

# Effect of Project Management Practices on Project Success in Make-to-Order Manufacturing Organizations

Ahmed Fraz\*, Asim Waris, Saad Afzal, Mohsin Jamil, Syed Tasweer Hussain Shah and Safia Sultana

National University of Sciences and Technology (NUST), H-12, Islamabad, Pakistan; ahmed\_fraz82@hotmail.com, aw@hst.aau.dk, saadafzal345@hotmail.com, mohsin@smme.nust.edu.pk, safiasultana09@gmail.com

## Abstract

**Background/Objectives:** Engineering organizations operating on Make-to-Order projects have a specific work environment where an integration of manufacturing practices with the project management practices is needed for project success. The aim of this research is to analyse the Project Management Practices. **Methods/Statistical Analysis:** Engineering organizations operating on Make-to-Order projects have a specific work environment where an integration of manufacturing practices with the project management practices is needed for project success. The Project Management practices evaluated are Project Scope Management, Project HR Management, Project Communications Management, Project Stakeholder Management and Project Planning. The effect of these Project Management Practices is analysed on Project Success. Various statistical tools were employed to validate the hypotheses. **Findings:** The aim of this research is to analyse the Project Management Practices adopted by engineering organizations operating on Make-to-Order projects both for public sector and private sector manufacturing organizations of Pakistan. The proposed results provide realistic analysis and are quite different from previous research works. Using the suggested techniques, the performance of the organization can be improved. The analyses and results point out that Project Success is directly correlated with Project Management Practices in Make-to-Order manufacturing organizations. The Private sector and Public sector organizations primarily implement the Project Management Practices to the same extent and there is no significant difference in the practices being put into practice by them. **Application/Improvements:** The suggested work is more suitable in small and large scale organization.

**Keywords:** Make-to-Order Manufacturing, Project Management Practices, Project Success

## 1. Introduction

Manufacturing organizations have various environments depending upon the type of products they manufacture<sup>1</sup>. There are a variety of manufacturing paradigms like Make-to-Stock, Make-to-Order, Assemble-to-Order and Engineer-to-Order, etc. Some of them implement Make-to-Stock where they manufacture products using mass production approach thus adopting the push type production system while some implement the Project Manufacturing approach which makes use of pull type production system<sup>2</sup>. Products in Project Manufacturing are usually high-valued capital goods instead of consumer

goods and are manufactured after confirmed orders are received<sup>3</sup>.

Application of best Project Management (PM) practices is of critical importance for organizations operating on Make-to-Order (MTO) projects. The question arises what a best practice is: The author<sup>4</sup> defines best practice as a more effective and resourceful method for achieving a goal that is better than other methods, processes and techniques being previously observed. He also emphasized that the adoption of Best practices by organizations is an evolutionary process which takes times and adaptability to execute and implement. It is a procedure whereby standard methods for carrying out various tasks are developed and followed. Project Management best practices can be effectively

\*Author for correspondence

adapted from International standards and Guidelines like International Standardization Organization (ISO), American National Standardization Institute (ANSI), the International Project Management Association (IPMA) and the Project Management Institute (PMI)<sup>5</sup>.

Projects are an essential product of engineering organizations that operate in Make-to-Order environments of compatible manufacturing systems and must have an efficient project management system, in order to meet their customers' tighter demands and standards for cost, time and quality<sup>6</sup>. All the organizations, whether public sector or private sector, working in project environment need to adopt the PM practices, in one form or the other, for sustainability. They may differ in terms of rules and regulations being applied to them but at the core, integration of manufacturing and project management is mandated by the specificity of this environment.

The rationale of this study is to analyse the Project Management Practices adopted by engineering organizations operating on Make-to-Order projects both for public sector and private sector manufacturing organizations in the context of Pakistan and to study the effect of these PM practices on success of the projects executed by these organizations. The study also finds if there is any difference between the PM practices being followed by the public sector and private sector MTO manufacturing organizations. Although various researchers have studied PM practices in MTO manufacturing organizations but no such study has been conducted in Pakistan.

## 2. Literature review and Research Hypotheses

According to<sup>7</sup>, Project Management in industrial settings has progressed over time, becoming the primary source of attaining success in project execution. The implementation of best practices has evolved as a consequence of business growth and widespread success of observing Project Management practices internationally. Project management best practices, if adopted at an institutional level increase the prospects in attaining the objectives and deliverables when dealing with projects successfully.

In Make-to-Order, each product is specifically manufactured as a consequence of a project<sup>8</sup>. Hence, the techniques applied in mass production and manufacturing on Make-to-Stock and other manufacturing paradigms are different for MTO manufacturing. The

authors in<sup>3,8</sup> emphasized that these projects do follow the standard definition of projects as being unique and temporary. Elements for project manufacturing require low inventory levels. They are defined and demanded by customers and are unique in their designs and requirements. Though, the final product is always decided by the customers and the engineers involved in the project<sup>8</sup>.

Project manufacturing is a set of islands which demands integration for improved control and planning<sup>9</sup>. Giving authority to the customer, change of customers' requirements/priorities and high variations in delivery times are a few of various challenges and problems being encountered by project manufacturing<sup>10</sup>.

The field of project management, since it is very beginning and execution, has been dominated with the idea of development and identification of best practices for achieving maximum optimal output and researchers have tried to identify best practices for project management from time to time. Some of the researchers include in<sup>8,11-17</sup>. Standards like PMBOK<sup>18</sup> and APMBOK<sup>19</sup> have also identified best practices in project Management. The findings from literature review are summarized in Table 1. The factor lists are not necessarily specific points of consideration. They may be broad general outlines.

The definition of project success and Critical Success Factors (CSFs) are considered a way for identification of best practices source<sup>4</sup>. Success is defined as gaining advantage, superiority, victory, accomplishment, achievement and added value<sup>20</sup>. Generally the definitions on success of projects have progressed over time from concepts and were restricted to the execution period of the project plan to concepts that show an understanding of success over the complete product and project life cycle<sup>21</sup>. The author in<sup>22</sup> was among the first to identify the difference between a project success and project management success. The differentiation between project success and project management success is not only about argument in terminology but this difference in perception will prolong if significant characteristics between project success and project management success is not recognized and practiced<sup>23,24</sup>. Defining and determining how success for a project is essential to achieve the desired goals and deliverables, the establishment and selection of appropriate methods for managing the project life cycle while implementing the project management successful measurement techniques is very vital for successful project completion. The author in<sup>14</sup> has also distinguished between project success and project management success

**Table 1.** Literature review matrix

Project Management Practices from the literature	Georgiva and Allen	Loo	PMBOK	Pinto & Dominguez	White & Fortune	Cooke	APM-BOK	Angela Clark	Yang
Integration Management			×						
Scope Management		×	×			×	×	×	
Time Management			×						
Cost Management			×				×		
Quality Management			×				×		×
HR Management		×	×	×	×		×		×
Communications Management	×	×	×	×	×		×	×	
Risk Management			×		×	×	×		
Procurement Management			×				×		
Stakeholder Management	×	×	×	×			×		
Client / Customer Management	×	×		×	×				
Managing Awareness	×				×				
Development & Motivation of project team	×			×	×				×
Effective Project Planning		×		×	×		×	×	×
Effective Project Scheduling		×			×	×	×		
Effective Project Controlling		×		×	×				
Effective Contract Management		×							
Resource management	×	×			×		×		

in his research. He defines Project management success as a measure against the conventional measures of performance in terms of time, cost and quality while Project success is calculated aligned by and large with the purpose of the project’s final deliverable, specifically project goals, project functions and satisfaction of stakeholders<sup>14</sup>.

Defining Project success factors is also an important step in determining success, the input to the project management system and has a significant impact on outcome. In general, critical success factors are a set of project parameters and variables significantly correlated to project success and their maximization or minimization, achieves project success. Effective Planning, Clear defined dependable tasks responsibility and liability, Schedule programme control, Project leadership management and authority and effective Communications between all channels are key factors of successful projects<sup>25</sup>. Human Resource concern in Project Management is also of prime importance, since employees are organizations’ critical asset. Many Human related Factors of culture and ethnic

diversity, right personnel for the right job are considered the non-technical factors, related to success and performance in management of organizations<sup>26</sup>. Among PM practices, project scope management, project HR management, project communications management, project stakeholder management and project planning have been selected since these factors are most frequently cited by researchers (Table 1). The following hypotheses have been formulated for the study:

**H1:** Project Success is related to Scope Management in Make-to-Order Organizations.

**H2:** Project Success is related to HR Management in Make-to-Order Organizations.

**H3:** Project Success is related to Communications Management in Make-to-Order Organizations.

**H4:** Project Success is related to Stakeholder Management in Make-to-Order Organizations.

**H5:** Project Success is related to Project Planning in Make-to-Order Organizations.

**H6:** Project Success is related to PM Practices in Make-to-Order Organizations.

**H7:** There is a difference between the extent to which PM practices are being followed by Private sector organizations and Public sector organizations.

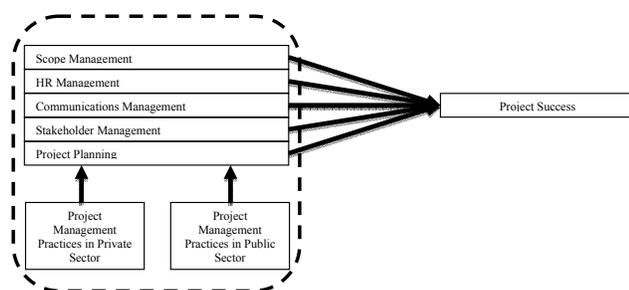
### 3. Theoretical Framework and Research Model

By going through the literature, five Project Management practices were identified and project success is dependent on the implementation of project management practices or critical success factors. Therefore, a research model is developed where Project Success is the dependent variable and the Project Management practices of Scope Management, HR Management, Communications Management, Stakeholder Management and Project Planning are the independent variables. The model shows how the PM practices affect the Project Success in Make-to-Order manufacturing environments. The difference between the means of PM practices in Private Sector organizations and PM practices in Public sector organizations is also shown in Figure 1.

## 4. Research Design

### 4.1 Sample selection and description

The population for the study was engineering organizations operating on Make-to-Order projects for both the private sector and the public sector in industrial regions of Lahore and Rawalpindi in Pakistan. Simple random sampling was used to decide the sample. Questionnaires were sent to 125 organizations. 14 organizations (58 respondents) from the public sector and 19 organizations (51 respondents) from the private sector responded. The response rate was 23.2%.



**Figure 1.** Proposed research model.

The respondents were Project Management professionals from middle and top management levels associated with MTO manufacturing projects. The characteristics of the respondents are presented in Table 2.

### 4.2 Questionnaire and Method of Analysis

The questionnaire employed was designed to assess the five Project Management practices i.e., Scope Management, HR Management, Communications Management, Stakeholder Management, Project Planning and Project Success. The questionnaire had a total of 50 questions falling under 6 constructs. Questions were adopted from PMBOK Guide 5th Edition. Pilot testing was first carried out and Cronbach's alpha was calculated to find the reliability and internal consistency of the constructs. Results are presented in Table 3. Quantitative research was carried out by employing various statistical techniques in SPSS 16. Normality was checked and confirmed with Skewness, Kurtosis and Shapiro-Wilk test. Correlation and multiple regressions were then performed to find the association between variables. T-test was finally performed to find the difference between the extent to which PM practices are being followed by private sector organizations and public sector organizations.

## 5. Results and Discussion

The analyses were performed using SPSS16. First of all normality of responses was ascertained using histograms, skewness, kurtosis, Shapiro-Wilk test. The results of

**Table 2.** Characteristics of sampled organizations and respondents

Characteristic	Class	Number	Percentage
Type of organization	Public Sector	58	53.2
Type of organization	Private Sector	51	46.8
Size of organization	less than 100 employees	61	56
Size of organization	100 to 500 employees	32	29.4
Size of organization	greater than 500 employees	16	14.7
Experience of the respondents	3 to 6 years	27	24.8
Experience of the respondents	6 to 12 years	52	47.7
Experience of the respondents	greater than 12 years	30	27.5

**Table 3.** Cronbach's alpha

Factor	Cronbach's Alpha (15 Respondents)	No of Items
Statement of Project Success	0.760	12
Scope Management	0.821	8
HR Management	0.784	9
Communications Management	0.806	5
Stakeholder Management	0.691	5
Project Planning	0.808	11

skewness, kurtosis and Shapiro-Wilk test are presented in Table 4. The values of skewness for all the variables are within the range  $\pm 1$  which indicates that distribution is normal. Similarly, the values for kurtosis for all the variables are within the range  $\pm 1$  which implies that the distribution is neither too peaked, nor too flat. For the Shapiro-Wilk test, the values for the variables "Communications Management" and "Stakeholder Management" are less than 0.05 which indicates that the distribution for these two variables is not normal. However, the results for visual tests and other tests like skewness and kurtosis indicate normality, so taking the overall results into consideration and the biasness due to sample size<sup>27</sup>, the distribution is assumed to be normal. After assessing normality, the project management practices that are related with project success were evaluated. In<sup>28</sup>, categorization was used to classify correlations as strong, weak or moderate.

Results of correlation for each PM practice are discussed below. Scope Management is significantly correlated with Project Success,  $r(107) = 0.49, p < 0.01$ . The result is supported by<sup>14-16</sup>. Our first hypothesis **H1** i.e., Project Success is related to Scope Management in Make-to-Order Organizations is therefore accepted.

HR Management is significantly correlated with Project Success,  $r(107) = 0.771, p < 0.01$ . The importance of HR management for project success has also been indicated by<sup>11</sup> as motivation and inspiration of the project team is the subsequent significant action acted upon by the successful project managers. Researchers in<sup>8,13</sup> have also emphasized the role of HR management for project success. This proves our hypothesis **H2**: Project Success is related to HR Management in Make-to-Order Organizations to be true

Communications Management is significantly correlated with Project Success,  $r(107) = 0.424, p < 0.01$ . The

**Table 4.** Skewness, kurtosis and shapiro-wilk test

Factor	Skewness	Kurtosis	Shapiro-Wilk (Sig.)
Statement of Project Success	-0.195	-0.274	0.448
Scope Management	-0.367	-0.207	0.067
HR Management	-0.501	-0.084	0.069
Communications Management	-0.518	-0.093	0.008
Stakeholder Management	-0.520	0.032	0.005
Project Planning	-0.353	-0.628	0.052

correlation is moderate according to the characterization by<sup>28,29</sup>. Communication with the project team and clients is considered an important factor for project success<sup>11</sup>. The author in<sup>12</sup> found that good communications play a vital role towards project success. Communication is one of the people competencies that are being done well by the successful project managers<sup>15</sup>. The moderate correlation shown by communications management with project success in MTO manufacturing organizations is in commensuration with previous researches and validate our hypothesis **H3**: That communications management is related to project success in MTO manufacturing organizations.

Stakeholder Management is significantly correlated with Project Success,  $r(107) = 0.415, p < 0.01$ . Stakeholder management involves taking on board all the stakeholders at each stage of the project. The authors in<sup>12,15</sup> have also highlighted the importance of dealing with customers' requirement and unexpected changes during the projects, thus validating **H4**: Project Success is related to Stakeholder Management in Make-to-Order Organizations.

Project Planning is significantly correlated with Project Success,  $r(107) = 0.298, p < 0.01$ . The author in<sup>11</sup> showed that project planning was one of the most important activities performed by the Project Manager. Project planning is a project life cycle phase after project initiation<sup>11</sup>. Hence, it encompasses other project management practices like scope management, planning project communications, planning stakeholder management and HR management. The importance of project planning has been emphasized by<sup>8,13-16</sup>. A weak value of correlation i.e.,  $r(107) = 0.298$  implies that Project Managers in Pakistani manufacturing industries need to pay more attention

towards Project Planning, hypothesis **H5**: Project Success is related to Project Planning in Make-to-Order Organizations to be true.

Project Management Practices is determined by taking the mean of all the five independent PM Practices and is significantly correlated with Project Success,  $r(107) = 0.626$ ,  $p < 0.01$ . Overall a moderate to strong correlation has been found between Project Management Practices and Project Success. This implies that aside from manufacturing practices and other factors, application of PM practices also plays a significant role towards achievement of project success thus **H6**: Project Success is related to PM Practices in Make-to-Order Organizations is accepted. To which extent these practices account for project success is presented in the overall model discussed in a later section.

### 5.1 Difference between PM Practices in Private Sector and Public Sector Organizations

T-test was employed to examine the difference between two group means of PM practices in Public and Private Sector Organizations. The sample descriptives depicted in Table 5 show that the mean score for PM practices

**Table 5.** Sample descriptive of equality of means using t-test

	Private Sector or Public Sector	N	Mean	Std. Deviation	Std. Error Mean
PM Practices	Public Sector	58	3.4481	.54521	.07159
	Private Sector	51	3.4057	.46755	.06547

followed by Public Sector organizations and Private Sector organizations is very close. This fact is signified by the results of Table 6 where  $p > 0.05$  which shows that significant difference is not seen in PM Practices in Private sector Organizations and PM Practices in Public Sector Organizations. The results of t-test can be summarized as follows:

“There was homogeneity of variance as assessed by Levene’s Test for Equality of Variances,  $p > 0.05$ . As a result, statistical independent t-test was performed on the data at 95% Confidence Intervals (CI) for the mean difference. It was establish and concluded that the difference between the means of PM Practices in Public Sector Organizations ( $3.45 \pm 0.545$ ) and PM Practices in private sector organizations ( $3.41 + 0.468$ ) was not statistically significant”.

It has been studied the effective implementation project management practices in organizations of changing sectors and size. Their research concluded that techniques and practices implemented in project management are mainly similar regardless of the organization size or being a public or a private enterprise<sup>29</sup>. Similarly, other researchers also found that apart from some differences, many similarities exist between public sector and private sector<sup>30</sup>. The results of this study are hence found to be consistent with studies undertaken in the past. Organizations, regardless of whether they are public sector or private sector, shall adopt project management practices for success of their projects.

### 5.2 Model Fit

Model fit of the regression model can be analyzed using Table 7. Quality of the prediction of the dependent variable can be measured by Multiple Correlation Coefficient (R). The amount of variance in the dependent variable due to independent variables is represented by  $R^2$ .  $R^2 = 0.635$

**Table 6.** Independent samples t-test for equality of means

		Levene’s Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
PM Practices	Equal variances assumed	3.627	.060	.433	107	.666	.04241
	Equal variances not assumed			.437	106.940	.663	.04241

**Table 7.** Model summary for multiple regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.797 <sup>a</sup>	.635	.617	.30996

a. Predictors: (Constant), Project Planning, Stakeholder Management, HR Management, Scope Management, Communications Management.

b. Dependent Variable: Project Success.

indicates that 63.5% of the variability of the dependent variable i.e., Project Success is explained by the independent variables. It means that other than the five project management practices taken in this study, there are factors that account for 36.5% of the variability of Project Success. So most of the variance is explained by the PM practices being studied.

The results of ANOVA were:  $F(5, 103) = 35.819$ ,  $p < .0005$  (i.e., the regression model is a good fit of the data) which means that the dependent variable Project Success is statistically significantly predicted by the independent variables.

The results of regression analysis can be summarized as “A multiple regression was performed to predict Project Success from Scope Management, HR Management, Communications Management, Stakeholder Management and Project Planning. These variables statistically significantly predicted Project Success,  $F(5, 103) = 35.819$ ,  $p < .0005$ ,  $R^2 = 0.635$ ”.

## 6. Conclusion

The main goal of this research was to analyse the Project Management Practices adopted by engineering organizations operating on Make-to-Order projects both for public sector and private sector manufacturing organizations in the context of Pakistan and to study the effect of these PM practices on success of the projects executed by these organizations. The population was the private sector and public sector MTO manufacturing organizations of Pakistan. The study analysed the effect of Scope Management, HR Management, Communications Management, Stakeholder Management and Project Planning on Project Success. The study established that Project Success is strongly correlated with PM Practices in Make-to-Order Organizations. The private sector and public sector organizations follow the Project Management

Practices to the same extent and there is no significant difference in the practices being followed by them.

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