Application of project management body of knowledge in RAVONSICS project

DAI Ruidong[1], and ZENG Hai[2]

1. State Nuclear Power Automation System Engineering Company, No.7, Cangwu Road, Xuhui District, Shanghai, 200233, P.R. China (dairuidong@snpas.com.cn)

2. State Nuclear Power Automation System Engineering Company, No.7, Cangwu Road, Xuhui District, Shanghai, 200233, P.R. China (zenghai@snpas.com.cn)

Abstract: In the last decade, more and more international research cooperation has been conducted between China and worldwide in nuclear domain. However, limited experiences shared on the project management skills may lead to the inefficiency of international-cooperated researches. Project Management Body of Knowledge is recognized as a good and practical guidance for its compatibility to general project. From the viewpoint of China-EU cooperated RAVONSICS project`s coordinator, this paper firstly introduces Project Management Body of Knowledge and background information of RAVONSICS, then proposes the approach of defining detailed action items for project management through mapping the 5 Process Groups with the 10 Knowledge Areas. The actual applied action items in the Planning Process Group for RAVONSICS are demonstrated and practical management experiences are summarized finally.

Keyword: RAVONSICS; HARMONICS; PMBOK; project management; international research cooperation

1 Introduction

Reliability And V&V Of Nuclear Safety I&C Software (RAVONSICS) is a Chinese government funded project aiming at reliability assessment and V&V technologies researches of safety I&C software with cooperation with the Euratom FP7 (Seventh Framework Programme for Research) funded project named HARMONICS (Harmonised Assessment of Reliability of MOdern Nuclear I&C Software). During project management (PM), RAVONSICS shall face the possibility of consuming great amount of resources including time and budget because of stakeholders` different languages, cultures, legal system, needs and so on. Real technical researches could thus be affected. However, few practical management approaches and experiences are shared for these international cooperated research projects so far. Recognized as good practice, the Project Management Body of Knowledge (PMBOK) identifies a set of knowledge, processes and techniques with significant impact on project success. In this paper, after a brief introduction on RAVONSICS in section 2.1 and PMBOK in section 2.2, specific features of RAVONSICS are investigated. A simple approach is proposed in Section 3.2 for the non-expert in project management domain by defining detailed action items for PM through mapping the 5 Process Groups with the 10 Knowledge Areas based on PMBOK. Actual applied action items for the Planning Process Group in RAVONSICS are introduced later as a demonstration. Some major experiences and lessons learned gained so far would be summarized finally.

2 Background information

2.1 RAVONSICS

The objective of the RAVONSICS project is to propose a systematic and practical safety I&C software assessment method by conducting deep research on reliability technologies such as Hierarchical Structure Modeling and Verification and Validation technologies such as Formal Verification. The project started in January 2012 officially and will end in December 2015. RAVONSICS is supported and funded by Chinese Government. Table 1 is the core project team, which involves vendors, universities, regulatory body and end users. During the research processes, project team also attended and organized a series of international workshop with other stakeholders` attendance for comprehensive and valuable suggestions and feedback. All these effort is intended to form a firm basis for a widely accepted software assessment method.

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RAVONSICS is also the results of cooperation between the EU (European Union) and China. There is a European project named HARMONICS funded by Euratom FP7 with researches for assessing software of safety system of Gen-II and Gen-III nuclear power plants. The core project team is shown in Table 2. RAVONSICS and HARMONICS have similar research direction but different approaches and financial resources. Both projects communicated with each other based on individual staged research achievements during project lifecycle as appropriate.

Table 1 Core project team of RAVONSICS

Organizations	Roles
State Nuclear Power Automation System Engineering Company (SNPAS)	Coordinator/Vendor
Harbin Engineering University	Scientific Coordinator/University
Nuclear and Radiation Safety Center	Partner/Regulatory Body
Institute for Standardization of Nuclear Industry	Partner/Standards Administration
Shanghai Jiao Tong University	Partner/University
Jiangsu Nuclear Power Corporation	Partner/End User
Shanghai Automation Instrumentation Co., Ltd	Partner/Vendor
China Techenergy Co. Ltd	Partner/Vendor

Table 2 Core project team of HARMONICS

Organizations	Roles
VTT Technical Research Centre of Finland	Coordinator/Research Organization
Électricité de France	Scientific Coordinator/ Research Organization
TÜV Rheinland ISTec GmbH	Partner/ Research Organization
Adelard LLP	Partner/ Consultancy
The Swedish Radiation Safety Authority	Partner/Regulatory Body

2.2 PMBOK

PMBOK offers guidelines for managing individual project by describing the PM life cycle and identifying its related knowledge, processes and techniques [1]. These attributes are generally applicable to most projects and have a significant impact on project success. PMBOK summarizes 5 Process Groups in project lifecycle and 10 Knowledge Areas during PM based on good practices of PM practitioners.

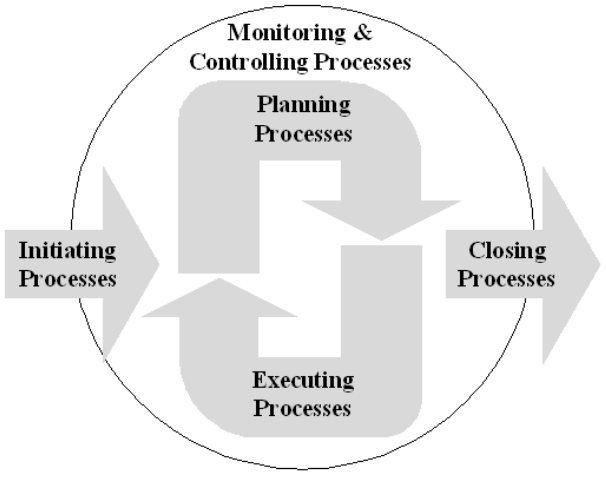

Fig. 1 Project management process groups.

As shown in Fig.1, the 5 Process Groups sequentially includes Initiating, Planning, Executing, Monitoring and Controlling and Closing Processes, while the Monitoring and Controlling Processes should be conducted throughout the project life cycle. Due to change possibilities and progressive elaboration nature of a project in reality, the 5 Process Groups are generally iterative activities. The 10 Knowledge Areas include Integration Management, Scope Management, Time Management, Cost Management, Quality Management, Human Resource Management, Communication Management, Risk Management, Procurement Management and Stakeholder Management. PMBOK then provides an overview of process interactions among the Knowledge Areas and Process Groups and thus forms 47 processes as seen in the attachment table in the last page of this paper. The inputs, outputs, suitable tools and techniques of each process are further expanded and described. Through suitable application of these 47 processes, a comprehensive and interactive monitoring workflow can be formed during project lifecycle. The PM team can make use of these processes to assess the practical

progress, balance the demands and maintain proactive communication with stakeholders in a systematic manner. It is believed that the appropriate application and integration of the 47 logically grouped PM processes will enhance the chances of success over many projects. Of course, PMBOK do not always be applied uniformly to all projects, the PM team should be responsible for determining what is appropriate for a specific project.

3 Management approach

3.1 Specific features of RAVONSICS

Comparing with engineering project, three specific features of RAVONSICS should be noticed, which lead to additional manpower and budget requirements of the project:

(1). RAVONSICS is a technology research project. Along the decided research direction and approaches, further detailed action maybe adjusted according to the staged achievements, which enhances the progressive elaboration nature of the project.

(2). RAVONSICS has multiple stakeholders with different Enterprise Environmental Factors and Organizational Process Assets. Besides the organizations in Table 1 and Table 2, Chinese Government and Euroatom are also important stakeholders of the project. Numerous stakeholders make the balance of demands even harder. Meanwhile, the Enterprise Environmental Factors like different geographic location are out of control of the project team, but influence directly or indirectly the project.

(3). Insufficient international coordination experiences in China leads to the lack of Organizational Process Assets like mature international contract template and risk data, *etc.*

3.2 A Management approach

Based on the survey of PMBOK and investigation of RAVONSICS as a research project, a simple but systematic management approach is proposed hereby. With appropriate application of the steps and action items identified along the approach, it is believed that RAVONSICS could be under appropriate control with its major objects fulfilled.

(1). List the 5 Process Groups sequentially in column-by-column format in a worksheet.

(2). List the 10 Knowledge Areas sequentially in line-by-line format in the worksheet.

(3). Investigate any existing available Organizational Process Assets and specific features of the project.

(4). List all detailed processes in the corresponding mapping space of each Process Group and each Knowledge Area according to PMBOK. Simplify, tailor or merge processes as appropriate according to the investigation in step (3).

(5). Define all detailed action items in order to fulfill each process identified in step (4). Arrange detailed schedule and allocate resources needed.

(6). Conduct and close the action items according to the schedule.

(7). Evaluate and adjust action items through project lifecycle as needed.

3.3 Demonstration of the project management process

Among the total 47 PM processes in the 5 Process Groups, 24 processes are included in the Planning Process Group. For their direct influence to the success of a project, the major applied action items in the Planning Process Group in RAVONSICS are briefly introduced hereby in Table 3 as a demonstration.

The Enterprise Environmental Factors generally differ from one project to another. For an international cooperated project, major factors such as geographic location, cultures, legal system and so on among stakeholders were recognized and identified firstly by RAVONSICS PM team, so that negative effects were to be mitigated and good influence to be enhanced by defining particular action items later. Meanwhile, available Organizational Process Assets like existing Quality Assurance System, mature Procurement System and so on in SNPAS were fully utilized to avoiding duplicated workload or unnecessary resources consuming. Within the Scope Management, both technical objectives like Software Modeling Technical Research Report and non-technical objectives like Project Management and Dissemination Report were

identified with comprehensive consideration of technologies development direction, various stakeholders` interests and so on. After the scoping process, Work Breakdown Structures (WBS) acted as the tie to connect most action items in the table actually. With the participation of all stakeholders, RAVONSICS decomposed of the total research work to multiple research packages according to project scope, relationships among packages and research capabilities, *etc*. Each research package leader further decomposed the package to single multiple work packages based on practical situation of each organization with its proposal of necessary resources needed. The outputs of each work package, either tangible or intangible, should be deliverable, verifiable and measurable. With each work packages and related information, RAVONSICS coordinator was able to integrate all these information, schedule the tasks, apportion total available resources, append necessary supportive action items like identifying communication means, and finalize the comprehensive project management plan.

Table 3 Major Action Items applied in Planning Process Group by RAVONSICS

Types	Planning Process Group	Major Action Items
Integration Management	Develop PM Plan.	Identify Enterprise Environmental Factors and available Organizational Process Assets, *etc*. Integrate and consolidate all subsidiary plans.
Scope Management	Plan Scope Management. Collect Requirements. Define Scope. Create WBS.	Identify and document scope comprehensively, mainly based on project goals promised to Chinese Government. Identify Requirements Tracing Matrix. Create WBS.
Time Management	Plan Schedule Management. Define Activities. Sequence Activities. Estimate Activity Resources. Estimate Activity Durations. Develop Schedule.	Identify schedule, detailed activities and resources needed comprehensively based on promised schedule and available resources, *etc*. Demonstrate and document in a readable format like Gantt Chart. Identify the Critical Path.
Cost Management	Plan Cost Management. Estimate Costs. Determine Budget.	Identify budget for each work packages in WBS. Integrate and document project budget.
Quality Management	Plan Quality Management.	Identify quality requirement based on existing Quality Assurance System. Document requirements in the contract with stakeholders.
Human Resource Management	Plan Human Resource Management.	Identify and document project organization charts, staffing responsibilities and required skills, *etc*.
Communications Management	Plan Communications Management.	Identify most efficient communication methods including teleconference and workshop *etc*.
Risk Management	Plan Risk Management. Identify Risks. Perform Qualitative Risk Analysis. Perform Quantitative Risk Analysis. Plan Risk Responses.	Identify and analyze risks. Coordinate with relative stakeholders. Document risk responses and resources needed.

Types	Planning Process Group	Major Action Items
Procurement Management	Plan Procurement Management.	Identify procurement needs based on existing procurement system. Document requirements in the contract with stakeholders.
Stakeholder Management	Plan Stakeholder Management.	Identify stakeholders, potential needs and responses, *etc*.

3 Lessons learned

During the last three years of RAVONSICS, only few researchers were assigned in a part time fashion in the PM team as the coordinator. Some major lessons learned during practical management using the approach in Section 3.2 are as follows.

(1). During international contract negotiation in the Initiating Process Group and the Planning Process Group, it should be noticed that Chinese government signed neither the Paris Convention on Nuclear Third Party Liability nor the Vienna Convention on Civil Liability for Nuclear Damage.

(2). Although most of the concerns are negotiable through teleconference, face to face contact is still recognized as an essential and more efficient mean for the Communication Management and the Stakeholder Management. Nowadays some influential international conference would be held with a fixed time schedule. Selecting appropriate occasions among project stakeholders and using one day before or after the conference for a face-to-face coordination is recommended.

(3). In the Stakeholder Management, stakeholder`s rights should be equal to its obligation and contributes. Occasionally, final decision shall be made among all stakeholders` possible serious conflicting needs in reality. Under this rare circumstances, stakeholder with greatest obligation in the project should make the decision by balancing all interests to the greatest extent. The opinion of stakeholders with greatest contribution to project researches should be referenced with more weights. These stakeholders generally include project sponsor, project coordinator or scientific coordinator who is responsible for the success of the project to the government.

(4). During the entire project life cycle, PM team should update the knowledge bases like lessons learned as its Organizational Process Assets at regular intervals in a serious manner. These assets should be treated as valuable as other technical achievements to support future researches sustainably.

4 Conclusions

Through the appropriate application of PMBOK in RAVONSICS, a simple, but systematic approach to initiate, plan, execute, monitor and control and close the project is proposed, especially for the non-expert in PM domain. During the last three years, RAVONSICS is under good control with limited resources for management using this approach. Researchers are released from tedious management workload, while project can be managed efficiently and effectively. We suggest that other similar research projects in nuclear domain could take the approach and lessons learned as reference.

References

[1] A Guide to the Project Management Body of Knowledge, Fifth Edition, Project Management Institute, Inc., 2013.

Attachment All 47 Recommended PM Processes by Mapping the 5 Process Groups across the 10 Knowledge Areas[1]

Process Groups & Knowledge Areas	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
Integration Management	Develop Project Charter.	Develop PM Plan.	Direct and Manage Project Work.	Monitor and Control Project Work. Perform Integrated Change Control.	Close Project or Phase.
Scope Management		Plan Scope Management. Collect Requirements. Define Scope. Create WBS.		Validate Scope. Control Scope.	
Time Management		Plan Schedule Management. Define Activities. Sequence Activities. Estimate Activity Resources. Estimate Activity Durations. Develop Schedule.		Control Schedule.	
Cost Management		Plan Cost Management. Estimate Costs. Determine Budget.		Control Costs.	
Quality Management		Plan Quality Management.	Perform Quality Assurance.	Control Quality.	
Human Resource Management		Plan Human Resource Management.	Acquire Project Team. Develop Project Team. Manage Project Team.		
Communications Management		Plan Communications Management.	Manage Communications.	Control Communications.	
Risk Management		Plan Risk Management. Identify Risks. Perform Qualitative Risk Analysis. Perform Quantitative Risk Analysis. Plan Risk Responses.		Control Risks.	
Procurement Management		Plan Procurement Management.	Conduct Procurements.	Control Procurements.	Close Procurements.
Stakeholder Management	Identify Stakeholders.	Plan Stakeholder Management.	Manage Stakeholder Engagement.	Control Stakeholder Engagement.	