



Prim - A Framework for Project Management

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Prim – A Framework for Project Management

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Abstract- In today's world, project management is a rapidly developing area. The various models and frameworks available to implement a project vary according to the nature of the project. However, not all of them are applicable to all types of projects. This paper describes a project management framework, PRIM, which is a combination of CMMI, PRINCE2 and PMBOK. The framework integrates these three technologies. Key process areas of CMMI are aligned with PRINCE2 while tools and techniques are taken from PMBOK. The already available framework of PRINCE2 was used as a guide in developing a new one. Research was done to make a new framework for project management that can be used to handle projects of various nature and sizes.

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I. INTRODUCTION

Project management is a growing field. In coming years, it will be one of the most practiced disciplines. It is the skill of controlling and organizing different parts of a project. It may include making of a new product, expansion of a business or even a wedding plan.

According to PMI [1], "a project is a temporary group activity designed to produce a unique product, service or a result." It is temporary because it has defined start and an end. It is unique since it includes activities, which are not carried out daily. A project requires and uses resources like people, money and time. It can be very small to a big one comprising teams from around the world. Construction of a plaza, expansion of a business even writing a code is all projects. It provides useful techniques and knowledge for making a project.

According to [2], "a management in all organizational and business activities is the act of coordinating the efforts of people to accomplish desired goals and objectives using available resources efficiently and effectively." This contributes to the concept of Project Management. It includes managing project consisting of small teams to a project consisting of expanding a business to geographical level.

Project management is thought to have three main components time, money and scope. Increasing or decreasing one affects the others. Project managers

have to use these resources skillfully so that none of the three is exhausted.

Baars [3] says the six phases of initiation, definition, design, development, implementation and follow up form the basis of all the methods. By dividing a project into smaller phases, handling the project team and division of workload between them becomes easier. In addition, it leads a project towards the right direction.

II. BACKGROUND

This area has expanded in past years and will continue to expand in coming years. According to Kerzner [4], "The growth and acceptance of project management has significantly changed over the past forty years, and these changes are expected to continue well into the twenty-first century, especially in the area of multinational project management."

Many of today's projects fail because of unrealistic time scales. This is because time is decided before the project start and is unchangeable afterwards. Another reason is lack of proper communication between the team members and the project managers. This leads to improper requirements choice and hence failure. Yet another reason is insufficient resources for a project. When properly applied, it results in better use of financial, human resources, and time constraints.

III. LITERATURE REVIEW

The literature identifies the research done to investigate project management frameworks and various development methods. According to Ana et al. research [5], CMMI works with SCRUM. This way small teams use it as a starting method without defined processes. Research indicates that it can help organizations to make a new project management framework based on both practices. While Ana et al. suggest this, Carsten et al. [6] claims combining it with SCRUM for more complex and larger projects. It shows how this combination handles increasing size and complexity.

Lina et al. [7] also suggest a combination of CMMI with Scrum, however, for small and medium sized organizations. The result is an improved project management framework for use in such organizations.

Zaidoun [8] and Jerzy et al. [9] both show that PRINCE2 works well with agile method XP. Both studies incorporate agility into PRINCE2's rigid structure. However, [10] claims combining it with DSDM based on their product-driven nature.

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Taher et al. [11] study assesses PMM and CMMI to make a conceptual framework that fits into project management environment. In addition, it is easy to use it in various situations. Likewise, Felipe et al. [12] study attempts to make a maturity model for agile methodologies based on CMMI.

Ana et al. [4] and Jeff et al. [13] both claim that projects using combination of CMMI and agile methods like SCRUM produce better results. However, the former study does not specifically address small teams or organizations.

IV. THE OBJECTIVE

While these studies suggest integrating CMMI with agile practices like SCRUM and PRINCE2 with XP and DSDM, little research done on integrating these with each other. The study suggests combining CMMI with PRINCE2 to make a new framework while using tools, techniques from PMBOK.

V. RESEARCH METHODOLOGY

A methodology is the result of a series of studies carried out in a certain area or on a problem. It describes a new idea, a research, a finding or an innovation in that area. It puts into form the research or the study done. A methodology can be a framework of a new finding, a new working model or can be a way of doing something. It tells the pattern or a way of carrying out certain task or a project.

VI. PROPOSED FRAMEWORK, THE PRICM

PRICM stands for PMBoK, Prince2 and Cmmi. The combination includes project management's proven framework of PRINCE2 while using CMMI's improvement approach and PMBOK's tools. The proposed framework incorporates their strengths and reduces weaknesses as much possible.

a) PRICM's Framework

The proposed framework is a combination of model of CMMI, PRINCE2 method and rules from PMBoK. PRICM utilizes PRINCE2's predefined method for how to and CMMI model for what to do and why to do while PMBOK for what.

VII. PROPOSED FRAMEWORK

This section describes the proposed framework in detail. The framework implements the gaps identified in the previous studies. The study identified that work has been done to combine CMMI with SCRUM [5] [6] [7] and PRINCE2 with XP [8] [9] and DSDM [10]. Taher et al. [11] suggested a project management model by integrating these two with each other but it did not use PMBOK.

Likewise, research has been done on combining PRINCE2 with XP to incorporate flexibility into its rigid structure. The various studies suggested making a new project management framework by combining CMM and PRINCE2 with afore mentioned methods but no work is done to integrate the two with each other.

This research integrates CMM with PRINCE2 while using PMBOK's knowledge areas and rules. The rigid nature of PRINCE2 is made flexible so that it is applicable to smaller projects as well.

The framework consists of seven stages, five life cycle phases and the associated inputs and outputs. The inputs are the documents, charters, work planning whereas outputs are the work packages, milestones and results of that particular stage. In addition, each stage has initiation, planning, executing, monitoring and controlling and closing phases.

These five phases are basic steps of every project life cycle. Utilization of already available framework of PRINCE2 was helpful in making a new one. It does not incorporate only flexibility or strictness as either can result in a design that may be over-modified or cannot be modified at all.

Therefore, it was important to keep balance between these two qualities. It took into consideration previous design shortcomings, hence, resulted in a design that is simple in interface and use as well.

Fig.1 below describes the design of proposed framework. The figure is made in colors for better understanding of its stages, processes, documents, inputs, outputs etc. Arrows are also shown as solid and dotted lines for clear representation.

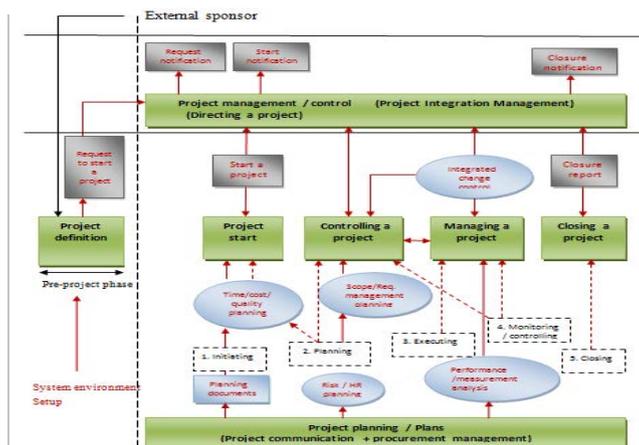


Figure 1: The Proposed Framework

a) Description of Framework

The solid green boxes are the main seven stages of this design; dotted black boxes show five phases that are present in every project's life cycle. Oval-shaped blue boxes are the knowledge areas from PMBOK; square grey boxes show the additional information or documents of stages. Solid red arrows are the links among stages, dotted red arrows show which of the five main phases are present in main stages. The black dotted line partitions the pre-project phase and the main project phase. The two solid black lines partition external sponsor, management and direction and project controls.

b) Detailed Description

The final design of framework was made according to already available framework of PRINCE2. The framework of PRINCE2 is not flexible enough resulting in some parts of projects falsely tailored. Moreover, it is not well suited for small projects. It is also document-centric and lacks proper analysis of requirements. CMMI's process areas, PMBOK's knowledge areas are combined along with PRINCE2's to make a framework best suited. The framework has seven stages and the associated inputs and outputs. Already available design of PRINCE2 is altered accordingly by combining CMMI's and PMBOK's knowledge areas. External sponsor or corporate management is the entity external to the project. The business aims of a project and the charter is prepared by the management and is then approved by the project board officials. The board also appoints the project team and project manager.

After authorization, the project starts. As it starts, overall schedule and plan of how it will be carried out is finalized. In addition, all the team members are assigned their respective tasks. Time, cost and quality factors are also discussed to ensure proper and optimal handling of all the available resources.

Since PRINCE2 lacks this, PMBOK's knowledge areas of time, cost and quality management help in ensuring this. At this point, the project is formally initiated.

Now project team members and manager are decided and tasks are assigned, planning on time, cost and quality is also done, the project goes into the next stage. This stage does all the important planning on project, including risk and human resource planning. During this stage, decisions and guidance on on-going activities of project are discussed with external management. If the project's scope or requirements need any changes, they are incorporated. Since PRINCE2 lacks proper requirements analysis and scope management, PMBOK's scope and requirements management areas assist in this. Moreover, integrated change control is used.

After incorporating any necessary changes, the project enters into the execution phase. At this stage, all staff and team members actually start executing their respective tasks. Proper communication with staff and stakeholders is a critical part of this phase. This communication creates a feedback, which is used for improvements. The communication can be through regular meetings with staff and manager, telephone calls or even interviews. While the project executes, monitoring and controlling is also done to ensure activities are going as planned. The management and planning phases run throughout the project to supervise all the activities.

When the project is done, it enters into the closing phase. This phase officially closes a project. The board members review the project for its completion and a closure report is issued along with the closure notification. This notification is sent to the external authority after approval. It officially closes a project.

c) Detailed Design

Fig.2 shows detailed design of the proposed framework. It shows inputs and outputs of every stage along with the notifications sent or received. Grey squares are the main stages. Blue rectangles are planning documents and authorizations while blue rounded rectangles are the notifications and decisions. Oval red boxes are the outputs of the respective stages. The figure is drawn in colour to show better understanding of stages, processes, documents, authorizations, inputs and outputs.

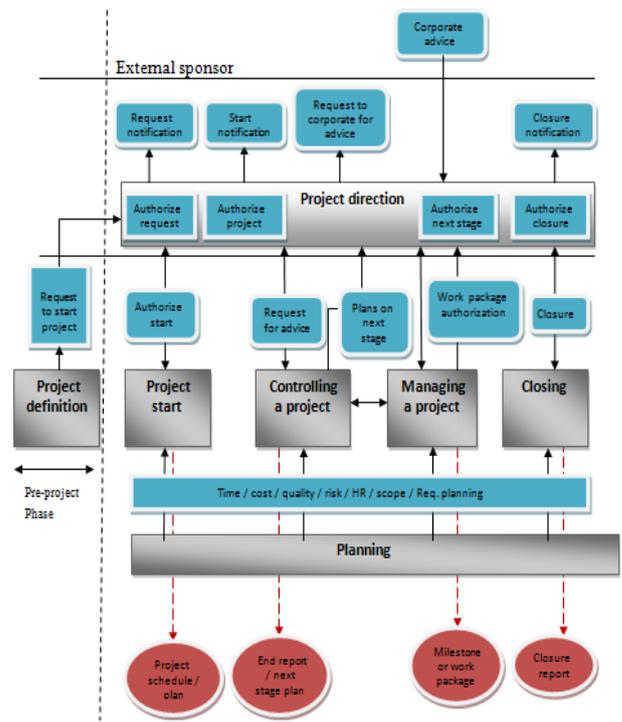


Figure 2 : Detailed Design

i. *Project management / Control*

This stage officially starts and closes a project and continues throughout the project life cycle. This stage also includes project integration management. Therefore, both directing a project (of PRINCE2) and integration management (of PMBOK) are involved. While directing a project tells how to carry out a project, project integration management helps in coordinating other areas to work together throughout. It also handles and manages any change in project's plan or scope through integrated change control.

ii. *Project Definition*

This stage is a pre-project phase. All the activities that are part of pre-project are carried out during this phase. Project's environment is also decided. A project brief or definition outlining what a project will accomplish is prepared. In addition, justification of business importance is also prepared.

iii. *Project Start*

This stage formally starts a project. A project start notification starts it. It includes agreement on all the planning documents including quality and time management. In addition, a business case and how the project will be carried out are developed. Quantitative project management is also a part of this stage, which includes managing quality, performing quality control and check and confirms quality assurance. Authorization of project team members and manager is also part of this stage.

iv. *Controlling a Project*

This stage includes all the major planning on the project. In addition, it also plans on the next stage. Project's scope and requirements management are catered for during this stage. Risk and human resource planning is also discussed. It is during this stage that guidance and decisions on on-going project's activities are asked from the external management, and then scope of project is accordingly adjusted. Integrated project management is used for this purpose.

v. *Managing a Project*

This stage formally starts the execution of project. All the team members start their work against the assigned tasks. Proper communication with all the staff and team members is critical for project success, so, project schedule is carefully rotated among them. Project communication is used for this purpose. While the project is in execution phase, monitoring and controlling is also started to ensure that project is going as planned. Performance analysis is also carried out. This creates a feedback, which is used for necessary improvements or scope changes through integrated change control.

vi. *Planning*

The planning stage continues throughout the project providing guidance on time, cost, quality, risk, human resource, communications and procurement

plans. Communication plan includes managing interaction among the stakeholders and team members while procurement plan includes appointing and contracting the suppliers. PMBOK's procurement management provides guidance on this.

vii. *Closing a Project*

This stage officially closes a project. It includes reviewing project's completion according to the project plan. Output is a project closure report, which is authorized by the project board or officials and a closure notification is issued.

d) *Flow Diagram*

The flow diagram shows systematic description of the design. Square boxes are the main stages of the design while arrows show flow of information. Diamonds boxes are the decisions. Planning phase is not shown in the flow as it continues throughout the project life cycle. Fig.3 below shows the flow diagram.

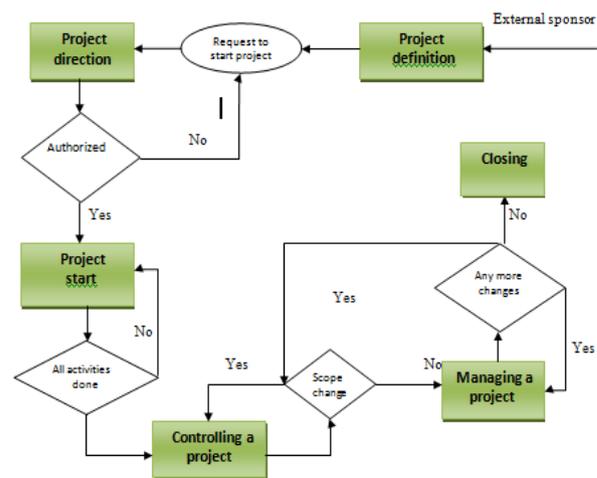


Figure 3 : Flow Diagram

e) *Context Diagram*

The context diagram shows a single process (stage) of project direction and its relationship with the entities. These entities are always external to a project. This single stage generalizes the function of complete design in relation to the entities. These are the factors from which inputs and outputs come and go. Arrows show flow of inputs/outputs. Corporate management entity is responsible for handling all the matters related to project start, closure, proceedings etc. External sponsorship is funding to project from outside. Stakeholders are people who directly or indirectly have any kind of stake in project. They are affected by all the factors important to the project. Contractors or suppliers are the people who have interest in buying the project once it is complete. System environment is the environment where the project will be tested and evaluated. These entities provide input to project and then receive output. The I/O depends on the nature and

type of entity. For example, the corporate management entity would ask for overall progress of project etc. Fig.4 below shows the context diagram.

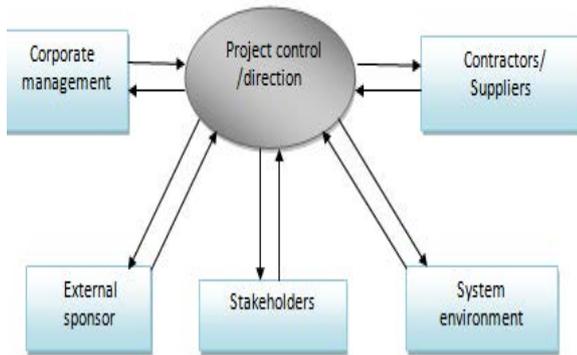


Figure 4 : Context Diagram

VIII. EVALUATION OF PRICM

PRICM's framework aims at increasing efficiency and reducing weaknesses. PRICM's framework incorporates all the possible benefits including afore mentioned benefits. These include flexibility by allowing maximum communication among all the stakeholders, reduced time and cost, maintaining the scope of the project as stated and the benefit of adaptability.

a) Quality of PRICM

Too much flexibility in a method can lead to over running the requirements stated. This in turn can affect the products produced. Therefore, the strict and product-based nature of PRINCE2 can lead to the desired outcomes. CMMI provides the discipline for carrying out the project while PMBOK provides the knowledge. The project management proven framework of PRINCE2 ensures quality.

b) Efficiency of PRICM

The main benefits as stated earlier provided by the framework are reduced time, cost, and flexibility. Moreover, the interface is simpler as focus is on working and efficiency of the framework. The strengths combined enhance the efficiency and performance. This way the resulting framework will deliver better results up to the expectations of the customers.

c) Assessment of PRICM

Jeff et al. [13] study shows an outcome of improved performance. It also claims increase in productivity and a better quality as compare to traditional methods. Taher et al. [11] study also claims that the framework is applicable wherever required but keeping in view the specifics of the project. Research indicates that framework itself is explanatory providing benefits. However, Zaidoun [8] study concludes with an

improved customer relationship. It also shows project remains within time, budget and quality constraints.

PRICM's model is expected to show an increase in performance, better productivity, flexibility, quality improvement and adaptable to any environment. As it includes flexibility and best practices, expectation is it will provide maximum positive results and an improved performance.

d) Applications of PRICM

The proposed framework will be applicable to any working environment. An industry, whether it is software or an IT will benefit from this combination. In addition, it is applicable to smaller projects as well that cannot use heavy frameworks to start with.

IX. RESULTS

This section describes overall results based on evaluation of framework. Tables 1 and 2 below show various parameters related to proposed framework. These show evaluation of framework in context of these parameters. These parameters were selected keeping in view various factors against which to evaluate the framework.

Table 1

Parameter	Support (%)
Quality	90
Productivity	85
Performance	85
Flexibility	95
Discipline	95
Efficiency	85
Time/Budget constraints	85
Results	90

Table 2

Parameter	Support (%)
Applications	85
Level of communication/customer relationship	90
Interface	90
Innovation / Creativity	90
Requirements handling	90
Scope changes handling	90

The above support percent is based on feedback from different people. The participants were given framework to study it and then rate it on a scale from one to five. The percentage is related to the corresponding scale ratings. The tables show improved results as compared to previous counterparts of framework. Overall feedback shows 88.92% results. Table 3 below shows rating of framework and in the category, it falls.

Table 3

Scale	Percentage	Description
5	90 and +	Outstanding
4.5	80 and +	Excellent
4	70 and +	Very good
3.5	60 and +	Much acceptable / good
3	50 and +	Acceptable
2.5	40 and +	Average
2	30 and +	Below average
1.5	20 and +	Should improve
1	10 and +	Must improve / poor

According to the rating scale above, the proposed framework falls in the category of being excellent. Hence concluded, this framework has almost all the qualities and features required by people, experts and professionals. In addition, it has a great level of support for the domain it is made. Moreover, the outstanding category can be achieved with some more enhancements based on participants feedback.

a) PRICM vs. other Frameworks

Zaidoun's research [8] combines project management's method PRINCE2 with agile method XP. He incorporates XP's flexibility in PRINCE2's rigid and strict methodology while making use of PRINCE2's defined framework. The resulting product was a newer version of XP having management's best practices.

Jerzy et al. [9] also suggests integrating PRINCE2 with XP while keeping a balance between agility and discipline. Research indicates that by integrating these methodologies while using appropriate tools results in a much better working framework. [10] claims integrating PRINCE2 with DSDM. It suggests a new management framework by making use of PRINCE2's control and DSDM's agility. However, it has little to no industrial applications.

Ana et al. [5] point seems to be that CMMI's integration with SCRUM works well for small teams and for organizations who wish to move towards agility. Carsten et al. [6] suggests the same combination but argues that SCRUM when integrated with CMMI can handle projects of increasing size and complexity.

However, Lina et al. [7] claims combining it for small and medium sized organizations. Jeff et al. [13] research claims that combination of CMMI and SCRUM can work wonders for any type of company and organization. Research indicates that combination satisfies customer's needs of changing requirements and on time delivery by incorporating CMMI's process discipline and SCRUM's flexibility.

However, the aim of Felipe et al. [12] study is to make a maturity model for agile methodologies based on CMMI's model. It uses process improvement approach from CMMI for software development organizations.

Taher et al. [11] investigate the idea of assessing and integrating CMMI with PMM. Research proposes an enhanced framework that improves efficiency and effectiveness of a project. While these studies suggest integration of CMMI or PRINCE2 with different agile methods, PRICM is a combination of CMMI and PRINCE2 using tools, skills, knowledge and techniques from PMBOK. The result is a synthesized framework for project management that uses best practices and delivers the best possible results. The framework incorporates flexibility along with the strictness for discipline.

Tables 4 and 5 below show nine main studies closest to the research. Only five parameters are shown for comparison as they cover all the remaining parameters.

Table 4

Parameters/ Frameworks	Zaidoun	Jerzy et al	Mike et al	Ana et al
Quality	Yes	Yes	Yes	Yes
Performance	Yes	Yes	Yes	Yes
Time/budget constraints	Yes	Partially	Partially	Partially
Innovation/creativity	Partially	Partially	Yes	Yes
Scope/requirements handling	Partially	Partially	Partially	Partially

Table 5

Parameters/ Frameworks	Carsten et al	Lina et al	Jeff et al	Felipe et al	Taher et al
Quality	Yes	Partially	Partially	Yes	Yes
Performance	Yes	Yes	Yes	Yes	Yes
Time/budget constraints	Partially	Partially	Yes	Partially	Yes
Innovation/creativity	Yes	Partially	Partially	Yes	Yes
Scope/requirements handling	Partially	Partially	Yes	Partially	Partially

The tables show that these frameworks have the required qualities and support, however, not all of them. Performance of all the frameworks is up to the expectations but certain factors, like, scope changes and time or budget constraints are not catered for well. Therefore, the proposed framework PRICM aims to cover up all these factors as much possible and be up to the expectations of professionals and experts.

X. CONCLUSION

This paper presented a proposed framework for project management. The framework integrated three main technologies namely CMMI, PRINCE2 and PMBOK. The already available framework of PRINCE2 was helpful in making it while PMBOK provided necessary tools and techniques for guiding the implementation. Results show a significant improvement in overall performance and quality of framework as compare to already available frameworks. It aims at implementing almost all types of projects in different environments.

Future research on this topic can include integrating the same framework with other project management models as well expanding the domain of its applications.

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