Improvement of Project Activities in University by Applying the Method of Project Management and Fundamental Competencies

Masahisa Shinoda

***Abstract*—A method to improve a quality of both product and process of each project in university is introduced. Special ideas and tools should be required to success projects, since students are beginners for project activities. The method of project management well known as PMBOK (Project Management Body Of Knowledge) GUIDE, that is widely used in business world, is applied to improve project activities in this study as a methodology for the processes of projects. In addition, achievement abilities are also important to proceed with projects. To satisfy this requirement, an idea of "Fundamental Competencies for Working Person" is also tried to apply in this study. Using the above method and idea, useful tools to improve the project activities and systematize a style to success the projects are described.**

***Index Terms*—Project management, project activity in university, fundamental competency for working persons, PMBOK GUIDE, systematization.**

I. Introduction

Kanazawa Institute of Technology (KIT) has a wide variety of facilities and unique environment to support project activities as extra-curricular programs. Total number of project activities that are recognized officially at KIT is 82 in 2017. Manufacturing robots and hand aircrafts aiming at contests are the typical examples. Professors and lecturers belonging to KIT are making various efforts to improve these project activities [1]-[4]. Similar projects and these analysis are also performed in other universities [5], [6].

The project based on fundamental science and engineering, which is one of the officially recognized projects at KIT and the extra-curricular program, is managed by the author and his colleagues. In this project, the students propose project subjects individually. Next, the students and the teaching staff verify the principle of each proposed subject from the standpoints of mathematics, physics, engineering, electronics, software programing, production, and so on. After that, the students proceed to manufacture their products of project subjects.

The author is studying how to improve the quality of both a process and a product through each project activity. He moved to KIT from the electric company in 2015. He has a wide variety of experiences about designing and manufacturing electric appliances, for examples, DVD player/recorder, Blu-ray player/recorder, and liquid crystal displays. He has been also certified as PMP (Project Management Professional) by Project Management Institute (PMI) since 2007. With these points as backgrounds, he is tackling with the projects based on fundamental science and engineering to improve the quality of both the product and the process of each project by applying the well-known method of project management [7], [8]. This method was established and published as "A guide to the project management body of knowledge", so called as "PMBOK GUIDE", [9]. Therefore, the author were trying to apply PMBOK GUIDE to the projects.

From the project activities hitherto performed by the students, the author has felt that progress of the project activities has not always based on PMBOK. PMBOK GUIDE is practically defined as a useful methodology. To utilize PMBOK GUIDE, it is supposed that various abilities such as acting power and communication are also required to the project performers. The author noticed that abilities for performing project as well as the methodology of PMBOK are necessary at the same time.

The ministry of Economy, Trade and Industry (METI) in Japan defined the basic abilities required in working together with various people in the workplace and in the local communities as "Fundamental Competencies for Working Person" in 2007 [10]. This definition consists of three competencies at a committee comprising of intellectuals in the businesses and universities. Each competency includes several competency factors. Since, these competencies are necessary to start a working person, university students should acquire them by their graduation.

The author started to examine whether this definition for working person becomes a driving force to utilize PMBOK GUIDE through the projects. His final goal of research is to systematize the method of the project management that is optimum for education in university by 2019.

In this paper, the attempt to construct and systematize the method of the project management by combining PMBOK as the project methodology and METI's definition as fundamental competencies is introduced.

II. Previous Approach to Systematize the Method of the Project Management by Using Project Management Body of Knowledge (PMBOK)

PMBOK GUIDE describes the method how to proceed with projects to success, and is recognized practically as the world standard for a wide variety of projects in the business

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M. Shinoda is with the Mathematics and Science Education Research Center, Kanazawa Institute of Technology, Nonoichi, Ishikawa 921-8501, Japan (e-mail: shinoda@neptune.kanazawa-it.ac.jp).

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world. The first edition was published in 1996 and the latest version is the sixth edition published in September, 2017. PMBOK GUIDE defines 49 processes of the project, here, the process means a procedure or a treatment which is a necessary action in the project activities. All processes are divided into five process groups and ten knowledge areas.

Five process groups are as follows:

- Initiating process group,
- Planning process group,
- Executing process group,
- Monitoring and Controlling process group, and
- Closing process group.

The relationship among the five process groups is schematically shown in Fig. 1. The project starts according to the initiating processes, then, is planned according to the planning processes and is executed according to the executing processes. When a final product is completed or cancelled, the project is finalized according to the closing processes. The monitoring and controlling processes affect the other processes to investigate and improve the quality of both the process and the product.

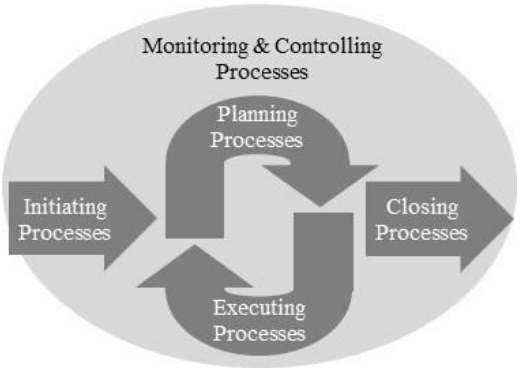

Fig. 1. Schematic diagram of the relationship among five process groups. (This figure is re-drawn by the author according to PMBOK GUIDE.)

The knowledge areas including essential processes to achieve the project management are classified into to ten management groups as follows:

- Project integration management,
- Project scope management,
- Project schedule management,
- Project cost management,
- Project quality management,
- Project resource management,
- Project communications management,
- Project risk management,
- Project procurement management, and
- Project stakeholder management.

Using these five process groups and ten knowledge areas, 49 processes are defined at cells somewhere on a two-dimensional map, in which the process groups are placed on the horizontal columns and the knowledge areas are placed on the vertical ones as shown in Fig. 2. In this paper, we do not mention the contents of 49 processes.

The author has analyzed the project activities proceeded by the students and the teaching staff by applying the two dimensional map shown in Fig. 3. Especially, he has tried to classify the relationship between this map and project members' contributions [7], [8].

Management of Knowledge Area	Processes				
	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Integration					
Scope					
Schedule					
Cost					
Quality					
Resource					
Communications					
Risk					
Procurement					
Stakeholder					

Not defined in PMBOK GUIDE

Fig. 2. Two dimensional map with process groups and knowledge areas.

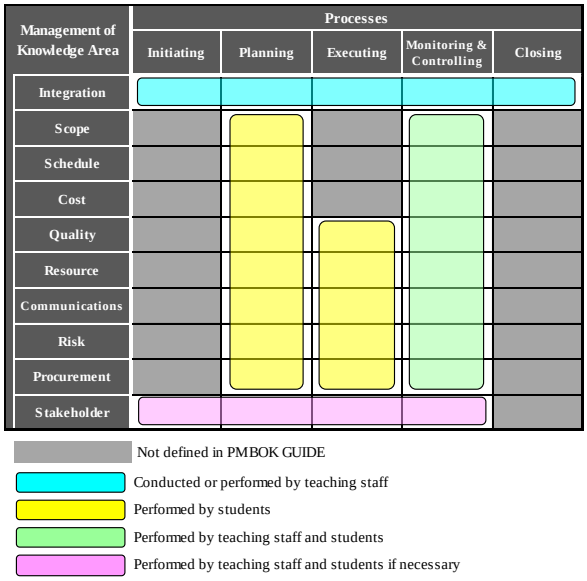

Fig. 3. Contribution analysis on two dimensional map with process groups and knowledge areas.

As the results shown in Fig. 3, it became clear that the cells on the map were filled up completely with actions by the project team students and the teaching staff as follows.

- The project integration management of the knowledge areas was conducted or performed by only the teaching staff, because processes of this management were very important so that the purpose, significance, and rules of the project were officially declared. Also, it was another reason that the students involved in the project were beginners. After this integration management, each project was started by the project students.
- As for the planning and executing processes, the project students proceeded with each management processes mainly by themselves, because these processes were core actions of the projects. The students acquired various skills for such as planning, executing, and manufacturing.
- As for the monitoring and controlling processes, the teaching staff and the students jointly proceeded with these processes. Since all project students were beginners on projects, the teaching staff should basically propose corrective actions if there was the possibility that the quality of the product or the process was getting worse than those were planned. Based on the results of

these processes, each student reflected the results to the planning and executing processes to improve the quality of both the process and the product.

- As for the project stakeholder management, if there are some stake holder related to the projects, this management should be performed.

As the results, using the two dimensional map shown in Fig. 3, the teaching staff and the students easily understand what have done so far and what have to do next, respectively. They also can confirm actions that who have to do mainly, or they collaborate with each other.

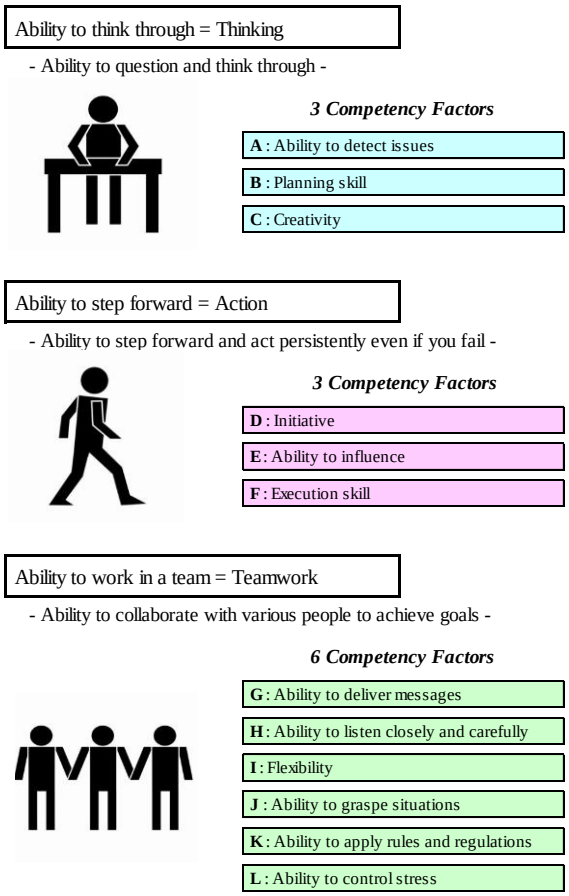

Fig. 4. "Fundamental Competencies for Working Person" defined by METI in 2007. (This figure is re-drawn by the author according to METI's web site.)

III. New Approach to Systematize the Method of the Project Management by Using Fundamental Competencies for Working Persons

As mentioned in Sec. I, METI defined "Fundamental Competencies for Working Person" in 2007 [10]. This definition describes the basic abilities required in working together with various people in the workplace and in the local communities. University students are recommended to understand and acquire competencies listed in this definition by their graduation. Fig. 4 shows the details of this definition. This definition consists of three competencies, "Action", "Thinking", and "Teamwork" at a committee comprising of intellectuals in the businesses and universities. Each competency includes several competency factors.

The author was convinced that this definition was applicable to introduce to the projects, especially extra-curricular programs in which students with various grade and special study gather, and that this definition became a driving force to proceed with the projects. The competencies described in this definition are seemed to enhance the progress of the project activities according to the methodology of PMBOK.

In the same manner with Fig. 3, the author analyzed to specialize twelve competency factors in three competencies, which are required to the students, on appropriate cells of the two dimensional map. Fig. 5 shows the result of mapping with competency factors. Here, competency factors are marked using A–L as marked in Fig. 4. Here, the knowledge area of "Integration" management, and "Initiating" and "Closing" processes are not marked because these fields are managed by the teaching staff. In "Planning" process, competency factors of "Thinking" are required. In "Executing" process, competency factors of "Action" and "Teamwork" are required. Especially, all competency factors of "Action" and "Teamwork" are concentrated on "Communication" management for "Executing" process. This means that collaboration ability with various team members is very important, and that good communication makes good practice. In the same manner, "Monitoring and Controlling" process mainly requires competency factors of "Teamwork".

Management of Knowledge Area	Processes				
	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Integration					
Scope		A–C		D, G–L	
Schedule		A, B		D, G–L	
Cost		A, B		D, G–L	
Quality		A–C	F	D, G–L	
Resource		A, B	F, I	D, G–L	
Communications		A, B	D–F, G–L	D, G–L	
Risk		C	D–F, G–L	D, G–L	
Procurement		B	F, K	D, G–L	
Stakeholder		A, B	D–F, G–L	D, G–L	

Not defined in PMBOK GUIDE
A, B, C Competency factors in Ability to think through = **Thinking**
D, E, F Competency factors in Ability to step forward = **Action**
G, H, I, J, K. L Competency factors in Ability to work in a team = **Teamwork**

Fig. 5. Distribution map of twelve competency factors on the two dimensional map pf PMBOK GUIDE.

From the result of Fig. 5, all competency factors defined in "Fundamental Competencies for Working Person" appropriately located in the two dimensional map of PMBOK. Therefore, it is clear that good thinking in planning and good action and teamwork in executing, monitoring, and controlling are indispensable to success the projects.

IV. Formats for Annual Project Plan and Biweekly Report to Improve Project Activities

The author has already proposed the formats for the annual project plan and the progress of the project proceeded by students. These formats are considered with the ten knowledge areas of PMBOK GUIDE [8]. The author also

analyzed the relationship with the fundamental competencies.

A. Format of Project Plan

Fig. 6 shows the example of the annual project plan format. The projects students fill out this format at the beginning of the projects. The teaching staff and the project students discuss and verify the principle of the proposed subjects, and then, the students proceed to manufacture their products of project subjects. The right side of the format, the knowledge areas in PMBOK and the fundamental competencies corresponded to the items of the format are indicated. As the results, these factors are included into the items of the format effectively. This means that the project students can proceed their projects with steps and methods which are defined in PMBOK GUIDE and the fundamental competencies.

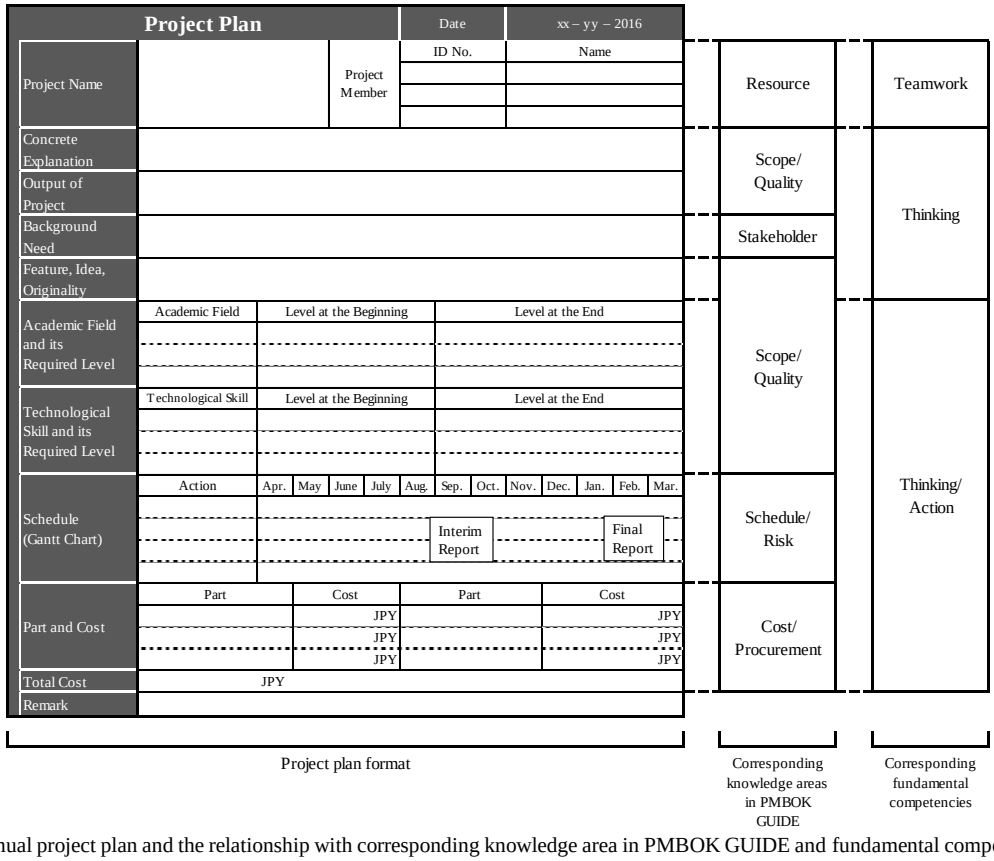

Fig. 6. Format of annual project plan and the relationship with corresponding knowledge area in PMBOK GUIDE and fundamental competencies for working persons.

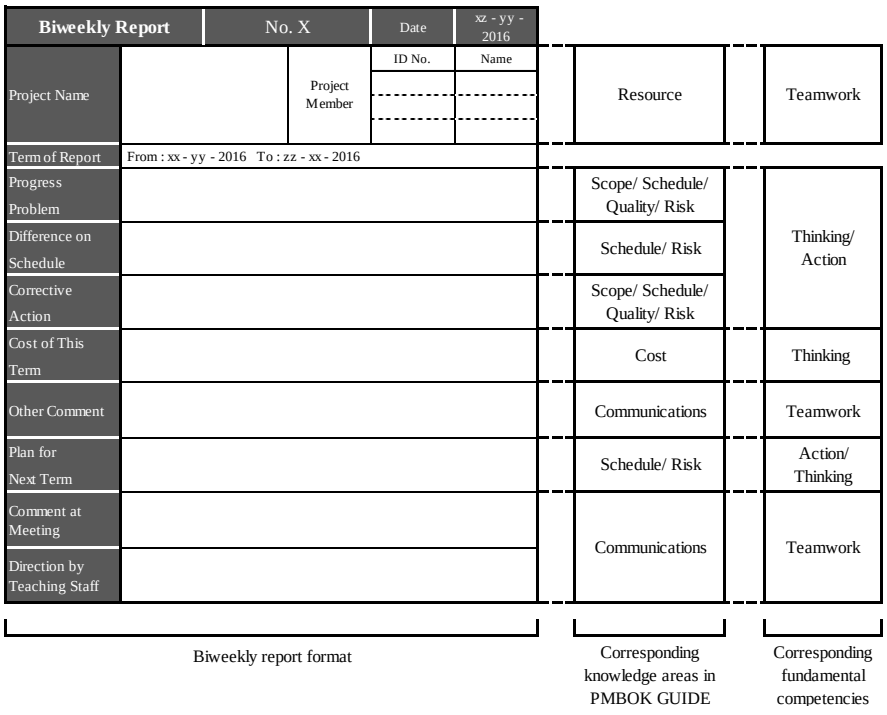

Fig. 7. Format of biweekly report and the relationship with corresponding knowledge area in PMBOK GUIDE and fundamental competencies for working persons.

B. Format of Project Plan

Fig. 7 shows the example of the biweekly report. After starting the projects, the students have to report biweekly their progress, and problems if happened. The right side of the format, the knowledge areas in PMBOK and fundamental competencies corresponded to the items of the format are indicated. The significance of this this format is the same as that of the project plan format.

C. Results of Questionnaire

At the end of the project term in 2016, the author conducted a questionnaire on the project students.

The project students' answers were typically as follows.

- Both formats were very useful to confirm own activity and understand other members' activities.
- The students recognized that the items of "Progress / Problem", "Difference on Schedule", "Feature / Idea / Originality", and "Corrective Action", "Technological Skill and its Required Level", and "Academic Field and its Required Level" were useful in this order.

V. Conclusion

The author intends to make the students recognize to improve the quality of both the process and the product, and analyzes the project activities. The two dimensional map defined in PMBOK GUIDE is one of useful and effective tool to understand how to proceed with projects, and confirm the contribution of the teaching staff and the students. Therefore, PMBOK GUIDE is the practical methodology. To succeed projects, however, abilities to manage the processes of the projects are also dispensable. The author introduced "Fundamental Competencies for Working Person" defined by METI, and analyzed the relationship between the two dimensional map and each competency factors of three fundamental competencies. Since all competency factors are appropriately located in the two dimensional map of PMBOK, this map is the useful tool to guide the projects their goals.

Taking into account the above results, the author proposed the annual project plan and the biweekly report. In these formats, each item that the students must fill out are closely related to the factors on PMBOK GUIDE and "Fundamental Competencies for Working Person". Using these formats, the students think deeply of their projects on purposes, outputs, schedule, progress, problems, risks, and so on. These are also important for the teaching staff to control the project activities. The map and formats introduced in this paper become meaningful tools to conduct projects and systematize the method to improve the quality of both the process and the product of projects.

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Masahisa Shinoda is a professor of the Mathematics and Science Research Center of Academic Foundations Programs in Kanazawa Institute of Technology, Japan. He received his BS and MS degrees in physics from Osaka University in 1979 and 1981, respectively. He worked for Mitsubishi Electric Corporation from 1981 to 2015. He was a researcher and an engineer on optical engineering, and was in charge of developing DVD and Blu-ray equipment at Mitsubishi. He received his Dr. degree in optical engineering from Osaka Prefecture University in 2001. He was certified as Project Management Professional (PMP) by Project Management Institute (PMI) in 2007. Then, he moved to Kanazawa Institute of Technology (KIT) in 2015. His current research interests are educational engineering and project management.

Prof. M. Shinoda is a member of The Japan Society of Applied Physics, The Optical Society of Japan, Japanese Society for Engineering Education, and Project Management Institute (USA). He is a senior member of The Institute of Electronics, Information and Communication Engineers (Japan).