PROJECT MANAGEMENT EDUCATION FOR NEW MANUFACTURING SYSTEM

Toshihiro Ioi[1], Shinzo Enomoto[2], Kazuhiko Kato[3], Masahisa Matsunaga[4], Yao Zhihui[5] and Rafiqul Noorani[6]

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

Index Terms — project management, new manufacturing system, factory of the future, creation of ideas

INTRODUCTION

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

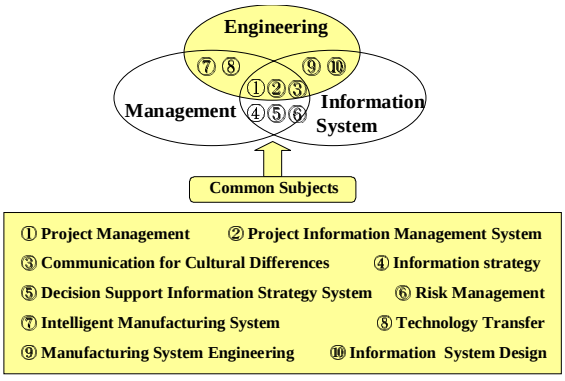
This paper describes the PM for the new manufacturing system in the undergraduate education at CIT in Japan. The goal of the PM education in manufacturing system course is to train students in the important areas of PM such as planning, execution, creative problem solving skills, etc. The specific objective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

The subjects of the paper are classified into the following three cateories : first, the introduction of project management education at 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 using complex projects.

As a result, 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.

PROJECT MANAGEMENT EDUCATION AT THE DPM OF CIT

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



Major Education Subjects for the DPM

FIGURE 1
EDUCATION PROGRAM OF CIT

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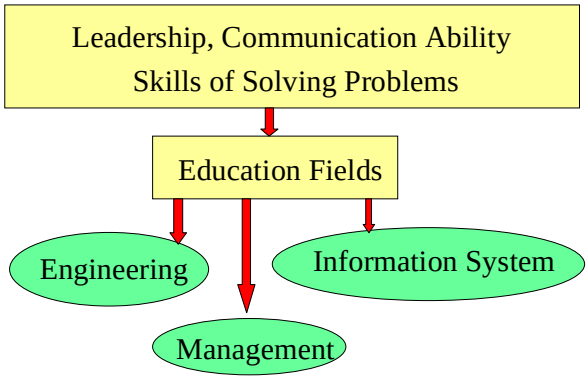
As the main component, student can select one course of Engineering, Information Systems and Management. The other courses then become the sub-components of the student program of study. Also, the field of engineering is classified into Manufacturing Systems and Process Systems. Manufacturing systems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



Main Subjects for PM Education

FIGURE 2
SPECIAL SUBJECTS FOR PROJECT MANAGEMENT

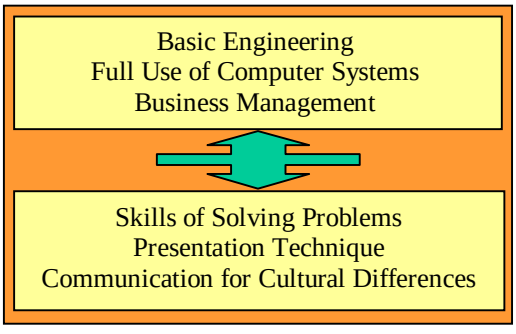


FIGURE 3
FEATURES OF PM CURRICULUM

Process Systems deal with the project management issues related to plant operations and other chemical 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. As a practical educational programs, laboratory experience and test case studies are included. Studies affiliated with Engineering, Information Systems and Business Management are related to project management. The 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 DPM 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.

PM EDUCATION FOR NEW MANUFACTURING SYSTEM

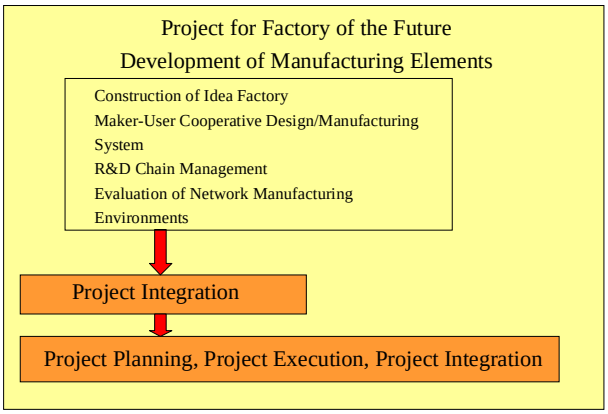
Factory of the Future And PM Education

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. It is introduced as the research theme of students projects, 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 courses. The factory of the future will be completed by the integration results from each R&D student project.

The students can learn both the techniques of a planning and execution of project through the PM education including these case studies. 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 mamagement of



Case Studies for the PM Research

FIGURE 4
PROCEDURE OF PM EDUCATION IN MANUFACTURING

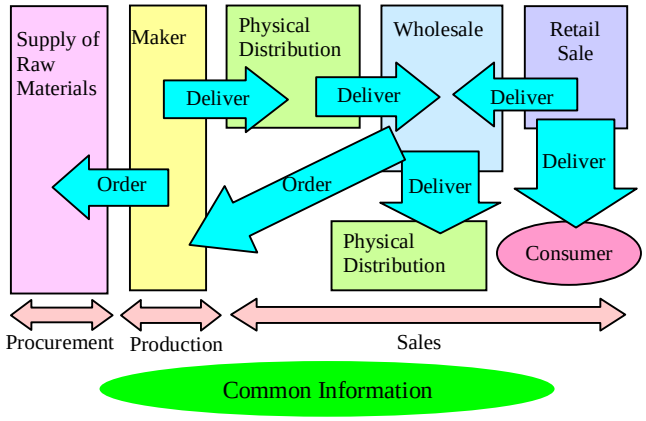


FIGURE 5
OUTLINE OF SUPPLY CHAIN MANAGEMENT

complex project and the construction principles of the factory of the future.

This paper shows 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.

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 been 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 the conventional SCM system, which is introduced to many industries. The SCM is composed of supply of raw materials, manufacturing company, physical distribution, wholesale, retail sale and consumers. 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, technical calculation and others. The student project that carried out the integration between SCM and R&D support system to establish the concept of R&D chain management is shown in Figure 7. **A**lso 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 to recognize the progress. It can evaluate the results in real time using network technologies. Many kinds of finishing techniques

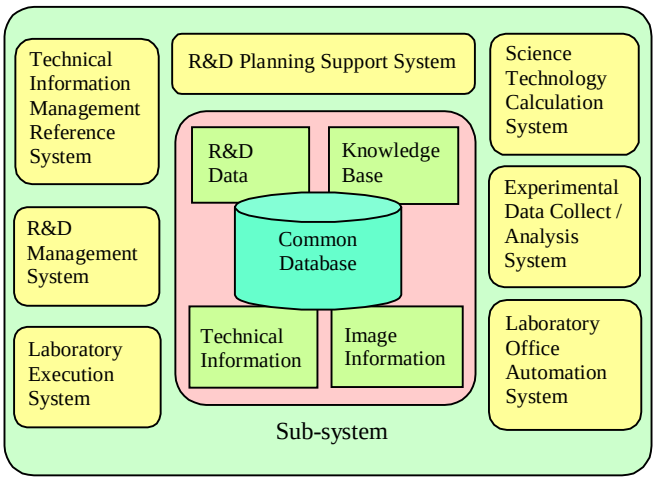


FIGURE 6
R&D SUPPORT SYSTEM

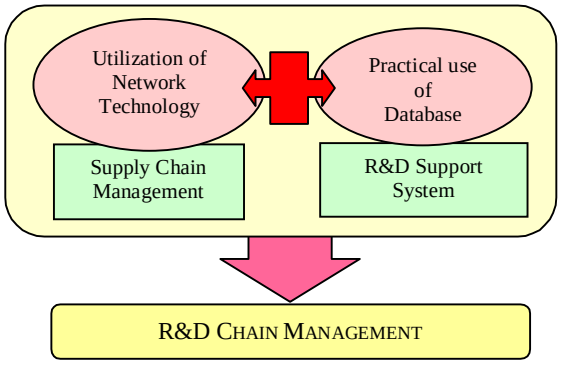


FIGURE 7
PROPOSAL OF R&D CHAIN MANAGEMENT

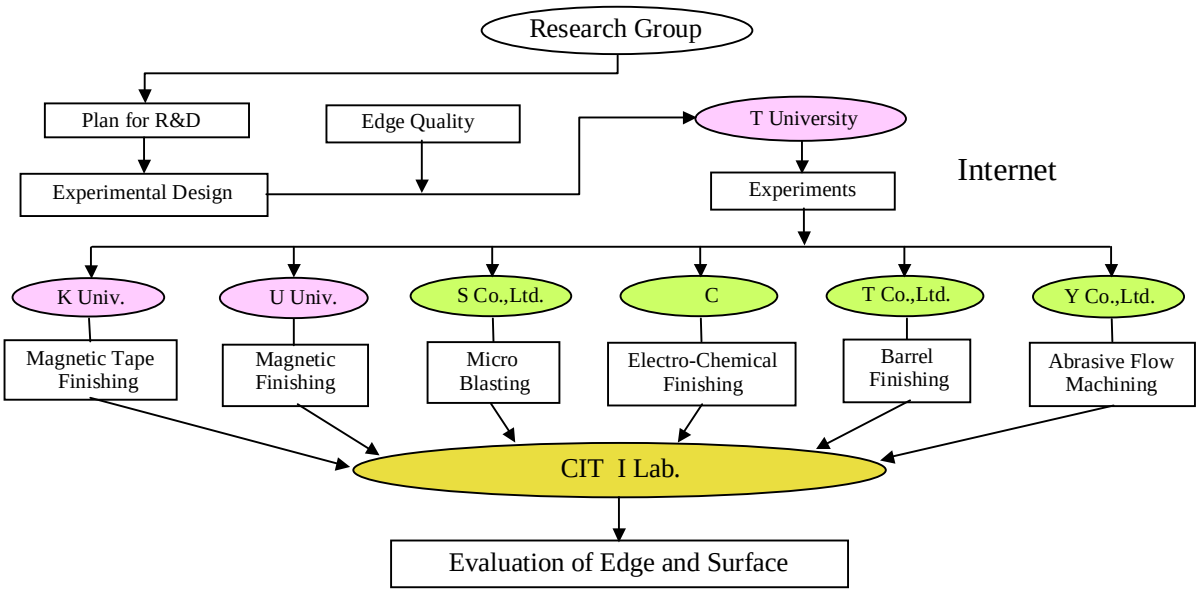


FIGURE 8
R&D CHAIN MANAGEMENT FOR THE EVALUATION OF SURFACE INTEGRITY

have been introduced into the R&D, such as magnetic tape finishing, micro blasting, electro-chemical finishing, barrel finishing and abrasive flow machining technologies. The student can learn not only the project planning and execution methods, but also application techniques on the SCM and finishing technologies.

Development of the Maker-User Cooperative Design /Manufacturing System

It is possible to make a product such as mountain bike (MTB) or wrist watch using a custom made system, if the network manufacturing is introduced. However, technical and systematic concepts for custom made manufacturing have not been developed in the past. The development of maker-user cooperative design manufacturing system has been carried out by the student project. The student project treats the development of custom 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 manufacturing company in a field of design of MTB frame, function, price and others. Especially, it has the remarkable features when both the maker and user can have access to same sesign information if both have the same CAD database. 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 system is shown in Figure 10. The student project has proposed the new CAD system similar with the CAD for garden design, which is used easily. Also, the network manufacturing , composed of

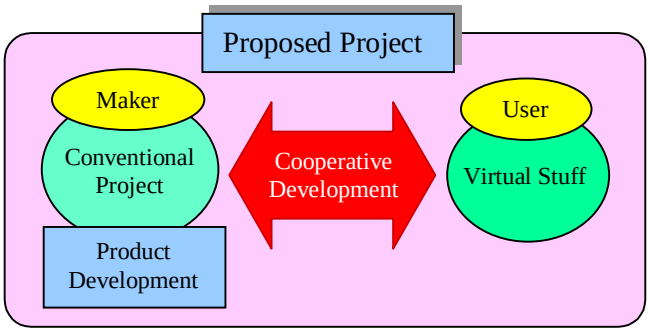


FIGURE 9
NEW CONCEPT FOR R&D PROJECT USING VIRTUAL STUFF

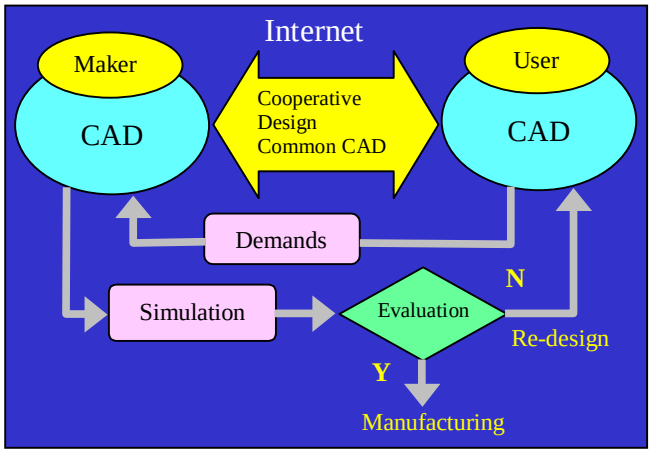


FIGURE 10
SYSTEM CONFIGURATION OF MAKER-USER COOPERATIVE DESIGN/MANUFACTURING SYSTEM

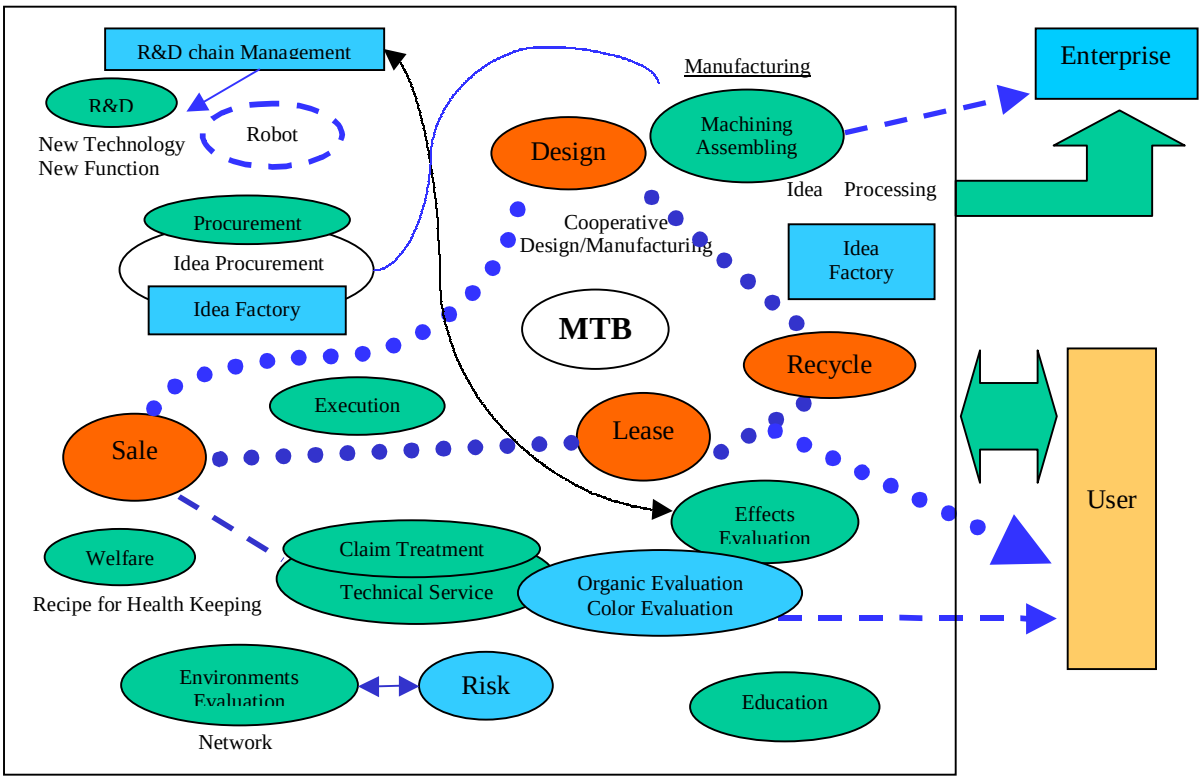


FIGURE 11
SYSTEM CONFIGURATION OF THE FACTORY OF THE FUTURE

CAD/CAM, CAE for customer made manufacturing systems, has been proposed as the new idea.

It is recognized that the ability for creation and originality has been implemented through the concepts of a virtual PM member and new network manufacturing system such as the maker-user cooperative design and manufacturing.

Integration of Students Project Results

The factory of the future can be completed by integrating results from each R&D projects.

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

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

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

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

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 introduced.
(2) The project management case studies to train the creation and originality capabilities of the students are introduced through the development 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 presented through the construction principle of the factory of the future.

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