Project Management Strategy of Physical Protection System Upgrading for Nuclear Facilities

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Abstract-This paper introduces the main concepts of the project management strategy for upgrading the Physical Protection System (PPS) at nuclear facilities. The project scope is redesigning the security systems to enhance the security measures to fulfil the requirements and recommendations of IAEA and the vision of the member states. The most challenging of security project is the successful management of the project and solving the problems such as lack of resources, budget, and qualified contractors. However, failure in managing project causes waste of resources and delays the closing, which affect the reliability of protection and increase the threat likelihood. This work gives an integrated model for the project phases based on the project management standard and the Project Management Institute (PMI) models.

Key word: *project management, project management institute (PMI), project management model.*

1. Introduction

Project management was born in the 1950s, in the space and construction sectors. Nowadays, these are used not just to manage complex tasks in technical environments, but also for problem solving and crisis situations in all management fields, such as marketing, personnel, finance and corporate organization, in both businesses and public sector organizations. In recent years, the need of the integrated management systems as a consequence of the complexity of the business environment has increased rapidly. Challenges of the successful project management basically depend on different parameters such as the good organization, team selection and clear responsibilities of all, budget, acceptance of the stakeholders, end users, time schedule, contractors and vendors. History of project management model such as PMI was founded in 1969 by industrial professionals group who believed focusing on project management processes was the right strategic answer for improving the management of projects. This view had been defined in 1975; the main concepts of the PMI model continued to be distributed and formalized as a management process [1]. In 1990s it had grown to 90,000 members and the need to provide more standard definition to their message led to the 1996 issuance of a document called the Project Management Body of Knowledge, PMBOK Guide, which is known in the industry today as the PMBOK. PMBOK has now more than 20 years of application in the field of project management and many editions was released till the six edition, 2017. The evolution of PMI as an organization continued after the first PMBOK edition. In 1984, a credentialing effort was announced to formally recognize a

project management skill level. Last two decades the number of interesting in project management and members of PMPs has grown exponentially. During the same period PMI continued to introduce various other certifications within the project management model. On the other hand the PMBOK became viewed as somewhat of a bible defining project management with new editions of the PMBO. All of the previous references introduced, described and explained the project management phases, model, life cycle processes and activities that should be evaluated and utilized in executing a project as follows [2].
The paper is constructed as follows: section II introduces the project phases model according to the PMI model. Section III shows the integration management system, while section IV indicates the nuclear security project upgrading model based on PMI. Section V explains the project risk management as an important part of the project. Section VI introduces the risk assessment and risk matrix methodology. Section VII gives the conclusion of the article and the results.

2. Project Phases Model

Project phases: All projects follow the same basic workflow; it starts with the Initiating Phase. Essentially, this is where the project objective is determined and the high-level constraints are identified through a process called scoping. Next comes the planning phase, this is where the project team develops their overall plan; how they will execute the project, what resources are needed, what the specific deliverables will be, a detailed schedule, etc. It's often considered the most challenging phase of a project to manage the work that is hard, such as stakeholder management. We can move into the Execution Phase as the core of the project, during this phase, the project should be monitored and controlled to correct any deviation can affect the project schedule and close the project with the final phase [3]. Figure 1 shows the five phases of the project, which include initiation, planning, execution, monitoring and control and closing with release.

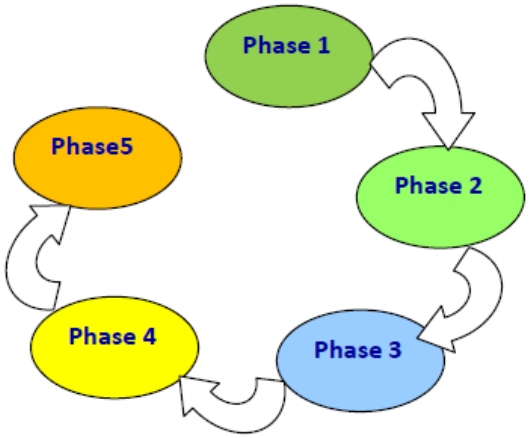

Figure 1: Project Five phases

3. Integration Management System

All project phases are connected with each other and need to interface together. Management comes in coordinating efforts to integrate the various plans into the needs of the project management plan to be managed. The most of project management is performed through processes, which collect sub process that run one after the other and then are done. These processes depend on each other; they are linked to each other by outputs and input and many of them need to be iterated several times based on the need.

The integration management system offers processes to integrate various activities and processes within each project management process group. Integrated project management system integrates the following parameters [4-5]:

Scope: The main purpose of project scope management is to ensure that the entire project required and the stakeholder's requirements are fully performed to complete the project. Scope of a project is determining its boundaries to follow what is included and what is not. In scope management process, it is possible to develop the scope baseline as one of the project triangle lines, quality and cost.

Schedule: The primary purpose of project schedule management is to establish and manage the project schedule to complete the project in time as planned. It contains processes to generate all information needed to develop the schedule, a process to develop the schedule, and a process to control the schedule.

Quality: covers the processes required to assure that the project will satisfy the operational objectives for which it was formed and within the organization's policy goals. This includes processes for quality planning, quality assurance, and quality control.

Resources: include the processes to identify, acquire, and manage resources needed for the project.

Communications: includes the processes related to ensure timely and appropriate timely information distribution and management related to the project.

Risk: includes the processes related to identifying and managing various risk aspects of the project.

Procurement: includes the processes required to purchase products and services for external sources.

Stakeholders include the processes required to identify and manage the individuals, groups, or organizations that can impact the project.

Integration: includes the processes and activities needed to integrate all of the other nine KAs into a cohesive and unified plan that is supported by the project stakeholders. Figure 2 illustrates the integrated project management model and how the project management can be integrated in each process of the project phases.

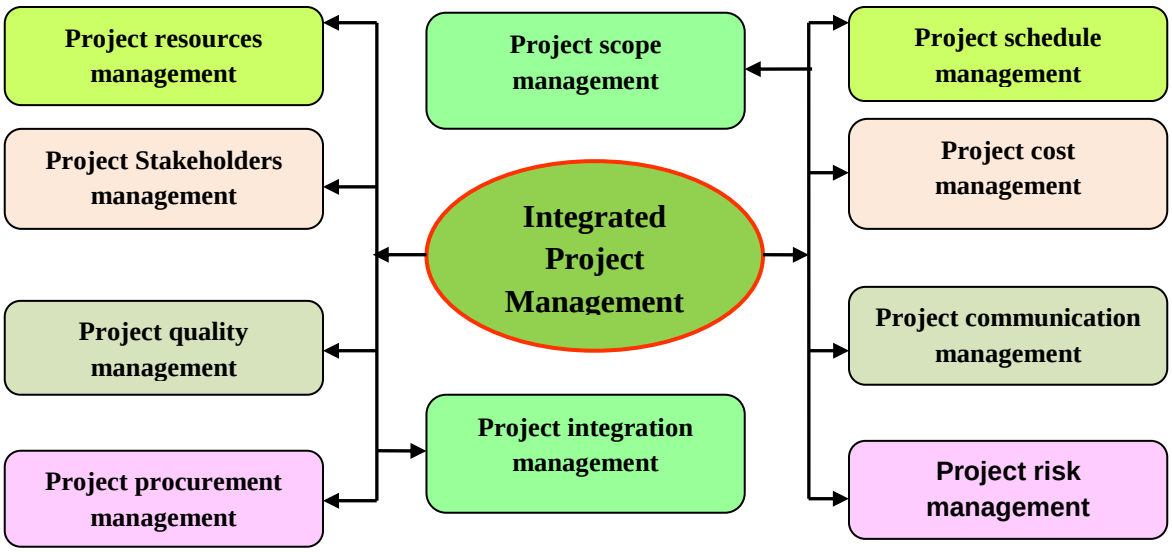

Figure 2: Integrated project management

4. Nuclear Security Project upgrading Model

Security project management model can be constructed based on the following inputs which act as the main core of the project to comply with the PMI model. The first stage of the project is initiated by the operation requirement to concern the whole requirements of the project. Practically the project initiation document is the PID to define the following items: Project objective, project scope (statement of work), operation requirements, constraints and assumptions, risk management strategy, project control strategy, communication and stakeholders, timeline planning, procurement and milestones and project approval.

Operation Requirements: This stage introduces the first part of the project to indicate the area of concern, functions of the systems will be upgraded, vulnerable points of the existing systems, constraints, operation and maintenance and the management issues related to the systems.

Project initiation and planning (PID): This project document starts with the project title and introduces the project, project objective, project scope, constraints, assumptions and risk management strategy.

Planning: plan the project according to the

- ✓ ***SOW*** includes the details of the project system and equipment to be implemented according to the project schedule.
- ✓ ***Vendors Evaluation and Selection:*** this part of the project is very important to evaluate the local vendors will be involved in the project phases as a preliminary stage.
- ✓ ***Contract preparation and approved***

Project Execution: The execution of the project is the core of the project and it should be monitored and control to follow the schedule implementation and if any delay and its affect on the project.

Monitoring and control during this phase we can fulfil if the project stays on track, is performed as planned, and, if it goes off track, to take action to bring it back on track. Risk assessment will be needed if the schedule is delayed and if resources are failed.

Release: during this phase of the nuclear security upgrading project life cycle the following activities should be done according to the project schedule: Complete the release readiness checklist, plan the release activities, and complete the release activity and formal release approval.

Closing is the final stage of the project life cycle, which includes the following: Conduct a project retrospective, disposition leftover HW, archive SW and documentation, publish project summary, obtain agreement that the project work is complete, celebrate the project completion, recognize the team and release resources from the project.

Guarantee is very important to save the spare parts of the same or advanced technology to enhance the operability and reliability of the upgraded nuclear security system.

5. Project Risk Management

The Project Planning strategy should conduct an in-depth study to assess the risks for all phases of the project and to assess the negative impacts of the risks on the completion of the project and planning for control the risk. On the other hand, if the risk occurs, it may have a positive or negative impact on achieving project objectives related to components such as project implementation time, cost and quality. A negative impact is a threat; a positive impact provides a good opportunity to complete the project. For example, one reason for a successful project is to complete the project on schedule. If the risks are related to the project schedule, it can delay the completion of the project, or can make it possible to finish the project earlier.

Figure 3 shows the risk management model, which includes risk management planning, risk identification and analysis, planning and preparation of risk responses, implementation of risks and

response if risks occur, and risk monitoring in all phases of the project. Project manager can assess the risk in accordance with the risk matrix methodology to control any delay of the project come from the risky elements [6].

Figure 3: Project risk management model

6. Security Risk Assessment

Assessment of risk means that we must examine carefully what, in the workplace, could cause harm to the workers, facilities, public, including visitors and environment. This allows weighing up whether we have taken enough precautions or whether we should do more efforts to prevent harm. Risk estimated by the following equation

$$R = P_A * (1 - P_E) * C \quad (1)$$

Where: R is the risk associated with adversary attack; P_A is likelihood of attack; P_E is the probability that the security system is effective against the attack; $(1 - P_E)$ system ineffectiveness and C is the consequence of the loss from the attack. Risk assessment by determine the Likelihood of attack, consequence of successful adversary attack and system ineffectiveness integrated in an analytical model, which is used to assess risk by estimating the effectiveness of the security and safety systems [6].

The risk ranking can be defined as a matrix whose axes are the ranks of consequences and probability. The combination of ranks of consequence and likelihood creates risk rank. Although many risk matrices have development of new risk assessment matrices is a special challenge.

A project manager should ensure that risk management planning is comprehensive, remains up- to-date to identify which method is suitable for risk identification and risk mitigation strategies are applied in a timely fashion when needed. For large size and complex projects, a formal risk management plan may be necessary. As mentioned earlier, one tool that is invaluable is the use of a Risk Register. For larger projects, specific breakdown of risks may be kept as a living document in the form of a spreadsheet that captures the risks, their drivers, their numerical priority number (such as Risk Priority Number (RPN)). It is frequently (e.g. weekly) updated to allow management to address priorities and allocate resources where needed.

Table 1: Risk assessment matrix construction

Likelihood	Consequences					
		Insignificant	Minor	Moderate	Major	Catastrophic
	Almost certain	Medium	High	High	Extreme	Extreme
	Likely	Medium	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	Extreme
	Unlikely	Low	Low	Medium	Medium	High
	Rare	Low	Low	Low	medium	High

7. Conclusion

This paper illustrated the main concepts of the project management and how it can be used as a strategically concepts to enhance the management of nuclear security project for nuclear facilities. Project phases are similarly implemented in nuclear security upgrading project from the initiation to the closing and release. Project phases lifecycle consists of many Process, all are integrated and managed in an integrated manor, which save the project schedule. Project Risk management model and risk matrix methodology used for risk assessment to simplify the process.

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