COMPUTER-BASED STAFF ALLOCATION FOR ENGINEERING CONSULTANCY

by

Ms. Suphaphan Inluksana

A Final Report of the Three-Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

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Project Title Computer-Based Staff Allocation for Engineering Consultancy

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Academic Year July 2000

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ABSTRACT

This system analysis project focuses on developing a computerized information system to support staff allocation system of one engineering consultancy company which is one of the most sizable consulting engineering firms in Thailand.

The study of the project started from finding all the processes related to the staff allocation and focus on the areas for improvements. The study suggested that the manual process should be replaced by a computerized process. The analysis tools such as data flow diagram and entity-relationship diagram are the main techniques used for developing the behavioral model and data model.

Since the existing system are mainly manual, problems arised in many ways; for example, difficulties in information retrieval, difficulties in managing hard-copy, communication problems, lack of security control.

The proposed system is designed to cope with these problems; for example, the time/efforts in acquiring the information will be reduced, the redundant process is eliminated or simplified, the security control techniques is introduced.

Moreover, the proposed system allows immediate access to the information and provides up-to-date information for decision-making, convenience and fast services recording, and ability for searching or reporting the staff allocation information. By employing this proposed system in the company, the efficiency of the staff allocation system used in the company will be improved.

ACKNOWLEDGEMENTS

Fundamentally, the researcher would like to express gratitude and great appreciation to her advisor Dr. Visit Hirankitti for his valuable guidance and full effort involved support from beginning to end of this study. The researcher also would like to express her truly grateful to members of the examination committees for their valuable comments and suggestions.

This study could not have been accomplished without help and cooperation given by managers, engineers and other officers in the company who provide valuable information and useful recommendations.

The researcher is grateful to all faculty members from whom the researcher received a wealth of knowledge, kindness and guidance during her study at ABAC.

Finally, the researcher is most grateful to her beloved family members who have been behind all her achievements in life. The researcher also wants to thank them for their love, sacrifice, encouragement and support throughout her studying period.

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I. INTRODUCTION

1.1 Background of the Project

The company mentioned in this study is in the engineering consultancy business. It has expertise and extensive experiences in the following areas of consultancy services: water, environment, urban and regional development, community-based development, infrastructures and transportation, power and energy, public consultation and participation, institutional restructuring and capacity building, information technology, and privatization. It provides scope of services such as policy and strategy formulation, project conception and formulation, survey and investigation, master planning, feasibility study, environmental impact assessment and public consultation, construction supervision, operation and maintenance, etc.

As it is one of the most sizable consulting engineering firms in Thailand, the clients are mostly the government agencies. In the method of selecting the consultancy companies to work with a government project, first consultancy companies submit their Technical and Cost Proposals to the government agency; then the agency's consultant selection committee will decide which company would win the proposal. Later the selected company negotiate the cost of services; if they both agree, the company, then sign the contract with the agency.

The criteria for selection a company to work for the project is the consideration of the technical proposal, the proposed staffs and the business/management experiences. Especially, the proposed staffs is one of the key factor for this consideration.

To compete with other companies, the company itself is necessary to select the most suitable staffs to work with the project. The most suitable staffs are selected according to their skills and experiences to match with the agency's predefined

requirements and their available man-months. If man-months of a staff are not available, the company is necessary to find someone else who is available and can work for the project, and the latter staff must have the same skills and working experiences as the former.

The company has faced a problem of staff allocation, that is, to get information about man-month availability of staffs, the company has to check directly with the departmental manager, who is normally inconvenient to check man-month availability of several different departmental staffs. The departmental manager obtain the information by checking with several different departmental managers. This is very inefficient and consumes a large amount of time to get the information.

To overcome such a problem we propose that the company should establish a kind of information centre which provides information about the staff availability, so that this information will help the department manager select staffs to work in a project more efficiently. The centre employs a "computer-based staff allocation system" which is what we propose for this project. The system can collect and update data concerning staff availability, as well as process and prepare man-month report. We believe this is a very useful tool for selecting staffs to work with a project.

1.2 Objectives of the Project

(1) To study the existing system which is based on manual procedure and identify problems and weaknesses of that system.

(2) To replace the existing staff allocation system based manual procedure by a computer based system.

(3) To design the new computer-based staff allocation system using system analysis and design techniques.

1.3 Scope of the Project

(1) The scope of the project is limited to the design of the staff allocation system only, not including the implementation of the system.

(2) This system is designed to use in an engineering consultancy company employing 300-400 staff members.

1.4 The Contributions of the New Proposed System

(1) The time/ efforts in acquiring the information will be reduced.

(2) The redundant process is eliminated or simplified.

(3) Security control techniques is introduced. Therefore, the staff allocation information is well stored and difficult for intentional or unintentional attack, only authorized users can access to the system.

(4) The new staff allocation system is easy to use.

1.5 Project Plan

Activities	January				Febuaiy				March				April				Max				June				July,			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Identifying the existing system procedure and problems																												
2. Identifying user requirements																												
3. Designing new system																												
- Data flow diagram																												
- ER diagram																												
- Data stored and database design																												
- Interface design																												
4. Report preparation																												
5. Correction of the project report																												

Figure 1.1. Project Plan.

H. THE EXISTING SYSTEM

2.1 The Existing Staff Allocation System

When the company decides to submit a proposal for being selected to work with a government project, the staff allocation process begins. The procedure of existing staff allocation can be divided into steps as follows:

(1) A government agency sends an invitation letter and a term of references (TOR) to a consultancy company. It describes the objectives and the scope of services the consultancy company will provide during the project period. It is sent to the chairman of the board who has authority to choose one Executive Director (ED) among seven of them to take responsible for the project. The selected ED will act as a project supervisor.

(2) The selected ED then assigns a senior staff to be a Project Manager (PM) of the project; the PM will act as a team leader.

(3) The PM plans the work schedule by extracting all the works needed to be accomplished according to the TOR and then split it into several tasks.

(4) The PM decides on the position/ skills required for each tasks and then selects the team members from several potential staffs of several departments. This step requires the staff information, which is the information of staff skills and staff availability (previous M-M allocation). Both staff skills and staff availability can be checked manually by asking for information from that staffs departmental manager. To check the availability of staffs, the PM has to check if that person has available time to work for the project or not. If the staff has available time, he/she is then

assigned to work for the project. If there is no available time, the other staff with the same skills who has available time is selected instead.

(5) After the M-M allocation process finished, this M-M allocation plan will be distributed to the proposal preparation team, then is sent together with the technical proposal to the government agency for consideration. This M-M allocation plan is also sent to the Accounting Department to be used in the project budget preparation process.

The flowchart of the existing system is in Figure 2.1.

2.2 Current Problems of the Existing System and Contributions of the New Proposed System

Since the existing system of the staff allocation is done manually, some unnecessary work has been repeated many times and caused many problems which can be concluded as follows:

(1) Repetitive Requests

Many repetitive requests are processed if there are several projects to be proposed at the same time period. The departmental manager is asked for information many times and this will cause disturbance.

With the proposed system, the departmental manager is not asked for the information at all. The system will check automatically for the available person who can work for the project, his/her name will be kept in M-M allocation file and be accessible to the user.

(2) Difficulties in Information Retrieval

The users cannot retrieve all the information they want in a short time. Since all the information were manually written, it leads to the problems as follows:

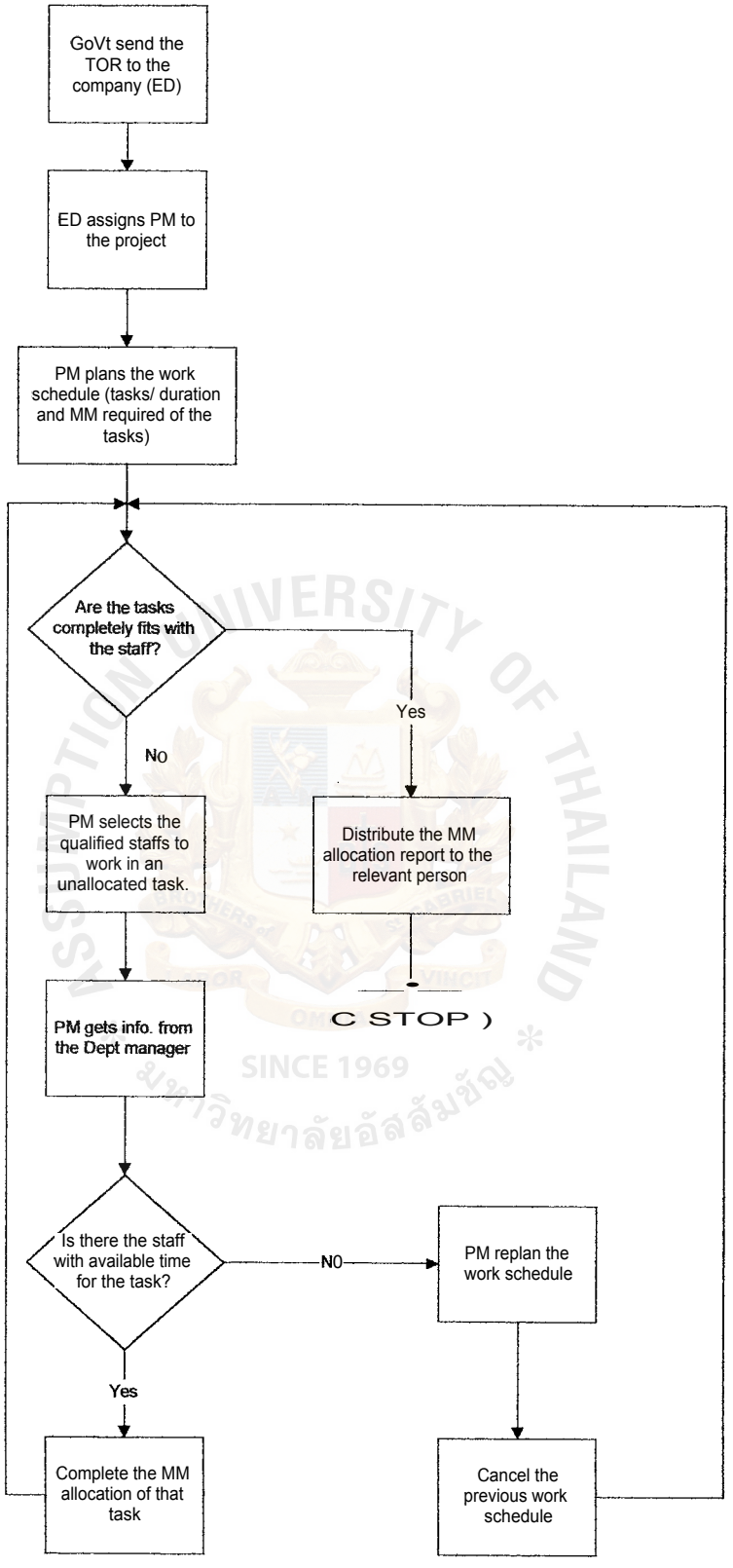

Figure 2.1. Flowchart to Explain How the Existing System Works.

(a) It is difficult to access/manage the documents.

(b) The users sometimes wastes a lot of time searching for the needed information.

(c) It takes a large amount of space to keep the hard-copy.

(d) To change/update the information is difficult.

With the proposed system, the above problems can be solved easily. The system provides on-line retrieval information.

(3) Dependence on Hard-Copy

Every user depends on the hard-copy, which is uniquely created and is not be shared among the groups of users. This problem causes excessive copies. Moreover, the information sometimes is not up to date when there is a change and is not sent to all of the relevant persons.

With centralized database, data were kept in one place. Every users can utilize and share the information. The need for many hard-copies will be reduced.

(4) Communication Problems

The users (ED/PM) sometimes have to contact the Personnel Department and the Business Development Department to get the relevant information which normally consumes a large amount of time.

The new system will provide the right for access to and modification of databases from the relevant departments/users; this right will allow the person in charge to add more information to the databases as necessary. This makes it easier for communicating between groups.

(5) Limited Security Handling

There is no security control for the information which is very important for the company. The information is, for example, the staff information/qualification, the assigned man-month. Without the security handling, the information may be erased or modified by mistake or due to bad intention.

The new system will provide the security by the use of passwords at two levels: first, at the login on a LAN system, and the second at the entry access to the system. The password is assigned with a different priority to access/modify data in the databases. For example, the PM has a right to modify data in the M-M allocation file while the personnel department has a right to only access the data.

(6) The Underload M-M Assigned to the Staffs

Since there is no formal report showing how the staff is allocated to the project, the selecting method of the staffs to work for the project sometimes does not consider all the potential staff who can work for the project. The underload M-M of some staffs still exists without consideration.

The new system will solve this problem easily because the system allows the users to retrieve all the staff names matched with the users criteria. More underworked staffs will be assigned more work, and as the result will have more man-months.

III. REQUIREMENTS AND FUNCTIONS

3.1 Requirements in the Proposed System

The objective of the new system is to study the existing system, identify the problems, and design the new computer based staff allocation system using system analysis techniques.

After analyzing an existing system procedure and the problems described in Chapter II, the new system employs a sharable computerized databases that support the transactions of the staff allocation procedure. The users expected that, such databases will provide them faster information retrieval, more reliable information and better decision making. In conclusion, the requirements of the new system can be identified as follows:

(1) The time and efforts in acquiring the information should be reduced.

(2) The redundant process should be eliminated or simplified.

(3) The security control should be introduced.

(4) The total efficiency of the staff allocation process should be improved.

(5) The staff allocation system must be easy to use.

3.2 Functions of the Proposed System

The new proposed system should be designed to serve the users requirements mentioned above. The concept is to maintain the existing process while trying to solve the problems stated in item 2.2. by introducing the computerized system and database management technique. After the critical study, the new proposed system can be divided into 7 main functions as shown below:

(1) Project Information Service

The Business Development Department is assigned to update the project information. For example, add the project ID, project name, client name, project duration, etc. The new project information will be added for future updating the M-M plan, moreover the project file is always monitored and updated; e.g. in the case of a project is confirmed as a lost project, that project information record will be deleted.

(2) Staff Information Service

The Personnel Department have right to access and modify the staff file which is updated every time after admission the new staff or resignation of the staff. Modifying the staff file can be done by adding, editing or deleting the staff information depending on the project status at that time. The staff file will identify staff name, position, years of experiences, skills, etc. This staff information is helped users in generating lists of the qualified staff matched with the criteria given in the work schedule.

(3) Project Information/Report

The system can extract the project information from the project file to produce report. The project information will be printed out according to the conditions given by the users.

(4) Staff Information/Report

The system can extract the staff information from the staff file to produce report. The staff information will be printed out according to the conditions given by the users.

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(5) Work Schedule Planning

The users can log-in to the system and plan the work schedule of the project by specifying the tasks to be done, duration, M-M, skills and years of experiences required of each tasks. The design of the work schedule makes the process of M-M allocation planning easier. The work schedule can be revised many times until all the tasks is completely allocated with qualified staffs.

(6) M-M Allocation Planning

The system will match the criteria set by the work schedule with the staff information stored in the staff and M-M allocation file, then extract or display the names of the staffs who have the same qualifications and available time as required. If all the tasks are completely allocated with the staffs, the M-M allocation process is finish. If it is not , the criteria in the work schedule should be revised until the system can allocate staffs to every tasks.

(7) M-M Report

The report is designed to be 2 types:

(a) M-M report listed by projects: this is used for the proposal preparation team as the working plan of the project. It is also sent to the Accounting Department for preparation of the project budget. This type of report allows the users to select to view the task assignment either in the form of man-day (M-D), man-month (M-M), or man-hour (M-H).

(b) M-M report listed by staffs: this will represent the workload of the staffs specifying how many projects they are assigned, how long they

are assigned to work in each project, and what amount of man-months they are assigned. Like the first type, this type of report allows the users to select to view the task assignment either in the form of man-day (M-D), man-month (M-M), or man-hour (M-H).

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IV. DATA FLOW DIAGRAM

4.1 Design of the Data Flow Diagram of the Proposed System

The data flow diagram of the proposed system was developed as a tool for defining the behavioral model of the new proposed system. The context diagram is represented in Figure 4.1.

(1) Context Diagram

Figure 4.1 shows that, the staff allocation system has to communicate with many external entities.

(a) The Business Development Department

The Business Development Department will provide the project information to the staff allocation system as the basic information for PM to use in staff allocation planning. The Business Development Department can also get the project information/ report retrieved from the system to use for their specific proposes.

(b) The Personnel Department

The Personnel Department will provide the staff information to the staff allocation system by typing the updated staff information to the system, therefore, PM who connects to the system to plan for the staff allocation will always get the right information of the whole staffs in the company and can select the right ones to fill in their project. Like the Business Development Department, the Personnel Department can retrieve the staff information/report to use for their specific purposes. Moreover, the M-M allocation information can also be retrieved because the Personnel Department has to know who is

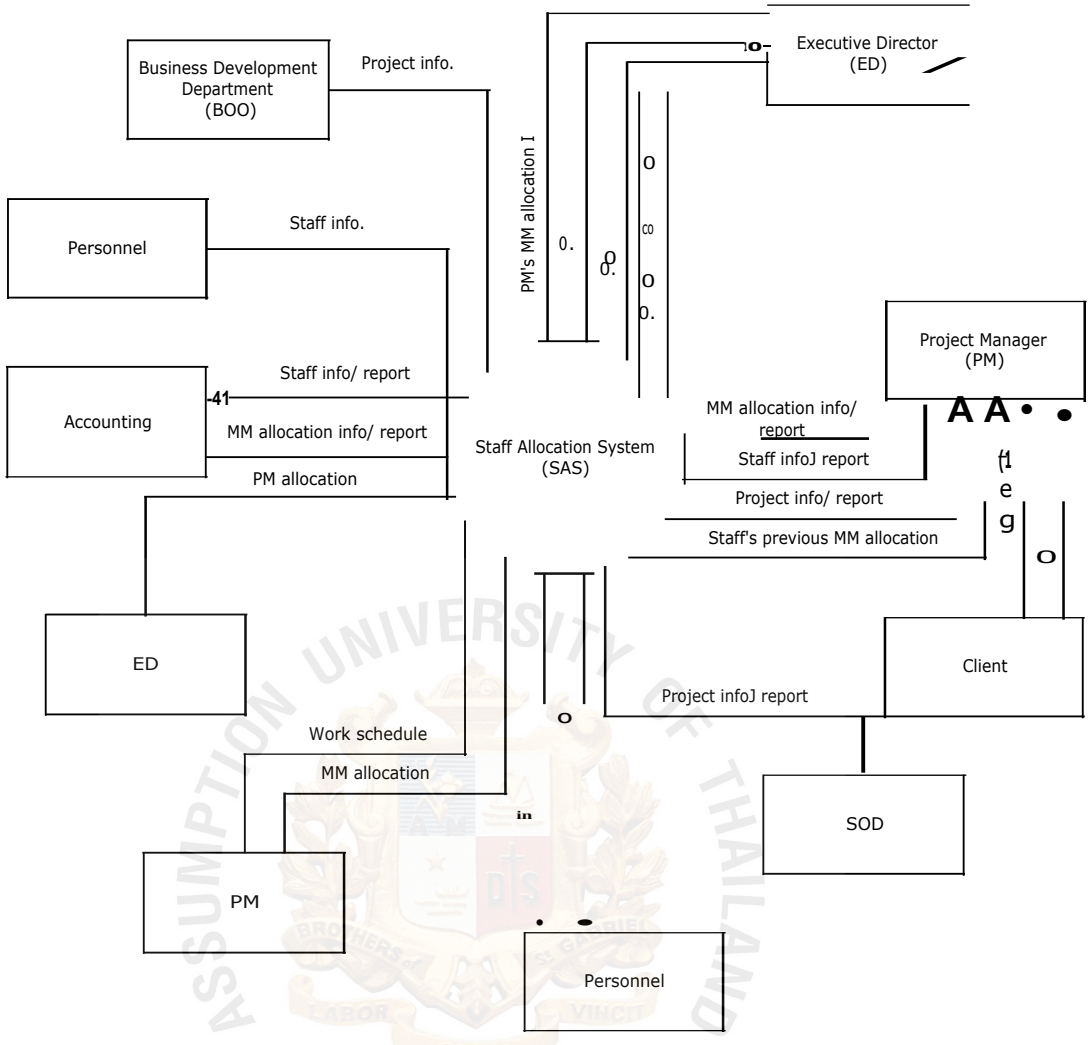

Figure 4.1. Context Diagram.

working in which project. In case of the resignation of a staff, the Personnel Department will inform PM of that project to allocate the new staff instead.

(c) Executive Director (ED)

The ED gets the previous M-M allocation, PM information and project information from the staff allocation system and then allocates the appropriate PM to be the project's team leader.

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(d) Project Manager (PM)

After being assigned to be the PM for the project, the PM has to plan the work schedule of the project and then assign M-M allocation to the project by using the beginning information such as project information, staff information, previous M-M allocation.

(e) Client

The information from the Client is listed in the Terms of References (TOR). The PM should clearly understand what is the requirement of the client by thoroughly reading the TOR. The PM has to generate the whole tasks to be done, the number of staffs required and the staffs' qualifications used in the project. The TOR is basically splited into two main parts: the project requirements and staff requirements.

(f) The Accounting Department

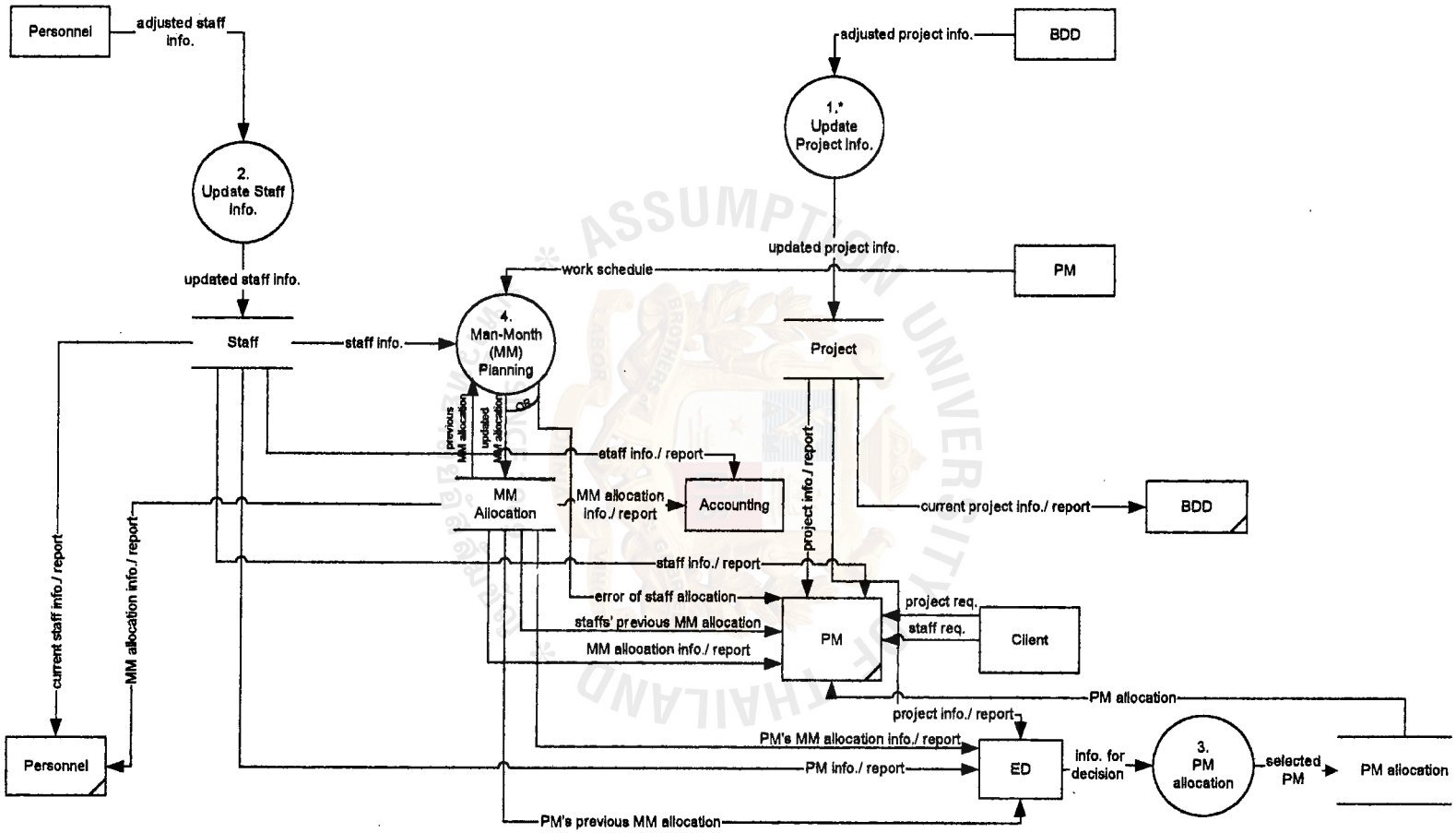
The Accounting Department is the only department which does not provide any information to the system, but receives the staff information and M-M allocation to use in project budget preparation.

(2) Level 0: Staff Allocation Process of the Proposed System

This level shows the main functions that the new proposed system can do in Figure 4.2.

(a) Process 1: Updating Project Information

As described above, the Business Development Department provides the project information to the system. The project information will be used in the following processes.


Personnel
adjusted staff info.
2. Update Staff info.
updated staff info.
Staff
staff info.
4. Man-Month (MM) Planning
previous MM allocation
updated MM allocation
OR
MM Allocation
MM allocation info./ report
Accounting
adjusted project info.
BDD
1.* Update Project info.
updated project info.
work schedule
PM
Project
project info./ report
current project info./ report
BDD
staff info./ report
error of staff allocation
staffs' previous MM allocation
MM allocation info./ report
PM
project req.
staff req.
Client
current staff info./ report
MM allocation info./ report
Personnel
PM allocation
project info./ report
PM's MM allocation info./ report
PM info./ report
ED
info. for decision
3. PM allocation
selected PM
PM allocation
PM's previous MM allocation

(1) It is used in the first step of the PM allocation, the ED retrieves the information of the project of which the ED is in charge, and then assigns the PM to the project.

(2) It is used by the PM in M-M allocation process, which is, first, the PM retrieves his/her assigned project, then plans the work schedule and assigns staffs to the project.

(3) The Business Development can retrieve the project information provided by themselves, either in the form of the screen display or the project information report.

(b) Process 2: Updating Staff Information

The Personnel Department provides the staff information to the system. It is used in the following processes.

(1) The ED uses the staff information retrieved to make decision for selecting the PM of the project.

(2) The PM uses the staff information retrieved to make decision for selecting other staffs to work in the project.

(3) The staff information can be retrieved by the Accounting Department as the important information source in preparing the project budget, the information is, for example, the staff name, position, years of experiences, etc.

(4) The Personnel Development can retrieve the staff information provided by themselves either in the form of the screen display or the staff information report.

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(c) Process 3: PM Allocation

This process is done by the ED. The PM assigned by the ED should be activated by the Business Development Department in order to plan the M-M allocation of his/her assigned project.

(d) Process 4: M-M Planning

The M-M planning can be divided into two parts:

(1) Work Schedule Plan

First, the work schedule is planned by the PM of the project. The work schedule is the overall work to be done in the project; it is divided into several tasks. The PM should identify the task's specification, for example, the tasks duration, the M-M required, the staff qualifications for each task, etc.

(2) Assign M-M Allocation

After the PM plans the work schedule, the system will search the staff in the databases who have the requirements and available time matched with the conditions specified in the work schedule. After every tasks are completely assigned with staffs, then this work schedule is then called the M-M allocation plan of the project and distributed to the relevant person.

Level 1: Process 1— Updating Project Information

Table 4.1 shows the decision table of updating project information process. The project information should be key-in to the system when the Business Development Department receives information of the new project from the Client. The project information is maintained in the project file of the staff allocation system and will not be deleted unless there is no

confirmation that the company loses that project from the selection committee.

Table 4.1. Decision Table: Process 1 -- Update Project Information.

	The government agency send the TOR to the company	Y				
	Win a project		Y			
	Loss a project			Y		
	Ongoing Project Confirmation				Y	
	Complete Project Confirmation					Y
	Key in the project information	X				
	Update the project status		X		X	X
	Delete the project information			X		

(4) Level 1: Process 2 — Updating Staff Information

Figure 4.3 show the data flow for updating staff information. The staff information should be updated because of:

(a) New Staff Admission

The Personnel Department extracts important staff information from the staff's application form and then stores it in the staff file of the staff allocation system.

(b) Staff Resignation

When a staff resigns, the Personnel Department will change that staff status to be "resigned". After that, they inform the PM to plan for a new staff to replace. When the PM already find the new staff to replace the vacant position and change the M-M allocation plan, the Personnel Department can then delete that staff record from the staff file.

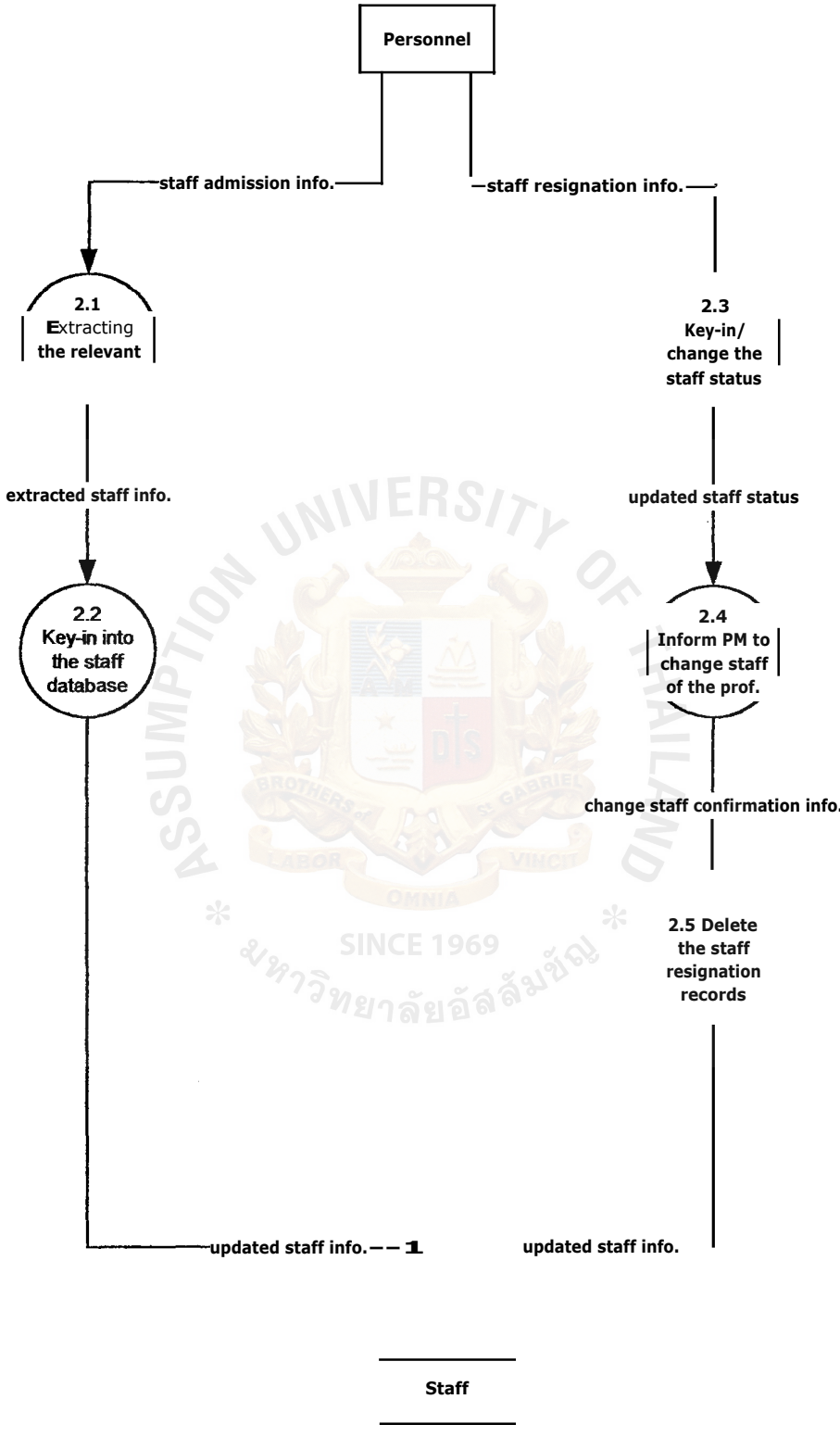

Figure 4.3. Level 1: Process 2 - Update Staff Information.

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(5) Level 1: Process 4 — Man-Month Planning

Figure 4.4 shows the data flow diagram of Man-Month Planning process. First step of the M-M planning process is the planning of the work schedule. After the PM has finished planning the work schedule, the system will extract the information from the constraints given in the work schedule and then assigns staffs to tasks. After the system can match staffs with every task in the work schedule, the work schedule obtained is then called the M-M allocation plan and is kept in the M-M allocation file. If not, the system will send error messages to the PM to re-planned the work schedule. The work schedule should be re-planned many times until the system can find staffs who can fit all positions in the work schedule.

(6) Level 2: Process 4.7 — Assigning Staffs to Tasks

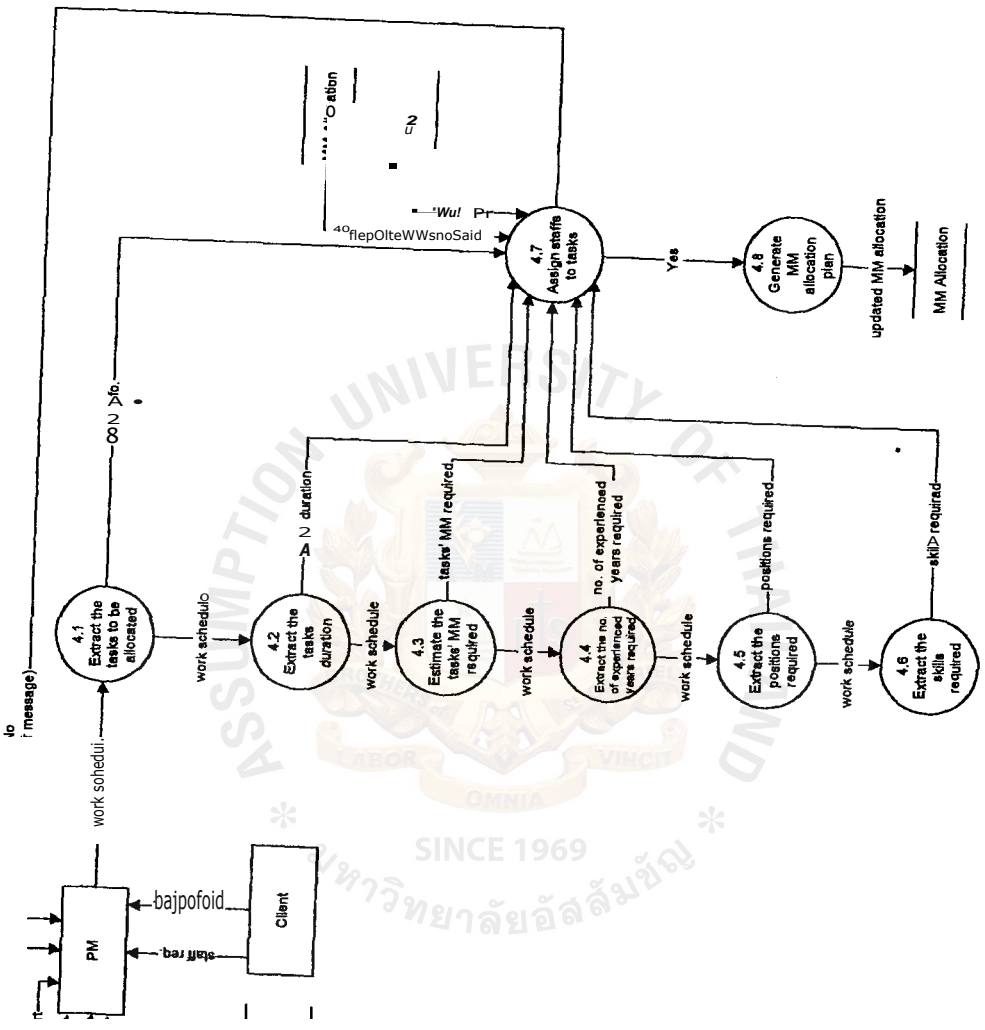
Figure 4.5 shows the data flow diagram for assigning-staffs-to-tasks process.

(a) Process 4.7.1

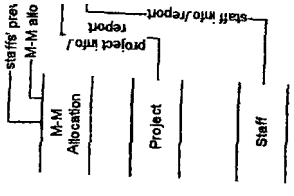
To assign staffs to tasks, first, the system will check the staffs who have the requirements matched with tasks in the work schedule; e.g. position, skill required, then extract the staffs'name as a list being sent to the next process.

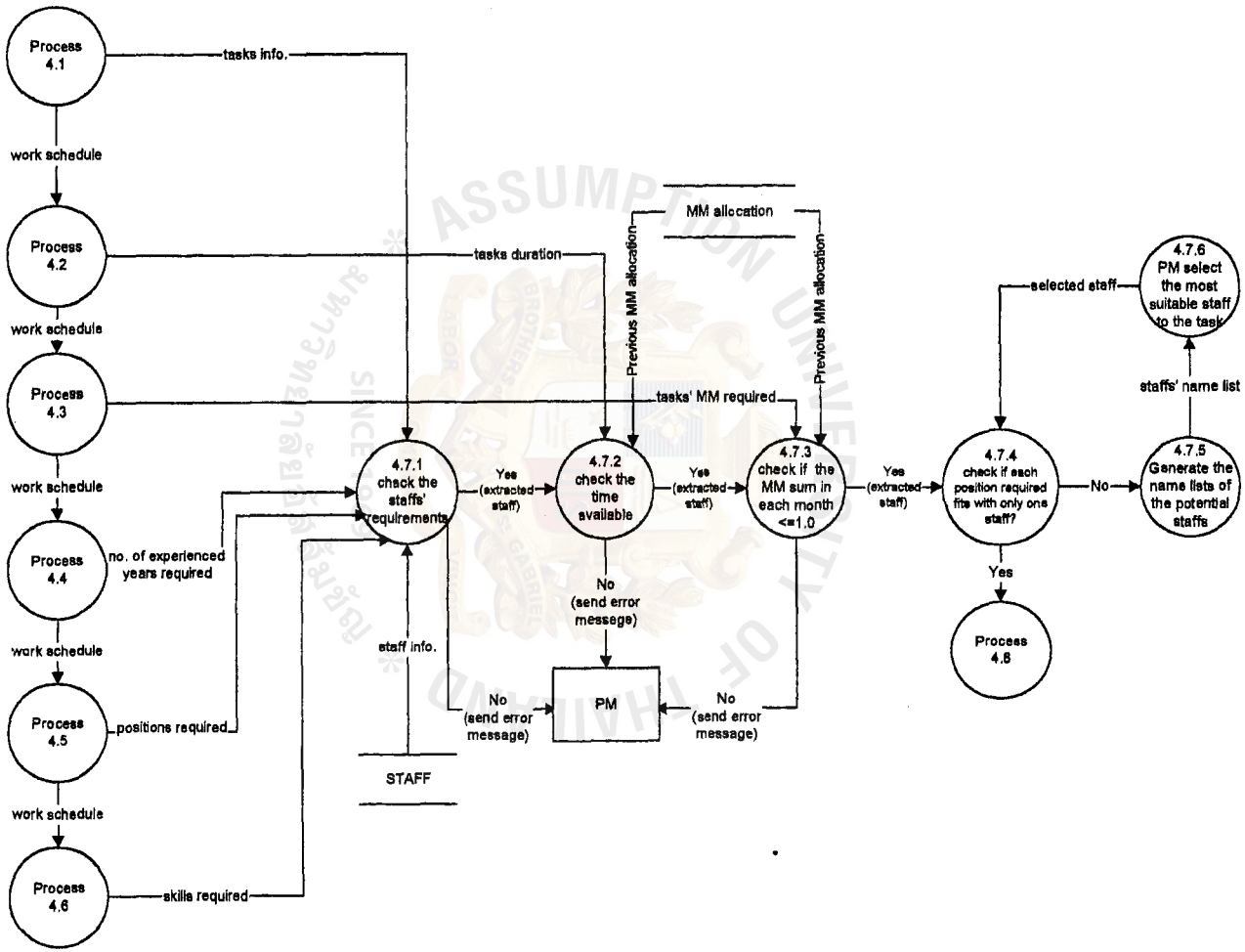
(b) Process 4.7.2

In the next process, the system finds the staffs' available time to match with the tasks' duration and the extracted names of the staffs from this process are passed from this process to the next process. If there's no staffs available for the project, the PM has to re-planned the work schedule.


4.1 Extract the tasks to be allocated
4.2 Extract the tasks duration
4.3 Estimate the tasks' MM required
4.4 Extract the no. of experienced years required
4.5 Extract the positions required
4.6 Extract the skills required
4.7 Assign staffs to tasks
4.8 Generate MM allocation plan
Yes
updated MM allocation
MM Allocation
work schedule
tasks' MM required
no. of experienced years required
positions required
skills required
duration
PM
Client

g Pia


M-M Allocation
Project
Staff
project info./report
staff info./report



Level 2: Process 4.7 — Assigning Staffs to Tasks.

(c) Process 4.7.3

The system will check the M-M summation of each month, the staffs who can get through this process will not have the M-M summation in each month >=1.0 or 30 days a month (for all assigned tasks). Again, if there is no staffs having M-M available for that period, the PM has to re-planned the work schedule.

(d) Process 4.7.4, 4.7.5 and 4.7.6

This process will check if each position required has only one potential staff or not. If there is more than one potential staff for a position, the system will list the names of potential staffs for the PM to decide to select only one staff to fit that position.

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V. ENTITY-RELATIONSHIP DIAGRAM AND DATABASE DESIGN

5.1 Entity-Relationship Diagram

The entity-relationship diagram (E-R diagram) was developed as the data modeling of the new proposed system. The figure of E-R diagram of the proposed system is presented in Figure 5.1.

Figure 5.1 shows that the proposed system has mainly five entities and each entity has relations between another.

(1) Entities and Its Atliibutes

(a) Entity 1: Staff Entity

The staff entity can be identified into 6 subtypes (ED, PM, Business Development Department, Personnel Department, Accounting Depaitinent and Other key staffs) which have the same atiributes staff ID, staff name, position ID, position, department, years of experiences, s_status ID and sstatus name. The exception is the attribute "skill name" which is an extra attribute belonging to only three subtypes : ED, PM and Other key staffs.

The staff entity has its own relations between other subtypes which are:

(1) Each ED must supervise many PM.

(2) Each PM must be allocated by only one ED.

(3) Each PM must supervise many key staffs.

(4) Each key staff may be organized by one or more PM.

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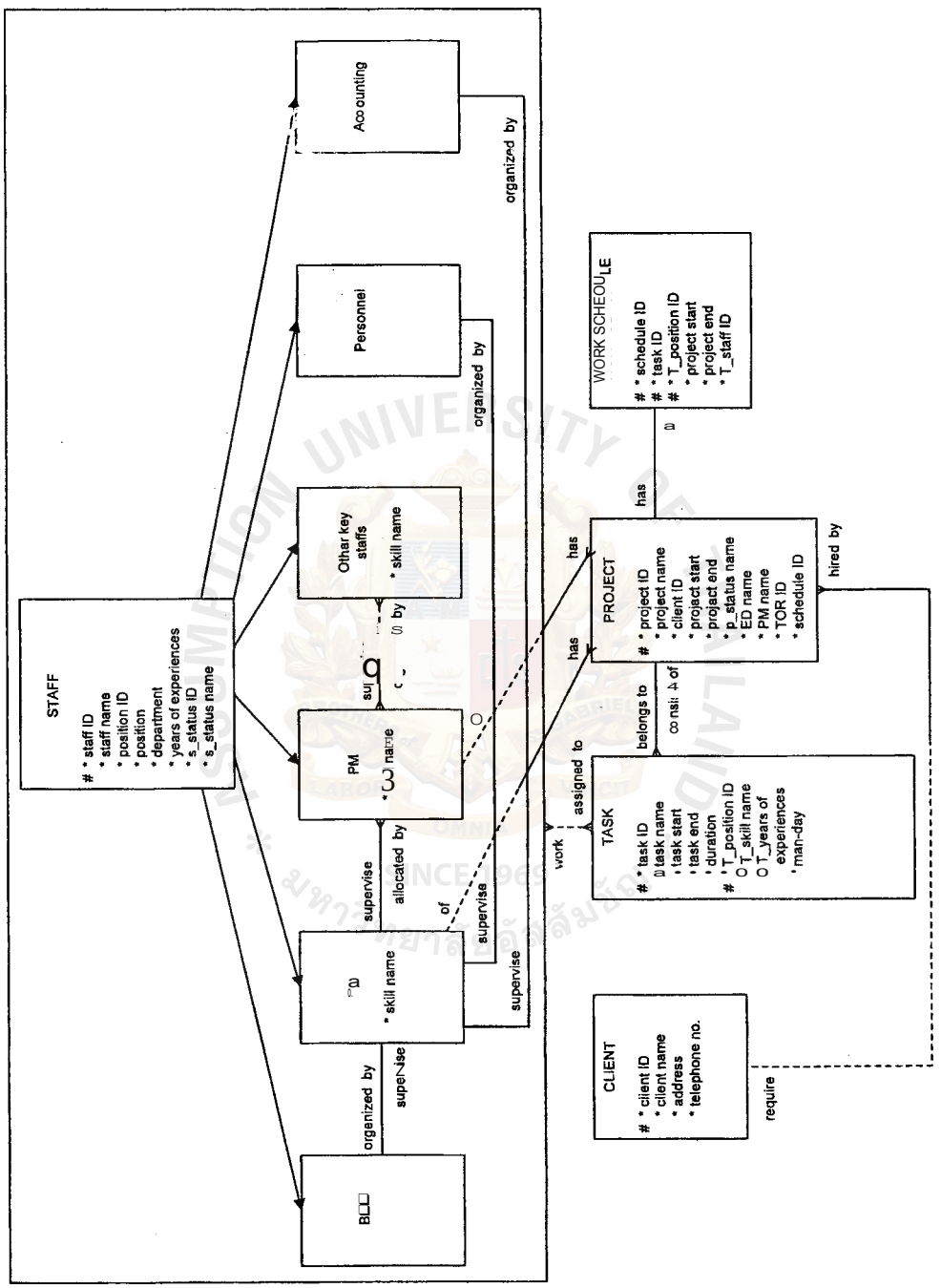

Figure 5.1. E-R Diagram of the Proposed System.

(5) Only one ED has authority to supervise Business Development Department, in the other words, Business Development Department is organized by only one ED.

(6) Only one ED has authority to supervise Personnel Department, in the other words, Personnel Department is organized by only one ED.

(7) Only one ED has authority to supervise Accounting Department, in the other words, Accounting Department is organized by only one ED.

(b) Entity 2: Project Entity

(c) Entity 3: Task Entity

(d) Entity 4: Client Entity

(e) Entity 5: Work Schedule Entity

For this entity 2 to 5, its attributes are also presented in the Figure 5.1.

(2) Relations between Entities

Each entity has relations between another. Such relations are:

(a) Each ED may supervise one or more project.

(b) Each project must have only one ED.

(c) Each PM may be the team leader of one or more project.

(d) Each project must have only one PM.

(e) Each staff may work for one or more task.

(f) Each task may be assigned to one or more staff.

(g) Each project consists of many tasks.

(h) Each task belongs to only one project.

(i) Each project has only one work schedule, in the other words, each work schedule must be for only one project.

(j) Each project was hired by only one client.

(k) Each client may have the requirements for one or more project.

5.2 Database Design

The tables map directly from the E-R diagram is shown in Figure 5.2. After considering thoroughly, we found that some of the tables are not in the normal form according the rules of normalimtion which are:

(1) First Normal Form (1NF): Relations with only simple attribute values.

(2) Second Normal Form (2NF): All non-key attributes must be functionally dependent on the whole of each relation key.

(3) Third Normal Form (3NF): There must be no dependencies between non-key attributes.

(4) Fourth Normal Form (4NF): A relation must not contain more than one independent multivalued dependency or one independent multivalued dependency together with a functional dependency.

(5) Fifth Normal Form (5NF): It is an extension of 4 NF in the sense that now the multivalued dependencies are no longer independent.

Figure 5.3 presents the normalized tables which are:

(1) Staff Table: Staff table is optimized in third normal form (3NF).

All non-key attributes are functionally dependent on staff ID which is the relation key. The relation is already in second normal form, but still contains redundancies because s status name and position are functionally dependent on the non-key attributes which are s_status ID and position ID

# * ID	* staff name	* position ID	* location	* department	* years of experiences	* s_status ID	* s_status name	* TOR name

PROJECT

# * project ID	* project name	* client ID	* project start	* project end	* p_status name	* ED name	* PM name	* TOR ID	* schedule ID

CLIENT

# * client ID	* client name	* location	* total project

TASK

# * task ID	* task name	* task start	* task end	* duration	# * T_position ID	T_skill name	T_years ofexperiences	* man-day

WORK

# * schedule ID	# * task ID	# * T_position ID	* T_skill ID	* T_years ofexperiences	* T_staff ID

				*years ofexperiences	* s status ID	

	* s status name

# * position ID	

	*project name			*					* schedule ID

#* client ID	* client name		

*				

	#* Lposition ID	T skill name	Tyears of experiences	

#* schedule ID			

Normalized Table.

respectively. Therefore, the table can be decomposed into third normal form relation as shown in Figure 5.3.

(2) Project Table: Project table is optimized in second normal form (2NF).

All non-key attributes are functionally dependent on project ID which is the relation key. Therefore, the table is optimized in second normal form.

(3) Client Table: Client table is optimized in second normal form (2NF).

All non-key attributes are functionally dependent on client ID which is the relation key. Therefore, the table is optimized in second normal form.

(4) Task Table: Task table is optimized in second normal form (2NF).

The task table has two relation keys which are task ID and Tposition ID, but some the attributes, e.g., task name, task start, task end, and duration are functionally dependent on only one relation key which is task ID. Therefore, the task table can be decomposed into two tables which both are functionally dependent on the whole of its relation key. The task table is optimized in second normal form.

(5) Work Schedule Table: Work schedule table is optimized in second normal form (2NF).

The attributes project start and project end can be retrieved from the project table. Therefore, it is not necessary to have this two attributes in the work schedule table at all. The remaining non-key attribute is T_staff ID which is already functionally dependent on all three relation keys. Therefore, the table is optimized in second normal form.

VI. INTERFACE AND REPORT DESIGN

6.1 Interface Design

The interface design of the new proposed system is to simplify the process in the system development phase. Moreover, it can help the system development team to have the same concept of what the system interface should be.

The interface is designed to support the first 6 functions of overall 7 functions described in Chapter III.

(1) Function No.1: Project Information Service

To add/ edit/ delete the project information can be done by using the following 3 screens respectively.

(a) Screen 1: Add Project Entry (Figure A.1. of Appendix A)

(b) Screen 2: Edit Project Information (Figure A.2. of Appendix A)

(c) Screen 3: Delete Project Information (Figure A.3. of Appendix A)

(2) Function No.2: Staff Information Service

Like the project information service, to add/ edit/ delete the staff information can be done by using the following 3 screens respectively.

(a) Screen 1: Add Staff Entry (Figure A.4. of Appendix A)

(b) Screen 2: Edit Staff Information (Figure A.5. of Appendix A)

(c) Screen 3: Delete Staff Information (Figure A.6. of Appendix A)

(3) Function No.3: Project Information/ Report

The system can provide the list of projects with project information through the project information screen (Figure A.7. of Appendix A).

First of all, the user should use project enquiry screen (Figure A.8. of Appendix A) to search for the interested project, then the system will

display the results of the specified project information through the project information screen as mentioned above. From this screen, the user can select to read-only and exit this screen, print out the report or export the info'mation to MS-Excel.

(4) Function No.4: Staff Information/ Report

Like the project information, the system can provide a list of staffs with staff information through the staff information screen (Figure A.9. of Appendix A).

First of all, the user should use staff enquiry screen (Figure A.10. of Appendix A) to search for the interested staff, then the system will display the results of the specified staff information through the staff information screen as mentioned above. From this screen, the user can select to read-only and exit this screen, print out the report or export the information to MS-Excel.

(5) Functions No.5 and 6: Work Schedule and M-M Allocation Planning

The interface is designed to combine both functions 5 and 6 together. Figure A.11. of Appendix A presents the "M-M allocation plan" screen. From this screen, the user plans the project's work schedule and then the system allocates the staffs M-M automatically.

6.2 Report Design

The report format is designed to support the last function (function no.7) described in Chapter III.

(1) Function No.7: M-M Report

The M-M report is designed to use the following two formats.

(a) M-M report listed by project : the report example is shown in Figure BA . of Appendix B.

(b) M-M report listed by staff : the report example is shown in Figure B.2. of Appendix B.

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VII. HOW THE NEW SYSTEM WORKS

In this chapter, we use the system simulation technique to describe the steps to be performed by the new computer-based system under the real situation. We assume that there is a new project requirements (TOR) from the client being submitted to the company and we will show how the system works from the beginning until the end.

To ease understanding, the explanation part of this chapter will follow the part "Functions of the new proposed system" already described in Chapter III and the processes design described in the part "Design of the data flow diagram of the proposed system" of Chapter IV. Moreover, we will present the figure of relevant interfaces used in each process by showing when and how what interface is used.

7.1 Function No.!: Project Information Service

(1) How to add the project information

In this chapter, we use the real project called "Consulting Services for Environmental Impact Assessment for Tha Ton Canal, Nakhonsrithammarat Province" as the example project (see the project's TOR in Appendix C).

To add project information, the user fills in the blank the project information in the "Add Project Entry" screen. See Figure 7.1.

(2) How to edit the project information

If there is any error or data change of the project information, the user should use the "Edit Project Information" screen to edit the project information. First of all, The user has to select the project to edit before changing any information of project information field.

For example, to change the project status change from "Potential" (every new project should use this project status) to "Award" (means the

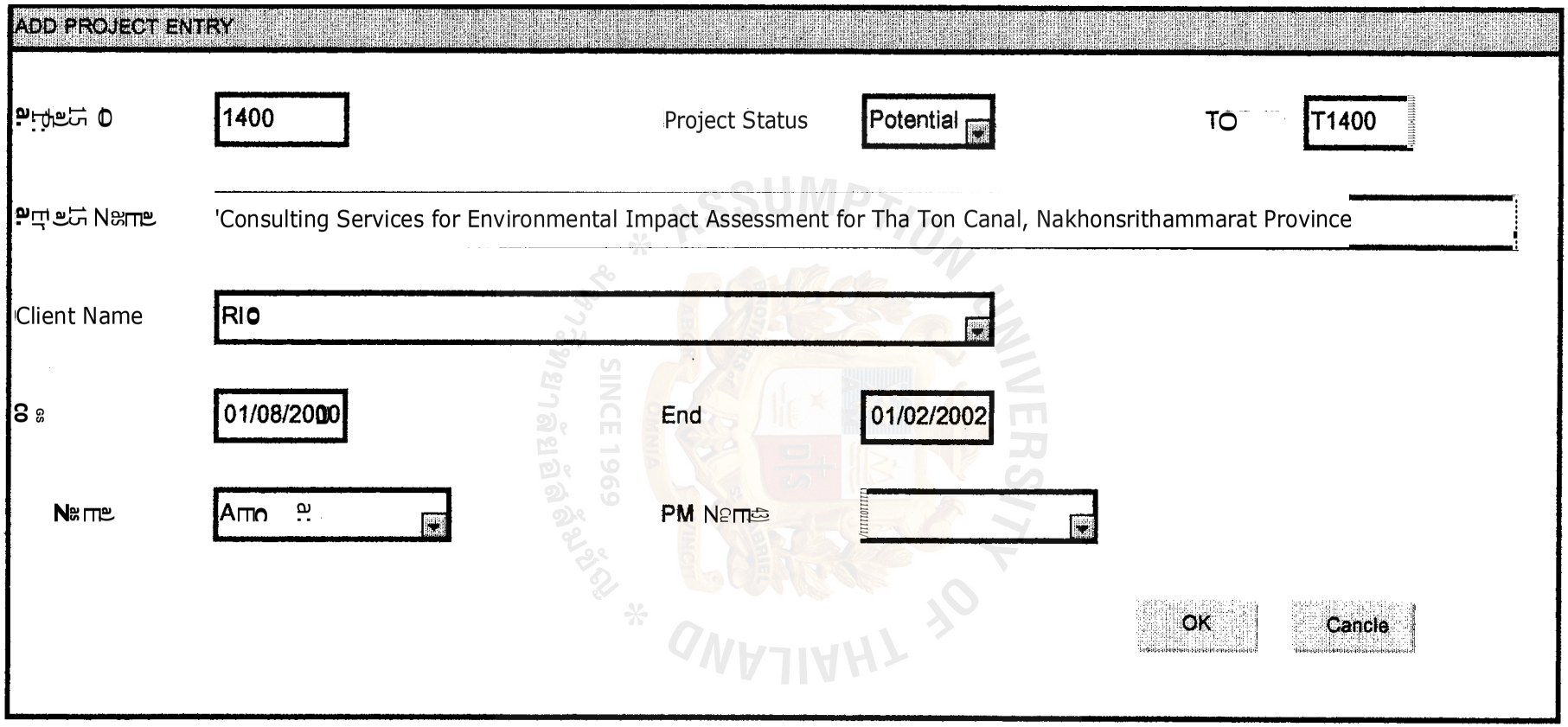


Fig 7.1. Add Project Entry Screen.

company win the project), the user should change the status by clicking at the arrow sign on the right hand side of the project status box and select the tab "Award", then click "OK" button to save the change. See Figure 7.2.

(3) How to delete the project information

If the company loses the project, then the project information is not important. The business development has the right to delete the project record by using "Delete Project Information" screen. After the user selects which project to delete, the system will retrieve that project information for the user to check if it is the right project to delete. If it is right, the user then click "OK" button to confirm the deletion. See Figure 7.3.

7.2 Function No.2: Staff Information Service

(1) How to add the staff information

When the new staff is admitted, that staff's information should be added to the system by filling in the information in the "Add Staff Entry" screen. See Figure 7.4.

(2) How to edit the staff information

If there is any error or data change of the staff information, the user should use the "Edit Staff Information" screen to edit the staff information. First of all, the user has to select the staff to edit before changing any information of staff information field.

For example, to change the staff status change from "Contract" to "Permanent", the user should change the status by clicking at the arrow sign on the right hand side of the staff status box and select the tab "Permanent", then click "OK" button to save the change. See Figure 7.5.

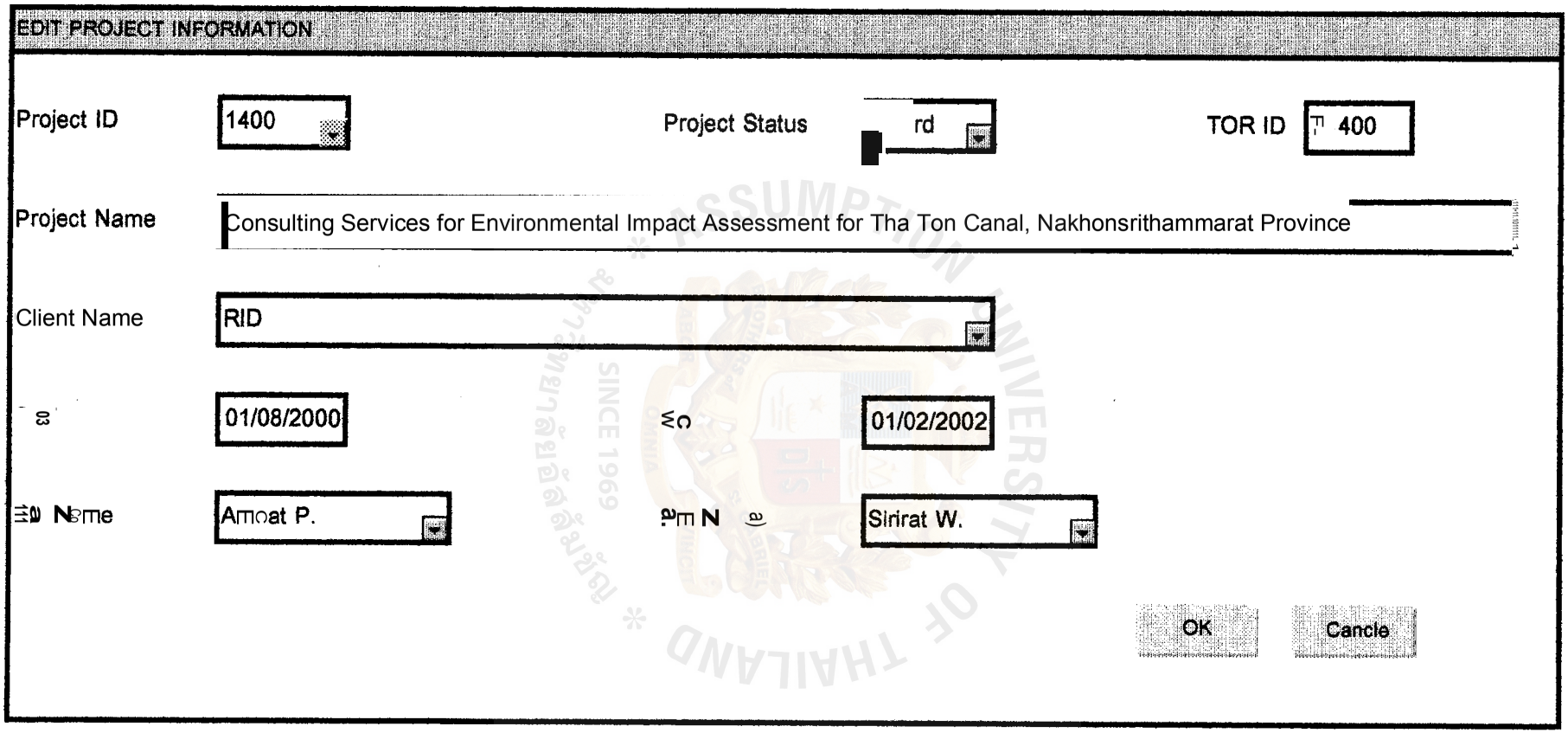
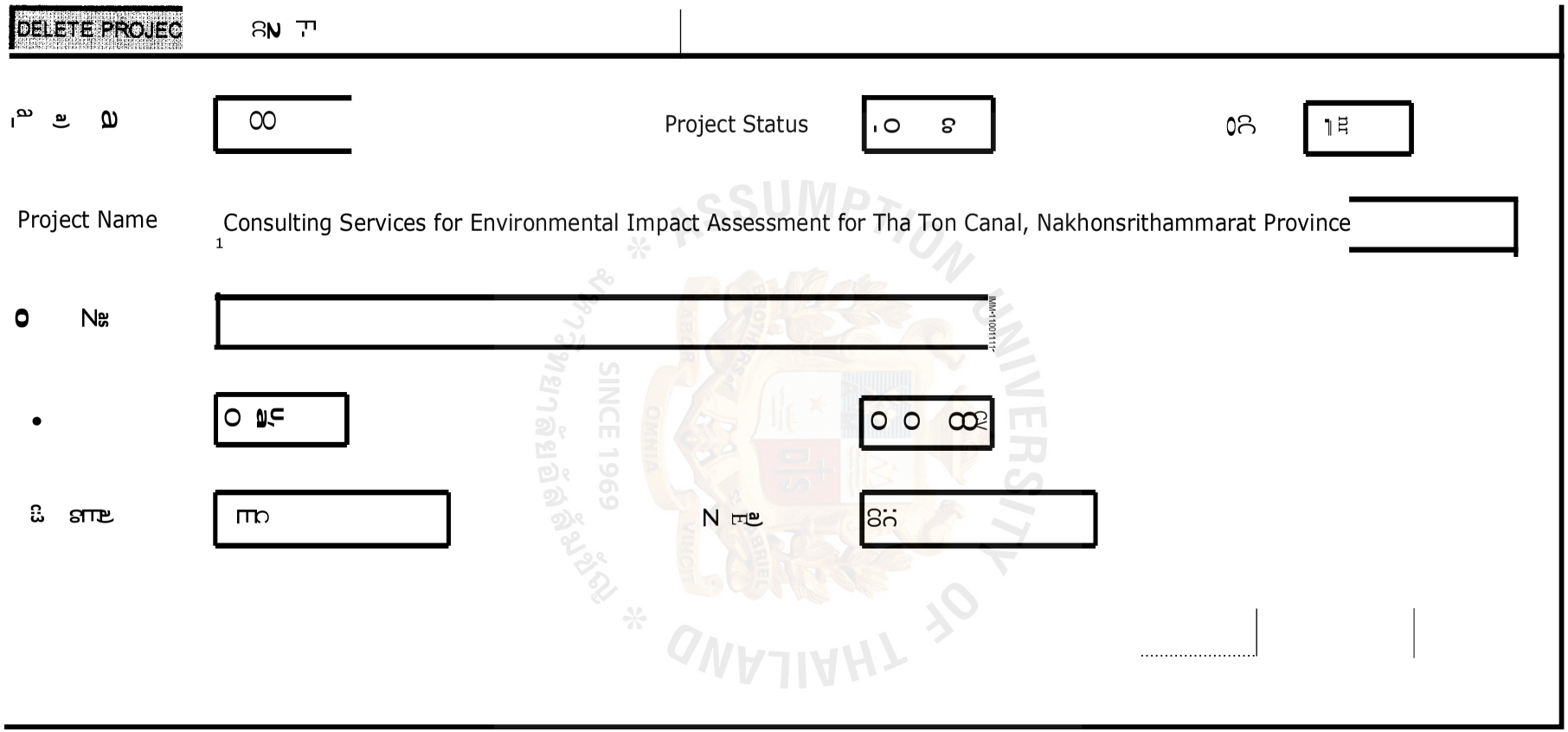
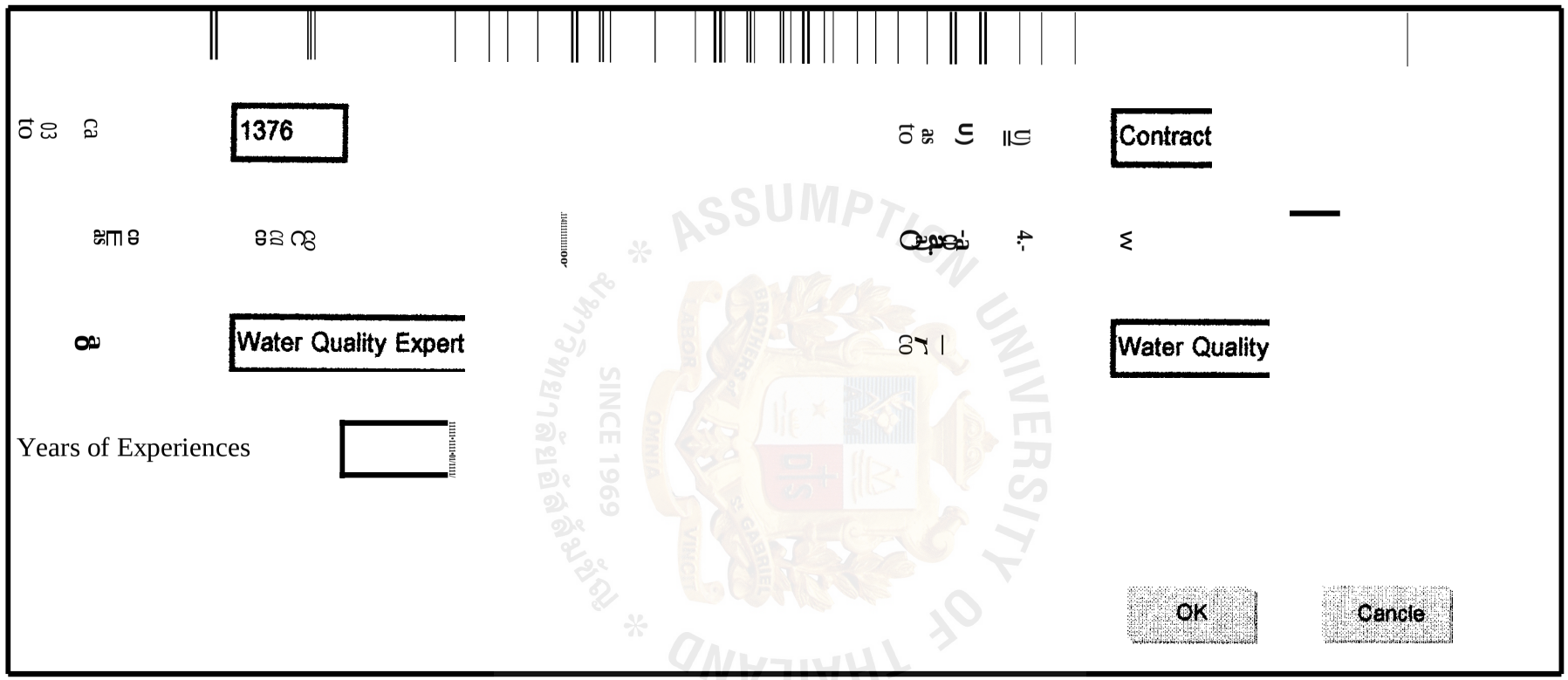


Figure 7.2. Edit Project Information Screen.



Delete Project Information Screen.



Add Staff Entry Screen.

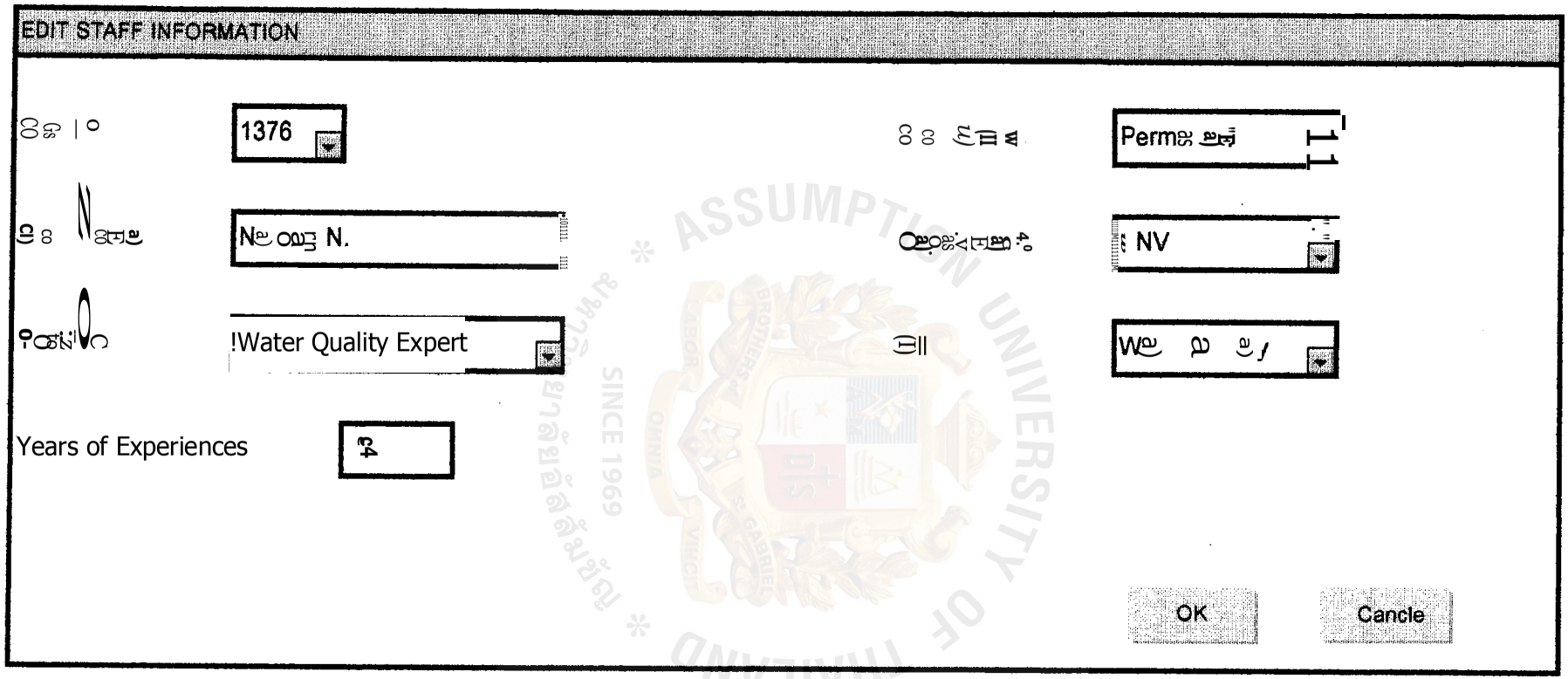


Figure 7.5. Edit Staff Information Screen.

(3) How to delete the staff information

When the staff resigns, that staffs information should be deleted from the system by using "Delete Staff Information" screen. After the user selects which staff to be deleted, the system will retrieve that staff information for the user to check if it is the right one to delete. If it is right, the user then click "OK" button to confirm the deletion. See Figure 7.6.

7.3 Function No.3: Project Information/ Report

In this topic, we should use the example to explain how this function works under the new proposed system. Suppose that we want to know how many and what projects belong to the ED named "Amnat P.", first, the user should fill in the project condition(s) of the project enquiry screen. See Figure 7.7. Then click "OK" button, the results would be displayed on the project information screen. See Figure 7.8.

7.4 Function No.4: Staff Information/ Report

Suppose that we want to know who and how many staffs are in the position "scientist", first, the user should fill in the staff condition(s) of the staff enquiry screen. See Figure 7.9. Then click "OK" button, the results would be displayed on the staff information screen. See Figure 7.10.

7.5 Functions No.5 and 6: Work Schedule and M-M Allocation Planning

Suppose the PM wants to plan the M-M allocation of the project **named** "Consulting Services for Environmental Impact Assessment for Tha Ton Canal, Nakhonsrithammarat Province", first, he/she should search for this project from the project enquiry screen by directly filling in the project ID or filling in any other condition(s) provided. See Figure 7.11. Later, the system will show a blank screen of the "M-M allocation plan". See Figure 7.12.

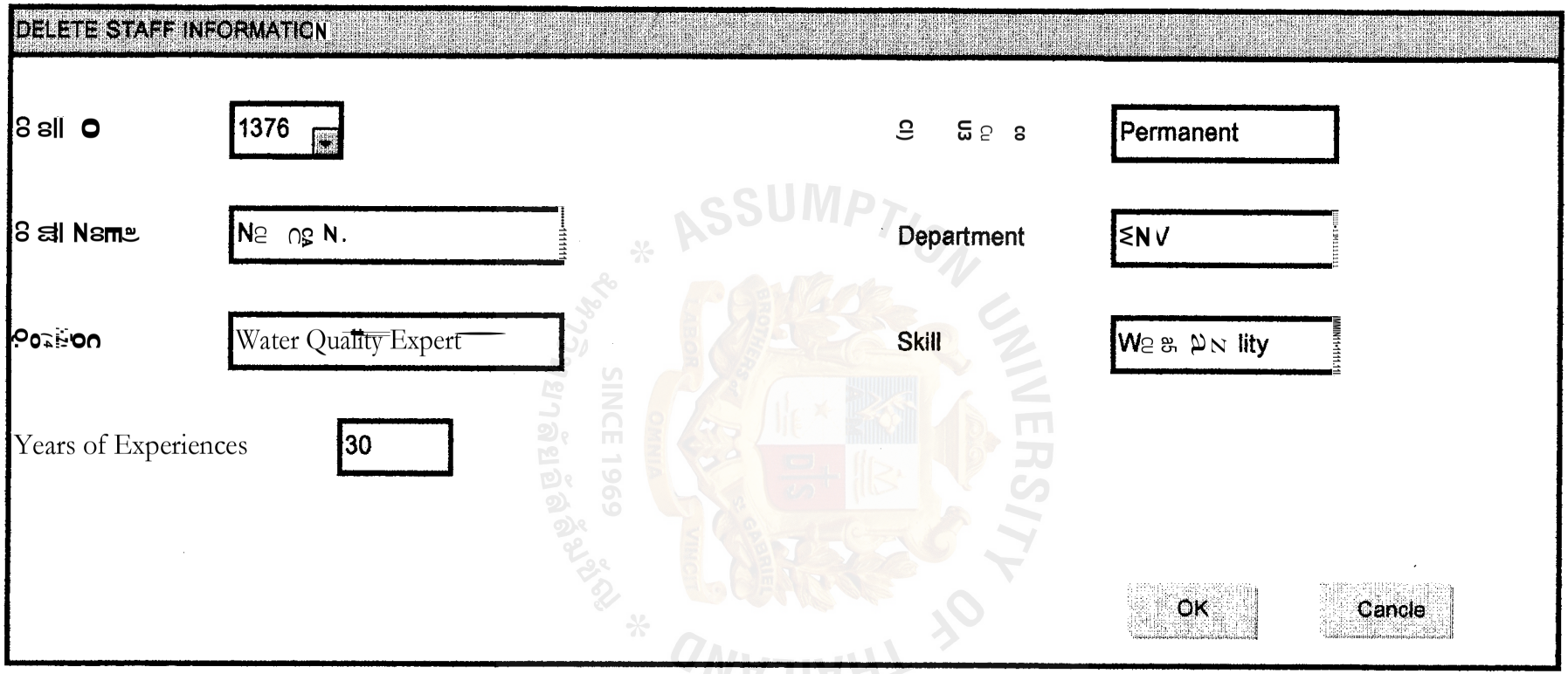


Figure 7.6. Delete Staff Information Screen.

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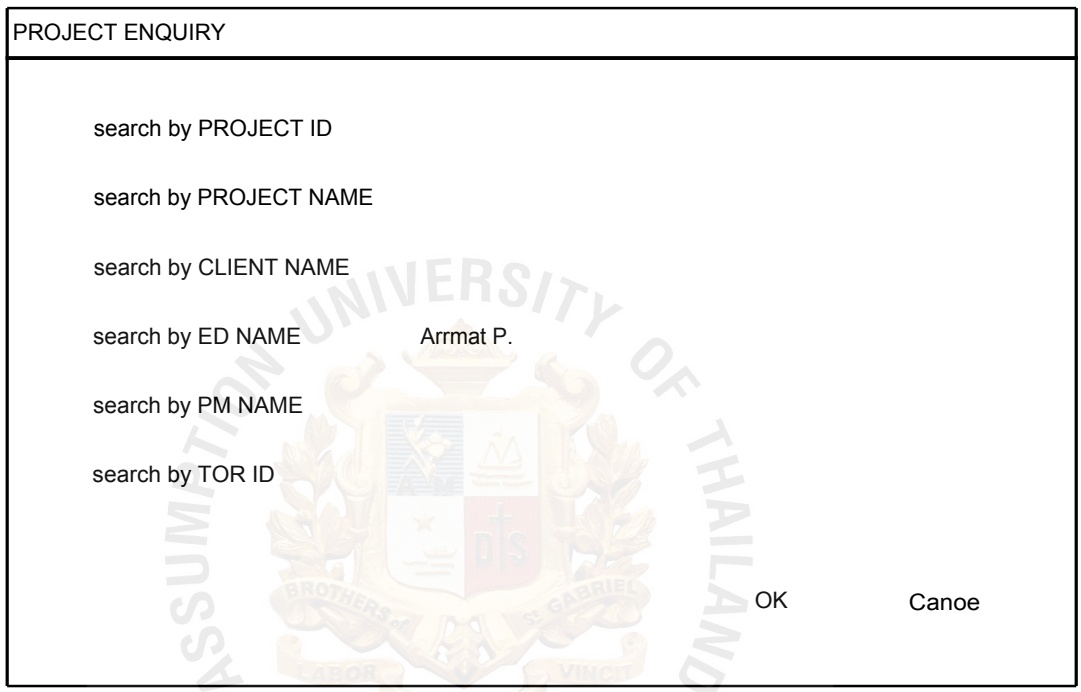

Figure 7.7. Project Enquiry Screen.

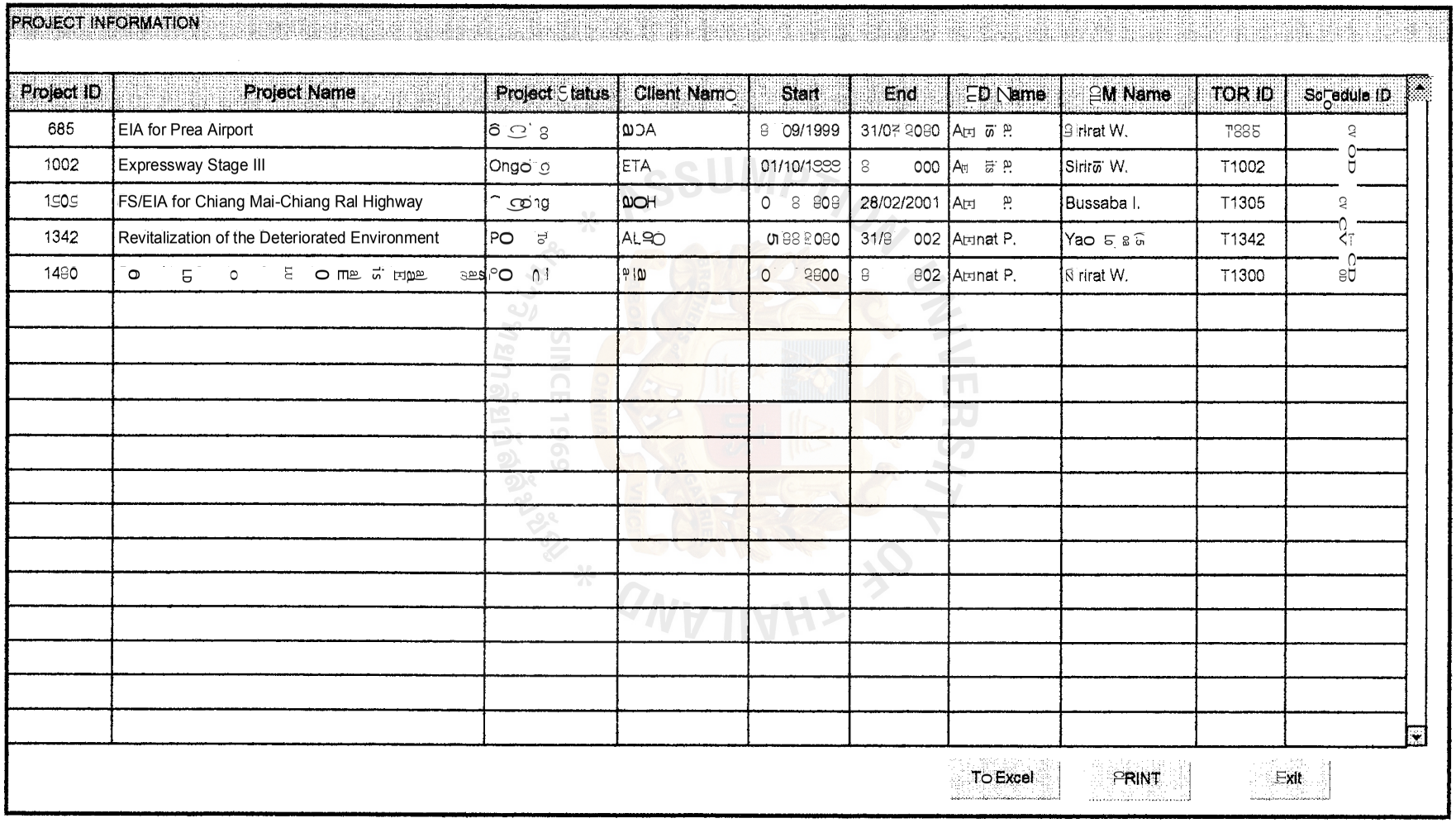

Figure 7.8 Project Information Screen.

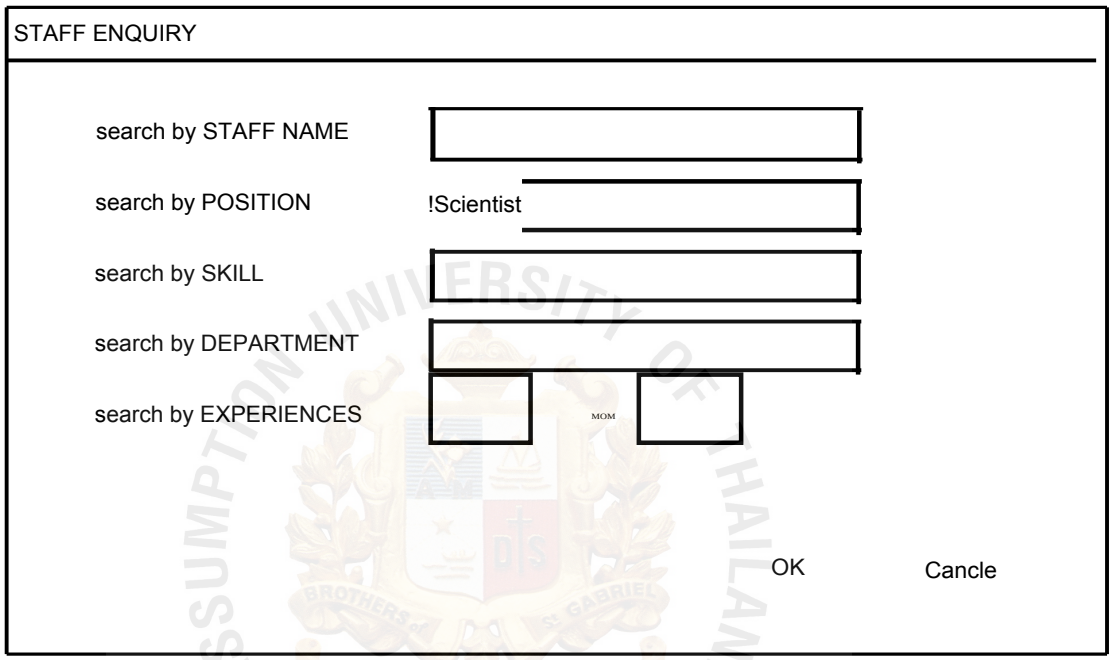

Figure 7.9. Staff Enquiry Screen.

Staff Information Screen.

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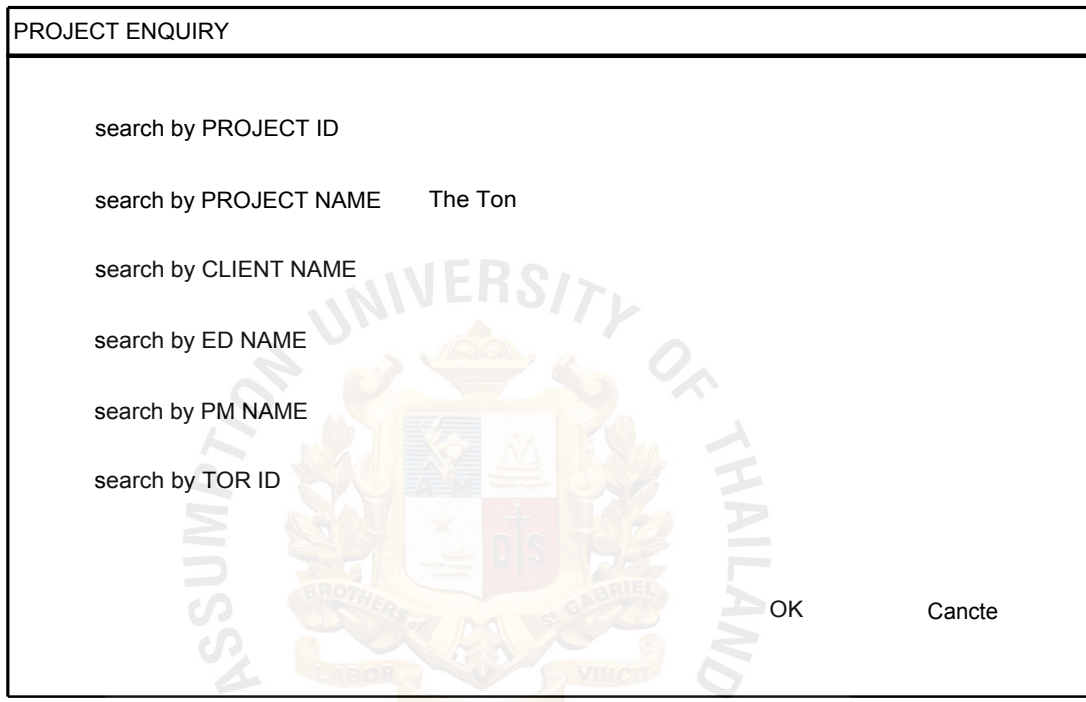

Figure 7.11. Project Enquiry Screen.

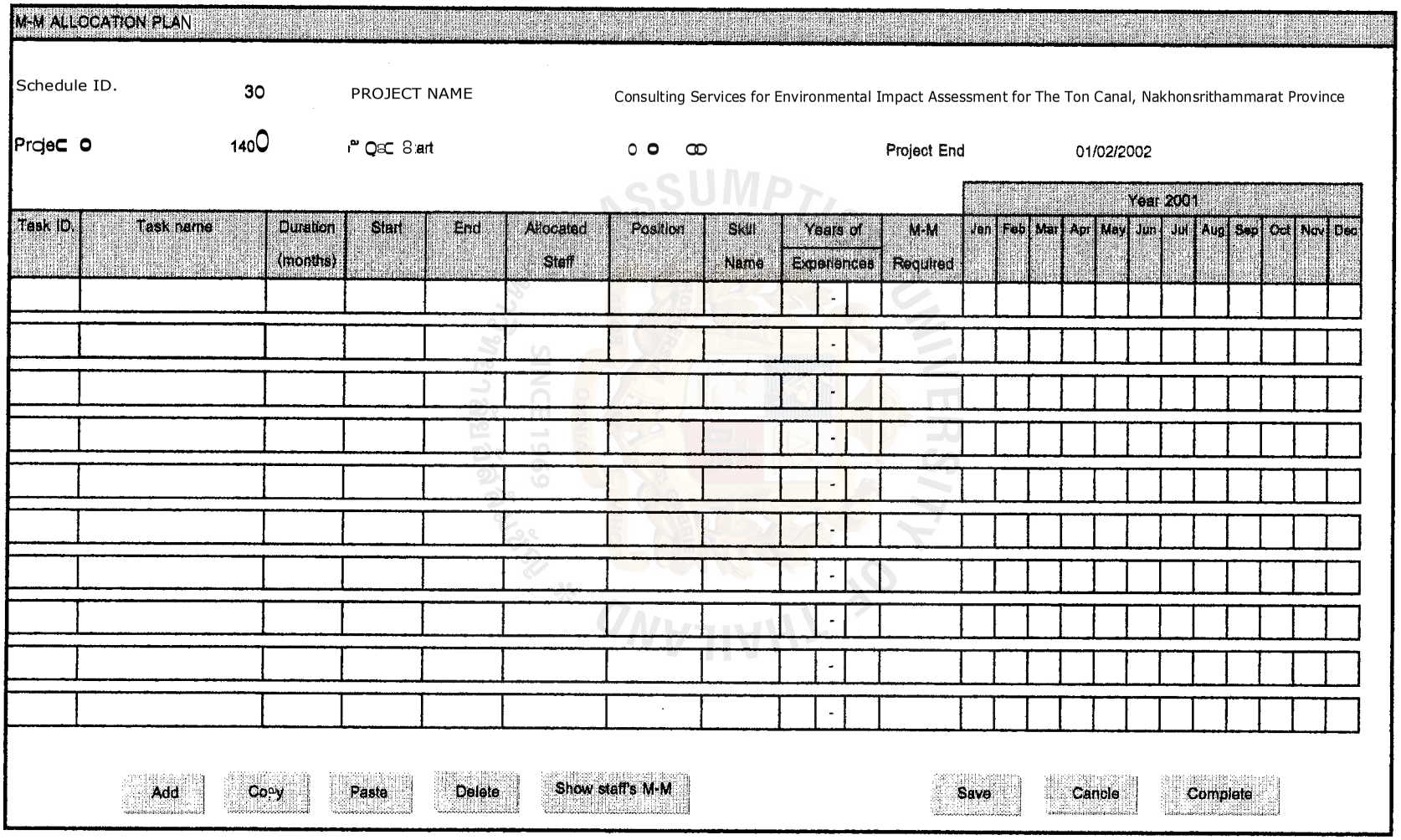

Figure 7.12. M-M Allocation Plan (Blank Screen).

Next, the PM has to identify tasks to be accomplished and each task's specification; for example, task name, task's duration, position(s) require for each task, etc. See Figure 7.13. After completing in identifying the tasks, click "Complete" button, the system will assign the staff to each position automatically. See Figure 7.14. This example is based on the condition that the project, staff, and M-M allocation files (of other projects) already exist.

If there is more than one staff fitting with each position, the user should choose only the most preferable one by selecting the name from the name list tab. To save this M-M allocation plan to the M-M allocation file, the user should click "Save" button.

For more convenience, the user can check the existing M-M allocation of the staff (s) on this screen by clicking "Show staff's M-M" button. The example screen is shown in Figure 7.15.

7.6 **Function No.7: M-M Report**

The example of M-M report of this project is shown in Figure 7.16.

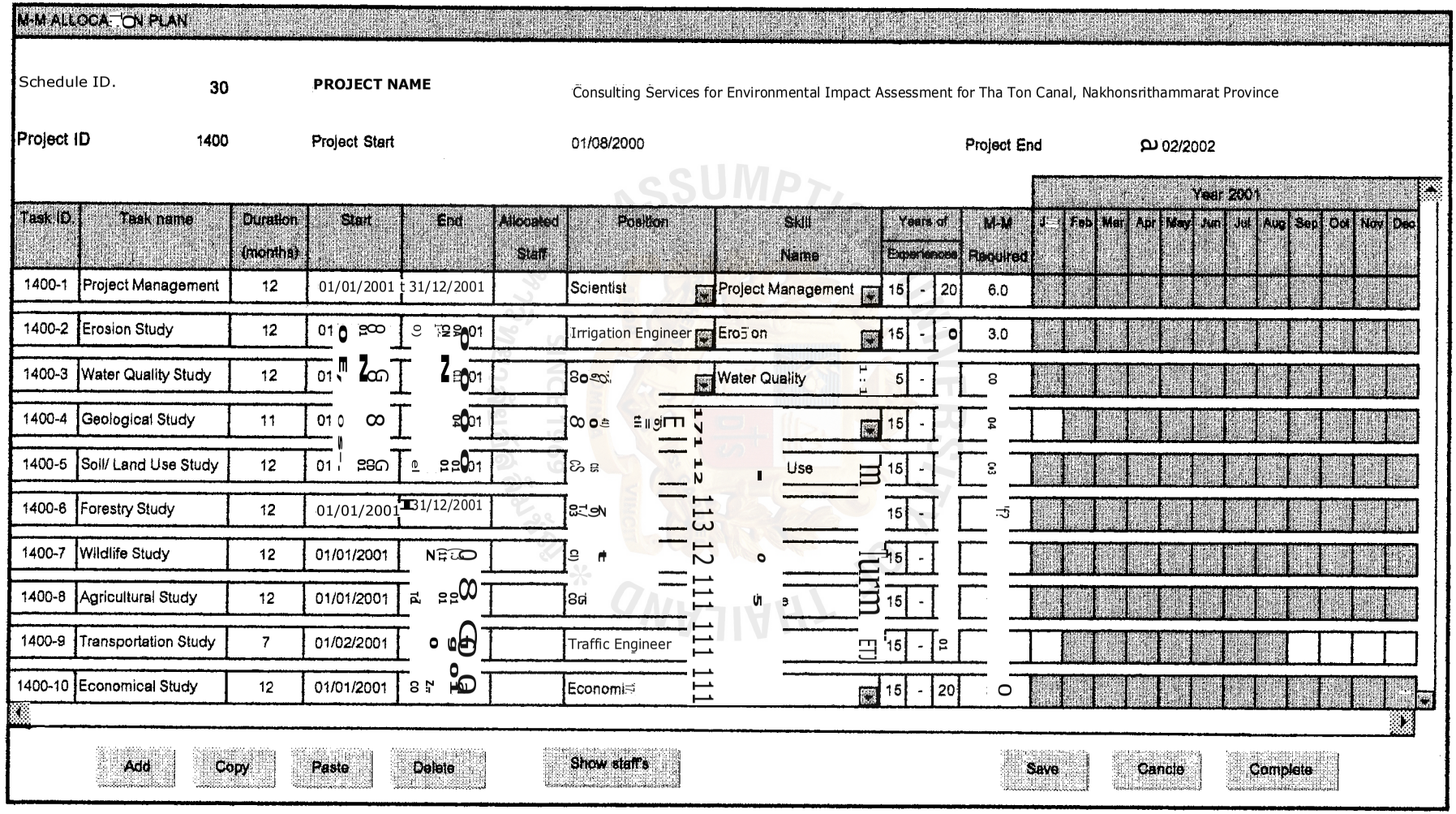

Figure 7.13. M-M Allocation Plan (Identify Task's Specification).

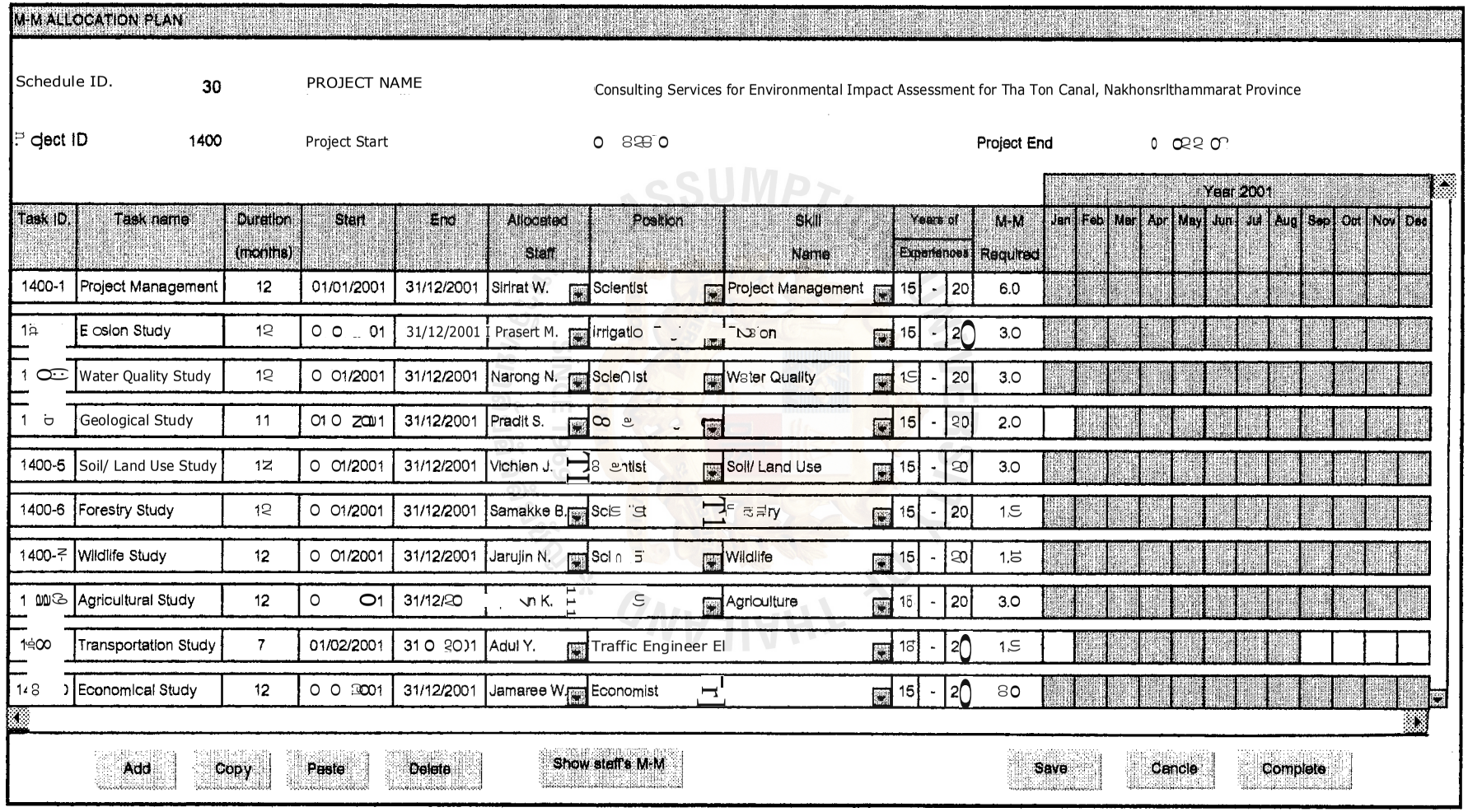

Figure 7.14. M-M Allocation Plan (After Assigning Staffs to Tasks),

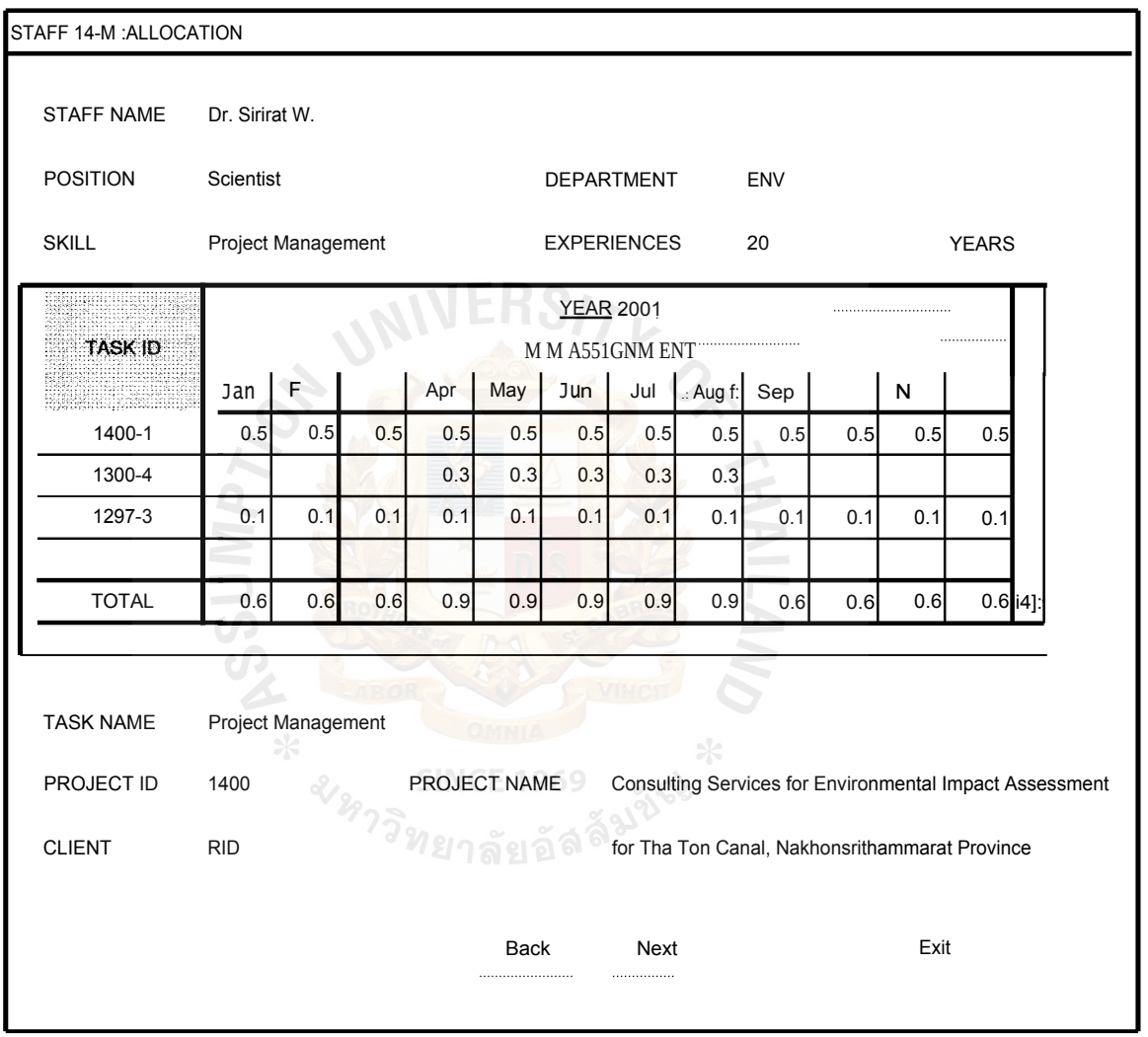

Figure 7.15. Staff M-M Allocation Screen.

Project	Project Name	Task	Start	End	Staff ID	Staff Name	Figures
[illegible]	Consulting Services for Environmental Impact Assessment for Tha Ton Canal, Nakhonsrithammarat Province						
		Project Management	01/01/2001	31/12/2001	[illegible]	[illegible]	[illegible]
			01/01/2001	31/12/2001	[illegible]	[illegible]	[illegible]
		Geological Study	01/02/2001	31/12/2001	[illegible]	[illegible]	[illegible]
		Soil/ Land Use Study	01/01/2001	31/12/2001	[illegible]	[illegible]	[illegible]
		Forestry Study	01/01/2001	31/12/2001	[illegible]	[illegible]	[illegible]
			01/01/2001	31/12/2001	[illegible]	[illegible]	[illegible]
		Transportation Study	01/02/2001	31/08/2001	[illegible]	Jamaree W.	[illegible]

M-M Report Listed by Project.

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VIII, EVALUATION OF 'THE PROPOSED SYSTEM AND CONCLUSION

8.1 Evaluation of the New Proposed System

(1) Advantages of the New Proposed System

(a) The repetitive requests to the departmental manager for checking staff M-M allocation is eliminated. This gives the department managers more time to concentrate in their work.

(b) The time wasted in searching the needed documents will be reduced because the system with databases allows on-line information retrieval.

(c) The latest information can be shared among many users, therefore, the need of keeping hard-copy will be reduced. Moreover; with the new proposed system, the time/efforts in managing the hard-copy will be less as well.

(d) The security control is used in the proposed system. Each user will have the different right to access the system; that means the chance of erasure or modification the information by mistake should be reduced.

(e) The proposed system improves the efficiency of the staff allocation process, for example, all the available staffs will be proposed for selection, but with the existing system some of the available staffs are missing during the process of selection.

(2) Disadvantages of the New Proposed System

(a) The implementation of the new proposed system requires the cooperation between many persons/departments. If cooperation is not going well, the system will not work efficiently.

(b) The new system requires two new positions: the system administrator and the system operator in Business Development and Personnel Department, that means the extra expenses of the company for hiring the new staffs.

8.2 Conclusion

The proposed computer-based staff allocation system is a beginning of the computerized system of its kind for the company. The system can be developed to eradicate the current problems and support future requirements of the users.

The study of the existing system suggested that the new system should have a computerized database system that can manage the information related to the staff allocation and also other information sharable among the relevant users. According to our critical study of the existing staff allocation system, apparently there were several problems in information retrieval and management decision making in the existing system because the system operates manually, all the information in the system was not stored properly. The users spent too much time acquiring information. This means that the current staff allocation system did not work efficiently.

After surveying and collecting user requirements, we have designed a new staff allocation system using the data flow diagrams and entity relationship diagrams.

The new computerized staff allocation system is designed to provide suitable solutions and to satisfy the user requirements. It helps the users reduce the redundant work , leading to the increase in efficiency of their work.

8.3 Recommendation

With reference to the analysis of an existing system procedure and the problems in Chapter **II,** the new proposed system should employ a sharable computerized databases that support the transactions of the staff allocation procedure. After we

consider the capability of the existing software packages in the market, we found that no package matches with our requirements. For example, Microsoft Project is the package helping the users in planning and controlling the project schedule only, but it can not work with the database system which is the most important part of the new system. The new system should have the databases contains the information of the staff qualifications with the capability to allocate the staffs for the project automatically by selecting the most suitable staffs from the databases. Those staffs must have the qualifications match with the users requirements. Therefore, we can say that the company should develop their own package to most satisfy their requirements.

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APPENDIX A

SCREEN LAYOUT

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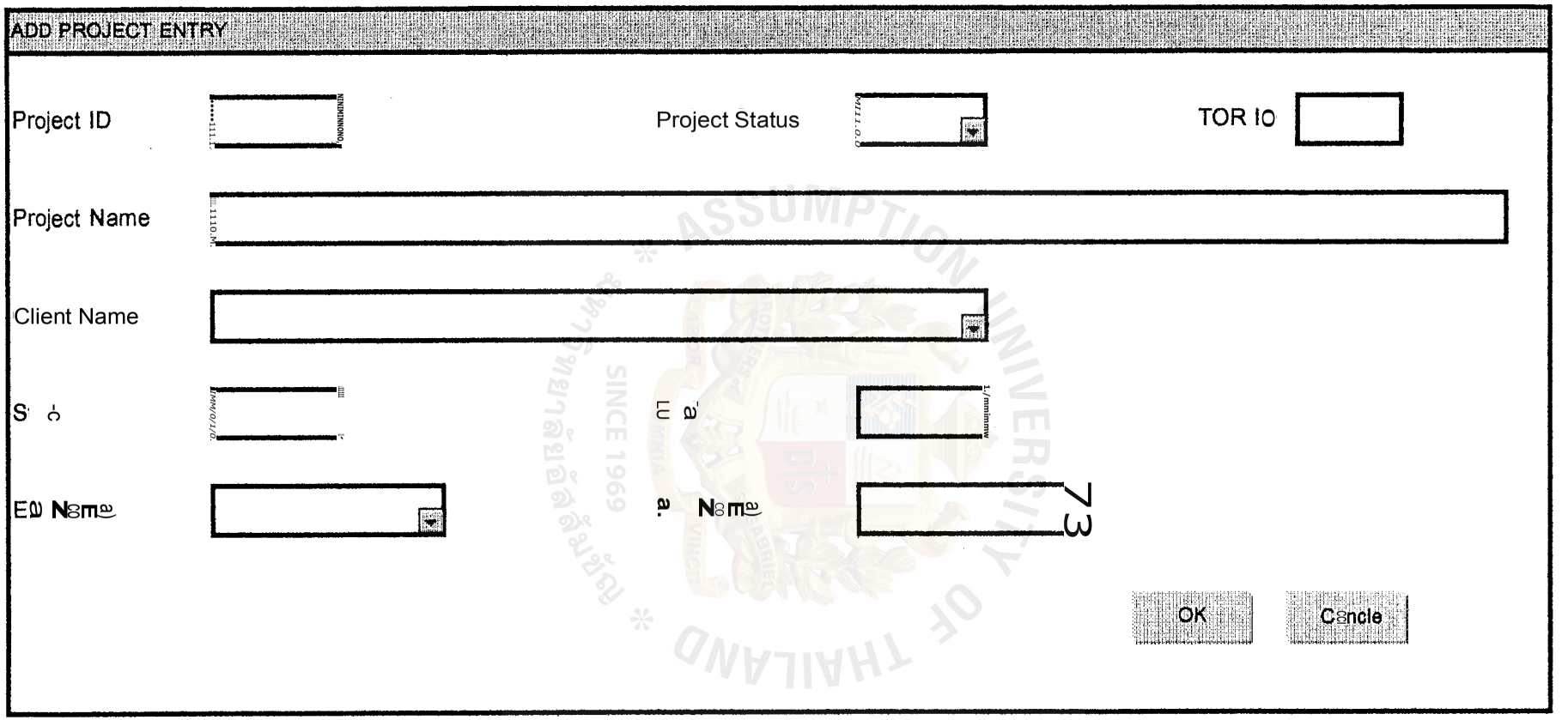


Figure A.1. Add Project Entry Screen.

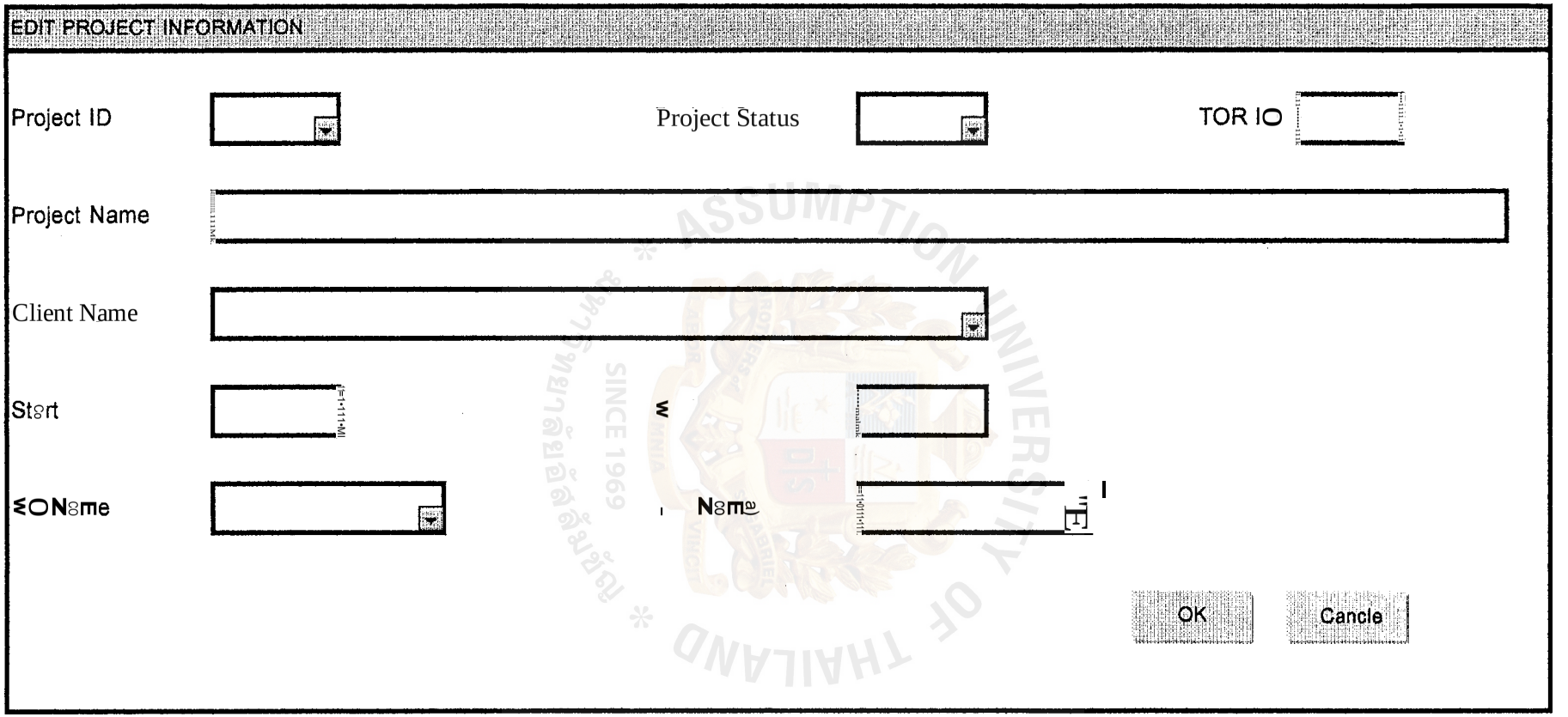
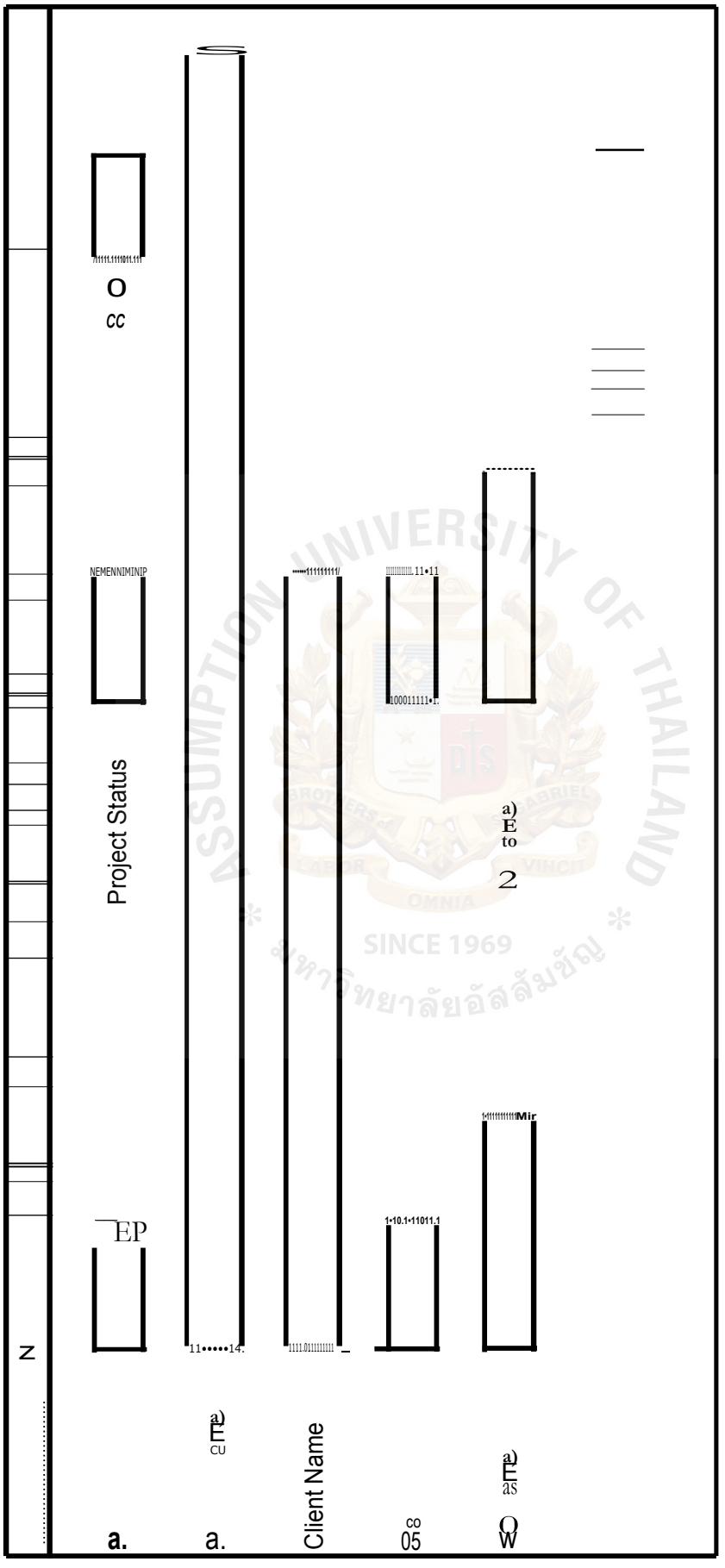


Figure A.2. Edit Project Information Screen.



Delete Project Information Screen.

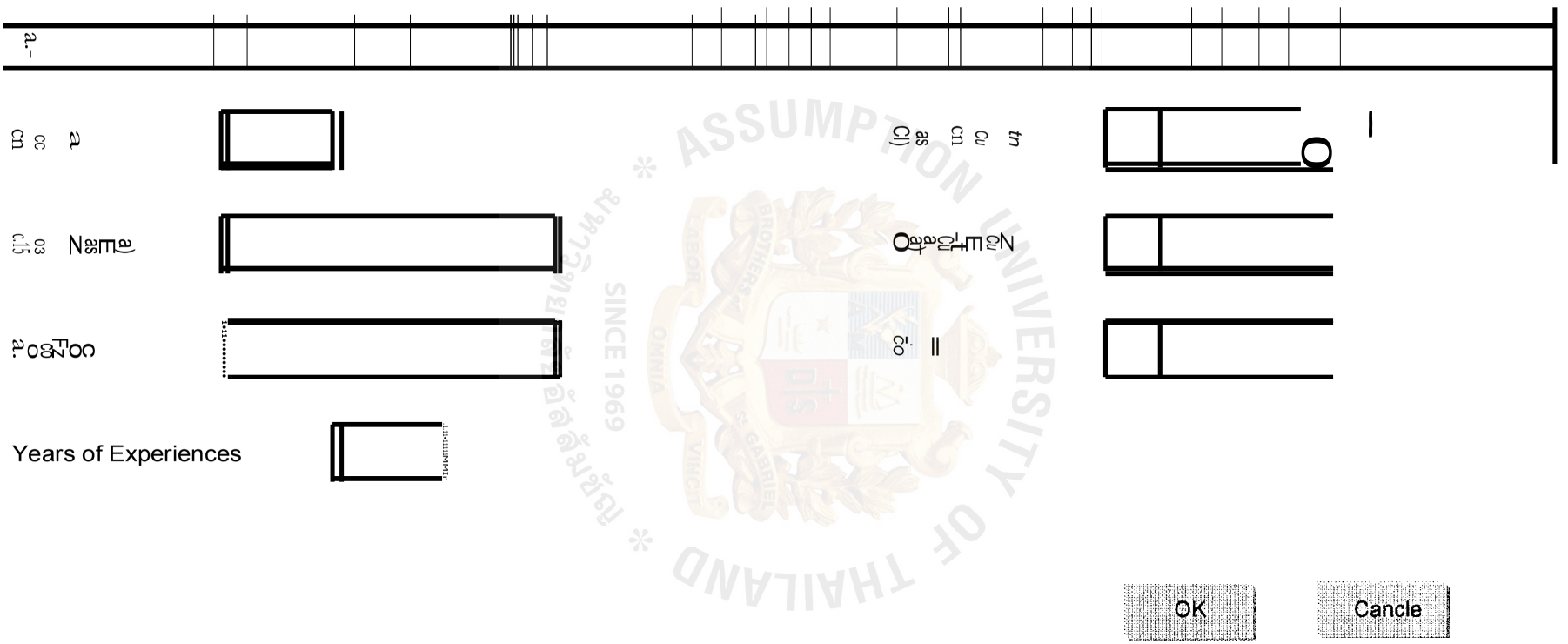
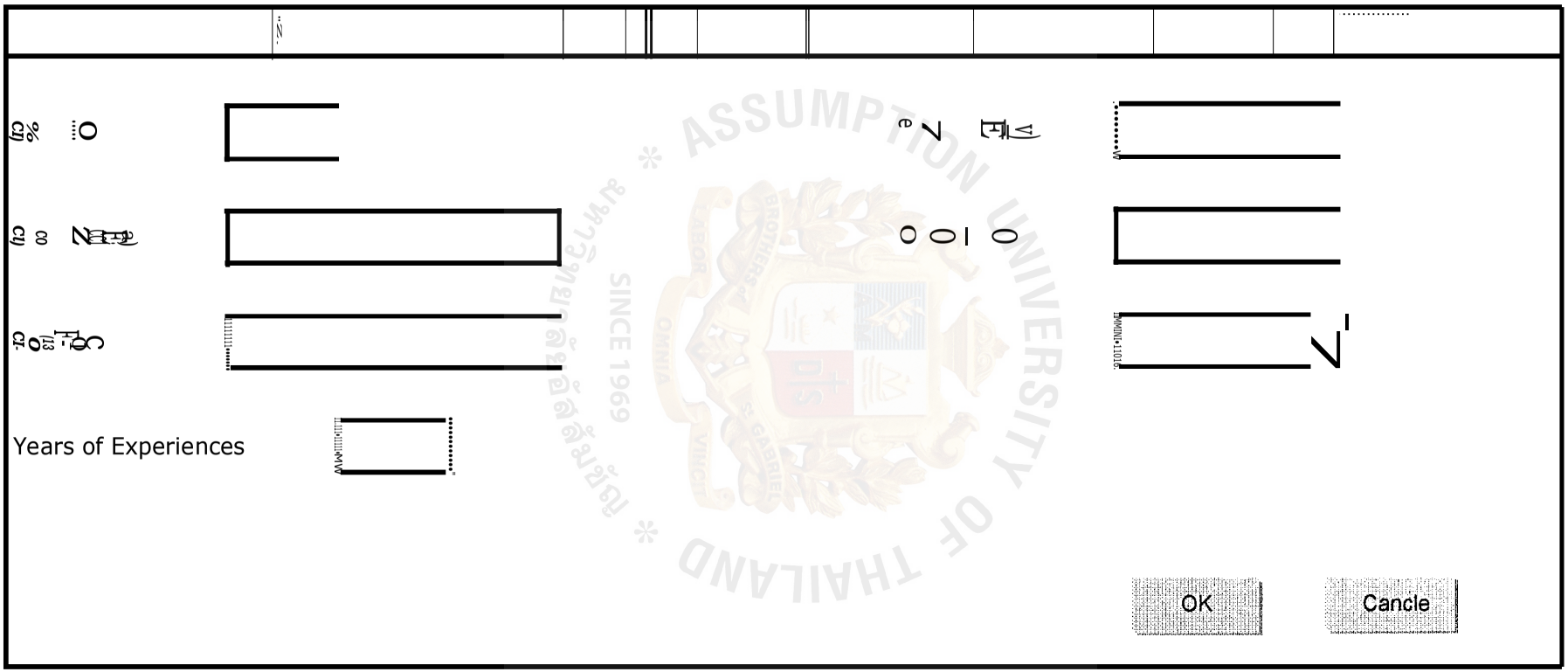


Figure A.4. Add Staff Entry Screen.



Edit Staff Information Screen,

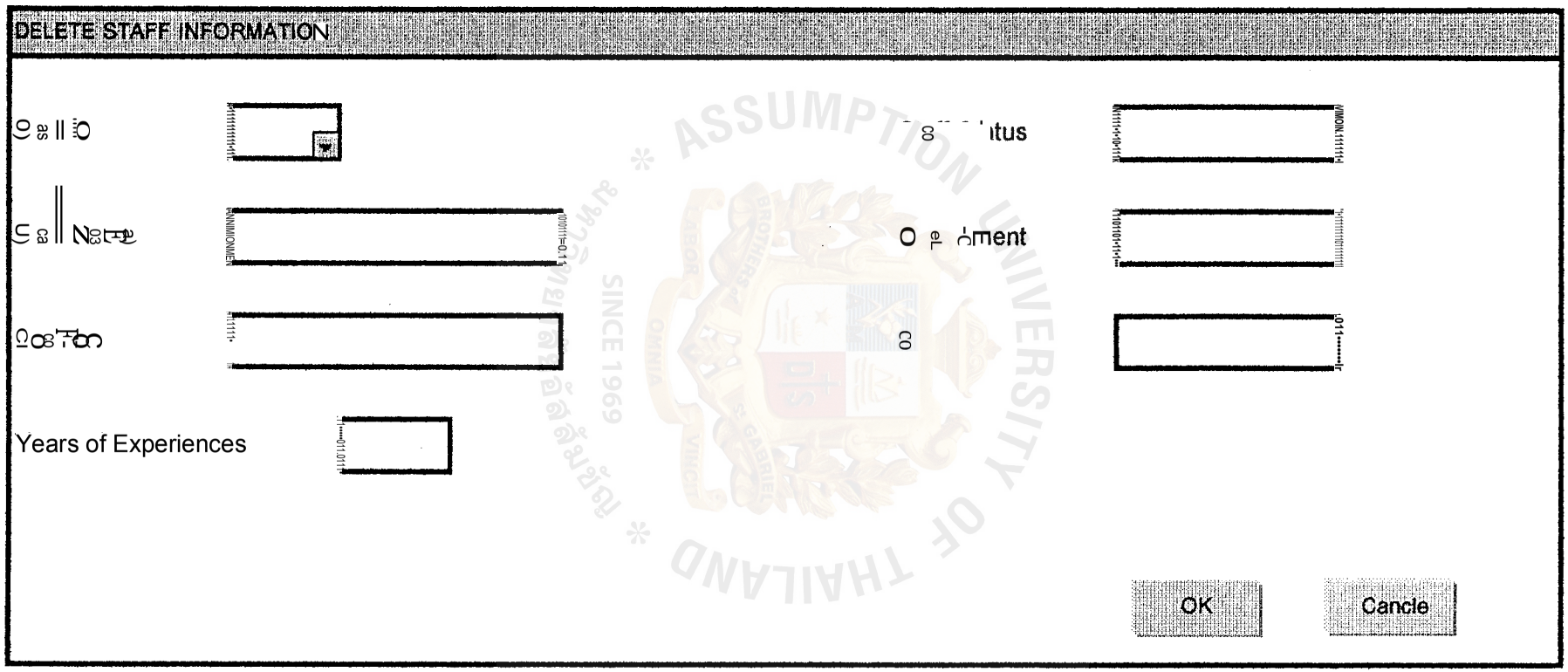


Figure A.6. Delete Staff Information Screen.

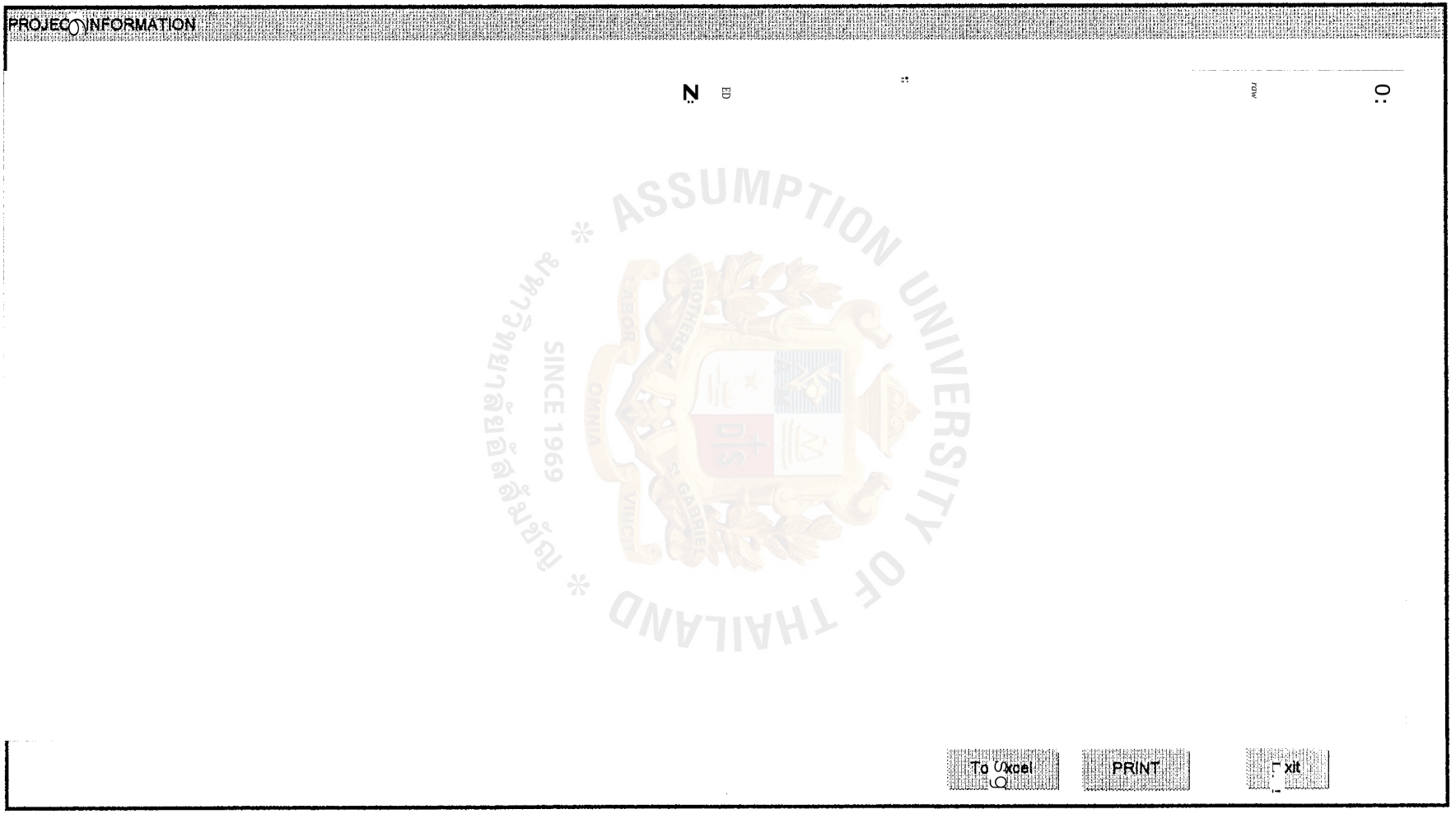


Figure A.7. Project Information Screen.

St. Gabriel's library

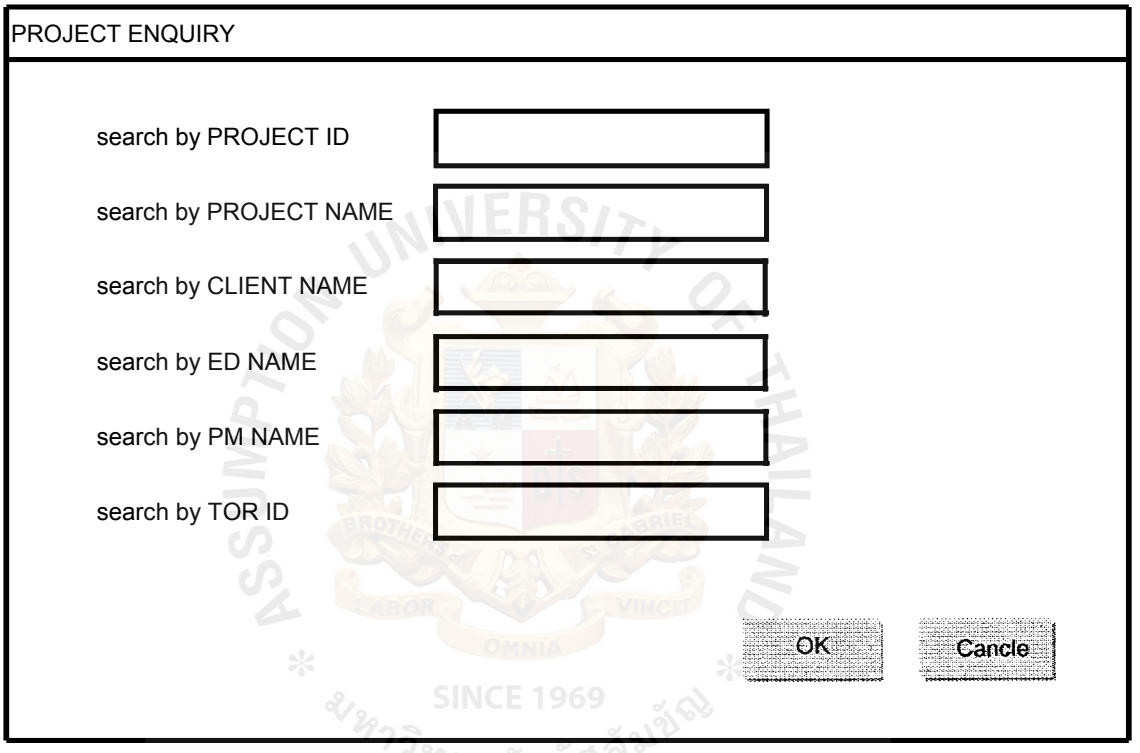


Figure A.8. Project Enquiry Screen.

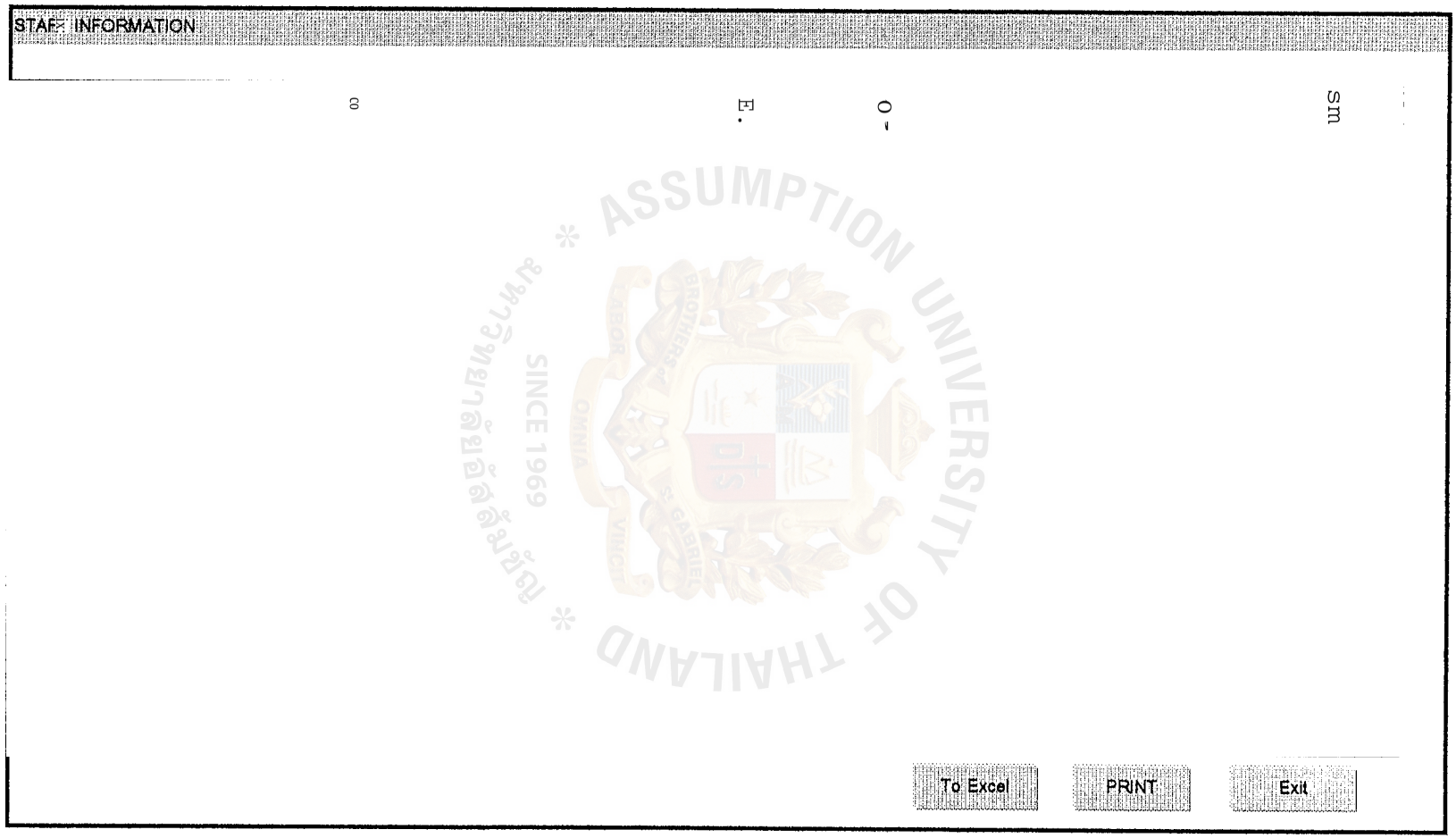


Figure A.9. Staff Information Screen.

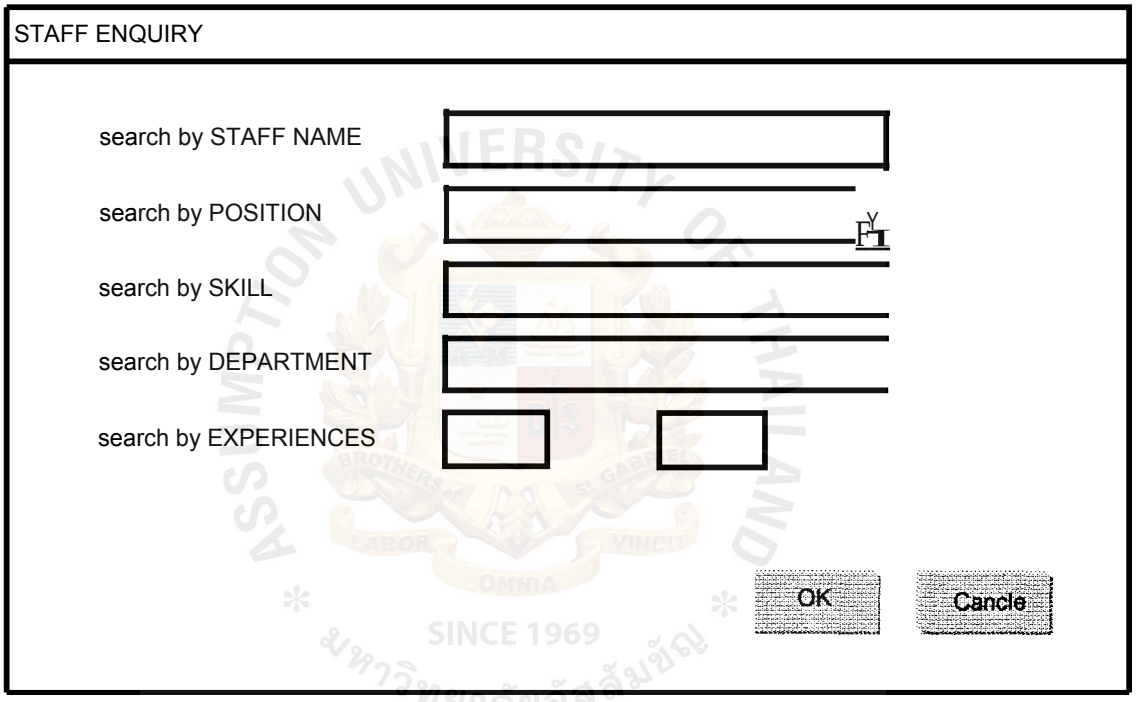
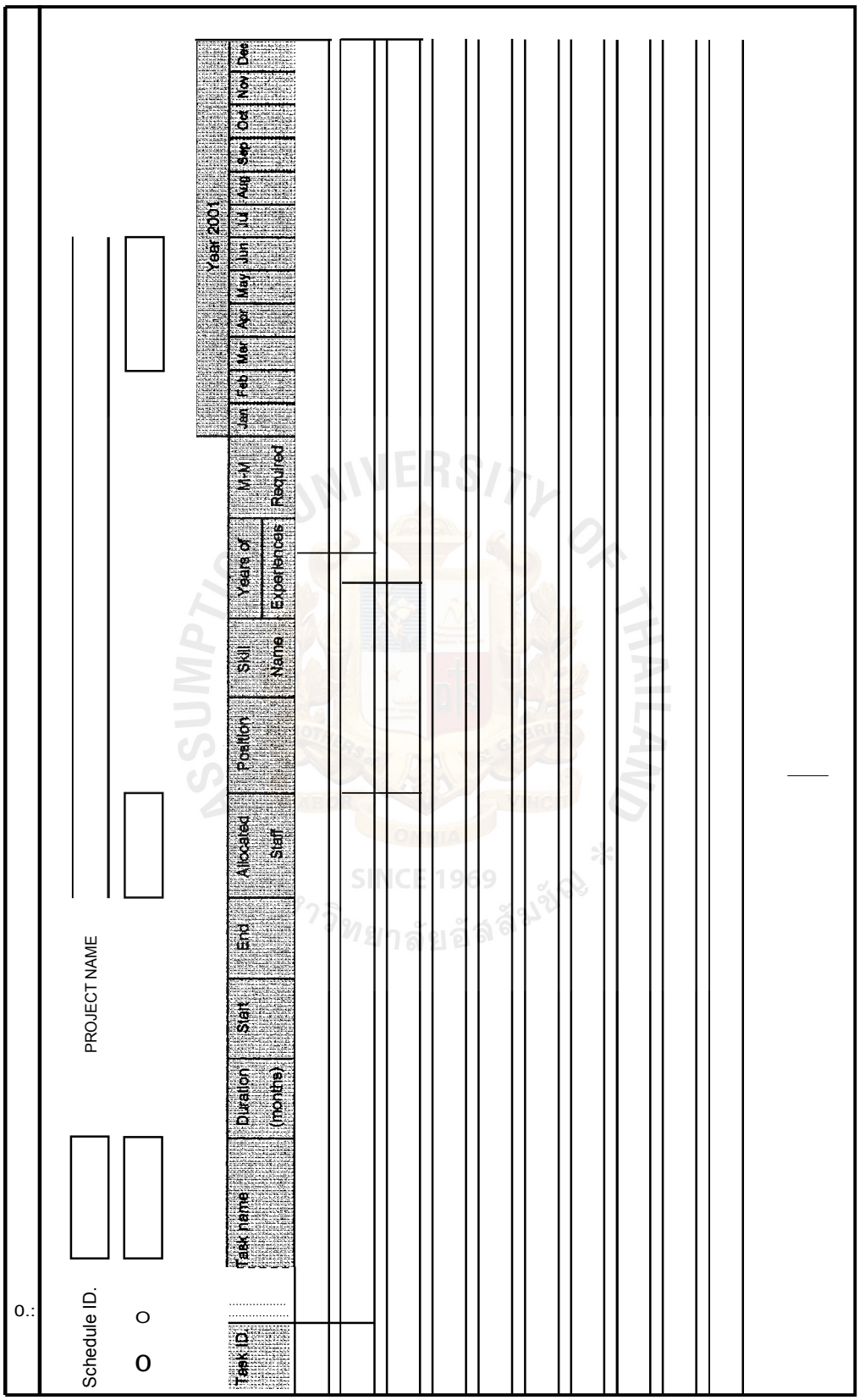


Figure A.10. Staff Enquiry Screen.

St. Gabriel's Library



M-M Allocation Plan Screen.

APPENDIX B

REPORT LAYOUT

ASSUMPTION UNIVERSITY OF THAILAND
SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

M-M Report Listed by Project.

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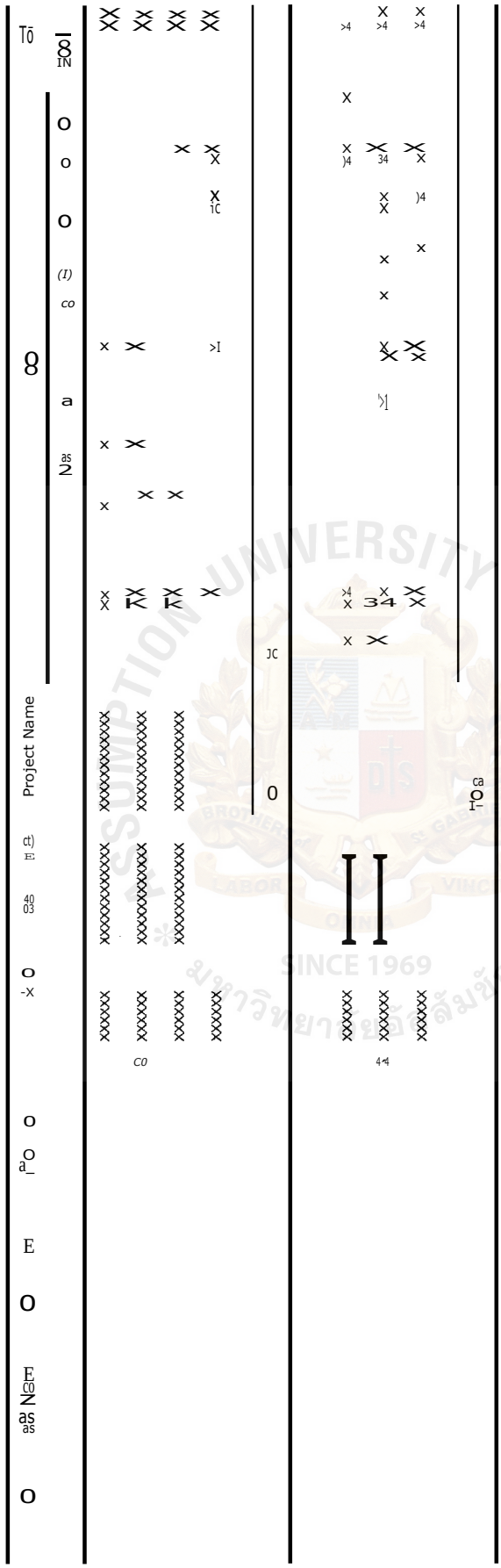

M-M Report Listed by Staffs.

APPENDIX C

EXAMPLE OF 1ERM OF REFERENCES (TOR)

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SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

St. Gabriel's library

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ASSUMPTION UNIVERSITY OF THAILAND
SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

APPENDIX I)

DATA DICTIONARY

ASSUMPTION UNIVERSITY OF THAILAND
SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

Table al. Data Dictionary.

Field name	Description
address	Address of the Client
client ID	Client ID
client name	Client name
department	Staffs department
duration	Task's duration
ED name	Project's ED name
man-day	Number of man-day use for a task
p_status name	Project status; for example, potential, award, ongoing, complete, loss
PM name	Project's PM name
position	Staffs position
position ID	Staffs position ID
project end	Project's end date
project. ID	Project ID
project name	Project name
project start	Project's start date
s_status ID	Staff status ID
s_status name	Staff status; for example, permanent, contract, part-time, external consultants
schedule ID	Work Schedule ID
skill name	Staffs skill
staff ID	Staff ID
staff name	Staff name
T_position ID	Position required for a task
T skill name	Skill required for a task
T_staff ID	Staff assigns to a task
Tyears of experiences	Years of experiences required for a task
task end	Task's end date
task ID	Task ID
task name	Task name
task start	Task's start date
telephone no.	Client's telephone number
TOR ID	TOR ID
years of experiences	Staffs years of experiences

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