Project Management Education for New Manufacturing System

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The specific objective of this paper is to verify the impact of education effects in field of project management to train the both creation and system integration capability through the case study. The research and development (R&D) project for the factory of the future using network technology has been introduced to train the creation and integration capabilities of the students. As the results, the students can learn both the techniques of a project planning and a project execution through the project management education including the case study. Furthermore, it will also show that the students learn communication and problem solving capabilities for project management, creation of idea, project integration, and originality through the management of complex project and the construction principles of the factory of the future.

Key Words & Phrases: Project Management, New manufacturing system, Factory of the future, Creation of idea

1. Introduction

The approach of project management (PM) is the comparatively new method of enabling efficient team management for the specialist group of a different field using the given resources within the specified term, and attaining the target of a business project. The curriculum, which educates the PM has not been introduced in Japanese universities until recent years. The department of Project Management (Dept. of PM) of Chiba Institute of Technology (CIT) was established for the first time in Japan in 1997, in order to practice the education and the research about PM[1]-[3].

This paper describes the PM education for new manufacturing system in the undergraduate education at CIT in Japan. The goal of the PM education for manufacturing system course is to train students in the important areas of PM such as planning, execution, creative problem solving skills and so on. The specific objective of this paper is to verify the impact of education effects in field of project management to train the both creation and system integration capability through the case studies.

The subjects of the paper are classified into following three categories; first, the introduction of project management education in the CIT in Japan [1]-[3], second, the summary of each development in projects to train the creation capability, and finally, the introduction of project integration by the unification of complex projects.

As the results, it will also show that the students learn communication and problem solving capabilities for project management, creation of ideas, project integration, originality through the management of complex project and the construction principles of the factory of the future.

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2. Project Management Education at the Dept. of PM in CIT.

The Dept. of PM in CIT was founded in Japan to establish the education program for the first time to prepare the project manager with high skill. Figure 1 shows the educational program at the Dept. of PM in CIT. The Dept. of PM has three components as educational courses.

As the main component, student can select one field out of Engineering, Information Systems, and Management. The others then become the sub-components of the student program of study. Also, the field of engineering is classified into Manufacturing Systems and Process Systems. Manufacturing systems deal with the project management issues related to advance manufacturing systems such as network manufacturing system, digital factory, virtual enterprises and others. Although the subjects relevant to factory automation (FA) technology and computer integrated manufacturing system (CIM) are also prepared, it is difficult to cover the technical range and the depth of the special field of study, if it is compared with the special curriculum of the de-
partment of the mechanical engineering. The main target of PM education is focused to not only the ability for project planning and project execution, but also leadership, communication ability with specialists, problem solution capability, and negotiation capability. Each special education subject as shown in figure 2 is classified into engineering, information system and management.

Leadership, Communication Ability
Skills of Solving Problems

Education Fields

Engineering
Information System

Management

Main Subjects for PM Education

Figure 2 Special Subjects for Project Management

Process system deal with the project management issues related to plant operations and other chemical continuous flow systems. A student has to take 50% of his or her credits from the main component and the remaining 50% from other two sub components. In the curriculum, in addition to teaching basic engineering, the objective is to help students to master the art of business management as well, and to develop their skills of solving problems through the full use of computer systems shown in figure 3.

Basic Engineering
Full Use of Computer Systems
Business Management

Skills of Solving Problems
Presentation Technique
Communication for Cultural Differences

Figure 3 Features of PM Curriculum

Practical educational programs laboratory experience and experiments, and case studies are included. Studies affiliated with Engineering, Information systems and Business management that are related to project management, or interdisciplinary studies which link these subjects together are also included in the curriculum. Similar education with a broad curriculum based on business management study including technology and information system have traditionally been included in the Master of Business Administration (MBA) curricula at the graduate level. However, the educational intent of the Dept. of PM education is directed toward mastering, both the basic theory and practical experiences of project management by the engineering students at the undergraduate level at CIT.

3. PM Education For New Manufacturing System
Factory of the Future and PM Education

The change in manufacturing system using advanced information technology (IT) such as Internet and simulations requires us to investigate the new education methods in the manufacturing system course of project management education.

The research and development (R&D) project for the factory of the future using the network technology has been introduced to train not only project planning and execution, but also the creation and integration capabilities of the students through the construction of new manufacturing system, additionally, to train the creation of ideas and originality. It is introduced as the research themes of students project that a development of idea factory, a R&D chain management, a maker-user cooperative design/manufacturing system, evaluation system for network manufacturing and others.

Figure 4 shows the procedure of the PM education in manufacturing system course. The factory of the future will be completed by the integration results from each R&D student project.

Case Studies for the PM Research

Figure 4 Procedure of PM Education in Manufacturing
The students can learn both the techniques of a planning and execution of project through the PM education including these case studies in the faculty of university. Furthermore, it will also show that the students learn communication and problem solving capabilities for the project management, creation of ideas, project integration, originality through the management of complex project and the construction principles of the factory of the future.

In this paper, it is discussed that the project management education with technical subjects through two case studies such as the R&D chain management and the maker-user cooperative design/manufacturing system.

4. Development of the R&D Chain Management

It is very important to introduce the supply chain management (SCM) into many manufacturing enterprises. The development of the R&D chain management (R&DCM) has carried out by the student project. First, the state of the SCM was surveyed, and then the concept of R&DCM was completed applying the PM planning and execution processes. Figure 5 shows outline of conventional SCM system, which is introduced to many industries.

The SCM is composed of supply of raw materials, maker, physical distribution, wholesale, retail sale and consumer. Figure 6 shows the R&D support system, which is introduced into many research institutions. The system is composed of R&D planning support system, technical information management, science technical calculation and others. The student project carried out the integration between SCM and R&D support system to establish the concept of R&D chain management shown in figure 7, and also the R&DCM for evaluation of surface integrity of mechanical machine parts was proposed by the project. Figure 8 shows the system configuration of the R&DCM for the evaluation of surface integrity of mechanical machine parts. The R&DCM is composed of a planning for R&D, experimental design, collaborative experiments and evaluation of experimental results. It is possible to plan the R&D theme, to discuss the experimental conditions and the research progress situations, and also to evaluate the results each other in real time condition using a network technologies. Many kinds of finishing technique have been introduced into the R&D, such as magnetic tape finishing, micro blasting, electro-chemical finishing, barrel finishing and extrude phone technologies. The student can learn not only the project planning and execution methods, but also application technique on the SCM and finishing technologies.

5. Development of the Maker-User Cooperative Design/Manufacturing System

It is possible to make a product such as mountain bike (MTB) or list watch using an order made system, if the network manufacturing will be realized. However,
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development cooperative design manufacturing has been carried out by the other student project. The student project treats the development of order made MTB. The new concept, which means a project team includes a customer and/or user of MTB as a virtual project member, is proposed by the student project as shown in figure 9. The customer will be expected to advise for the maker in field of design of MTB frame, function, price and others. Especially, it is the remarkable features that the user owns the same CAD (Computer Aided Design) system with a maker CAD system as shown in figure 10, also the maker can simulate the strength, vibration characteristics of the MTB, which is designed by a user, using the CAE software such as FEM (Finite Element Method). The student project has proposed the new CAD system similar with gardening CAD, which is used easily to user. Also, the network manufacturing composed of CAD/CAM, CAE for order made manufacturing systems have been proposed as the new idea. It is recognized that the ability for creation and originality has been trained through the concepts of a virtual PM member and new network manufacturing system such as the maker-user cooperative design and manufacturing.

6. Integration of Students Project Results

The factory of the future can be completed by the integrating results from each R&D results of student projects. Figure 11 shows the system configuration of the factory of the future using the network and advanced simulation technology. The factory can be composed of R&D chain management, procurement, design, processing & assembling, sales, execution, lease, recycling,
welfare, claim treatment, technical service, risk management, evaluation of environments in information society are connected to other elements freely using network technology although the manufacturing elements in industrial society are located as if a time series.

Two research results such as the R&DCM and the maker-user cooperative design manufacturing system will be implemented into the factory of the future. Also, students can learn the configuration of new manufacturing elements, and how to connect, how to integrate the elements, function of elements and others.

The effects from PM education in manufacturing course are summarized as follows:

1. The abilities for project planning and execution can be trained through the construction principle of factory of the future.

2. The abilities for creation and originality can be trained through the development of new manufacturing elements such as the R&DCM, the user-maker cooperative design/manufacturing system and other students’ projects.

3. The abilities for system integration can be trained through the integration of the complex projects.

7. Conclusions

The conclusions drawn from the research are as follows:

(1) The features of education curricula at the Department of Project Management of Chiba Institute of Technology in Japan are clarified.

(2) The project management case studies to train the creation and originality capabilities of the students are introduced through the developments of manufacturing elements for the factory of the future.

(3) The project integration case studies to train the system integration capabilities of the students are indicated through the construction principle of the factory of the future.

References

