No. 1, pp. 7-16.

[14] Davis, J., MacDonald, A., & White, L. (2010), Problem-structuring methods and project

management: An example of stakeholder involvement using Hierarchical Process Modelling methodology, The Journal of the Operational Research Society, Vol 61, No. 6, pp. 893-904.

[15] Deephouse, C., Mukhopadhyay, T., Goldenson, D., & Kellner, M. (1995), Software Processes and Project Performance, Journal of Management Information Systems, Vol 12, No. 3, pp. 187-205.

[16] Eskildsen, J. K., Kristensen, K., & Westlund, A. H. (2004), Work motivation and job satisfaction in the Nordic countries, Employee relations, Vol 26, No. 2, pp. 122-136.

[17] Gopal, A., & Gosain, S. (2010), Research Note: The Role of Organizational Controls and Boundary Spanning in Software Development Outsourcing: Implications for Project Performance, Information Systems Research, Vol 21, No. 4, pp. 960-982.

[18] Gopal, A., & Sivaramakrishnan, K. (2008), Research Note: On Vendor Preferences for Contract Types in Offshore Software Projects: The Case of Fixed Price vs. Time and Materials Contracts, Information Systems Research, Vol 19, No. 2, pp. 202-220.

[19] Grünbacher, P., Halling, M., Biffl, S., Kitapci, H., & Boehm, B. (2004), Integrating Collaborative Processes and Quality Assurance Techniques: Experiences from Requirements Negotiation. Journal of Management Information Systems, Vol 20, No. 4, pp. 9-29.

[20] Guinan, P., Cooprider, J., & Faraj, S. (1998), Enabling Software Development Team Performance During Requirements Definition: A Behavioral Versus Technical Approach, Information Systems Research, Vol 9, No. 2, pp. 101-125.

[21] Haas, M. (2006), Knowledge Gathering, Team Capabilities, and Project Performance in Challenging Work Environments, Management Science, Vol 52, No. 8, pp. 1170-1184.

[22] Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011), PLS-SEM: Indeed a silver bullet, Journal of Marketing Theory and Practice, Vol 19, No. 2, pp. 139-152.

[23] Harris, M., Collins, R., & Hevner, A. (2009), Control of Flexible Software Development under Uncertainty, Information Systems Research, Vol 20, No. 3, pp. 400-419.

[24] Harrison, W. (1988), Using Software Metrics to Allocate Testing Resources, Journal of Management Information Systems, Vol 4, No. 4, pp. 93-105.

[25] Havelka, D., & Rajkumar, T. (2006), Using the Troubled Project Recovery Framework: Problem Recognition and Decision to Recover, E-Service Journal, Vol 5, No. 1, pp. 43-73.

[26] Hazır, Ö, & Shtub, A. (2011), Effects of the information presentation format on project control, The Journal of the Operational Research Society, Vol 62, No. 12, pp. 2157-2161.

[27] He, J., Butler, B., & King, W. (2007), Team Cognition: Development and Evolution in Software Project Teams, Journal of Management Information Systems, Vol 24, No. 2, pp. 261-292.

[28] Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009), The use of partial least squares path modeling in international marketing, Advances in International Marketing, Vol 20, No. 1, pp. 277-319.

[29] Hu, L. T., & Bentler, P. M. (1998), Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification, Psychological Methods, Vol 3, No. 4, pp. 424.

[30] Keil, M. (1995), Pulling the Plug: Software Project Management and the Problem of Project Escalation, MIS Quarterly, Vol 19, No. 4, pp. 421-447.

[31] Keil, M., Bernard C. Y. Tan, Wei, K., Saarinen, T., Tuunainen, V., & Wassenaar, A. (2000), A Cross-Cultural Study on Escalation of Commitment Behavior in Software Projects, MIS Quarterly, Vol 24, No. 2, pp. 299-325.

[32] Keil, M., Mann, J., & Rai, A. (2000), Why Software Projects Escalate: An Empirical Analysis and Test of Four Theoretical Models, MIS Quarterly, Vol 24, No. 4, pp. 631-664.

[33] Lee, G., & Xia, W. (2010), Toward Agile: An Integrated Analysis of Quantitative and Qualitative Field Data on Software Development Agility, MIS Quarterly, Vol 34, No. 1, pp. 87-114.

[34] Lee, L., & Anderson, R. (2006), An Exploratory Investigation of the Antecedents of the IT Project Management Capability, E-Service Journal, Vol 5, No. 1, pp. 27-42.

[35] Lewis, M., Welsh, M., Dehler, G., & Green, S. (2002), Product Development Tensions: Exploring Contrasting Styles of Project Management, The Academy of Management Journal, Vol 45, No. 3, pp. 546-564.

[36] Maruping, L., Venkatesh, V., & Agarwal, R. (2009), A Control Theory Perspective on Agile Methodology Use and Changing User Requirements, Information Systems Research, Vol 20, No. 3, pp. 377-399.

[37] McMullen, M. J. (2016), Contingency Theory: United States Small Business Predictive Performance with Project Management Using Partial Least Squares Structural Equation Modeling, Northcentral University.

[38] Mustaro, P. N., & Rossi, R. (2013), Project management principles applied in academic research projects, Issues in Informing Science and Information Technology, 10.

[39] Nidumolu, S. (1995), The Effect of Coordination and Uncertainty on Software Project Performance: Residual Performance Risk as an Intervening Variable, Information Systems Research, Vol 6, No. 3, pp. 191-219.

[40] Nidumolu, S., & Subramani, M. (2003), The Matrix of Control: Combining Process and Structure Approaches to Managing Software Development, Journal of Management Information Systems, Vol 20, No. 3, pp. 159-196.

[41] Pollyana Notargiacomo Mustaro & Rogério Rossi (2013), Project Management Principles Applied in Academic Research Projects, Issues in Informing Science and Information Technology, Volume 10, Mackenzie Presbyterian University, São Paulo, SP, Brazil.

[42] Powell, G. (1990), One More Time: Do Female and Male Managers Differ? The Executive, Vol 4, No. 3, pp. 68-75.

[43] Project Management Knowledge in Action The AMA Handbook of Project Management (4 ed., pp. 29-34): AMACOM Division of American Management Association International.

[44] Raelin, J. (1989), An Anatomy of Autonomy: Managing Professionals. The Academy of Management Executive (1987-1989), Vol 3, No. 3, pp. 216-228.

[45] Rafaeli, Anat, & Vilnai-Yavetz, Iris. (2004), Emotion as a Connection of Physical Artifacts and Organizations. Organization Science, Vol 15, No. 6, pp. 671-686.

[46] Rai, A., Maruping, L., & Venkatesh, V. (2009), Offshore Information Systems Project Success: The Role of Social Embeddedness and Cultural Characteristics, MIS Quarterly, Vol 33, No. 3, pp. 617-641.

[47] Raz, T., & Hillson, D. (2005), A Comparative Review of Risk Management Standards, Risk Management, Vol 7, No. 4, pp. 53-66.

[48] Rendon, R. G. (2008), Procurement process maturity: Key to performance measurement. Journal of Public Procurement, Vol. 8, No. 2, pp. 200.

[49] Revels, Ira. (2010), Managing Digital Projects. American Libraries, Vol 41, No. 4, pp. 48-50.

[50] Revels. Work Dispersion, Process-Based Learning, and Offshore Software Development Performance. MIS Quarterly, Vol 32, No. 2, pp. 437-458.

[51] Schmidt, R., Lyytinen, K., Keil, M., & Cule, P. (2001), Identifying Software Project Risks: An International Delphi Study, Journal of Management Information Systems, Vol 17, No. 4, pp. 5-36.

[52] Thompson, D. G. (2009), The impact of organizational performance measures on Project Management Institute's nine knowledge areas: An exploratory study of project managers' perceptions, Doctoral dissertation, Capella University.

[53] Wegelin, J. A. (2000), A survey of Partial Least Squares (PLS) methods, with emphasis on the two-block case, University of Washington, Department of Statistics, Tech. Rep.

[54] Xu, P., & Ramesh, B. (2007), Software Process Tailoring: An Empirical Investigation. Journal of Management Information Systems, Vol 24, No. 2, pp. 293-328.

[55] Xu, P., & Ramesh, B. (2008), Impact of Knowledge Support on the Performance of Software Process Tailoring, Journal of Management Information Systems, Vol 25, No. 3, pp. 277-314.

[56] Yakura, E. (2002), Charting Time: Timelines as Temporal Boundary Objects, The Academy of Management Journal, Vol 45, No. 5, pp. 956-970.