



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4

Issue: II

Month of publication: February 2016

DOI:

www.ijraset.com

Call:  08813907089

E-mail ID: ijraset@gmail.com

Empirical Relation between Capability Maturity & Significance of PPM Technique in Product Innovation of Manufacturing Industries

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Abstract— *Project portfolio management (PPM) helps organizations to select and manage an optimal portfolio of products/projects that maximizes organization's responsiveness, revenues, and adaptability while keeping the products/projects aligned with strategic business goals and objectives. PPM is not only maximizes performance and optimizes costs, it also promotes collaborative effort. PPM process facilitates decision making through evaluation, selection, prioritizing, balancing, execution of the work, harvesting of benefits and feedback of results for continuous process improvement. The present study aims to evaluate and find the relation between the capability maturity and the significance level of project portfolio management implementation in the manufacturing industries. This empirical analysis evaluates the objectives with the help of primary data that was collected from the selected of respondents of companies through a well structured survey questionnaire. The data analysis was performed using correlation and regression statistical analysis technique and it concludes that there is a high positive correlation and regression existing between the capability maturity and significance level of project portfolio management. Further, the research study recommends a need of improvement in the capability maturity in order to achieve the goals and to secure the strategic advantage of project portfolio as a part of strategic business management.*

Keywords— *Project Portfolio Management, Capability Maturity, Significance of PPM, Strategic Business Management.*

I. INTRODUCTION

In the present global volatile economy, product innovation has emerged as a critical and significant decision making function in order to sustain and development of the organization [1,2]. The effect of modern technologies and enhancements in distribution and services has changed the environment in which organizations compete. Organizations now face shorter product life cycles and shifts in consumer taste that compel them to review their existing products and to instigate new ones. Projects provide the means for an enterprise to respond to rapid change and to gain competitive advantage, helping in the design and execution of organizational strategies that yield innovative products and services. In today's competitive world, competition is characterized by the appearance of unknown, uncertain, not obvious products and services, which needs project-driven strategic planning [3]. The selection of right balance of projects yields maximum value of the portfolio in respect of scope, scarce resources, and contribution to the short-term and long-term development strategy of the organizations [4]. Different types of projects that are interrelated and in alignment with organization strategies should be compared and selected. Hence, it is necessary and beneficial to classify projects for the purpose of facilitating the process of selecting and prioritizing projects in project portfolio management [5].

The PPM capacity incorporates forms and in addition hierarchical variables. PPM processes are the strategies, policies, practices, activities, procedures, techniques and instruments that executives use for continuous asset allotment and reallocation among an arrangement of advancement tasks to amplify the commitment of ventures to the general welfare and accomplishment of the undertaking [6,7]. An association's innovative PPM capacity is in charge of the compelling arrangement of the advancement procedure and gives an all encompassing point of view to continuous choice making to keep up the best mix of ventures for new item and administration improvement. The goals of the IPPM capability are: aligning projects with the innovation strategy, maintaining a balance of project types, and ensuring that the project portfolio fits with resource capability so that the organisation can gain the maximum value from the investment in new product development [8,9]. Along these lines compelling PPM practices are proposed to improve an association's upper hand. . Advancement undertakings are characterized as tasks for the improvement of another item. These can be fabricated items, administration items or items that contain a mix of produced and administration components. An advancement venture portfolio is characterized in this theory as a gathering of development undertakings that are overseen midway to meet vital business targets. PPM is related to the more general project portfolio management (PPM) processes that can be applied to many types of project-based environments, and derives from the project management (PM) discipline [10].

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PPM capabilities are developed individually to suit the environment and play a strong role in tailoring product development processes to the environment. Capacities are emphatically incorporated with and rely on item advancement abilities and the underlying resource base such as skills, knowledge, equipment, funding to deliver competitive advantage.

II. METHODS AND MATERIALS

A product innovation stratagem is the master plan that provides direction for company's new product development efforts and it is the essential association between these efforts and the business strategy. There are many PPM methods that are used to assist with strategic decision-making, risk evaluation, and resource allocation for both new and ongoing projects. Financial analysis is almost always one of the tools used for project portfolio selection and management, and many different financial methods have been developed [11]. Other commonly used PPM tools include scoring models and checklists, strategic approaches, and mapping approaches [12]. Previously some PPM techniques attempted to develop formulaic solutions through the mathematical models and optimisation techniques; however these are not widely used due to the complex in nature.

Capability Maturity Models are often derived from 'best practice studies' and are designed to reflect the practices that are in use, with practices at the higher levels of maturity generally thought of as the 'best practices' that successful organizations' use. The proposition behind most maturity models is that organizations develop capabilities by achieving each level of capability in sequence across a range of capability dimensions. To execute a pragmatic and ingenuous qualitative research, the concept consists of the following six elements which are further considered as parameters to assess the adherence levels of the concept and are depicted in figure 1.

- Portfolio Revision – Frequency
- Selection Methods-Review and Adoption
- PPM Quality Control Process Level
- PPM Process-Maturity Level
- PPM Process-Longevity and
- PPM Process-People Familiarity

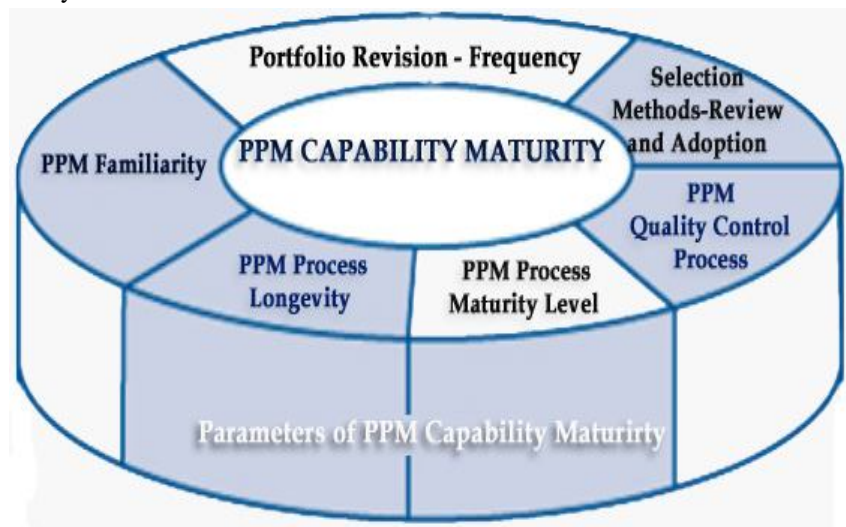


Fig. 1 Concept Elements of PPM Capability Maturity

Portfolio management has become a manifestation of the business's strategy and the companies are considering it as the only efficient tool to meet their strategic business goals. Maximizing the returns by optimizing the I.T cost, maintain the competitive position of the business, efficiently allocate scarce resources, link between project selection and business strategy, right balance between long- and short-term projects, high-risk and low-risk ones, consistent with the business goals" are the major reasons to acknowledge the importance of PPM in their organizations [13]. Significance of PPM has comprises seven elements that are listed below, further considered as parameters to measure the adherence levels of the concept in their respective organizations.

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- Importance of PPM
- Role in Optimizing I.T Cost
- Alignment with Business Strategy
- Right Balance of Projects
- Competitive Market Position
- Usage of Scarce Resources
- Reducing Project Failure Rate



Fig. 2 Concept Elements of PPM Significance Levels

A. Correlation Analysis

The degree and direction of correlation between the variables is measured with the help of coefficient of correlation and is denoted by Greek letter ρ (rho). Karl Pearson’s coefficient of correlation, which is most widely used statistical method, employed to measure the strength of relationship between variables. The value of coefficient of correlation lies between +1 and -1 and $\rho = +1$ indicates the perfect positive correlation and -1 indicates the perfect negative correlation and zero value indicates no correlation between two variables. The Correlation between two variables X and Y can be determined using the following Pearson’s Coefficient computational formula:

$$\rho = \frac{\sum xy - \frac{\sum x \sum y}{N}}{\sqrt{(\sum x^2 - \frac{(\sum x)^2}{N})(\sum y^2 - \frac{(\sum y)^2}{N})}}$$

Table I presents the summarized data pertaining to Capability Maturity and Significance Levels of PPM in order to perform the comparative statistical analysis to ascertain and establish the relationship between the concepts.

TABLE I
 INTERPRETATION OF COEFFICIENT OF RELATION

Selected Groups	PPM Capability Maturity (CWA)	PPM Significance Level (CWA)
Tier-I Management	3.28	3.50
Tier-II Management	3.02	3.32
Tier-III Management	2.90	3.18
Senior Technology Management	3.27	3.49
Operations Management	2.33	2.48
Marketing/Sales Management	2.68	2.80

Although the interpretation of a correlation coefficient depends on the context and purposes, the following table I is generally used for interpretations related to the degree of correlation based on the coefficient values.

TABLE III
 INTERPRETATION OF COEFFICIENT OF RELATION

Correlation	Negative	Positive
None	-0.09 to 0.0	0.0 to 0.09
Weak	-0.3 to -0.1	0.1 to 0.3
Medium	-0.5 to -0.3	0.3 to 0.5
Strong	-1.0 to -0.5	0.5 to 1.0

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B. Regression Analysis

Regression analysis is a statistical technique for the investigation of relationships between variables and it facilitates in assessing the degree of relationship existing between two variables so that they can be associated through a regression equation. Regression equation helps in predicting the future behaviour of a dependent variable given the value of independent variable. The linear regression equation can be expressed as $Y = a + bX$ where X is the independent variable that affects the dependent variable Y , a is intercept and b is slope of the independent variable. In this thesis, the PPM Capability Maturity Level is considered as independent variable, significance, performance, benefits and impediments of PPM are considered as dependent variables. The regression statistical technique was employed to estimate the cause and effect relationship between the variables and the test results are presented in the next sections of this paper. The regression analysis was carried-out and the co-efficient of determination (r^2), the intercept (a), slope (b) of PPM capability maturity level are calculated and formulated the regression equation. The regression test results are recorded for further analysis and the regression equation for the capability maturity and significance of PPM is given below:

$$y = 1.0029x + 0.2071$$

III. RESULTS AND DISCUSSION

A. Correlation Between Capability Maturity And Significance Levels Of PPM

To graphically illustrate the wide spread in PPM significance levels across the respondents, respondents are grouped according to *top* PPM significance levels representing the top 20 percent of scores for PPM significance levels measures and *poor* PPM significance levels representing the bottom 20 percent. Responses for these groups are displayed with the average responses across the entire survey population in Figure 3. Although some organisations score highly on these measures, the average significance levels leave much room for improvement. Correlation Analysis was conducted on the data that was presented in table III and the calculated Karl Person’s coefficient of correlation from the data for further analysis.

TABLE IIIII
 COEFFICIENT OF CORRELATION-CAPABILITY MATURITY AND SIGNIFICANCE LEVELS

Correlation Analysis	<i>Capability Maturity Level</i>	<i>Significance Level</i>
Capability Maturity Level	1	
Significance Level	0.984535	1

The coefficient of correlation value of 0.985 indicates the strong positive correlation between the Capability Maturity and Significance Levels of PPM and Figure 3 that interprets the correlation in the form of graph confirms the same.

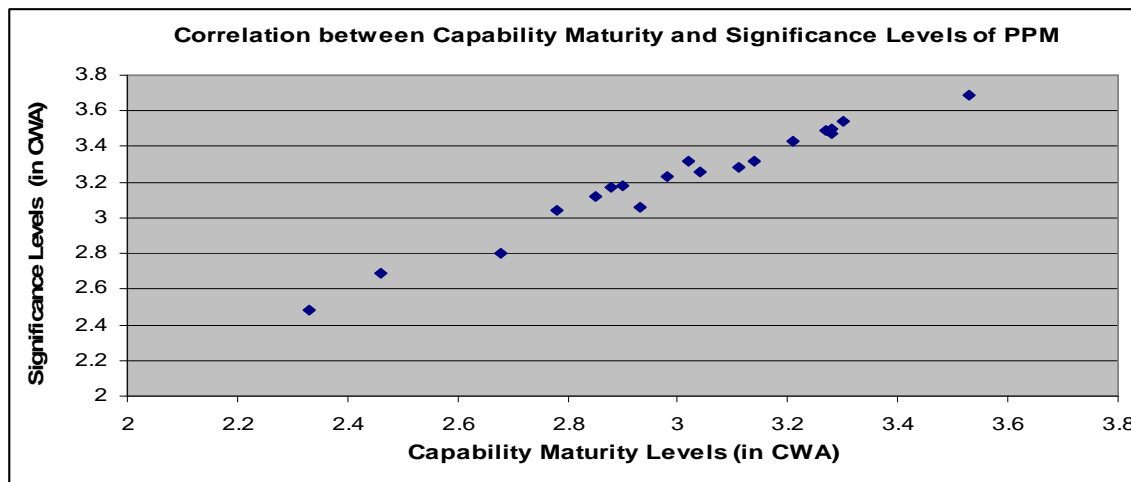


Fig. 3 Correlation Curve – Capacity Maturity and Significance Levels of PPM

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B. Regression Analysis Between Capability Maturity And Significance Levels Of PPM

Table I summarizes the data pertaining to Capability Maturity and Significance Levels of PPM and regression analysis was conducted to ascertain and establish the degree of cause and effect relationship between the two concepts.

TABLE IVV
 COEFFICIENT OF REGRESSION STATISTICS-CAPABILITY MATURITY AND SIGNIFICANCE LEVELS

Multiple R	0.984534633			
R Square	0.969308443			
Adjusted R Square	0.967503058			
Standard Error	0.055120024			
Observations	19			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.207148939	0.130391206	1.588672625	0.130558
PPM Capability Maturity Level	1.002881695	0.043281639	23.17106531	2.67E-14

The value of $r^2 = 0.969308443$ reveals that 96.93 percent of the total variation observed in the significance of PPM caused by the capability maturity level of PPM. The regression equation and the regression curve as a straight line (see figure 4) confirms the positive linear regression relation between PPM Capability Maturity and Significance.

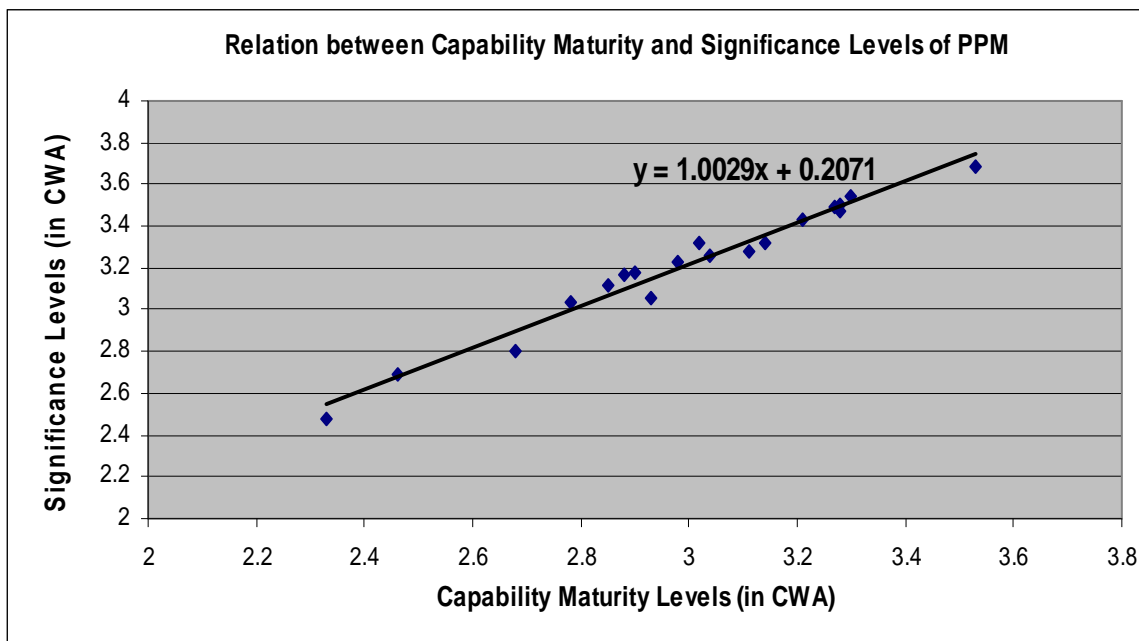


Fig. 4 Regression curve – Capacity Maturity and Significance Levels of PPM

IV. CONCLUSIONS

The research analysis indicating that best practices of project portfolio management will increase the capability maturity of the organization. While the capability maturity and significance levels are different activities of project portfolio management, the study concludes that capability maturity and significance levels of project portfolio management has higher degree of positive correlation. The research study findings also establishes strong positive linear regression between the capability maturity and significance levels of PPM .In order to secure the strategic advantages and achieve the business goals of the company, the research further suggests that there is a need of improvement in the capability maturity. The analysis on project portfolio management recommends that for better innovation outcomes, management should place a priority on developing and improving PPM processes especially in product innovation.

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