First International Conference on Construction in the 21st Century (CITC2002)
"Challenges and Opportunities in Management and Technology"
25-26 April, 2002, Miami, Florida, USA

APPLICATION OF ORACLE/CASE IN PROJECT COST CONTROL SYSTEM DESIGN AND DEVELOPMENT

Guangbin Wang
Research Institute of Project Administration and Management, Tongji University, Shanghai, China

Wenjuan Zhang
Shanghai Zhangjiang Hi-Tec Development Co. Ltd., Shanghai , China

Yan Jin
American Industrial Design Company (Shanghai), Shanghai, China

Yongsheng Zhao
AETNA School of Management, Shanghai Jiaotong University, Shanghai, China

ABSTRACT
CASE emerges from application of computer-aided technology to software engineering. Both in research and application, it is a hot field and development direction for the integrated design and development environment and tools of software. Based on the application of ORACLE/CASE in Project Cost Control Information System (PCCIS) design and development, this paper analyses some important topics including system develop strategy, CASE design process and CASE*Dictionary in PCCIS.

KEYWORDS
CASE□Project Cost Control, Software Development Environment and Tools, ORACLE

1. INTRODUCTION

Due to the rapid economy development in China, construction projects are becoming larger and more complicated, Project Management Information System (PMIS) has been a big issue and debate in the construction industry during the last decade. In 1990 the author participated in a research project on designing and developing a Project Management Information System for Shanghai Metro Project, which has cost more than 10 billion RMB (around 1.2 B US Dollars) in investment and lasted five years. The final software is named PM-SM in which the Foxbase RDBMS and C+ are the main developing environment and tools. In I991 another Project Cost Control Information System is developed for Shanghai Heliuwushui Construction Project and the Prototyping Method is used in the design and development process. This is the first time to use such method in developing project information system in China, with Foxbase RDBMS and C+ as developing tools. In 1997, Research Institute of Project Administration and Management at Tongji University, aided by two software engineers from Oracle Company, began to design and develop a new generation of construction project cost control information system named DP-1/CC to meet the large market in construction industry in China. DP-1/CC (Developer Profit/Cost Control) runs on Window NT or UNIX . Client/Sever architecture, ORACLE V7.1 RDBMS and Oracle Developer 2000 were used in this software. During

the system design and development, the development team fully used the abundant development environment and tools of ORACLE/CASE Designer 2000 to ensure the high performance of the software. This system is considered to have achieved international standard after two days' testing, examining and evaluation by tens of experts organized by Ministry of Construction, China. This paper, combining the author's system development practice, discusses and analyses the application of ORACLE/CASE in Project Cost Control Information System (PCCIS) development.

2. ANALYSIS OF ORALCE/CASE

CASE is the application of Computer Aided technology in Software Engineering. It is an important research field and development trend of the integrated environment and tools in software design and development, and has significant effect on improving efficiency and quality in software development. CASE method and tools have more and more influence on information system development. Figure 1 provides ORACLE/CASE influence on labor's distribution in development of information system.

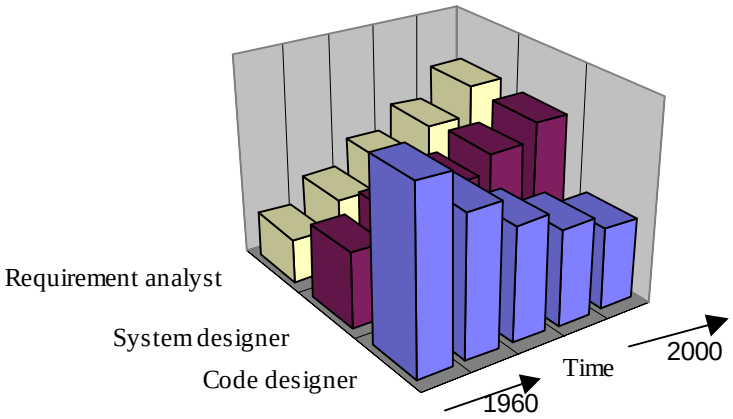

Figure 1: ORACLE/CASE Influence on Labor's Distribution

As a structural method, CASE automates every phase's work during design and development of the information system. It can precisely estimate every phase's task, assure integrity by crossed checking, greatly reduce the simple and repeating work of the developers, decrease writing and editing software documents work load, automatically make correction in early development stage, contribute to the program reuse, and automate code generation. The application of CASE and the integrated software engineering environment provided by CASE method greatly amplify the intelligence of system development persons.

ORACLE/CASE(Designer/2000) can automatically complete all database structure design according to the system's E-R graph, automatically generate 70% to 80% application program according to the system function structure. Furthermore, ORACLE/CASE has better error-checking tools, which can eliminate errors and omissions during system analysis and design. Its reverse generating method reflects any change of the users' requirement into database structure.

The typical tools of ORACLE/CASE include CASE*Dictionary, CASE*Generator, and CASE Project Management, which form an extensive circuit diagram during design and development of PCCIS (from planning phase to implementation phase).

3. ANALYSIS OF THE SYSTEM DEVELOPMENT STRATEGY AND PROCESS MODEL

As a structural method, ORACLE/CASE clearly defines system development framework, divides development work into a certain number of definite phases, formulates every phase's task, sequence, products and results, defines the design and development standards and specifications, and puts forward relevant quality checking means. The framework of the CASE is based on the life cycle development method, but it also supports prototyping method because it is a fast and high efficient man-machine means and it is capable in data storing, selection, and updating, which are greatly helpful to fulfill prototyping method.

Fully considering that date processing of PCCIS is very complicated and the user requirement is difficult to be defined accurately the development team decided to adopt the Evolutionary Prototyping Method combining with Object-Oriented Data Base Model (OODBM) to develop PCCIS. ORACLE/CASE fully supports this development strategy and process model and it was finally proved to be a success.

Application of Evolutionary Prototyping Method to develop cost control system does not mean that the fast-generating prototype does not need development documents. Prototype is an aid tool of system analysis and design. With the application of ORACLE/CASE tools and the fourth generation language to develop the system, we can setup the system by many times evolutionary prototypes. Reverse Engineering of CASE method has more important effect on the system developed by adopting prototyping method. Its effect includes two aspects: First, we can check CASE dictionary or data memory from bottom to top, analyze and evaluate possible influence of any change on system, assure such change within system object, and put forward the improvement plan when the system function changes and prototype increases. Second, the CASE dictionary can evaluate the change's effect on the existing system from top to bottom , and plant the change into the existing system during succeeding or added development. CASE tools can be used to configuration control, project control, system development's evaluation and monitor during design and development change, thus providing great convenience for system maintenance.

As PCCIS is a complicated database information system, we should adopt some system design and development strategy model as a direction to fulfill a great number of works systematically and guarantee product quality of every phase (including software procedure and technology documents). It has very important meaning to the success of the system development. The procedure of CASE method in project cost control system development is exemplified in Figure 2.

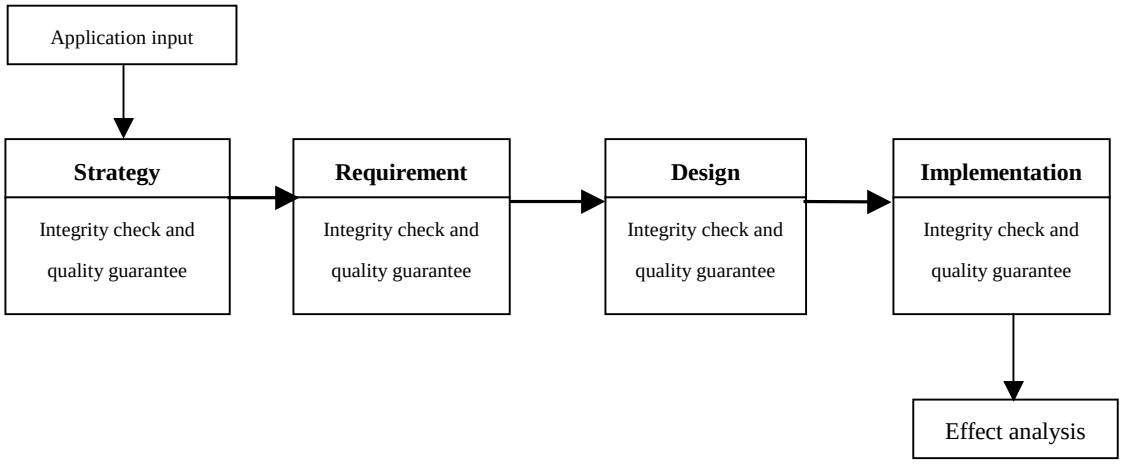

Figure 2: CASE Process in the System Development

4. CASE DICTIONARY APPLICATION ANALYSIS

CASE dictionary is the core of CASE development environment and supporting database for software engineering. It collects and manages system technical information in the system design and development period and system operating period, automatically records, organizes and checks all the information to assure the early error detection during system development. It provides tools for system analyses, design and development. During system data analysis and design, professional persons of data processing can define the accurate system with these tools. It provides an active multi-users environment so that system development persons of different phase can share all information in CASE Dictionary. Figure 3 describes the different working objects and users of CASE dictionary during the system designing and development.

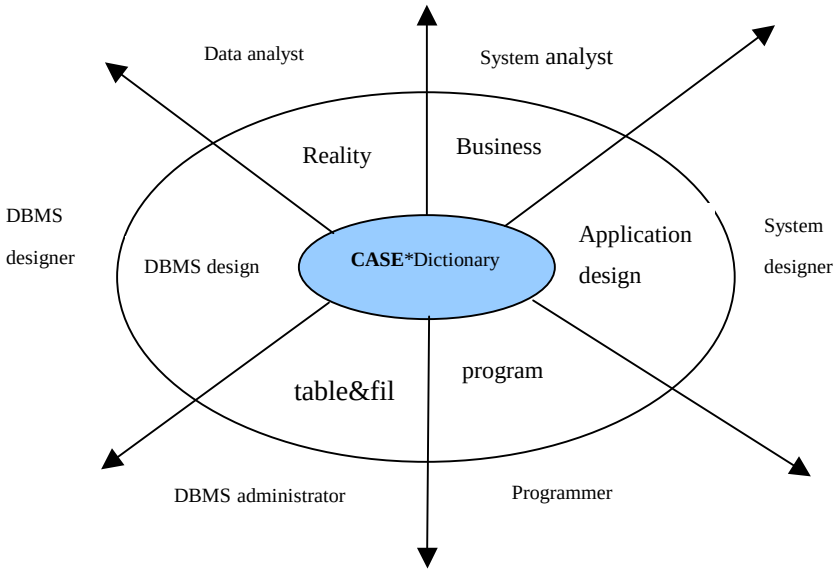

Figure 3: User Types of CASE Dictionary During System Development

During the PCCIS development, CASE Dictionary provides great help to the software development team. The main contents built by CASE Dictionary are exemplified in Table 1.

Table 1: Main Contents in CASE Dictionary During the System Development

No	Development phase	Main contents in CASE dictionary	Working Sequence
1	Strategy planning	Application system definition Function hierarchy definition E-R graph model definition Data-flow definition Total system scope definition	
2	System analysis	Detailed functions definition Detailed data definition Data flow definition Data structure definition Distribution requirement definition	
3	System design	Default database definition Database scale forecasting Procedure/module definition Users' interface (screen) definition Module net definition	
4	Programming	Program documentation Database and normal document definition	
5	System transfer	Re-engineering information Testing data System and environment configuration	
6	System operating	Effect and result analysis report Redefinition, re-document information System change, prototype control	

5. CONCLUSIONS

Through the design and development of the PCCIS, it can be concluded that the system development environment, method and development tools provided by ORACLE/CASE have great influence on the success of system development. In practice, it relevantly requires the persons of the development team should be much proficient. The development technical manager should have much experience and management skill.

ORACLE/CASE concept and method provide a systematic structure technique with standard task that makes it possible to design and develop high-quality system quickly. Furthermore ORACLE/CASE supports perfect communication and improves quality and efficiency of system development. Its concept and method provide efficient path for information system development toward automatic intelligence process, even finally toward "software factory" in the future.

6. REFERENCES

Barker, R. (1990). *CASE * METHOD: Tasks and Deliverables*, Oracle Corporation UK Co. Ltd.

Seibert, G.H. (1993). *Oracle DATA PROCESSING: A MANAGER'S HANDBOOK*, McGraw-Hill, Inc.

Gabgler, M. J. (1991). Successful Implementation CASE: Manage technical transfer, *Proceedings of ORACLE Application and Development*□ORACLE China Company.

Deng, R. (1996). *Practical Software Engineering*, Tsinghua University Press.

Zhijian Wang. (1991). The Powerful Base of Information System - ORACLE in prototype, *Proceedings of ORACLE Application and Development*□ORACLE China Company.