

# **DEVELOPMENT OF THE PM-SUPPORTING TOOL IN JAPANESE BUILDING CONSTRUCTION MARKET**

## **~ IMPROVEMENT OF AN APPLICATION SOFTWARE FOR SCHEDULING ~**

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### **SUMMARY**

Since the recent economic collapse of Japan, some companies engaged in building construction have regarded Project Management (PM) as one of the radical techniques for Business Process Reengineering (BPR), which possesses rationality and transparency of the method in itself. They have begun earnestly discussing the adoption of the PM-supporting tool. However, the multi- or general-purposed functions of the existing PM-supporting tool cause difficulties in its introduction into the Japanese building construction market. With regards to this, we are trying to develop "CAMES", for the improvement of the existing scheduler, in view of Japanese building customs. This report refers to "CAMES Ver1.0", the first phase of the development.

### **INTRODUCTION**

Since the economic boom of Japan -the so-called bubble period- collapsed 10 years ago, the construction industry has been confronted with many problems such as "keen price competition", "a lack of skilled engineers", "productivity drop", "quality deterioration", etc. On the other hand, the construction market has come to attach importance to the needs of the Clients more than ever before. Accordingly, the requirements of the Clients have gotten more diverse and more complicated, with the companies participating in design and construction having to account for their responsibilities. In consequence, many of them, driven to a difficult situation, have been obliged to reform their management or to take a drastic change in their business process such as Business Process Reengineering (BPR). In recent years, some of them have paid attention to the Project Management (PM) method for resolving those problems. They have regarded Information Technology (IT) as indispensable to BPR in the construction industry. As a result, they have started an earnest examination of using PM-supporting tools. However, the existing ones developed in the U.S. have proven to be difficult to use in Japan. Being equipped with various functions for general use, it was rather hard to apply these tools to the present Japanese field, where the traditional building customs still remain. In these circumstances, we decided to improve them for on-site users in Japan. This is a brief report on the research of the Japanese traditional building customs, such as schedule figures and on the development of the PM-supporting tool named "CAMES" (Collaborative A/E/C Management Enhanced Supports), which, based on the U.S. product "Microsoft Project", is modified and improved by adding several functions in view of the Japanese building construction market.

### **BACKGROUND**

#### **Needs for PM or PM-Supporting Tools**

The Japanese construction industry is gradually going to adopt Project Management or PM-supporting tools. The main reasons for this are given as follows:

- 1) As for the construction industry of Japan, productivity has been falling remarkably in comparison to other industries. Hence drastic BPR is being requested.
- 2) The construction industry of Japan has begun to give the highest priority to the Clients' needs like

other industries. Hence responsibilities of explanations to the Client are being required even more.

- 3) Since the bubble economy collapsed, the price competition is very keen between construction companies, with competitors proposing an inappropriate price. General Contractor's (GC's) skilled engineers have been decreasing in number to reduce personnel expenses. Also, Sub-Contractors (SC's) in charge of construction work on the site, who strictly observe specifications, are faced with difficulty. These influence the problem of quality control in building-construction. Therefore, improvements of quality management are required.
- 4) The Japanese government, municipalities and private enterprises have recently been examining the introduction of PM, and Project Managers (PMr) who have responsibility for managing the building construction projects.
- 5) The trend of internationalization is getting closer to the Japanese construction industry as well as other Japanese industries, corresponding with competition in the global environment.
- 6) The need to use information technology (IT) in the Japanese construction site is increasing. In addition to this, IT literacy of staff members, who work on site, are gradually improving.
- 7) Existing PM-supporting tools, in addition to that of schedule planning and control, are presently equipped with functions such as cost control and labor management. Furthermore, recently, some of these functions can be utilized on web sites by Intranet or Internet. The advancement will cultivate a new collaborative environment of PM in the Japanese construction industry.

### Reasons of non-Infiltration of PM or PM-supporting Tools

Despite rising needs of PM, it is very difficult to infiltrate the systems quickly into the industry. Some of the reasons of non-infiltration are given as follows:

- 1) Until recently, there was little necessity for the explanations about handling details by the maker's, because of the trust of Client. So, importance of PM was not infiltrated to the industry.
- 2) Even if some of construction tasks are delayed halfway, GC's somehow adjust the schedule and the resources to catch up to finish on time. Therefore, the contract is carried out including the various risks that occur with unreasonable schedule adjustment. Accordingly, there was no need to strictly carry out cost control or resource control by using the PM-supporting tool.
- 3) Since most traditional construction masters in Japan had already skills in schedule management for design and construction, such PM-supporting tools were not seriously demanded.
- 4) Many expert managers have used scheduling tools with co-workers, but they haven't used cost-management or resource-management tools. The operations weren't easy for the beginners.
- 5) The scheduling chart has been mostly adopted the arrow network view of Japanese style. So, the Gantt chart view has not been acceptable in the Japanese.

### Development and Promotion of PM-supporting tool

While some barriers still exist against adopting PM and PM-supporting tools into the construction industry in Japan, the national government, municipalities and private enterprises have started an earnest examination of their usage for Business Process Reengineering. On this occasion to overcome these hurdles, we decided to develop "CAMES", that corresponds with the work practices in Japan, by improving the existing PM-supporting tool. On the first version, we made an effort to build a framework of CAMES, and we will continue to promote its development.

## DEVELOPMENT OF CAMES

### Scope of Development

The development scope of CAMES Version 1.0 is shown in Table 1. The project work phase is for the construction work phase. The classification of buildings has 2 types, one is a "steel-structure building for office use" and the other is a "reinforced concrete-structure building for residential use".

	Use	Structure	Number of Floors	Typical Floor Area
Category 1	Office	Steel	20 or less	200 ~ 2000m <sup>2</sup>
Category 2	Residential	Reinforced Concrete	14 or less	200 ~ 2000m <sup>2</sup>

**Table 1** Development Scope of CAMES Version 1.0

## Concept of Development

As the concept of development we set the following 3 items:

### 1) Smooth Adoption to the Actual Project

To remove the barrier against the adoption we considered the “Japanese building construction market” and the “IT environment and user literacy of Japanese construction industries”.

### 2) Correspondence to the Needs of the Maker Side

To clarify the advantage for the Makers we considered the “Solution against the lack of skilled engineers”, “Promotion of productivity”, “Assurance of quality”, and the “Promotion of the information sharing/ transmission”.

### 3) Correspondence to the Needs of the Client Side

To clarify the advantage for the Client we considered the “clarification of schedule control, quality control, cost control and labor management”.

## Selection of the Base System

We selected “Microsoft Project 2002” (MS-Project2002), “Microsoft Project Server 2002” (MS-P.server2002), and “Microsoft Project WebAccess” (WebAccess) of Microsoft Corporation as base systems for CAMES. The selection criteria were that there shall be natural compatibility among various soft wares such as word processing data and spreadsheet data, which can be applied to many persons. It also must have many functions and be excellent for customers.

## Smooth Adoption to the Actual Project

From the viewpoint of the smooth adoption to the actual project, we developed a “Schedule planning support function”, “Task set support function”, “Japanese style task display function”, “View switching function”, “Task filtering function”, “Documents Folders Link and control functions”, and a “Tool bar arrangement function”. The studied and developed functions for CAMES are shown in Table 2.

	Conventional	MS-Project2002	CAMES's Functions
Schedule Planner	Skilled Engineer	Skilled Engineer	Inexperienced Engineer
Task Set	By hand, Excel, CAD	Setup each task	Half-Automatic
Task Display Style	Arrow Network Style	Gantt Chart Style	Arrow Network Style
Schedule Category	Whole/Monthly/Weekly , Contradiction data	Several Time Span , Unification data	Whole /Monthly/Weekly, Unification data
Task Filtering	Unable	Limited function	Filtering with 4 attributes building construction use
Documents Folders Link	-	Setup each task	Setup automatically
Tool Bar	-	Many buttons	Simple button

**Table 2** Studied and developed functions

## Correspondence to the Needs of the Maker Side

From the viewpoint of the Makers, we studied the needs based on the “solution against the lack of skilled engineers”, “improvement of productivity”, “assurance of quality” and “information sharing or transmission”. To overcome these problems, we aimed at the “unification of information” between makers that are Architect/Engineer, Supervisor, and Contractors. Then we developed the “editing function”, “registration function” and “inspection function” as various kinds of document control support with the original functions. And, for a function that even SC usage can be included, we developed with WebAccess one that exchanges various information through the Internet.

## Correspondence to the Client Side

From the viewpoint of the Clients, aiming for a rapid grasp of various kinds of management items for the project, or to make it easier for Clients to execute decision making, we studied functions that allows a Client to inspect information by Internet using the original functions of WebAccess.

# ACTUAL UTILIZATION OF CAMES

This section is described as the “Actual utilization of CAMES”, assuming a sample project.

## Building Outline

Use: Office / Floors: 9 Floors, 1B floor / Height: 42 m / Total floor area: 10,000m<sup>2</sup>  
 Structure: Steel Structure / Foundation: Cast in place piles / Outer Wall: Pre-Cast curtain wall  
 Contract method: Lump sum contract

## User Group

The User groups and their authority are shown in Table 3. This example is assumed as a lump sum contract method. A Leader of the GC executes the PMr’s work. Staff of the GC’s head office executes control of the whole system as a System Manager. Staff of the service company of CAMES execute support in case of problem occurrence as a System Maintainer.

User Group	Authority
Client	Perusal of summary of schedule and documents.
Architect/Engineer/Supervisor	Schedule (Perusal and progress report) Document (Perusal, Registration, Approval)
<b>General Contractor (PMr)</b>	<b>Schedule (Plan, Manage progress)</b> Document (Perusal, Registration, Approval)
General Contractor (others)	Schedule (Perusal and progress report) Document (Perusal, Registration, Approval)
Sub-Contractor	Schedule (Perusal and progress report) Document (Perusal, Registration, Approval)
System Manager	Executes control of the whole system
System Maintainer	Executes support at the time of problem occurrence

Table 3 User groups and their authority

## Introduction Knowledge of the Systems

Every user who is related to the project needs to gain knowledge of PM such as PMBOK (Project Management Body of Knowledge), and needs to learn about CAMES’ system.

## Work Breakdown Structure ( WBS )

As it shows in Figure 1, we set up WBS for this system only in 2 levels with the summary task and the sub-task, aimed at being simple and flexible. The introduction company or PMr should set up less than 3 level’s tasks and resources based on their knowledge and experience. And on the preparation phase of construction, detailed adjustments including other User Groups are necessary for PMr.

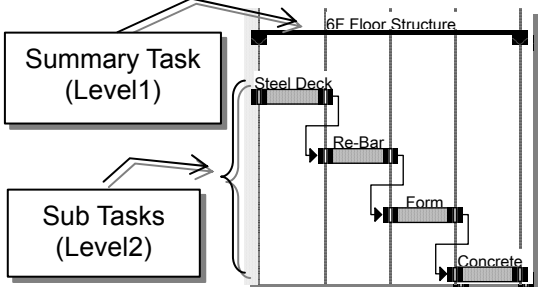


Figure 1 WBS on CAMES

## System Environment

The constitution of system environment differs by the order method and building scale of the building project. For instance, “Place of the server”, “definition of user group” and “authority of the access” should be arranged in each project. A general system environment with CAMES is shown in Figure 2.

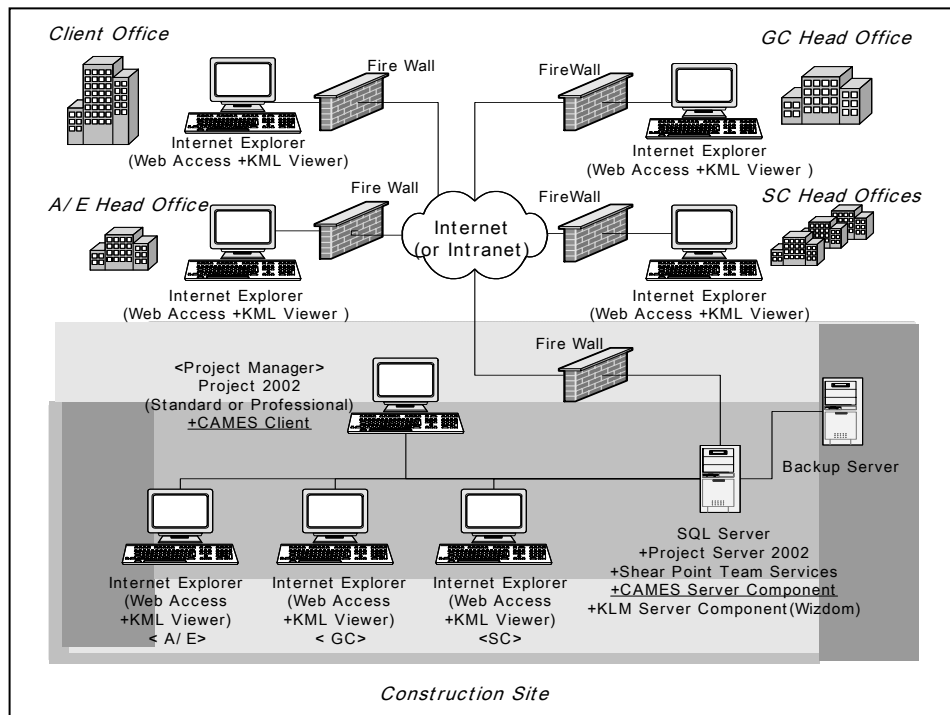


Figure 2 System environment

## FUNCTIONS AND EFFECTS

### Schedule Planning and Task Setting Functions

**Conventional problem:** The outline schedule planning for building construction project is possible only by skilled engineers of GC.

**Development function:** For the “schedule planning support and task set support function”, we developed the function that calculates a task’s contents, duration and order of each tasks half-automatically, and the function that draws tasks on the schedule table half-automatically, after the PMr inputs a building’s outline information. (Here “half” means that some decisions or arrangements are necessary for the PMr to make.) The flow of these functions is shown in Figure 3. The setup GUI and View of the Whole Schedule made by these functions is shown in Figure 4.

**Effect:** With these functions, the hard work of the planning schedule and drawing tasks is reduced. Even a less experienced engineer is able to make a useful outline plan. Also, it will be possible to calculate a rough estimate of the total construction period of the project as a simulation tool.

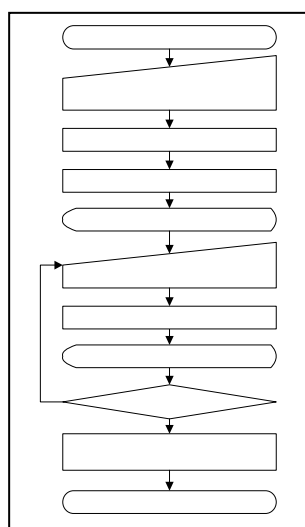


Figure 3 Flow of Functions

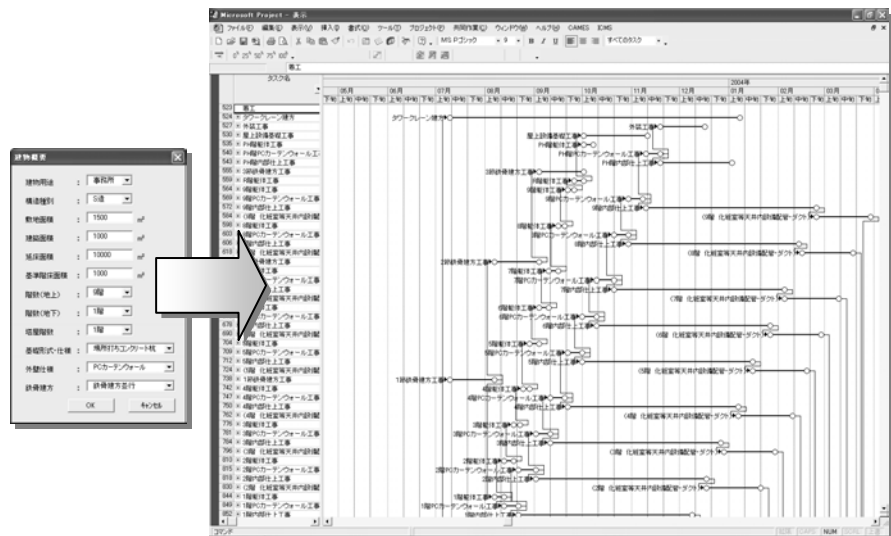


Figure 4 Setup GUI and completed Whole Schedule

## The Arrow Network Style Schedule Display Function

**Conventional problem:** In a foreign country such as the U.S., the Gantt Chart Style is generally being used in a schedule table, and tasks are usually displayed as toward the lower right part from the upper left part as the starting point. However, in a Japanese building construction project, the Arrow Network Style is generally used in schedule tables, and the tasks are usually shown in accordance with the height direction of the building. The default display function of MS-Project is a Gantt Chart Style and this is one of the introduction barriers.

**Development function:** For the “Japanese style task display form function”, we developed the function that exchanges the task bar style from the Gantt Chart Style into the Arrow Network Style. The whole schedule view with the Arrow Network Style display is shown in Figure 5.

**Effect:** Tasks of the same floor or same construction work area are expressed and are connected to the same level line continuously. The merit of this style is that the connection relation and place of each task are easy to understand. This makes it acceptable for the Japanese building construction market.

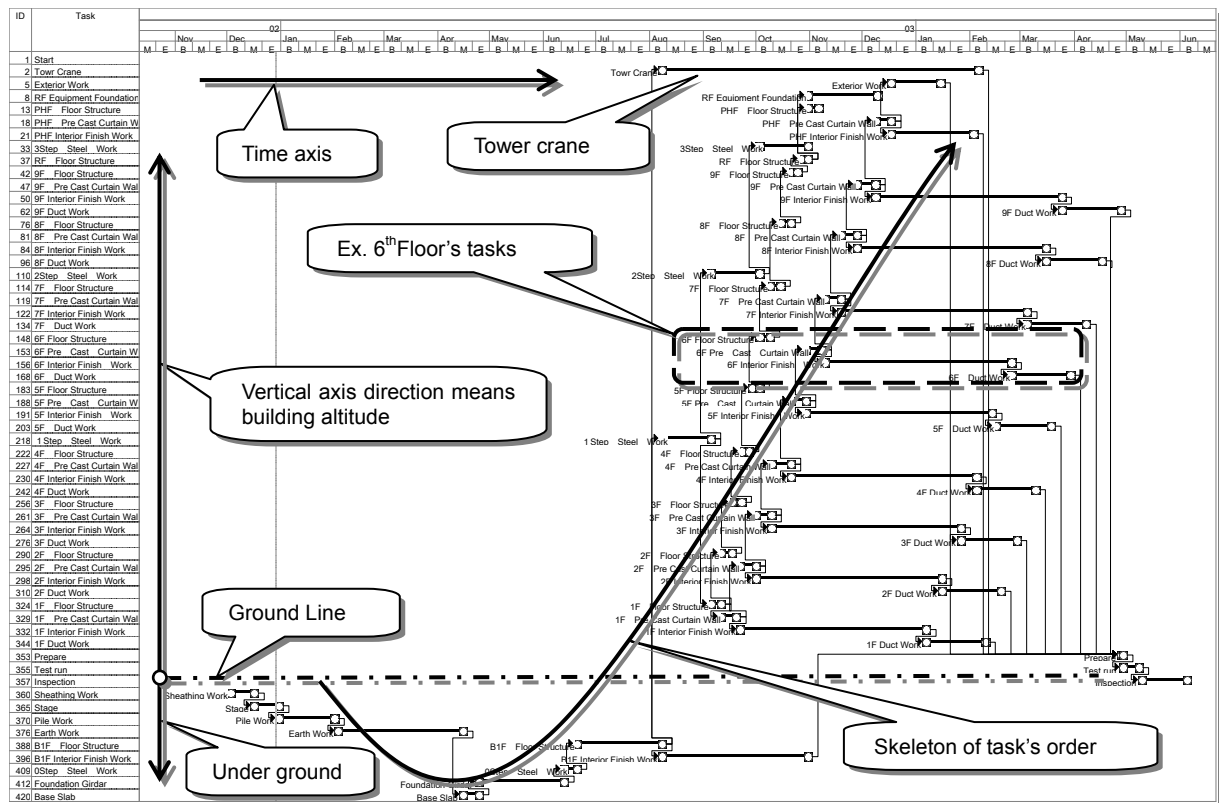


Figure 5 Arrow Network Style display /Whole Schedule

## Schedule Display Switching Function

**Conventional problem:** For the schedule table in Japan three kinds of view are mainly used. They are the “Whole schedule”, “Monthly schedule” and “Weekly schedule”. But these schedule tables are being made individually and information is not completely unified. Also these schedules are almost always delivered only on paper. Using MS-Project, unification of information is achieved, but the display form of the time scale and task bar of this software gives a sense of incongruity to Japanese.

**Development function:** For the “Schedule display switching function”, we developed the function that exchanges time span and bar style displays with three kinds of time spans, the “whole schedule view”, “monthly schedule view” and “weekly schedule view”.

**Effect:** You are always able to confirm unified information with the latest schedule, and three kinds of Japanese style time spans are displayed making it acceptable for the Japanese building construction market.

## Task Filtering Function

**Conventional problem:** There are many cases where SC's make their schedule table for their own

particular construction job. This trend is especially observed in Steel work, Interior Design work and Equipment work. Therefore, contradictions and faults sometimes may easily occur between each task, because the tasks' information is not integrated. By using MS-Project, the integration of the tasks' information will be able to be accomplished. However, a new problem occurs at the same time, where an increase of the number of tasks causes complications and is difficult to understand.

**Development function:** For the "Task filtering function", we developed a task-sort function adding four attributes i.e., "User group", "Task type", "Construction work type" and "floor/position".

**Effect:** By adding the four attributes, it will be able to easily check with task-sort views, and the function will mitigate complications caused by the integration of tasks.

### **Other Functions on MS-Project for PMr**

We have researched the standard function of MS-Project and have developed and studied other functions for the Japanese building construction use, but as space is limited, we have simply described them as;

- 1) Tool bar Arrangement Function (additional function) for easy use
- 2) Printing Support Function (additional function) for labor reduction
- 3) Progress Control Function (additional function) for easy use
- 4) PMr Report Preparation Functions (original function) for labor reduction
- 5) Resource Control Function (original function) for building construction use
- 6) Cost Control Function (original function) for building construction use

### **Functions on MS-P.Server and WebAccess for User Group**

After obtaining a user ID and password, user groups can confirm the schedule and progress report by using the Internet. We have researched the standard function of MS-P.server and WebAccess for Japanese building construction use, but as space is limited, we have simply described them as;

- 1) Task Inspections/Achievement Report Functions (original function) for collaborative use
- 2) Progress Report Functions (original function) for collaborative use
- 3) Documents Preparation Support Functions (additional function) for labor reduction
- 4) Task Link to File or Folder Functions (additional function) for improvement of productivity
- 5) Workflow Functions (original function) for building construction use

## **EVALUATION AND PROBLEMS**

### **Evaluation of CAMES**

CAMES has not been evaluated using a real project yet. We have only started to explain CAMES to the GC's members or real estate company's members. The tendency is that, real estate company's members who are close to the client are willing to accept CAMES, but the IT division's members of the GC haven't tried to actively accept it, even if they show interest in it. We guess that many GC's have problems with a lack of PM knowledge, insufficient IT literacy especially for on-site members, and an insufficient infrastructure as well. But then several companies who have evaluated CAMES succeeded to get rid of some barriers when installing the PM-Supporting tool to the project with various functions such as easy planning, checking, and exchanging information between stakeholders.

### **Problems of CAMES**

In this paper, we assumed the GC's Leader as PMr. But in the real project, the PMr will be a supervisor from an architect's or engineer's office, a Construction Manager of a CM company, or an in-house engineer of the client. Therefore we noticed that CAMES should have many different functions for their needs. And when they introduce CAMES, it will be very important that we have to take their environment, documents and knowledge into consideration. For instance, the following descriptions are important items;

- 1) Standards & Document templates (Original, ISO9000s, ISO14000)
- 2) Management Construction manuals, Supervisor's manuals
- 3) Special methods of construction or technology
- 4) Knowledge documents & data (Safety, Quality, Cost, Schedule, Resource)
- 5) Existing backbone system or sub system

And we have to investigate the following improvements;

- 1) Refine the developed functions
- 2) Functions for the Client's needs
- 3) Value Engineering function
- 4) Guidance function
- 5) Internet function under DB server

Furthermore, in the future, we hope to develop, improve and promote the CAMES functions into the planning/design phase, estimation/order phase, and the whole area of the Japanese building construction industry.

## CONCLUSION

There seemed to be much difficulty in introducing the existing PM-supporting tools into the Japanese construction industry with the traditional building customs. So on the basis of Microsoft Project (US), we developed CAMES as the system to solve those problems indigenous to the Japanese market. At first, for diffusing the PM method, we examined the traditional Japanese customs and pointed out obstacles in the way of its introduction: why these tools cannot be used as we expected. Secondly, we investigated the necessary functions: what in the existing PM-supporting tool needs to be improved or added. Then we developed CAMES, equipped with a half-automatic scheduler in the Japanese style, special viewer, document manager, and other functions. In consequence, we have prepared the IT-environment for a PM-supporting tool on the Internet for the Japanese construction industry. At the next phase, we will study these functions more and improve CAMES after further experimentation with this tool.

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