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Influence of ISO 9001 certification on project management performance in software industry

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Abstract

For the success of software projects, the Project Management is considered as an important tool. Organizations can understand Project Management Performance in an improved way if they exercise Quality Management System.

This empirical study investigates the impact of ISO 9001 certification on Project Management Performance (six constructs of PMP) and how PM Performance varies for ISO-certified software houses and Non-certifies software houses. Data was collected from project managers of both ISO-certified and Non-certificated software organizations registered under P@SHA and PSEB of Pakistan. 192 questionnaires were used for analysis. Independent Sample t-test was used for conducting the analysis and results concluded that software houses with ISO-certification show a better PM Performance than with no certification.

Keywords: Project Management, ISO 9001 certification, software industry.

Introduction

Currently, project management is being extensively used in business. Quality management and project management are two interlinked terms and can be described in similar manner. The situation in which there is a strong influence of repetitious processes, the quality management is most successful field. In reference to the project management process, how to conduct a project is a scenario where there is a very vivid effect of QM which is slightly ignored or a limited focus is paid on its effect by academic professional. Many studies had strongly agreed on quality and its relationship with project management (Oakland, 2000; BSI, 1995; PMI, 1996). (Oakland, 2000) had established the idea that for the fulfilment of customer prerequisite, quality is vital aspect. ISO 9001, the quality management system standard is used in operation effectively, it maintain competitive advantage aspect alive and attractive and greatly contributes in performance of company. (K.R. Beattie, 1999) has declared that certain basic parameters for ISO 9001, as it is well-known standard of quality and ensure that any firm with ISO 9001 has accomplished the early level of characterization by quality and documentation system for quality management.

Several organizations around the globe claims that they manage the project efficiently and performance is exceptional. Regardless of this claim, many organizations overlook the assessment of PM performance (Qureshi, 2009). They emphasize just on ROI and profit per unit. Therefore, identification of aspects that cause performance is very critical. (Bryde, 2003a) was able to establish the fact for PMPA model, by giving the reason for revision in EFQM model specifications. Both TQM and PM are compatible in nature (Barad, 2000; Lo & Humphreys, 2000; Orwig & Brennan, 2000; Bryde, 2003a; Din, 2011). So this leads to the point that TQM-based models can be adapted for the measurement of PM performance.

As project management enables the establishment of TQM culture in organization (Stamatis, 1994). Traditional PM provide confirmation of fulfilment of vision and goals in an efficient manner and emphasize on planning, monitoring and controlling procedures, though TQM provides ‘best in class’ goals. But there is a limited research on how TQM provide an environment in which

organizations can apply modern project management more effectively. This current study will focus on this aspect.

Literature Review

Project Management

According to PMI, "*Project Management is the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality and participant satisfaction" (PMI, 1987).* Project management is well defined structure that have a broader vision and usually organizations implement PM when there are complex or non-routine jobs. Managers, practitioners and experts can achieve multiple benefits from implementing project management practices (Becerik 2006; Jugdev and Mathur 2006; Martinsuo et al. 2006 and Reyck et al. 2005).

Quality Management

The term 'quality' has different meaning for different people. All stakeholders defines quality according to their own perceptions and needs (Wateridge, 1995) Project quality is considered to be a key concern for every single organization in the world. TQM is an important aspect which gives business a new horizon of vision. (Daft, 1997). TQM delivers an approach to organization for the improvement of performance (Wruck and Jensen, 1994) and is also used to increase the value of organization. It is a unique traditional strategy and organizations working under TQM environment has showed better performance than those with no TQM approach (Chow-Chua et al., 2003; Koc, 2007; Bayati and Taghavi, 2007; Kuo et al., 2009; Lo et al., 2009; Din et al., 2011).

Quality Management and Project Management

Quality management seems to be a relevant entity and has been accepted as most famous aspect that helps in project management performance improvement. Quality management also plays a key role in project success as it leads to the better understanding of clientele and stakeholder needs. (Barad and Raz, 2000) concluded in a study that there is association among practices of quality management and performance of project management.

With the passage of time TQM contributes to define improved methods to increase the performance of PM. The ideas of quality management is not only supporting for the alignment of main project stakeholders requirements, it also provides effort in other areas that can add value to the successful operation of the PM. Quality Management has given a concrete mechanism where PM approaches and ideas were functional (Kerzner, 1994). TQM methods gives a direction so that organization can enhance the performance for upcoming projects by analyzing the progress of previous projects (Stamatis, 1994).

The results of a study by (Din et al., 2011) depicted a two way relationship among project management system and QMS in project inclined structure somewhat like construction organization. The study described that ISO 9000 is quality certification that aims to the appropriate functionality of process which if further extended will augment the performance of the organization. Project management as a system is a source of knowledge and experience and helps in designing a valuable and efficient QMS. (Serpell, 1999) concluded that with QMS, there are significant improvements in results of construction projects, he further emphasized on the role of ISO-certification. A well-managed project in regards of quality, control, governance and best audit can only be exercised by ensuring the ISO-certification parameters, gives the perception that things are going very well and therefore increase the project success.

Some other studies by (McAdam & McKeown, 1999; Simmons & White, 1999; Chow-Chua et al., 2003; Koc, 2007; Bayati and Taghavi, 2007; Kuo et al., 2009; Lo et al., 2009) have also

persistently reported these results that performance of organizations having ISO-certification increases in their projects settings than those having no ISO-certification. Quality systems like ISO-9000 certification can increase the inside and outside quality of projects that will lead to an increase in cost-effectiveness (Häversjö T. , 2000).

PM Assessment Frameworks

The assessment of Project Management Performance has progressed, in past, (Bohanec et al. 1995) identified several principles that can be used for PMP assessment using expert system. Now a days researchers have started to emphasize on the use of PMP assessment models. Different models have been used to assess the project management performance. PPMS model was introduced by (Cheung et al, 2004), a monitoring system of PM performance through web that enables a project manager to have critical understanding/eye on performance of project management and also enables him to have control over system. (Westerveld's, 2003) developed a model named as Project Excellence Model, which relates critical success factors of project with success criteria. Furthermore (Dweiri et al, 2006) instigated an idea of PMP, which is a nebulous approach to combine all dimension of PMP together into a single entity, termed as internal efficiency of project management. An evaluation model of PMP was developed by (Chen and Lee, 2007) to assist project managers, where behavior of leadership turned out to be most operational and indispensable factor along with other vital aspects. Work of (Lauras et al, 2010; Crawford et al, 2007; Pich et al, 2002) have tried to establish the conscience that drawback with the assessment of PMP is that the number of dimensions of performance are too much to handle. Other models like EFQM and BNQA were also studied, which were used to evaluate the maturity of PM while measuring process of PM for business quality assessment.

Project Management Performance Assessment Model (PMPA)

According to (Van Der Wiete, 1997), TQM can be defined in expressive manner with the help of EFQM model. Many researchers have agreed on that EFQM model is an effective model for the evaluation of performance (Sandbrook, 2001; Neely et al., 2007). And after adaptation of EFQM model into PM environment, it can be used for evaluation of PM performance. It is concluded that EFQM model provides good basis for developing a model to assess PM performance.

A model was proposed by (Bryde, 2003a) that was grounded on EFQM model named as 'Project Management Performance Assessment' (PMPA) that relates PM and TQM. In EFQM model, nine measures were used but in PMPA model five measures were used i.e. PM leadership, PM staff, PM policy and strategy, PM partnerships and resources and PM life cycle management processes. These measures reveal necessary actions that helps to provide high level of Project Management performance. The last measure is PM Key Performance Indicators KPIs, to measure definite success.

Measures of PMPA are explained as follow;

- **PM Leadership & Culture**: According to PMPA framework, an exceptional leader in Project management should be talented enough to expand the extensive part of Project management in organization. PM leadership also includes spreading the awareness of this extensive part in project. In literature, project culture is considered as open, shared corporation among project clientele and a mutual, collective linguistic (Dubinskas, 1993; Levasseur, 1993; Boardman, 1994). So PM leader should guarantee that this culture is maintained by PM system.
- **Management of PM Staff:** One of the main concerns of PMPA is management aspect and planning along with acknowledgement for the personnel. There are two categories of project management staff. First category, which deals with point of view of an individual, ongoing project, whereas in second category, vision of perception gets broader and it deals with the

organization's ways of managing and planning the stuff of project management which encompasses the capacity building for organization's current and future projects by introducing training sessions and enhancing career opportunities (Bryde, 2003a).

- **PM Policy and Strategy:** Strategy and policy of project management comprise of how project managements' throughout systematic implementation and development occurs in an organization along with keeping intact the association between levels of project, organization, strategy and tactics (Bryde, 2003a).
- **PM Partnerships and Resources**: Engagement of the stakeholder means the involvement of all internal and external participants in reference to the organization and project. Partnership on the other hand is significant way for managing the stakeholders (Bryde, 2003a).
- **Project Lifecycle Management Processes:** In PMPA model, one of the focus is on the management processes for the life cycle. Literature has emphasized on the project management's basic concepts of lifecycle processes and their adoption in every phase of project (Turner, 1993b). The major concern of project lifecycle still remains to keep clientele and stakeholders' focus of attention.
- **PM Key Performance Indicators KPI's:** Principle for this application is not entirely based on outcome attained in reference to gathering the distinct supplies of many types of project shareholders but on the approaches that are used in project management system to enhance the performance based on PM KPI's (Bryde, 2003a).

Hypothesis Development

All hypotheses that are verified through empirical examinations are given below. Theoretical framework of these hypotheses is shown in Fig1.

H_1; Performance of project management is significantly better for ISO 9001 certified software houses than non-certified software houses.

H_2; PM Leadership & Culture will be more comprehend for ISO 9001 certified software houses than non-certified software houses.

H_3; PM Staff will be more comprehend for ISO 9001 certified software houses than non-certified software houses.

H_4; PM Policy & Strategy will be more comprehend for ISO 9001 certified software houses than non-certified software houses.

H_5; PM Partnership & Resources will be more comprehend for ISO 9001 certified software houses than non-certified software houses.

H_6; PM Lifecycle Management Processes will be more comprehend for ISO 9001 certified software houses than non-certified software houses.

H_7; PM KPI's will be more comprehend for ISO 9001 certified software houses than non-certified software houses.

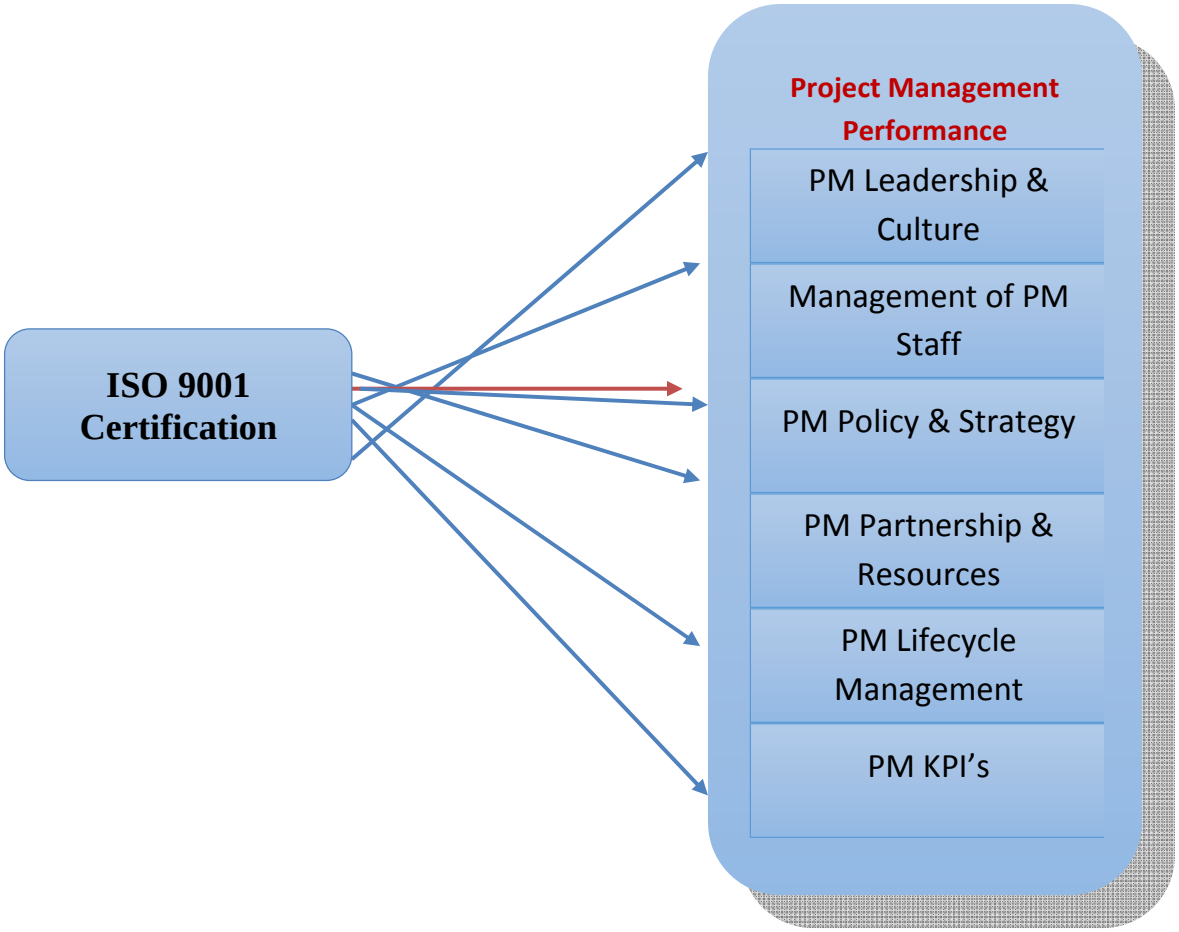

Figure 1. Theoretical Framework

Research Methodology

Data Collection

This study is designed to investigate the effect of ISO 9001 certification on project management performance in software industry of Pakistan. The population selected for this research was the software houses registered under Pakistan Software House Association (P@SHA) and Pakistan Software Export Board (PSEB). A list of registered software companies was taken from Pakistan Software House Association (P@SHA) and Pakistan Software export Board (PSEB). All the software houses are registered according to this list. The study set its population into two groups, based on ISO 9001 certification. There were 990 software houses that have ISO 9001 certification and 110 that do not have ISO 9001 certification. Project managers and team leaders are sampling unit of this research. Feedback was assembled from project managers and team leaders working in software houses. The sampling technique used for this study was simple random sampling in selecting the software companies from the list of companies registered in Pakistan Software Houses Association (P@SHA) and Pakistan Software Export Board (PSEB).

Sample size for ISO certified software houses was 86 and for non ISO certified software houses, sample size was 277. One questionnaire was sent to each Non ISO 9001 certified software

house and 3 questionnaires were sent to each ISO 9001 certified software house. Questionnaire was sent through email to project managers and HR managers.

A total 535 questionnaires were sent, 258 to ISO 9001 certified software houses and 277 were sent to Non-certified software houses. A total 199 responses were received, with 102 responses (40% response rate) from ISO-certified software house and 97 responses (35% response rate) from Non-certified software houses. 5 responses from ISO-certified software houses and 2 responses from Non-certified software houses were discarded because of missing data. So 97 responses (response rate 37%) were usable from ISO-certified software houses and 95 (response rate 34%) from Non-certified software houses.

Instrument for Data Collection

A well designed survey questionnaire was used as the research instrument. Close ended questionnaire was used to collect data from software houses in Pakistan. Required information was gathered from project managers and team leaders through comprehensive and simple questions. It was based on the items for each factor in the model from the relevant and valid scales used by Scholars and researchers in this field. Scale for 'Project Management Performance' (total 22 items) was adopted from (Bryde, 2003b). A five point Likert scale was used, reaching from 1(strongly disagree) to 5(strongly agree).

Data Analysis and results

To test the all hypothesis (H_1 to H_7) independent sample t test was used.

Internal and external validity

Two types of validity were considered: internal and external. Since selection of the initial measurement items was based on extensive review of theoretical and empirical literature, it was considered to have internal validity. In terms of external validity. A pilot study of twenty participants, 10 each from ISO-certified and noncertified companies from the sample population, was conducted to test the survey instrument. Additional refinement of the survey was not needed after the pilot study.

Reliability Analysis

Reliability of scales was measured using Cranach's alpha. All the values are above accepted value. The alpha coefficient value PM Leadership & Culture level was 0.78, for PM staff 0.83, for PM Policy & Strategy 0.82, for PM Partner & Resources 0.84, for PM Lifecycle Management Processes 0.86 and for PM KPIs 0.78. The overall value is 0.91.

Collinearity Diagnostic Test

To check the Multi collinearity between PM constructs Variance factor analysis was conducted. Results of variance inflation factor of independent variable are shown in Table 1 along with the values of tolerance.

Table 1. Collinearity Statistics for Project Management Performance

Model	Collinearity statistics	
	Tolerance	VIF
PM Leadership & Culture	.558	
Management of PM Staff	.752	1.329
PM Policy & Strategy	.578	1.731
PM Partnership & Resources	.824	1.214
PM Lifecycle Management Process	.688	1.454
PMKPI's	.640	1.562

According to ((Freund, 2010) acceptable value of tolerance is > 0.20 and for variance inflation factor, it is < 10. It is clear from table that values of tolerance of all PM constructs are greater than 0.20 and values of variance inflation factor of each construct is less than 10. So there is no multi collinearity between PM constructs.

Hypothesis Testing

Evaluation of Independent Sample t-test

To test the hypothesis, t-test was performed. Results of t-test had provided a contrast for mean value of project management performance in ISO-certified software houses and Non-certified software houses.

Assumptions for test

First of all, assumptions for test were verified. These assumptions included independence of observations, missing data, outliers, data normality, linearity, homogeneity of variance-covariance matrices.

Observations were different for both groups. There was no relationship between the observation of ISO-certified software house and non-certified group. Data was also checked for sample size, sufficient sample size was available for both groups. Data was examined for missing values and there was no missing data. Univariate outliers were checked by converting values of all variables into standard values. Standard score of a case beyond ±3.0 are considered to be outliers. Results indicated that there was no value beyond +3 or -3 so there were no univariate outliers in data. To inspect multivariate outliers in data, Mahalanobis distance analysis was performed. Mahalanobis D^2 follows a chi-square distribution with degrees of freedom equal to the number of variables. A case is a multivariate outlier if the probability associated with its D^2 is 0.001 or less. For ISO-certified companies, with three variables and a criterion of α=.001 no value less than 0.001 cook's distance test was also used to detect multivariate outliers, for ISO-certified software houses, maximum value of cook's distance was 0.199 and for non-certified software houses maximum value was 0.139. Both of these were less than 1 that indicates that there were no multivariate outliers in data for both groups.

Data was also analyzed for normality, results indicated that skew ness and kurtosis values for all variables were in range of +1 to -1, indicating that data was normally distributed. The homogeneity variance-covariance was tested by Levene's test between two groups. The value of F was 14.633 and p = 0.00. P value was less than 0.05 so it implies that variances were not homogeneous.

Project Management Performance and ISO 9001 Certification

Table 2. Independent Sample t Test for PM Performance and ISO 9001 Certification

		Levene's Test		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Project Management Performance	Equal variances assumed	14.633	.000	6.811	190	.000	.88371979
	Equal variances not assumed			6.786	166.934	.000	.88371979

Results of test indicates that t = 6.786 and P = 0.000 < 0.05. These results indicates that dependent variable (PM performance) significantly depend on ISO-certification of software houses.

It is clear from table, ISO certification has a statistically significant effect on Project Management Performance. The value of t is 6.786 and P-value is 0.000 which is less than 0.05. So it is concluded that performance of Project Management is significantly better for ISO-certifies software houses than non-certified software houses.

Impact of ISO-Certification on Individual PM Performance Constructs

Independent sample t-test was used to analyze the effect of ISO-certification on each construct of PM performance (H_2 to H_7.).

Table 3. Impact of ISO Certification on Individual PM Constructs

	t-test for Equality of Means			
	T	df	Sig. (2-tailed)	Mean Difference
PM Leadership & Culture	3.047	172.299	.003	.43193046
PM Staff	3.722	168.219	.000	.52173619
PM Policy & Strategy	4.310	145.699	.000	.59832855
PM Partnership & Resources	6.005	170.448	.000	.79901333
PM Lifecycle Management Processes	3.607	189.705	.000	.50505096
PM KPI's	4.803	175.573	.000	.65802302

For all Project Management constructs p value is less than 0.05 which indicate that performance of all project management constructs is different for ISO-certified software houses and Non-certified software houses. Performance of all the constructs of PM (PM leadership & culture, management of PM staff, PM policy & strategy, PM partnership & resources, PM Lifecycle management processes and PM KPI's) is better for ISO-certified software houses than non-certified software houses. So it is concluded that for ISO 9001 certified software houses, all constructs of PM are better comprehended than with those having no certification.

Findings

Most of the respondents had age below 30 (77, 79.4%) for ISO-certified software houses and (68, 71.6%) for Non- certified software houses. Most of the employees in software industry are males. Most of the respondents had done BS (Hons) CS for both ISO-certified software houses (43.3%) and Non-certified software houses (33.7%). Mostly respondents had 1 to 3 years' experience (37.1%) for ISO-certified software house and (30.5%) for Non-certified software houses. Most of the respondents had managed up to 5 projects (47.4%) in ISO-certified software houses and 47.4% in Non-certified software houses. Majority of the ISO-certified software house has more than 200 employees (41.2%) and Non-certified software houses has up to 5 employees (42.1%) in Pakistan. Most of the projects had duration of 6 to 12 months in ISO-certified software houses (36%) and 31% for Non-certified software houses. Most of the projects had a team up to 5 for ISO-certified software houses (62%) and 70% for Non-certified software houses.

ISO Certification and Project Management Performance

Findings show that ISO certification has statistically significant impact on project management performance. Results also reported that software houses with ISO certification perceive

PM practices in a better way than those with no certification. The value of F is 6.786 and P-value is 0.000 which is less than 0.05. So it is concluded that performance of Project Management Practices is significantly better in presence of ISO certification. So quality management systems and project management shares a collaboration in software development organizations. ISO-certification improves PMP which lead to increase in project success. Performance of all the construct of PM (PMLC, MPMS, PMPS, PMPR, PMLMP and PM KPI's) can be improved by having as ISO-certification in organization. This study confirms that project managers working in ISO-certified software houses are more likely aware of PM practices than those working in Non-certified software houses.

Conclusion

This study establishes that with ISO-certification, performance of PM can be improved and that will lead to success of projects. Results of t-test describes that PM performance of ISO-certified software houses is better than Non-certified software houses.

Recommendations

The study has established that ISO-certification has a significant positive effect on PM performance. Software houses with ISO-certification perceive PM practices in a better way than non-certified software houses. So it is recommended for software to have a QMS system to improve PM performance that will lead to project success.

Limitations and Future Suggestions

First, there is limited amount of literature is available in context of project management in Pakistan. Second, this study is limited to the context of the Pakistan. Future research can collect data from other geographical locations to see whether the findings are replicated and to explore the influence of national culture on the relationship between PM Performance and Project Success. Third, this study is conducted in IT sector of Pakistan. More studies can be conducted using other industries of Pakistan. Fourth, other factors can also be investigate to improve project management performance.

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