ACCOUNTING RULES MANAGEMENT SYSTEM

PHAYAO TIWAPORN

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Research Project
entitled
ACCOUNTING RULES MANAGEMENT SYSTEM

Miss Phayao Tiwaporn
Candidate

Assoc.Prof. Jarernsri L. Mitrpanont, Ph.D.
Major-advisor

Asst.Prof. Thanwadee T. Sunetnanta, Ph.D.
Co-advisor

Prof. Banchong Mahaisavariya, M.D.
Dean
Faculty of Graduate Studies
Mahidol University

Assoc.Prof. Supachai Tangwongsan, Ph.D.
Chair
Master of Science Programme in
Computer Science
Faculty of Science
Mahidol University

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Research Project
entitled

ACCOUNTING RULES MANAGEMENT SYSTEM

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for the degree of Master of Science (Computer Science)
on
May 4, 2009

Miss Phayao Tiwaporn
Candidate

Lect. Waraporn Jirapanthong, Ph.D.
Chair

Assoc.Prof. Jarernsri L. Mitrpanont, Ph.D.
Member

Asst.Prof. Thanwadee T. Sunetnanta, Ph.D.
Member

Prof. Banchong Mahaisavariya, M.D.
Dean
Faculty of Graduate Studies
Mahidol University

Prof. Skorn Mongkolsuk, Ph.D.
Dean
Faculty of Science
Mahidol University

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Phayao Tiwaporn

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ACCOUNTING RULES MANAGEMENT SYSTEM.

PHAYAO TIWAPORN 4637290 SCCS/M

M.Sc. (COMPUTER SCIENCE)

RESEARCH PROJECT ADVISORY COMMITTEE : JARERNSRI L. MITRPANONT, Ph.D., THANWADEE T. SUNETNANTA, Ph.D.

ABSTRACT

Mahidol University (MU) has managed the university's financial and monetary issues in accordance with the accounting policies on an accrual basis, which means the accounting basis is used to acknowledge items and events when they occur. Currently, MU has implemented its work systematically and in full circle as well as linked the data consistently, ranging from the budgeting and inventory system to the financial and accounting system. The current computer-based system has been developed by fixing the rules of the accounting policy within its program. This means that if errors occur, there is a need to alter the data directly and manually. Due to this scenario, although changes caused by both inside and outside MU have arisen, not only will the whole process of the current system be affected, but also difficult maintenance processes and data alterations will need to be performed accurately.

Based on the above-mentioned problems, this research project has proposed the Accounting Rules Management Framework (ARMF) and developed a prototype system, called the Accounting Rules Management System (ARMS). The contributions of this work are 1) to help as well as to manage constantly up-to-date accounting rules data by applying Event-Condition-Action (ECA) rules and 2) to use the principle of Business Rules Management System (BRMS) to assist in revising accounting rules. Hence, the proposed approach is automatic, easy, convenient, rapid, accurate and complete. In addition, the monitoring and controlling are also easy to perform and can instantly support an alteration that may occur, resulting in correct, reliable and congruous accounting data.

This research project has applied a problem-solving technique to a case study of the MU financial and accounting system, through the development of a prototype of the ARMS system. Real data derived from actual work implementation are used while parts of data are simulated to test the performance of the proposed system. Based on a test of the system's functions, the stages and time of an alteration to accounting rules data by the newly proposed system are more rapid and convenient, compared to the current working system at MU.

KEY WORDS : ACCOUNTING RULES MANAGEMENT SYSTEM/ ARMS/ ACCOUNTING RULES MANAGEMENT FRAMEWORK/ ARMF/ ACCOUNTING RULES

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ระบบการจัดการข้อมูลกฎการบันทึกบัญชี

ACCOUNTING RULES MANAGEMENT SYSTEM

พเยาว์ ทิวาภรณ์ 4637290 SCCS/M

วทม. (วิทยาการคอมพิวเตอร์)

คณะกรรมการที่ปรึกษาโครงงานวิจัย : เจริญศรี มิตรภานนท์, Ph.D., ธันวดี สุเนตนันท์, Ph.D.

บทคัดย่อ

มหาวิทยาลัยมหิดล มีการบริหารจัดการ งานการเงินการคลังตามหลักเกณฑ์และนโยบายการบัญชีเกณฑ์คงค้าง หรือเกณฑ์พึงรับ-พึงจ่าย (Accrual Basis) ซึ่งหมายถึง หลักเกณฑ์ทางบัญชีที่ใช้รับรู้รายการและเหตุการณ์เมื่อเกิดขึ้น ปัจจุบันมหาวิทยาลัยมหิดลมีรูปแบบและวิธีการในการดำเนินงานอย่างเป็นระบบและครบวงจร มีการควบคุมภายในที่ดี และมีการเชื่อมโยงข้อมูลอย่างต่อเนื่องตั้งแต่ระบบงานงบประมาณ ระบบพัสดุ ระบบการเงินและระบบบัญชี โดยระบบงานคอมพิวเตอร์ที่ใช้อยู่มีการนำกฎการบันทึกบัญชีที่เขียนชุดคำสั่งฝังไว้ในโปรแกรม ซึ่งหากมีความผิดพลาดของข้อมูลเกิดขึ้นจะแก้ไขจากฐานข้อมูลโดยตรง ด้วยรูปแบบของระบบและวิธีการแก้ไขดังกล่าว หากเกิดการเปลี่ยนแปลงใดๆ ที่ส่งผลกระทบต่อรูปแบบการบันทึกบัญชี เช่น การเปลี่ยนแปลงกฎเกณฑ์การบันทึกบัญชีจากหน่วยงานภายนอกและภายใน จะก่อให้เกิดการเปลี่ยนแปลงและปรับปรุงเงื่อนไขหรือกฎการบันทึกบัญชีต่อภาพรวมของระบบทั้งหมด และเป็นเรื่องที่ยากต่อการดูแลและบำรุงรักษา

จากปัญหาที่กล่าวมาข้างต้น โครงงานวิจัยจึงได้นำเสนอวิธีการสร้าง Accounting Rules Management Framework (ARMF) สำหรับพัฒนาระบบการจัดการข้อมูลกฎการบันทึกบัญชี และพัฒนาโปรแกรมต้นแบบ Accounting Rules Management System (ARMS) เพื่อช่วยแก้ปัญหาในเรื่องของการจัดการข้อมูลกฎการบันทึกบัญชีให้เป็นปัจจุบันอยู่เสมอ โดยประยุกต์ใช้เทคนิค Event-Condition-Action (ECA) Rule ในการออกแบบกฎการบันทึกบัญชี และใช้หลักการของ Business Rule Management System (BRMS) เข้ามาช่วยในการจัดการกับการเปลี่ยนแปลงกฎการบันทึกบัญชี ด้วยรูปแบบที่เป็นอัตโนมัติ สามารถแก้ไขกฎการบันทึกบัญชีได้ง่าย สะดวก รวดเร็ว ถูกต้อง ครบถ้วน การตรวจสอบและควบคุมทำได้ง่าย สามารถรองรับการเปลี่ยนแปลงที่จะเกิดขึ้นได้ทันที ช่วยให้ข้อมูลทางบัญชีมีความถูกต้องเชื่อถือได้ และสอดคล้องกัน

โครงงานวิจัยนี้ได้นำวิธีการแก้ไขปัญหามาประยุกต์ใช้กับกรณีศึกษาของระบบงานการเงินและบัญชีของมหาวิทยาลัยมหิดล โดยพัฒนาโปรแกรมต้นแบบของระบบการจัดการข้อมูลกฎการบันทึกบัญชี และใช้ข้อมูลจริงจากงานที่ดำเนินการจริง และจำลองข้อมูลบางส่วนสำหรับทดสอบการทำงานของโปรแกรมต้นแบบ ซึ่งหลังจากทำการทดสอบฟังก์ชันการทำงานต่างๆ ของระบบ ได้ผลลัพธ์ที่แสดงให้เห็นว่าขั้นตอน และเวลาที่ใช้ในการเปลี่ยนแปลงข้อมูลกฎการบันทึกบัญชี สะดวกและเร็วกว่าการทำงานของระบบงานปัจจุบัน

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CHAPTER I
INTRODUCTION

1.1 Background

Mahidol University has carried its financial management and accounting policies on an accrual basis, which records transactions and events when they occur, not when cash or cash equivalents is received or paid. Therefore, the university's systems consisting of the budget, inventory, and financial systems have to be recorded their accounting transactions as soon as they occur. For instance, a payable account is credited when goods or services are received, cash receipt is recorded in the financial system when there is a reception of state revenue, a payment is recorded in the financial system when a cheque is paid to a account payable, and the accounting is adjusted in the budget system in order to cancel accrued payable as request for a reimbursement of expenses is cancelled, etc. To develop a computer system that support the management of its finance and accounting on an accrual basis, Mahidol University performs its work systematically and in full cycle, has a good internal control, and integrates data flow among the budget system, inventory system, financial system and accounting system. The university also classifies its managerial unit into two levels, namely, university level (by Finance Division) and work unit level. This aims for each work unit to be independent and flexible in budget management to yield products and services that effectively meet its mission, goal and objectives. In so doing, the university's finance division is a central unit responsible for following up, verifying and controlling the financial management and the performance of related systems align to each others and to the university's policies.

Mahidol University's accounting regulation is defined by two agencies: the Comptroller-General's Department under the Finance Ministry, and the Finance Division of Mahidol University. The regulation defined by the Comptroller-General's Department may be adjusted to be consistent with the state policies on monetary and financial management, for example, when Mahidol University steps out from the traditional system. In addition, the university's finance division may modify the accounting regulations based

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on the university's performance or administration. Such a modification inevitably results in the related working system's revision of accounting regulations as well. In the case that the working system development implements hard-coded accounting rules or manual accounting rules, the rules revision is typically complicated and time-consuming. Additionally, it is hard to examine and control a revision of rules or regulations on working system in order to make them accurate and complete. Moreover, it is also difficult to manage all the systems using the same rule to have the same revision, or to revise related rules to align each system to the others. As a consequence of the above-mentioned shortcomings, the accounting data are either incorrect or not in accordance with the fact, causing the data to be unreliable.

This research project thus studies the problem of change in management of accounting rules under the environment in which rules may be regularly changed. The study also investigates the development of the accounting rules management system, using Mahidol University's financial and accounting system as a case study. The project development is based on the accounting rules management and applies a technique of event-condition-action (ECA) rules to design accounting rules, and uses the principle of the business rule management system (BRMS) to assist in managing the accounting rule change in order to automatic it and the accounting rule revision is easily, conveniently, swiftly, accurately and completely performed. Furthermore, the auditing and control are easy and able to support an instant change, thus, making accounting data are correct, reliable and congruous.

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1.2 The Project Problems

Mahidol University's financial and accounting system as a case study, the problems related to changes in accounting rule consist of the following.

1. There is a wide variety of conditions for writing hard-coded accounting rules in each system in order to examine different conditions of related accounting systems. Consequently, when there is a change in accounting rules the program modification is complicated and time-consuming.

2. For the manual accounting rules storage, the data in database have to be directly revised when there is a change in accounting rules. This can result in non-updated revision or addition of rule data or incomplete coverage of all related tables, causing incongruous among related rules.

3. There is a lack of uniformity of accounting rules since each related current working system manage and manipulate the accounting rules database individually. This normally results in a change in the accounting rule that will face with the inconsistency problem, such as many sub-systems refer to the same rule but assign the different compound account.

1.3 Objectives of the Research Project

This research project has the following objectives.

1. To study the problem of the 3-dimension accounting system with respect to accounting rules and accounting rules change management.

2. To apply the principle of business rule management system (BRMS) to the design of Mahidol University's accounting rules data management system.

3. To apply the event-condition-action (ECA) rules technique for the design and generation of accounting rules database and web application for the development of the accounting rules data management system.

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1.4 Scope of the Project

The project scope will concentrate on the development of the accounting rules data management system with an aim to manage the accounting rules of Mahidol University's financial and accounting system. The scope is composed of the following stages of development.

1. Study account booking stages of Mahidol University's working systems in order to apply as a case study for the research project.

2. Investigate the principle and theory of ECA rules and web application and apply them in the development of the accounting rules data management system and database to serve the accurate and up-to-date accounting rules.

3. Analyse and design the accounting rules data management system based on the principle and theory of web application.

4. Analyse and design the central database for accounting rules storage in order that Mahidol University's various work units can retrieve data from the unique source. The analysis and design will be based on the principle and theory of ECA rules.

5. Develop the prototype of the accounting rules management system based on the above analysis and design.

6. Test the system performance using actual data in existing working systems, including those on a receipt of goods and services in the inventory system, requests for expense reimbursement in the budget system, as well as money reception and payment of Mahidol University's financial system.

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1.5 Research Project Organization

This research project consists of the following chapters.

Chapter 1 : Introduction discusses the problems of the accounting rules of Mahidol University's accounting system, research scope and research objectives.

Chapter 2 : Literature Review discusses a study of related working system and theories.

Chapter 3 : Overview of Our Approach describes an application of the ECA rules technique and web application for the development of the Accounting Rules Management System.

Chapter 4 : ARMF Analysis explains stages of system analysis. The Analytical consequences are displayed in the formats of data flow diagram (DFD), E-R diagram, structure chart, data dictionary, control design, module specification and file structure.

Chapter 5 : Design and Implementation elaborates on the input/output design and techniques under various circumstances.

Chapter 6 : Discussion and Conclusion discusses an outcome of system development, methodology conclusion as well as a possibility of further development of the system.

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CHAPTER II
LITERATURE REVIEW

The study indicates that the 3-dimension accounting system of Mahidol University, is an automatic accounting system that has independent and separate accounting data management. The system has a large number of accounting rules and various complex conditions. Due to the lack of efficient accounting rules data management an alteration to the accounting rules generally results in a direct revision of the program in case of hard-coded accounting rules, or a modification to data on manual accounting rules if accounting rules are stored in a database. To solve the above-mentioned problems, it is crucial to study basic data and related theories in order to design and develop the prototype of accounting rule data management system that can support an automatic change in accounting rules easily, conveniently, swiftly and accurately reuse, and allow effective follow-up and monitoring.

This research project studies fundamental data and related theories, in order to apply the solution to such problems. The data and theories consist of two parts listed below.

- Knowledge of business rules and development of the business rule management system (BRMS)
- Knowledge of event-condition-action (ECA) rules.

2.1 A Study of Business Rules Concept and Its Implementation

2.1.1 Business Rules Overview

Business Rules are rules or conditions for business transactions that an agency has generated to define standard, and as requirements for its performance in order to achieve an established goal. Business rules are classified into two groups. The first group

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is internal rules set up within an organization agency, which are mostly derived from the agency policy. The second group is external rules formulated outside an organizational agency, for instance, laws, acts or stipulations. For the development of an information system such rules are typically used as conditions and process to determine system performance. Therefore, the development of an information system to support business transactions has to be carried out in accordance with business rules that an organization agency has defined so that the system can operate corresponding with the rules of real business performance.

The research [1] [6] proposed by Barbara von Halle has defined four steps of business rules formulation, which include the following.

1. Separate is to find business rules by studying business attribute and functions including business requirements and stipulations, all of which are collected in order to define an agency's business rules, which are separated from business functions. Existing rules may be analyzed and designed for reuse, or techniques related to rules are applied to enhance the quality of rules. Or business rules are separated and become independent of any one particular system to enable related systems to jointly use the data.
2. Trace is to follow up and monitor business rules such as sources of rules, relationship between rules or impacts stemming from rules alteration. This step is beneficial in business rules data management.
3. Externalize is to interpret rules meaning of rules so that it personnel and end users can to realize, understand, accept and comply with rules.
4. Position is to know the position of rules changed and how they are changed so that a change can be made easily and quickly.

The works [1] [6] describe the procedure to develope an information system for business rules, which consist of six major stages as follows:

1. Scope is a stage to define the scope and collect system requirements.
2. Plan is a stage to plan for working system development.
3. Discovery is a stage to investigate and collect business rules data without using technology.

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4. Analyze is a stage to analyze, verify and examine business rules data acquired in order to obtain only related and required data which are not repetitious or controversial.
5. Design is a stage to design, classify and create the pattern of storage and application.
6. Delivery is a stage to define and store data in a database, including creation of a working system and training for a real application.

In an information system, business rules are atomic ones that cannot be sub-divided and are explicable through a language used to create rules (formal description). Rules can be categorized based on an explanation and architecture. Finally, each rule derived will be linked to the IS physical component [1] [3] [9].

For a relationship between an information system and business rules, it is found that the latter is embedded in various parts, for instance, rules embedded in a work procedure, database or program, which are used to examine data or performances in response to business operations.

2.1.2 Business Rules Systems

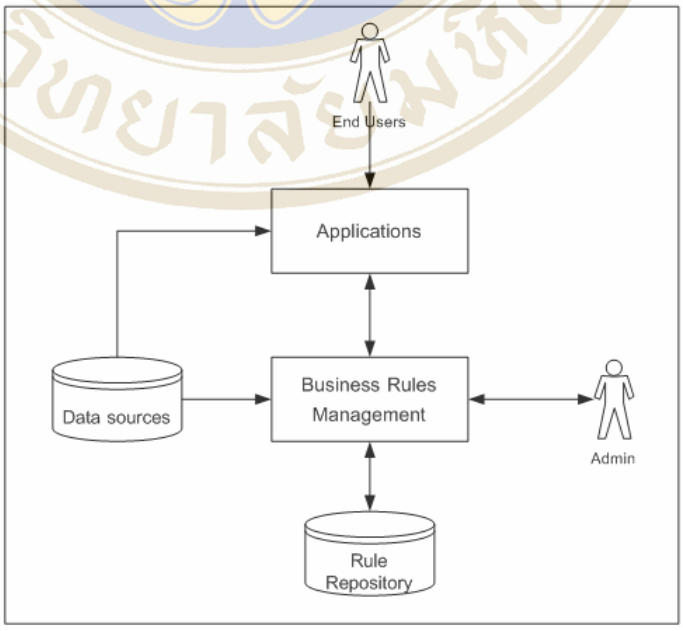

Figure 2-1 High-Level Conceptual Architecture for a Business Rules System

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Figure 2-1 illustrates the architecture of a business rules system, which is explained in the works [5] [8], consisting of the following.

1. End users are general people using the system.
2. Applications are an organization agency's working systems such as personnel system, financial system, etc.
3. Business rules management is a system used to manage business rules, for example, processing for rules retrieval, and rules data management such as addition, modification, cancellation, etc.
4. Data sources are an agency's database used to store data of each application from different working systems. They are also sources of data used as a reference for business rules management such as in rules formulation, or an examination of condition in rules retrieval, etc.
5. Rules repository is a part used to store rules data.
6. Admin is a person taking care of the system and is authorized to look after an organization agency's database of business rules.

Based on Figure 2-1, the part of business rules management comprises two major functions: business rules management used to generate, modify and update data, and business rules execution.

Business rules execution used to retrieve and use business rules, includes the following steps.

1. When an event occurs or there is a request for performance based on rules, a parameter will be sent to the rule engine to be used as data for analysis and decision making based on conditions or rules generated.
2. Decision services, one of the rule engine's services, verifies conditions and uses rules that are appropriate or relevant to the event occurring.
3. When the rule engine has used the rules in accordance with an event, it will decide based on the condition of in-coming data in order for analysis and execution, and send the value back to the application used, or use another application.

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The type of event using business rules stored in a database includes the following.

1. Trigger when an event occurs as defined in trigger.
2. Specific events when there is a request or use via an event defined in applications or working system of an organization agency, for example, when clicking on Save button.

2.1.3 Business Rules Management Scenario

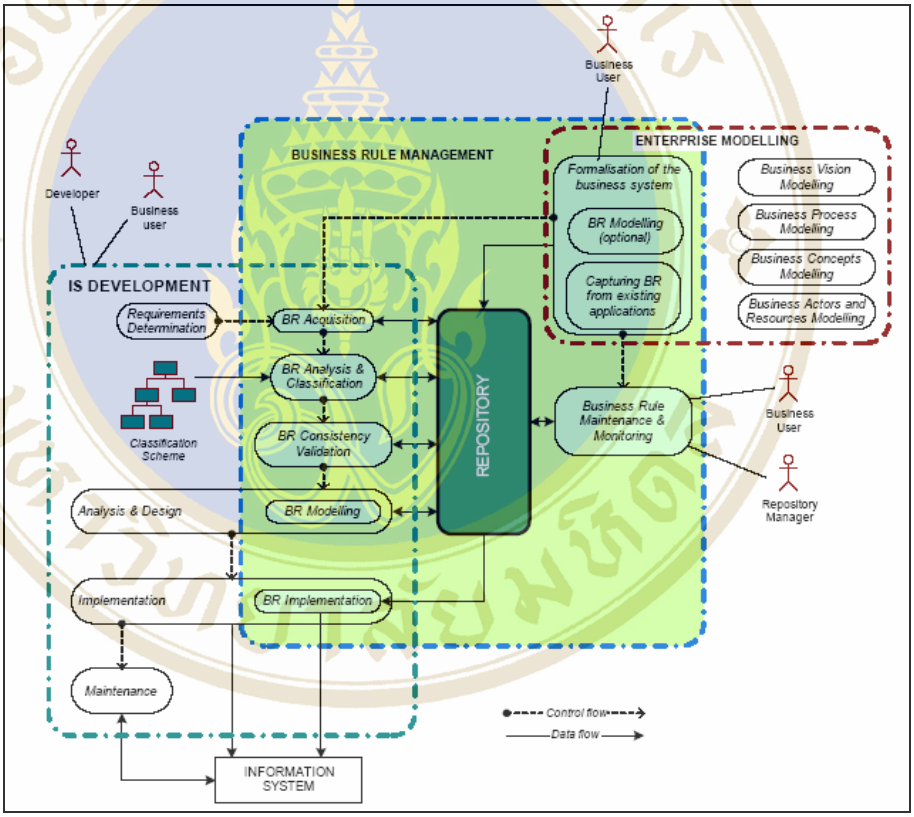

Figure 2-2 The Business Rule Management Scenario [2]

Figure 2.2 illustrates major activities to manage business rules data. The parts of business level and IS level also display activities used for business rules maintenance and monitoring.

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2.1.3.1 Activities occurring at business level

The most significant activity is formalization of the business environment because it will search for components acting as data sources of business rules such as the goal needed, the problem found, working procedure, etc. In addition, there is also IS software/hardware data structure. For the stage of business rules acquisition, it is composed of the following sub-activities.

- Identification of high-level business rules

It defines high-level business rules that are pertinent to an organization's agency's goal and vision. The rules will explain in the form of questions on how to select in order to fulfill the goal, and how important the business policy is for generating business rules.

- Identification of externally imposed rules

It is a study of details of business rules based on limitations or rules and regulations outside an organization agency to find out how they impact or limit business rules. This aims to define limitations for business rules.

- Refinement of the high-level business rules

After high-level business rules are acquired, they have to be modified and classified so that they are comprehensible and compatible with the goal required.

- Identification of the business rules and resources and actors

It is to explain resources data that each business rule uses. It also explains an actor's roles related to the business rules. The principal data of resources and actors are derived from business actors and resource model.

- Business rules consistency and conflict validation

After all business rules are acquired, they have to be validated to affirm that they are consistent and identify conflicting rules.

2.1.3.2 Activities occurring at IS level

- Business Rules Capture is a compilation of the system requirements in order to be analyzed as complete business rules required. An important data source is a business rule model existing in an enterprise model or it may be data of IS

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system development data stored in a database, which will be used for detailed analysis later.

- Business rule analysis and classification is the analysis and classification of atomic business rules obtained. An explanation is written in the form of rule description that has the same characteristic as the rule template of each category.
- Business rule consistency and conflict validation is to validate the function in various stages of business rules to find out whether they are conflicting.
- Business rule modeling is to generate a graphic model of business rules so that users can easily and better understand the relationship of business rules through such model. The model can be represented, for example, as a decision tree or activity diagram.
- Business rule implementation describes the establishment of business rules, which can be done through various approaches depending on technology and tools selected. Most importantly, we have to be confident where those data are and how to implement the business rules.

2.1.3.3 Activities used to modify and verify data of business rules

- Business rule change control is used when business rules are changed. For any change in business rules, its detail has to be collected, for example, who requests for a change, who approves it, when and why a change is made, etc.
- Business rule version control is the part used to control the detail of business rules version to find how a change is made because sometimes the same business rules are used but with a different version. So, a part stating which business rule version is in operation, and in which system needs to be available.
- Business rules consistency and conflict validation is to validate the function in various stages of changed business rules to verify conflicts.
- Business rule impact control since each business rule cannot be absolutely separated, when there is a change in any business rule, there has to be an analysis of the impact incurred by that change, including a detection of any impediment hampering business rule change.

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2.1.4 Business Rules Management Lifecycle

Business rules management (BRM) is a system for managing business rules data using the principle similar to software development life cycle (SDLC), which includes various stages shown in figure 2-3 [4]

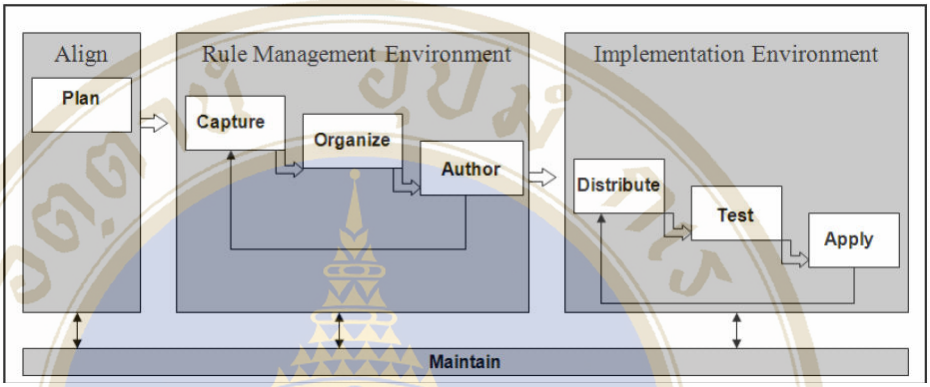

Figure 2-3 The Business Rule Management Lifecycle [4]

Based on figure 2-3, the business rule management lifecycle (BRML) is composed of three main steps: align environment, rule management environment, and implementation environment. The three steps can be divided into eight sub-steps described below.

1. Plan is to define an overall picture of the development of business rule management system. The consequences include work plan, work to be developed, development priority, and duration of development. It is just a rough sketch but has to cover every part required.
2. Capture is a step to analyze data received from the first step in detail. It begins with defining the scope for each part of development and analyzes possible impacts of business rules within the scope. Sometimes we may discover new business rules which yield indirect benefits, or have an opportunity to enhance the efficiency of the business process through reengineering of increasing codes or other approaches beneficial to the development.
3. Organize is to reexamine the business rules obtained from the ‘capture’ step in order to eliminate the rules which are not interesting or are not

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actual business rules. Then, the remaining business rules are classified and planned to which function they will be applied and when.

4. Author is to use the business rules derived from the ‘organize’ step to construct rules and keep them in a rule repository. In the step of rules generation, logic testing such as a test of accuracy, completeness, unrepetitiveness and easy understanding is required. Above all, a business rules repository has centralized management and is independently separated from the development part.
5. Distribute is a step of sharing business rules data collected in a rule repository so as to be used to develop for the work required. The data will be defined in the ‘organize’ step as what part (system, processes or layer) the rules will be developed and when they will be installed. This step makes the business rules management system pertinent to the need of and appropriate to an organization agency’s IT infrastructure attribute.
6. Test is the testing of performance between repositories and in the actual environment to find whether they can work together. The test is divided into three categories unit testing, integration testing and acceptance testing.
7. Apply is the final step of the BRLC process, in which the business rules received are applied in the existing working system. It is similar to an implementation phase of SDLC, which includes such patterns as cancellation of an old system / use of a new system (direct conversion), use of an old system for awhile time along with a new system and then cancel the old system (parallel start-up), and a change from an old to a new system, part by part (phased roll-out). Besides, a process of updating business rules has to be prepared also because business conditions factors may fluctuate.
8. Maintain is a step consisting of three parts. The first part is maintain alignment environment, which modifies and prioritizes business rules when a new system of business rules is needed. Such a case typically occurs when there is an alteration to business such as market change or new law, etc. The second part is maintain rule management environment,

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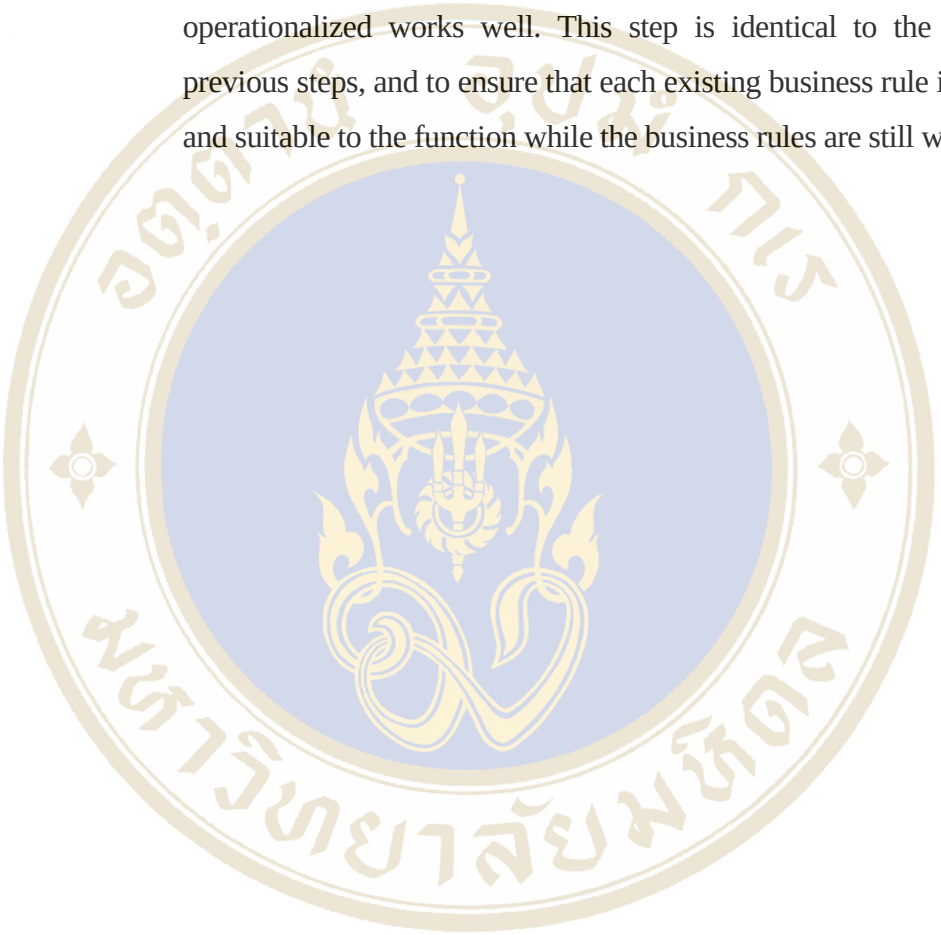
which manages emerging new rules or modifies existing rules, in order to evaluate which function still needs rules and which function does not. This aims to redefine the right to access a rule repository. The last part is maintain implementation environment, which does not require redevelopment of the system and ensures that the working system is still operationalized works well. This step is identical to the function in previous steps, and to ensure that each existing business rule is up-to-date and suitable to the function while the business rules are still workable.



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2.1.5 Business Rules Management System (BRMS) [10]

The business rules management system (BRMS) is the technology for an organization agency's business rules management. The system is used to record, store and manage business rules. The main principle of BRMS is to separate business rules from applications so as to get a system easy for business rules revision. As business adapts continuously business rules have to be adapted in accordance with reality to advantage the development of an information system and minimize an impact on the system when business rules are modified or added. Furthermore, the separation of functions enables the system development to be more rapid since the scope of operation is reduced while the system maintenance consumes less time, resulting in an organization agency's saving in system maintenance budget.

Typically, BRMS is used in combination with the business process management system (BPMS), of which the latter clings to a guideline of how to make the business succeed. As a consequence, BPMS processes a tool to design a model as well as to simulate an operation and establish business processes (workflow), which is an instrument used to define the pattern of automatic function and analyze the working system. Nevertheless, for BRMS, it has a guideline of what a successfully developed system has to do. Therefore, it is a tool for generating decision rules, defining working conditions, as well as managing and storing decision rules. The functions of BPMS and BRMS are interrelated. For example, BPMS functions (performances) simulation can identify functions that are automatic such as a calculation of commission data or discount rate for commodity purchase. With respect to this type of function, rules for monitoring BRMS functions are formulated to verify the system data and select the functions appropriate to a specific type of data.

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2.2 A Review of Event-Condition-Action Rules

Event-Condition-Action rules (ECA rules) [11] is a method to convert a requirement pattern or a monitored condition into rules. They consist of three parts, namely, a part defining events or conditions for rules function, function (performance) of command conditions, and acted functions when conditions are true. The data are stored in a database called an active database, in which the data can be easily managed in the form of event > condition > action. This means that when an event occurs in accordance with a condition defined, the system will perform based on the process or the real working part as defined.

The pattern of ECA rules may be written as follows :

ON Event IF Condition THEN Action

ECA rules include three following parts.

- Events are occurrences defined to generate an action when the condition is true.
- Conditions are conditions defined to verify each event in order to generate an action required when the condition is true.
- Actions are actions or processes that happen when an event occurs and all defined conditions are met a verification of conditions goes on as defined.

In this research project, a technique of ECA rules is applied to the design of accounting rules by defining an event, a condition to be verified for each event, and accounting based on the rules defined. When there is an event that has to be acknowledged, and a condition is true as defined, an action (accounting) is processed. In this regard, the three parts are mapped in the form of ECA rules and stored as a centralized pattern in a database, separately from an application. This technique will enable accounting rules data management and retrieval to be flexible and convenient, as well as make a swift verification possible. Similarly, such accounting rules can be jointly used among different working systems. Additionally, an alteration to accounting rules can be made rapidly, accurately and controlled easily.

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CHAPTER III
ACCOUNTING RULES MANAGEMENT FRAMEWORK (ARMF)

This chapter discusses an overview of this research, which applies a technique of ECA rules and business rules management system (BRMS), to develop the accounting rules management framework (ARMF), in order to design a database and develop the accounting rules management system (ARMS) of Mahidol University's financial and accounting system, which is used as a case study.

3.1 An Overview of ARMF

This section discusses an application of the business rules management principle, mentioned in section 2.1, to define the process of accounting rules management framework (ARMF) for the development of the accounting rules management system accounting rules data as a central database as well as the process of centralized accounting rules execution are generated and capable to interface with various working systems.

This design is based on the guideline of separating the accounting rules from the program to generate an automatic performance of the accounting rules data management. So, an alteration to accounting rules can be made at one point and does not affect the program, allowing for a swift, accurate, complete and verifiable revision.

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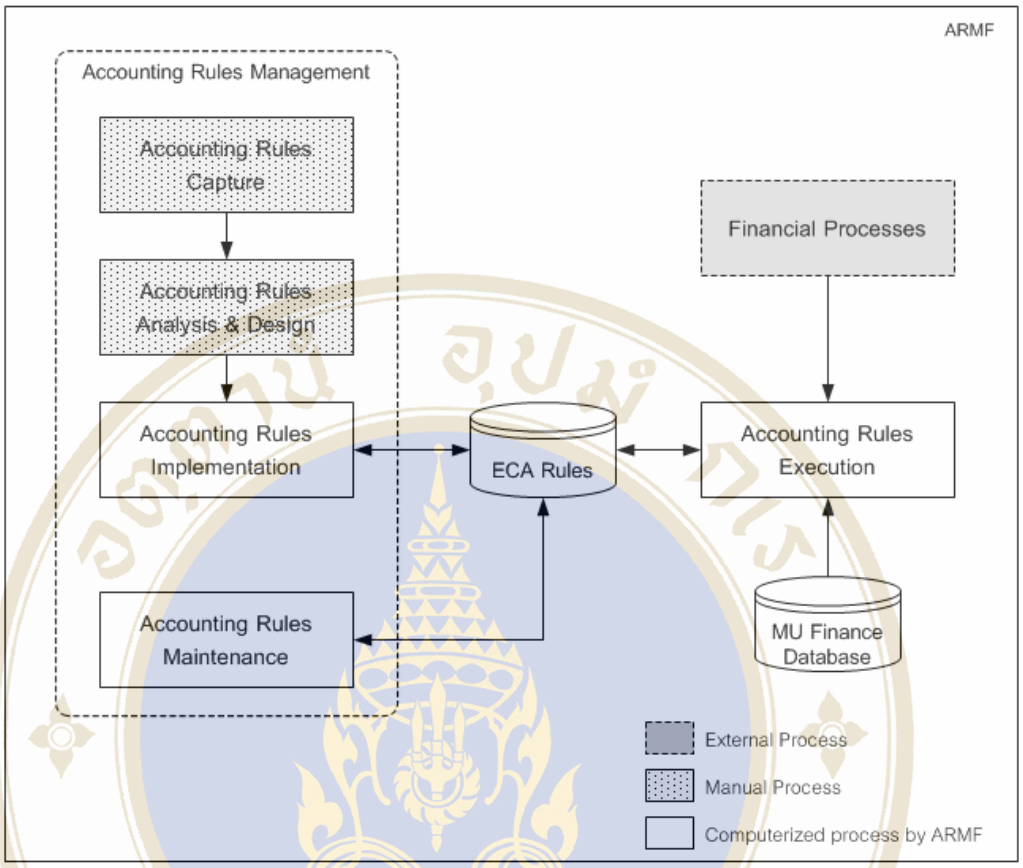

Figure 3-1 Accounting Rules Management Framework (ARMF)

Figure 3-1 reveals the process of development of the accounting rules data management system, of which the performance is divided into two parts. The first part is accounting rules management, which is a process used to manage accounting rules data, and the second part is accounting rules execution, which is a process used for processing to retrieve accounting rules in order to verify the accuracy. Details of each part are described below.

- **Accounting Rules Management** is a process related to accounting rules data management, consisting of the following.
  1. **Accounting Rules Capture** is a process of searching for and compiling accounting rules data, accounting transaction that have to be acknowledged, and condition statement condition data that have to be verified, the process is performed manually. It has a manual process of performance. For the transactions needed to be acknowledged and booked, including conditions to be verified, and

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accounting rules data, significant data sources are typically an accounting entry manual and accounting rules defined by responsible organizations agencies, to support their financial management.

2. **Accounting Rules Analysis and Design** is a process of analysis and design of accounting rules based on the principle of ECA rules, which consists of three important parts, namely, events to be acknowledged or recorded, conditions to be verified and affecting accounting rules, and an account to be booked when the event conditions are true. This process is performed manualy.
3. **Accounting Rules Implementation** is a process of generating an accounting rules database and developing the accounting rules management system (ARMS) so as to manage accurate and up-to-date accounting rules data. The functions (performance) of the system include accounting rules authoring and accounting rules monitoring, to assist in an inspection and follow-up. The functional structure in shown in Figure 3-2.

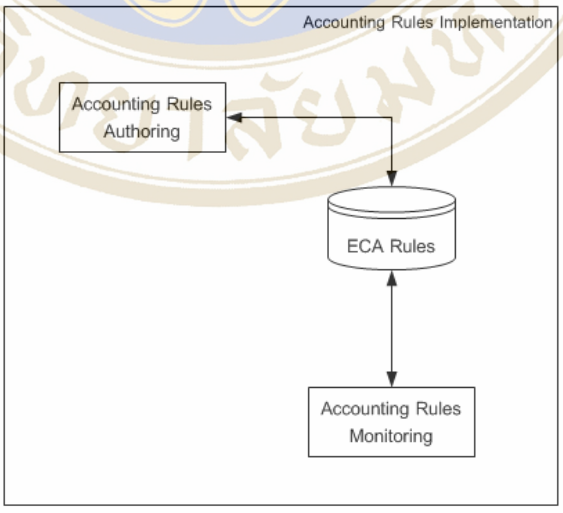

Figure 3-2 Main Structure of Accounting Rules Implementation

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3.1 **Accounting Rules Authoring** is a function used to generate or define accounting rules data. It consists of three significant parts, namely, data preparation, rules construction and process handler registration of related system process.

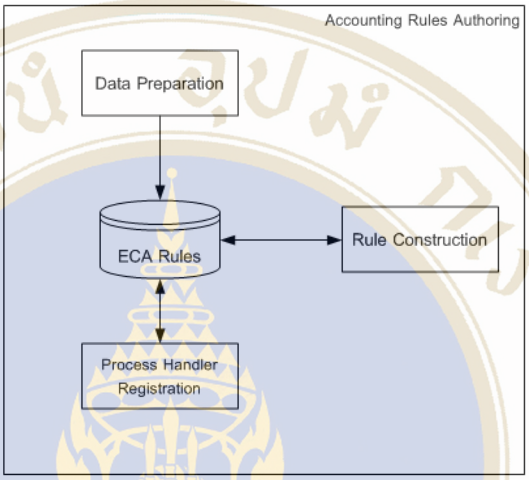

Figure 3-3 Main Structure of Accounting Rules Authoring

Based on Figure 3-3, the system's functions comprise three following significant parts.

- **Data Preparation** is a function used to prepare primary major data related to the generation of accounting rules, consisting of events data i.e. transactions to be acknowledged and booked, conditions data or conditions to be verified in each event, mapping of expenses-revenue accounts and accounting codes to be recorded.
- **Rules Construction** is a function used to define accounting rules, classified by the event type, including verification of conditions defined.
- **Process Handler Registration** is a function used to register accounting rules data of various processes in order to be used as data for a control, follow-up and verification of data. For example, when there is a

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change in accounting rules, which working system's process does it affect? Or when there is incorrect booking in an accounting journal it has to check to find out from which system's process the data are recorded, and which rule is used.

3.2 **Accounting Rules Monitoring** is a function used to inquire accounting rules data in different perspectives to assist in data monitoring and follow-up, for instance, when there is an alteration to accounting rules, the data on system process affected may be inquired in order to be used for monitoring before the alteration.

4. **Accounting Rules Maintenance** is a process of looking after accounting rules data through the accounting rules management system (ARMS) when there is a change in accounting rules, both from external and internal organizations, so that the rules are accurate and up-to-date. The functions include rules modification and cancellation. Very rules maintenance detail is kept for further audit.
   - **Rules Modification** is for modifying accounting rules data. Details of modification are recorded for future reference in case of later inspection, for example, date of and reason for modification, name of modifier, pre-modified rules, etc.
   - **Rules Cancellation** is for cancellation of rules which have not been used in the defined time. Details of rules cancellation are recorded for future reference in case of later inspection, for instance, date of and reason for cancellation, etc.

- **Accounting Rules Execution** is a process of monitoring the accuracy of processing and using accounting rules data, which has an automatic function. A test of accounting rules data use is made through events and conditions. The function of this process is composed of two important

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parts, namely, rules execution based on the events and conditions defined, and journal posting.

3.2 Applying ARMF to MU Financial System

This research project has applied the development process of the accounting rules management framework (ARMF), explained in section 3.1, to Mahidol University's financial and accounting system's accounting rules data through creating ECA rules database and developing the accounting rules management system (ARMS), as the following:

3.2.1 An Overview of MU Financial System

Based on a study of Mahidol University's financial and accounting system, which is used as a case study in this research, it can be overall summarized that the university's monetary system applies the principle of 3-dimension accrued account basis, which is a combination of the budget system, inventory system, and financial and accounting system. All systems are linked and transferred their data. For the accrued account basis, accounting transactions or events will be acknowledged at the time those items really occur regardless cash or cash equivalents are yet received or paid. Transactions are recorded in the financial statement of related period, for instance, an commodity sale on credit with an account receivable occurred. The financial and monetary management is divided into two levels of university and work unit. All systems have the finance division which is responsible for following up, monitoring and controlling so as to obtain accurate and verifiable financial and accounting data. There are accounting officers taking care of monitoring the accuracy and completeness of data based on accrued account basis.

Mahidol University's accounting data are derived from two sources. The first is data received from automatic record accounting, when there arise is a transaction acknowledged, in a general journal of working systems concerned, which is typically a major portion of data. The second is account adjustment data recorded by the accounting section, finance division, Mahidol University, including other accounting data that the

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current working system does not support, such as data on cash deposit or cheque payment cancellation, etc.

Documents used as evidences for accounting entries are classified into four types, based on transactions that occur as follows:

- A voucher for debt recording or a voucher for expense payment (IV) means an evidence of accounting to set up a debt of a work unit.
- A voucher for debit accounting or cash reception (RV) means an evidence of accounting related to cash reception such as cash, cheque, money order, bank deposit, finance division deposit, etc.
- A voucher for credit accounting or cash payment (PV) means an evidence of accounting related to cash or bank deposit payment, including withhold payment, such as withholding tax, a fine, consign or deposit.
- A voucher for general accounting or a general voucher (JV) means an evidence for non-cash accounting entries, such as account transfer, account correction modification, account adjustment, deposit of cheque or cash in a bank, or revenue acknowledgement.

The following are events to bode entries in general journal based on accrued basis of Mahidol University's financial and accounting system.

1. Setting up a debt from goods or services reception in the inventory system.
2. Reception of national revenue/overdrawn and returned money.
3. Cheque payment to creditors.
4. Acknowledgement of direct payment to creditors.

Accounting rules are defined by the Comptroller-General's Department, Ministry of Finance and the Finance Division, Mahidol University and are constantly modified to be in accordance with the administration policy, which is a significant problem of the current working system because the system uses a wide variety of overlapping accounting rules, for example, hard-code accounting rules or data retrieval from a database. Thus, when there is an alteration to accounting rules, the program and/or accounting rules in the database have to be directly corrected. This causes the modification difficult to monitor, follow up and control for its accuracy, completeness and

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rapid. This, of course, results in incorrect and incongruous accounting data based on actually changed accounting rules.

This research project will focus its study only on what is related to accounting rules data consisting of an automatic accounting process, conditions related to accounting entry, and accounting rules. It aims to investigate and develop the accounting rules management system and examples of the work process of automatic accounting, which can display a sequence diagram to simulate the processes concerned with accounting, ranging from a process of setting up a debt in order to reimburse for expenses to the process of debt payment to creditors. This is carried out based on the types of core activities as the following:

- Withdrawal (reimbursement) through procurement (purchase/hire of services). When the goods received is recorded in the inventory system, the ARMS system will automatically record an accounts payable through a incurred expense voucher in an accounting system.
- Withdrawal (reimbursement) not through procurement. When there is an establishment of a voucher requesting for payment of the budgeting system, the ARMS system will automatically record the accounts payable through a incurred expense voucher in an accounting system.
- Reception of public revenue/ returned overdrawn money. When there is recording of cash reception or payment in the financial system, the ARMS system will automatically record the cash received item through cash reception or payment voucher in an accounting system.

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- Money Withdrawal for Payment through Procurement (Purchase/Hire)

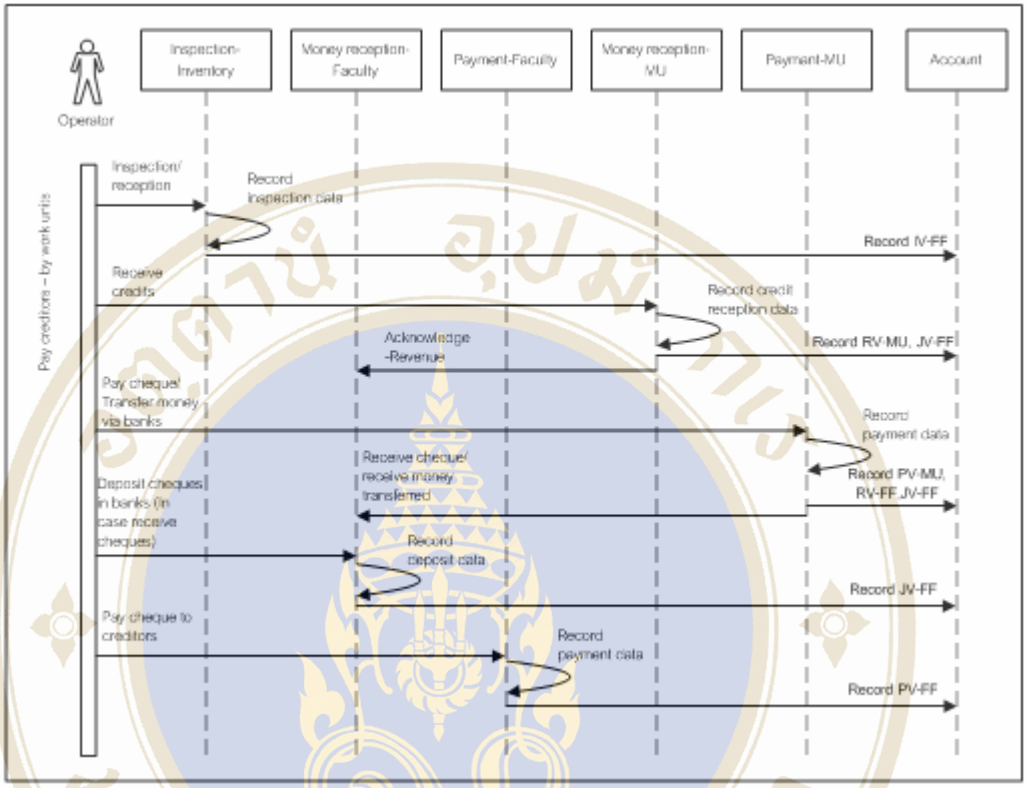

Figure 3-4 Working Process – A Case of Withdrawal of Expenses via Purchase/Hire (Payment Made to Creditors by a Work Units)

Based on Figure 3-4, we can explain implementation steps of the process related to the accounting entries of cash withdrawal for expenses, through procurement (purchase/hire) – a case of payment made to creditors by a work unit, as the following:

1. A work unit records data on goods reception of the inventory system. The ARMS system will automatically record the account in a daily basic account book or setting up a debt through a voucher for cash withdrawal for payment (IV) in an account of the work unit.
2. The finance division of Mahidol University records the transfer of money to the university's account, from the Comptroller-General's Department, in the university's receiving financial system. The ARMS system will automatically record the account in a general journal of two work units as follows:

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2.1 Reception of transferred money through a voucher for cash reception voucher (RV) in the university's account, and

2.2 Acknowledgement of transferred money reception through a general voucher (JV) in the work unit's account.

3. The university's finance division makes payment, to the work unit, in the university's paying financial system. The payment is classified into two types. The first type is money transfer to the work unit's bank account in the case of month-end payment, such as salary, wage, etc. The second type is cheque payment, in the case of normal payment, for instance, expenses on reimbursement, and spending. The ARMS system will automatically record the general journal of two work units as the following:

3.1 Cheque payment through a payment voucher (PV) in the university's account, and

3.2 Cheque reception through a reception voucher (RV) in the work unit's account.

4. The work unit deposits the cheque in a bank and records the deposit transaction in the work unit's receiving financial system. The ARMS system will automatically record the account in a general journal or to deposit the cheque in a bank through a general voucher (JV) in the work unit's account.

5. The work unit pays cheques to its creditors and records the payment in its paying financial system. The ARMS system will automatically record the account in a general journal or to pay cheques through a payment voucher (PV) in the work unit's account.

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- Money Withdrawal for Payment Not through Procurement (Purchase/Hire)

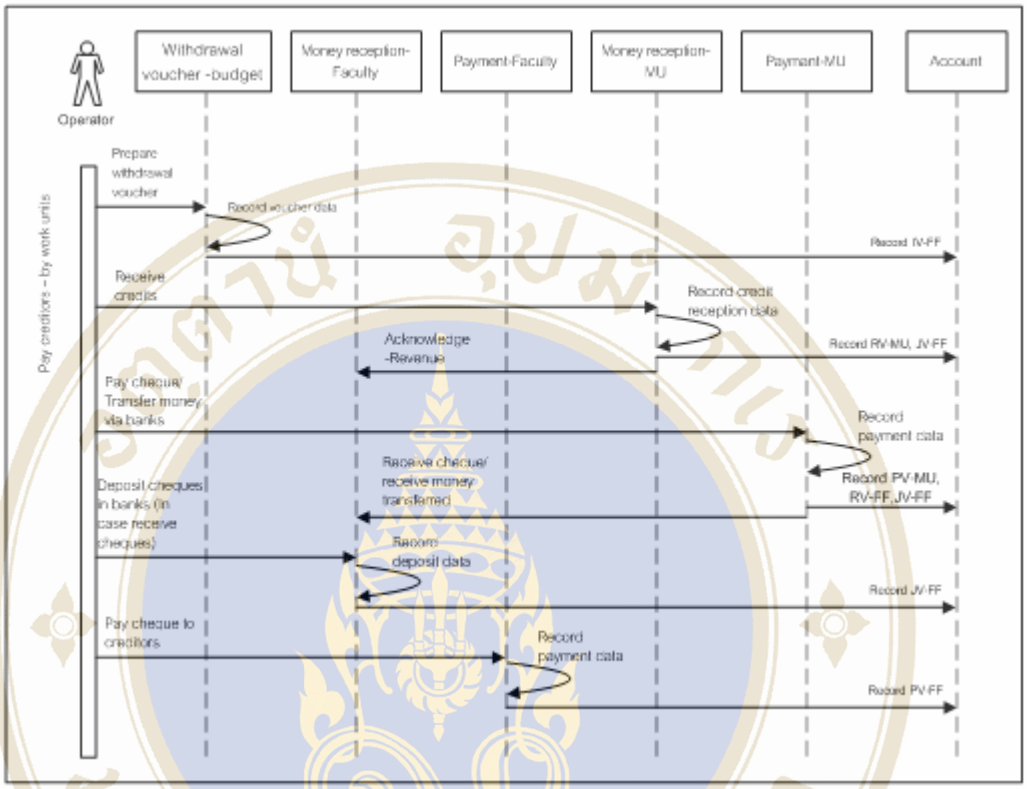

Figure 3-5 Working Process – A Case of Expenses Withdrawal Not via Purchase/Hire (Pay Creditors by a Work Units)

Based on Figure 3-5, we can explain implementation steps of the process related to the accounting entry cash withdrawal for expenses, not through procurement (purchase/hire) – a case of payment to creditors by a work unit, as the following:

1. A work unit records data on issuing a voucher for expense reimbursement in the budgeting system. The ARMS system will automatically record the account in a general journal or setting up a debt through a voucher for expense payment (IV) in the work unit's account.
2. The finance division of Mahidol University records the transfer of money to the university's account, from the Comptroller-General's Department, in the university's receiving financial system. The ARMS system will automatically record the account in a general journal of two work units as follows:

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2.1 Reception of transferred money through a reception voucher (RV) in the university's account, and

2.2 Acknowledgement of transferred money reception through a general voucher (JV) in the work unit's account.

3. The university's finance division makes payment, to the work unit, in the university's paying financial system. The payment is classified into two types. The first type is cash transfer to the work unit's bank account in the case of month-end payment, such as salary, wage, etc. The second type is cheque payment, in the case of normal payment, for instance, expenses on reimbursement, and spending. The ARMS system will automatically record the accounts in a daily basic account book of two work units as the following:

   3.1 Cheque payment through a payment voucher (PV) in the university's account, and

   3.2 Cheque reception through a reception voucher (RV) in the work unit's account.

4. The work unit deposits the cheque in a bank and records the deposit transaction in the work unit's receiving financial system. The ARMS system will automatically record the account in a general journal or to deposit the cheque in a bank through a general voucher (JV) in the work unit's account.

5. The work unit pays cheques to its creditors and records the payment in its paying financial system. The ARMS system will automatically record the account in a general journal or to pay cheques through a payment voucher (PV) in the work unit's account.

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- ❑ Direct Payment Made to Creditors by the Comptroller-General's Department

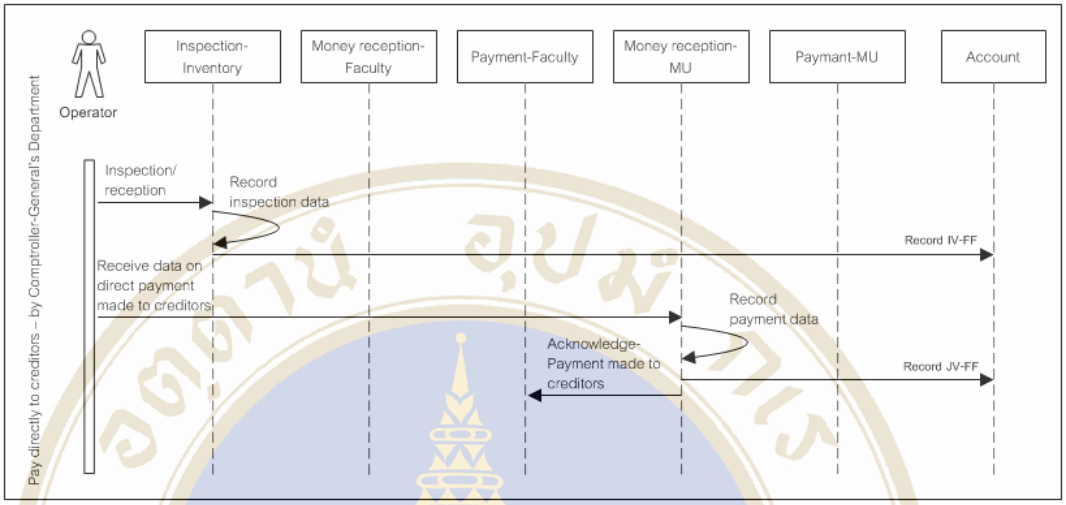

Figure 3-6 Working Process – A Case of Expenses Withdrawal via Purchase/Hire (Direct Payment Made to Creditors by the Comptroller-General's Department)

Based on Figure 3-6, we can explain implementation steps of the process related to the accounting entries of cash withdrawal for expenses, not through procurement (purchase/hire) – a case of direct payment made to creditors by the Comptroller-General's Department, as the following:

1. A work unit records data on issuing a voucher for expense reimbursement in the budgeting system. The ARMS system will automatically record the account in a general journal or setting up a debt through a voucher for expense payment (IV) in the work unit's account.
2. Mahidol University's finance division records the data on direct payment to creditors by the Comptroller-General's Department, instead of the work unit, in the university's payment system. The system will automatically record the account in a general journal or acknowledgement of direct payment to creditors through a general voucher (JV) in the work unit's account.

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- Direct Payment Made to Creditors by Mahidol University's Finance Division

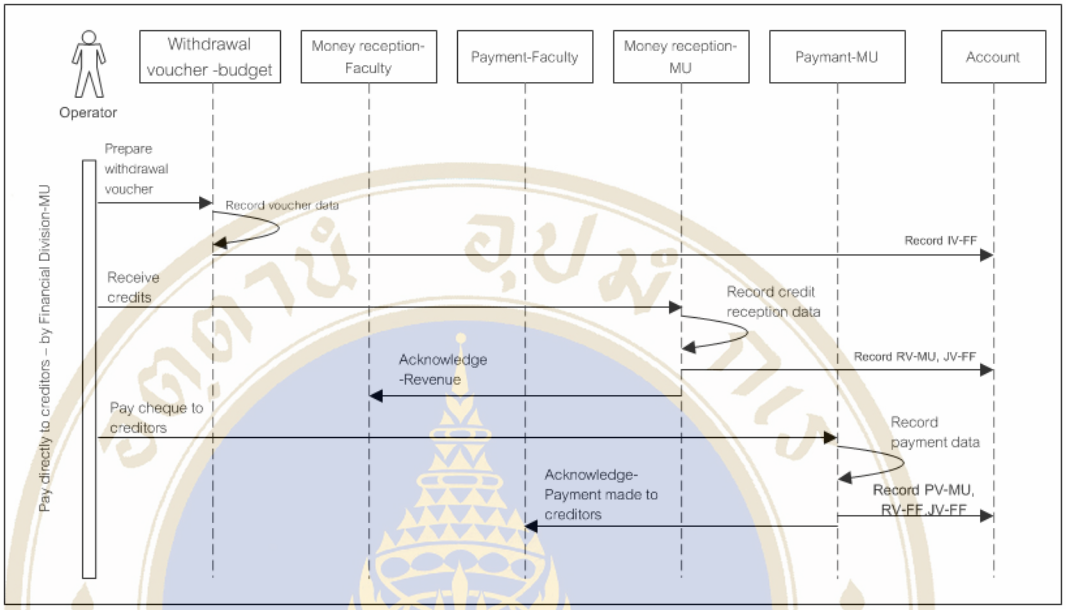

Figure 3-7 Working Process – A Case of Expenses Withdrawal Not via Purchase/Hire) (Direct Payment Made to Creditors by the University's Finance Division)

Based on Figure 3-7, we can explain implementation steps of the process related to the accounting entry of cash withdrawal for expenses, not through procurement (purchase/hire) – a case of direct payment made to creditors by the University's Finance Division, as the following:

1. A work unit records data on issuing a voucher for expense reimbursement in the budgeting system. The ARMS system will automatically record the account in a general journal or setting up a debt through a voucher for rxpense payment (IV) in the work unit's account.
2. The finance division of Mahidol University records the transfer of money to the university's account, from the Comptroller-General's Department, in the university's receiving financial system. The ARMS system will automatically record the account in a general journal of two work units as follows:
    2.1 Reception of transferred money through a reception voucher (RV) in the university's account, and

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2.2 Acknowledgement of transferred money reception through a general voucher (JV) in the work unit's account.

3. The university's finance division, on behalf of the work unit, makes direct payment to creditors and records payment data in the university's payment system. The ARMS system will automatically record the account in a general journal of two work units as the following:

3.1 Payment of transferred money through a payment voucher (PV) in the university's account, and

3.2 Acknowledgement of direct payment made to creditors through a general voucher (JV) in the work unit's account.

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- Reception of Public Revenue/Overdrawn Money Returned

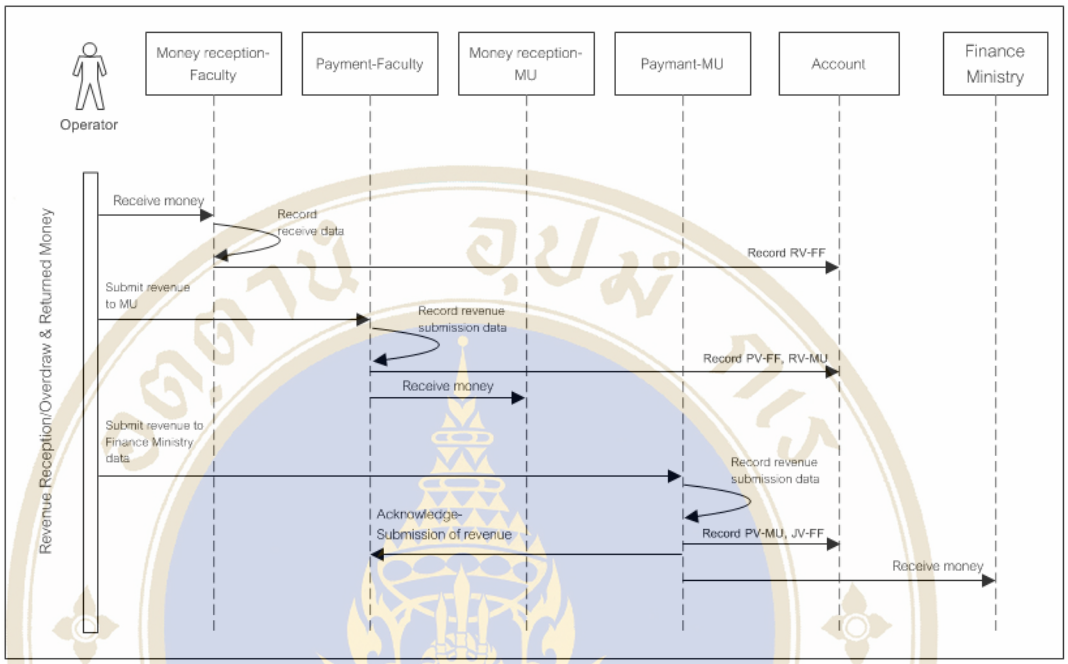

Figure 3-8 Working Process – A Case of Revenue Reception/Overdrawn & Returned Money

Based on Figure 3-8, we can explain implementation steps of the process related to the accounting entry of reception of public revenue/overdrawn money returned, as the following:

1. A work unit receives public revenue or overdrawn money to be returned and records the money reception data in the work unit's reception system. The ARMS system will automatically record the account in a general journal or reception of money via a reception voucher (RV) in the work unit's account.
2. The work unit submits the public revenue or overdrawn money to be returned and records the submission in its payment system. The ARMS system will automatically record the account in a general journal or payment via a payment voucher (PV) in the work unit's account.
3. The university's finance division obtains public revenue or overdrawn money to be returned and records reception data in the university's reception system. The ARMS system will automatically record the

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account in a general journal or cash reception via a reception voucher (RV) in the university's account.

4. The university's finance division submits the public revenue or overdrawn money to be returned to the Ministry of Finance, on behalf of the work unit, as well as records the submission data in the university's payment system. The ARMS system will automatically record the account in a general journal of two work units as follows:
    4.1 Submission of public revenue via a payment voucher (PV) in the university's account, and
    4.2 Acknowledgement of revenue submission via a general voucher (JV) in the work unit's account.

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3.2.2 Applying Accounting Rules Capture to MU-Financial System

Typically, the study and collection accounting rules, acknowledged accounting transactions, and conditions data to be verified, with respect to the accounting (account recording) is a manual process derived from two following sources.

- From a accrued accounting manual of the Comptroller-General's Department, Ministry of Finance, and accounting rules defined by the accounting section, Mahidol University's finance division.
- From a study of the current working system of Mahidol University's monetary system. The data obtained include events data to be recognized and booked, conditions data to be verified, and hard-coded accounting rules, including rules manually stored in a database of each concerned working system, such as the budgeting system, financial system and inventory system.

Based on the study and collection of accounting rules, we can summarize the number of accounting rules, especially for the government budget, classified by event and revenue-expenses group, as shown in Table 3.1.

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Table 3.1 The Number of Accounting Rules Classified by Event and Revenue-Expenses Group

Event type/Event	**No. of Rules (Approximate)**
1. Debts set-up (IV)	
1.1 Work unit - withdraw expenses via purchase/hire	84
1.2 Work unit - withdraw expenses not via purchase/hire	138
2. Receive (RV)	
2.1 MU Finance division – receive credits from the Comptroller General's Department	1
2.2 Work unit – receive national revenue	18
2.3 MU Finance division – receive national revenue from a work unit	1
2.4 Work unit – receive money overdrawn and returned	121
2.5 MU Finance division – receive overdrawn and returned money from a work unit	1
2.6 Work unit – receive cheque/cash from MU Finance division	1
3. Pay (PV)	
3.1 MU Finance division – pay cheque/cash to a work unit	1
3.2 Work unit - pay cheques to a creditor	225
3.3 MU Finance division – pay directly to creditors on behalf of a work unit	1
3.4 Work unit – submit public revenue to MU Finance division	1
3.5 Work unit – submit overdrawn and returned money to MU Finance division	1
3.6 MU Finance division – submit public revenue to Finance Ministry	1
3.7 MU Finance division – submit overdrawn and returned money to Finance Ministry	1

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Table 3.1 The Number of Accounting Rules Classified by Event and Revenue-Expenses Group (cont.)

Event type/Event	**No. of Rules (Approximate)**
4. General (JV)	
4.1 Work unit – acknowledge – Comptroller-General's Department pays directly to creditors	36
4.2 Work unit – acknowledge - MU Finance division pays directly to creditors	8
4.3 Work unit – acknowledge – reception of income from Comptroller-General's Department	199
4.4 Work unit – deposit cheques/cash in a bank	1
4.5 Work unit – acknowledge – submission of public revenue to Finance Ministry	18
4.6 Work unit – acknowledge – submission of overdrawn and returned money to Finance Ministry	121
Total	**979**

3.2.3 Applying Accounting Rules Analysis and Design to MU Financial System

A process of study, analysis and design of accounting rules using the principle of ECA rules, consist of three significant parts, namely, events to be recognized or recorded, conditions to be verified, and actions to be recorded based on defined rules. Accounting rules design applies the following ECA rules in the following pattern :

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- **Event** means an event to be recognized or recorded on an accrual basis when the conditions are true. For instance, when there is goods receipt, a debt-setting item has to be recorded in an accounting system through an expense issuance voucher (IV), or when a work unit pays cheques to its creditor, a clearing of creditor item has to be recorded in an accounting system via a payment voucher (PV). The classification of events to be recognized depends on two factors, namely, the type of event or action that has to be recognized, and an actor or work unit which performs that event. The structure of event classification is revealed in Figure 3-9.

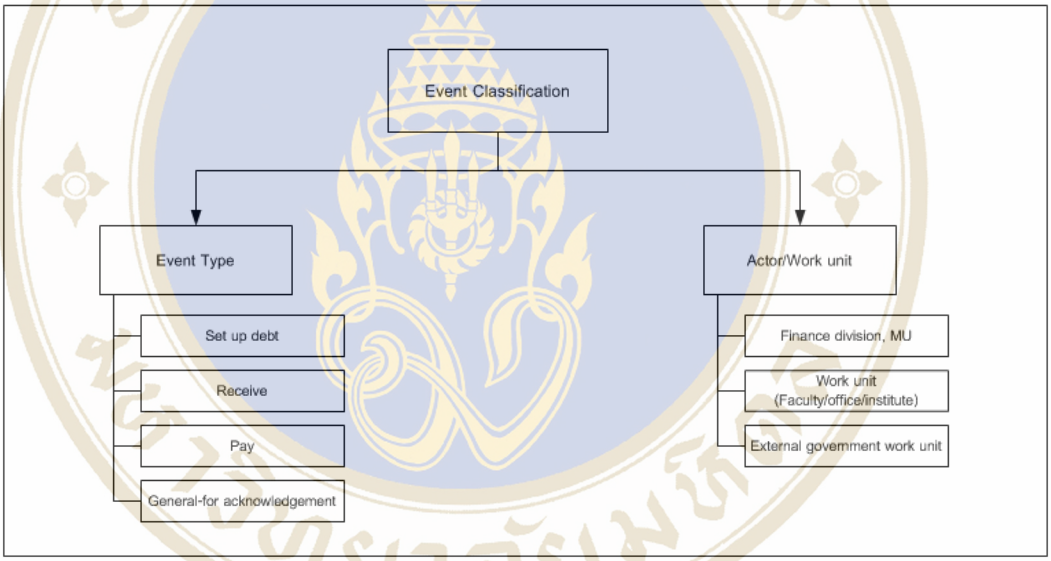

Figure 3-9 Structure of Events Classification

Figure 3-9 illustrates the classification of events into two groups of event type, and actor or work unit that carries out a particular event.

1. Event Type means an action which has to be recognized or recorded using the principle of event type classification which is based on an accrual basis principle, consisting of the following.
   - Set up debt means an event to be recognized when there is debt setting-up or when a work unit has a creditor. For example, when there is goods receipt or when a expense reimbursement is established, the accounting principle considers that as an incurred account payable. Thus, a debt setting-up item has to be recorded in an accounting

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system, using an expense issuance voucher (IV) to enter an accounting item.

- Receive means an event to be recognized when there is cash reception. Cash reception data have to be recorded at the point when cash is really received. So, a cash reception item has to be recorded in an accounting system, using a receiving voucher (RV) to enter through an accounting item.
- Pay means an event to be recognized when there is a payment. Payment data have to be recorded at the point when the payment is really made. Thus, a payment item has to be recorded in an accounting system, using a paying voucher (PV) to enter through an accounting item.
- General-for acknowledgement means other events that have to be recognized apart from debt setting-up, money reception and payment, as well as an account adjustment. For example, when a work unit deposits cheques in a bank, a deposit item has to be recorded. Or when a work unit cancels goods received, an account adjustment item has to be recorded, using a general voucher (JV) to enter through the accounting item.

2. Actor or work unit comprises the following.

- MU Finance division means officers of MU central work units who are responsible for different working systems at the university level, consisting of the inventory system, budgeting system, as well as financial and accounting system. The officers' core duties are users of the systems at the university level, as well as supervise, follow up and monitor data of all work units within the university. Events carried out by the finance division's officers are, for instance, reception of money transferred through a bank from the Comptroller-General's Department, cheques payment made to work units, or direct payment to creditors on behalf of work units, etc.
- Work unit means officers of work units in the university, consisting of faculty/office/institute/ project taking care of working systems at the

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work unit level, comprising the inventory system, budgeting system, financial system and accounting system. Events performed by work units are, for example, expense reimbursement through procurement (purchase/hire), revenue reception, cheque payment made to creditors, etc.

- External government work units means work units outside Mahidol University such as the Comptroller-General's Department, Ministry of Finance. Events implemented by external government work units are, for instance, the Comptroller-General's Department makes direct payment to creditors on behalf of work units, etc.

❑ **Condition** means various conditions to be verified due to the effect to usage of accounting rules, for instance, event type, data type, expenses group, etc. The factor influencing event classification consists of two types based on the performance functions. Figure 3-10 reveals the structure of condition classification.

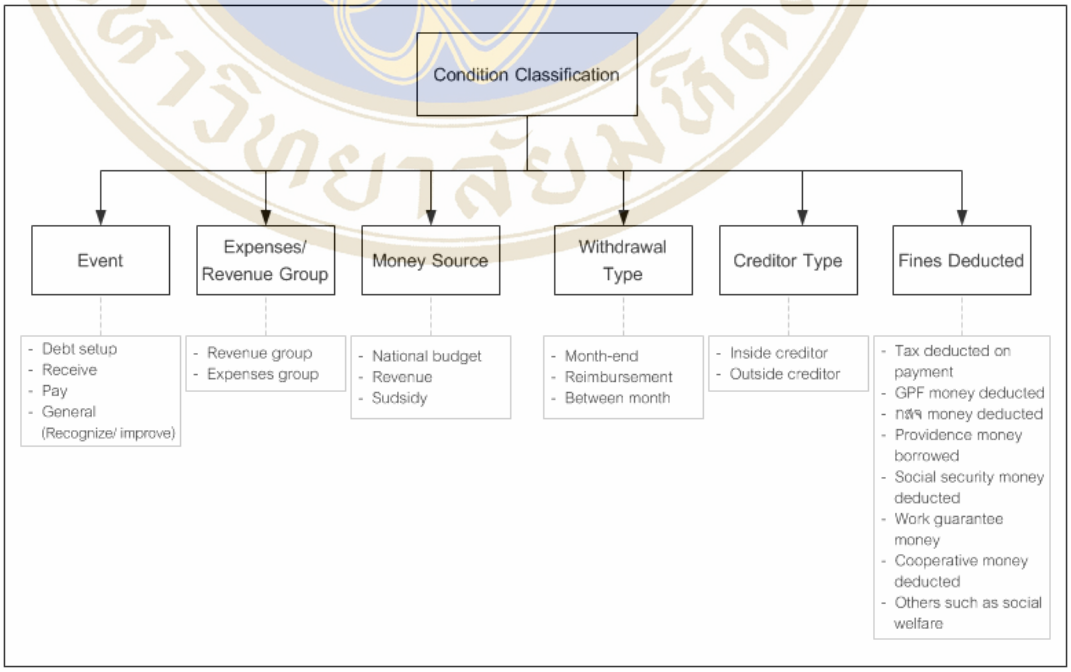

Figure 3-10 Structure of Conditions Classification

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Figure 3-10 illuatrates the classification of conditions to be verified to comply with the accounting rules of Mahidol University, and in compliance with an accrual accounting standard.

1. Event is the conditions to be verified, only for some events, for example, when a voucher is prepared to reimburse accrual salary, there will be a review of money deduction items such as GPF money deduction. However, the review of money deduction for GPF is not required in the cheque/cash deposited to bank process.
2. Revenue-Expenses group is a sub-expenses group for expenses reimbursement, and a revenue group for receiving revenue, for example, 1000 means salary, or 4110 means electricity expense, or 8300 means revenue from fines, etc.
3. Money source is a type of money source used in a withdrawal for payment or money reception. For Mahidol University, money is spent from three sources, namely, public budget derived from the government, public revenue received from work units, and subsidy-another type of public budget which is additionally obtained from the government in support of the operation of the university or its work units.
4. Withdrawal type is withdrawal of the university's expenses, for which a voucher for withdrawal of expenses from the budgeting system has to be prepared. For the stage of voucher preparation, the withdrawal type has to be identified, composed of an ordinary/month-end voucher, or a reimbursement voucher. This, of course, affects the accounting stage and rules. If it is withdrawal of normal or month-end expenses, there won't be debts set-up (IV) and the expenses or assets account is recorded. But if it is a reimbursement voucher, there will be debts set-up and an accrued account is recorded through an accrued payable voucher.
5. Creditor type consists of two types of external creditor and internal creditor or the university's staff or work units comprising government officials, permanent employees and temporary employees.
6. Fines deducted are items on deduction of money identified in an expenses withdrawal voucher, which are deduction items for which the

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accounting recorded has to be done for each events that has to be recognized, for instance, an item on tax deduction on payment or deducted FPF money or deducted social security money, etc.

In this stage, a decision tree technique is used to display overall conditions and the order of conditions to be verified. This technique enables the monitoring of completeness of conditions and the order that is swiftly and easily monitored, as illustrated in Figure 3-11.

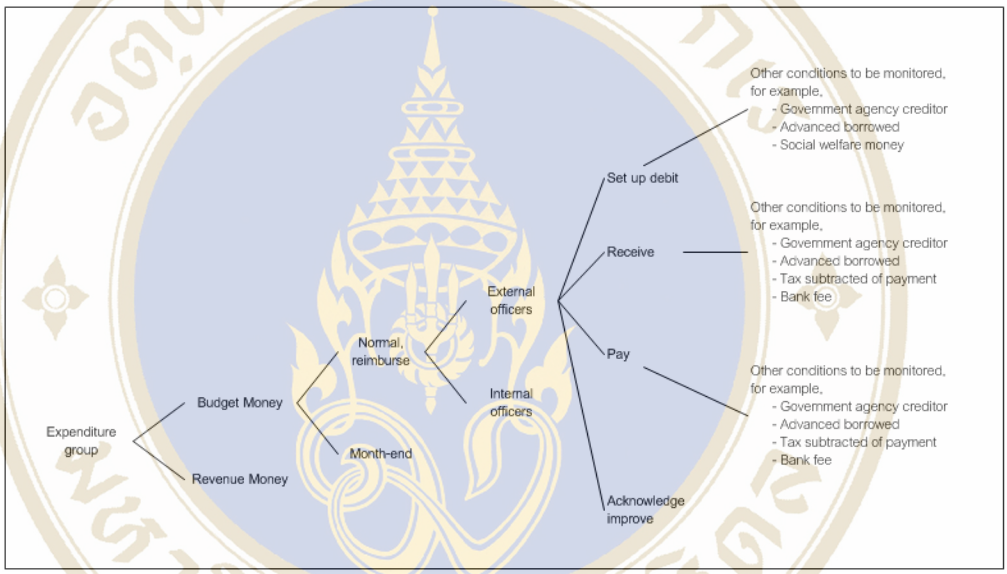

Figure 3-11 Reveal the Order of Conditions Verification to Use Accounting Rules

- **Action** is an action or the account recording based on the defined rules. An action or account recording is classified into two types based on the number of work units which need account recording, as revealed in Figure 3-12.

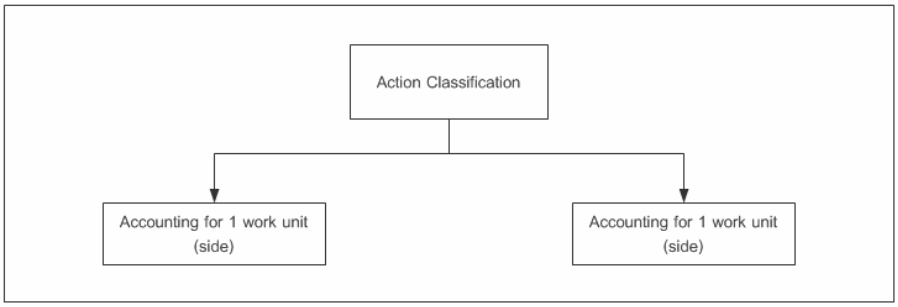

Figure 3-12 Structure of Action Classification or Accounting

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Figure 3-12 displays action classification or account recording based on the defined rules, in order to get correct data.

1. Accounting for one work unit (side) means an event affecting only a particular work unit and so the account recording is done only for that work unit, for example, debts set-up accounting from a work unit's goods and services receipt, or accounting for a work unit's reception of public revenue, or accounting of an item on the account adjustment from a work unit's cancellation of a voucher for expenses withdrawal, or a work unit's payment of cheques to its creditor, etc.
2. Accounting for two work units (sides) means an event impacting more than one work unit or an event that has to be recognized between work units, for instance, Mahidol University, through its finance division, makes a direct payment to its creditor on behalf of a work unit, or a work unit submits public revenue to the university, etc.

3.2.4 Applying Accounting Rules Implementation to MU Financial System

A process of creating an accounting rules database and developing the accounting rules management system (ARMS) to manage accounting rules comprises core data preparation, rules construction, process handler registration, and data inquiry to assist in following up and monitoring the performance.

3.2.5 Applying Accounting Rules Maintenance to MU Financial System

A process of maintaining accounting rules when there is a change in accounting rules consists of rules modification and cancellation via the accounting rules management system (ARMS).

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3.2.6 Applying Accounting Rules Execution to MU Financial System

A function used to process and execute accounting rules based on events that occur in various processes of the system is an automatic function and comprises two following important parts.

1. Rule Execution is used to process and execute accounting rules. Major stages include a reception of parameter data, verification of data and conditions, executing accounting rules, and passing on executed accounting rules to the next stage for further implementation.
2. Journal Posting is used to record accounting entries emerging through rules in the rule execution stage in a general journal via various types of vouchers, for example, work unit's debt setup is made via an expense reimbursement voucher (IV) or cheque payment to creditor is made via a payment voucher (PV).

3.2.7 Apply ECA rules to MU's Accounting Rules Database

The design and creation of accounting rules database in the form of ECA rules include three following significant parts.

1. Event means events related to accounting rules, for instance, when there is a goods reception, debts have to be set up by booking an expense reimbursement voucher, or when a work unit pays cheques to its creditor, the expenses have to be recorded in a payment voucher (PV), etc.
2. Condition means conditions, of data and events, to be verified in order to retrieve accounting rules that are correct as defined. Conditions to be verified include the following.
    - Reimbursed salary When there is a preparation of a voucher for expenses withdrawal, debt setup has to be recorded in the accrued payable account.
    - Utility expense. In reality, expenses have already occurred in that particular month. So, when the expenses are withdrawn for payment, debts set-up has to be recorded as accrued expenses (classified by type of utility expense)

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- For data of which the Government Officials' Pension Fund (GPF) money is deducted in the stage of withdrawal of reimbursed salary, debts set-up has to be recorded (Cr.) through an accounts payable account of other government agencies GPF, and GPF creditor has to be cleared off (Dr.) in the stage of payment-MU finance division pays cheques to a work unit.

3. Action means an action or accounting rules that is pertinent to events or conditions defined. For example, when a work unit makes a goods reception, debts has to be recorded by Dr. expenses or assets, and Cr. Accounts payable or accrued expenses, etc.

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3.3 Accounting Rules Data

Based on a study and collection of accounting rules data of MU's financial and accounting system, only for public budget, classified by event and revenue/expenses category, all rules data are revealed in the annex. This section displays examples of accounting rules data classified by event and general revenue/expenses category, excluding verification of other conditions as mentioned earlier, to demonstrate accounting entries in a general journal, based on the double entries principle accounting.

ON <Event> Work Unit – withdraw expenses via purchase/hire
IF <Condition> Expenses group = 4100 (Utility expenses)
THEN <Action> Account entries in a general journal through a voucher for expenses withdrawal (IV) as follow :

Dr. Other infrastructure fees (512049900)
Cr. Accrued infrastructure fee (212010000)

ON <Event> Work Unit – withdraw expenses not via purchase/hire
IF <Condition> Expenses group = 1100 (Position money for high-or middle ranking executive)
THEN <Action> Account entries in a general journal through a voucher for expenses withdrawal (IV) as follow :

Dr. Position money for high-or middle-ranking executive (511010200)
Cr. Accrued voucher (212020000)

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ON <Event> MU Finance division – receive money transferred to MU account from Comptroller-General's Department.

IF <Condition> Expenses group = 1100 (Position allowance for high-or middle-ranking executive).

THEN <Action> Account entries in a general journal through a reception voucher (RV) as follow :

Dr. Daily savings – Krung Thai Bank (Budget money) (111030102)

Cr. Deposit at MU Finance division (111020000)

ON <Event> Work Unit – acknowledge – reception of revenue from Comptroller-General's Department

IF <Condition> Expenses group = 1100 (Position allowance for high-or middle-ranking executive).

THEN <Action> Account entries in a general journal through a general voucher (JV) as follow :

Dr. Cash deposited at MU Finance division (111020000)

Cr. Revenue from personnel budget-salary budget (411010000)

ON <Event> MU Finance Division – pay cheques/transfer money to bank account to work unit.

IF <Condition> Expenses group = 1100 (Position allowance for high-or middle-ranking executive).

THEN <Action> Account entries in a general journal through a payment voucher (PV) as follow :

Dr. Cash deposited at MU Finance division (111020000)

Cr. Daily savings – Krung Thai Bank (Budget money) (111030102)

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ON <Event>	Work Unit – receive cheques from MU Finance division.
IF <Condition>	Expenses group = 1100 (Position allowance for high-or middle-ranking executive).
THEN <Action>	Account entries in a general journal through a reception voucher (RV) as follow :

Dr. Cash (111010100)

Cr. Cash deposited money at MU Finance division (111020000)

ON <Event>	Work Unit – deposit cheques/Cash in a bank.
IF <Condition>	Expenses group = 1100 (Position allowance for high-or middle-ranking executive).
THEN <Action>	Account entries in a general journal through a general voucher (JV) as follow :

Dr. Daily savings, Siam Commercial Bank (111050101)

Cr. Cash (111010100)

ON <Event>	Work Unit – pay cheques to creditors.
IF <Condition>	Expenses group = 1100 (Position allowance for high-or middle-ranking executive).
THEN <Action>	Account entries in a general journal through a payment voucher (PV) as follow :

Dr. Outstanding voucher (212020000)

Cr. Daily savings, Siam Commercial Bank (111050101)

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ON <Event> MU Finance division – pay directly to creditors on behalf of a work unit.

IF <Condition> Expenses group = 1100 (Position allowance for high-or middle-ranking executive).

THEN <Action> Account entries in a general journal through a payment voucher (PV) as follow :

Dr. Cash deposited money at MU Finance division (111020000)

Cr. Daily savings – Krung Thai Bank (Budget money) (111030102)

ON <Event> Work Unit – acknowledge – MU Finance division pays directly to creditors on behalf of work unit.

IF <Condition> Expenses group = 4110 (Power fee)

THEN <Action> Account entries in a general journal through a general voucher (JV) as follow :

Dr. Accrued electricity expense (212010100)

Cr. Cash deposited money at MU Finance division (111020000)

ON <Event> Work Unit – receive public revenue.

IF <Condition> Revenue group = 6420 (Revenue from miscellaneous sale)

THEN <Action> Account entries in a general journal through a receive voucher (RV) as follow :

Dr. Cash (111010100)

Cr. Revenue from miscellaneous sale (461010000)

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ON <Event> Work Unit – submit public revenue to MU Finance division

IF <Condition> Revenue group = 6420 (Revenue from miscellaneous sale)

THEN <Action> Account entries in a general journal through a payment voucher (PV) as follow :

Dr. Cash deposited money at MU Finance division (111020000)

Cr. Cash (111010100)

ON <Event> MU Finance division – receive public revenue from work unit

IF <Condition> Revenue group = 6420 (Revenue from miscellaneous sale)

THEN <Action> Account entries in a general journal through a receive voucher (RV) as follow :

Dr. Cash (111010100)

Cr. Cash deposited money at MU Finance division (111020000)

ON <Event> MU Finance division – submit national revenue to Finance Ministry

IF <Condition> Revenue group = 6420 (Revenue from miscellaneous sale)

THEN <Action> Account entries in a general journal through a payment voucher (PV) as follow :

Dr. Cash deposited money at MU Finance division (111020000)

Cr. Cash (111010100)

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ON <Event> Work Unit – acknowledge – submission of national revenue to Finance Ministry

IF <Condition> Revenue group = 6420 (Revenue from miscellaneous sale)

THEN <Action> Account entries in a general journal through a general voucher (JV) as follow :

Dr. Revenue from miscellaneous sale, submitted to Finance Ministry (531010000)

Cr. Cash deposited money at MU Finance division (111020000)

ON <Event> Work Unit – receive overdrawn and returned money

IF <Condition> Expenses group = 1100 (Position allowance for high-or middle-ranking executive).

THEN <Action> Account entries in a general journal through a receive voucher (RV) as follow :

Dr. Cash (111010100)

Cr. Position allowance for high-or middle-ranking Executive (511010200)

ON <Event> Work Unit acknowledge – submission of overdrawn and returned money to Finance Ministry

IF <Condition> Expenses group = 1100 (Position allowance for high-or middle-ranking executive).

THEN <Action> Account entries in a general journal through a general voucher (JV) as follow :

Dr. Revenue from personnel budget- salary budget (411010000)

Cr. Cash deposited money at MU Finance division (111020000)

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CHAPTER IV
ARMS ANALYSIS AND DESIGN

In chapter 3, we have studied the implementation steps and problems found in Mahidol University's financial and accounting system. This research project applies the designed Accounting Rules Management Framework (ARMF) to accounting rules data problems of MU financial and accounting system. This chapter discusses the analysis and design of the Accounting Rules Management System (ARMS) developed with an application of the techniques of ECA rules and business rules management system described in chapter 2. Figure 4-1 illustrates the architecture of the Accounting Rules Management System (ARMS).

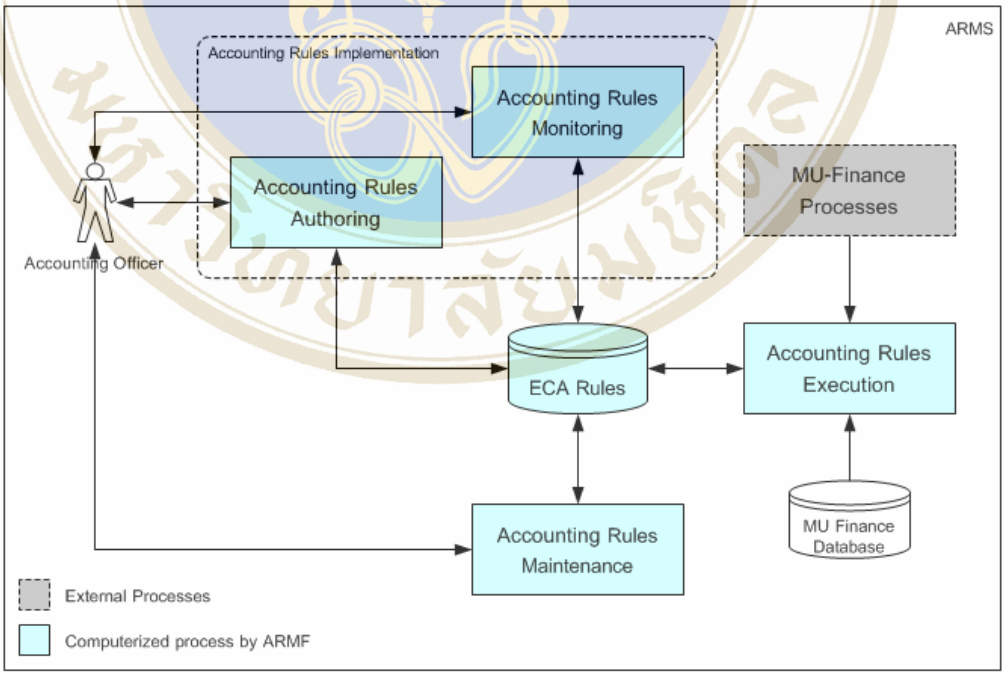

Figure 4-1 The Architecture of the Accounting Rules Management System (ARMS)

Figure 4-1 reveals the architecture of the Accounting Rules Management System (ARMS) using the principle of use case analysis. A technique of ECA rules is applied to the design of accounting rules.

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4.1 Use Case Modeling

Figure 4-2 illustrates the high-level use case of the Accounting Rules Management System (ARMS).

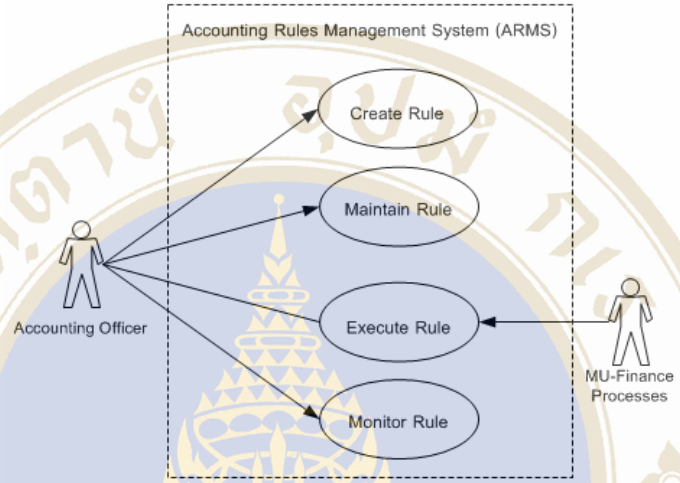

Figure 4-2 The High-Level Use Case of the Accounting Rules Management System (ARMS)

Based on Figure 4-2, the high-level use case of the ARMS consists of two following parts.

1. Performance function comprises four functions, namely, create rules, maintain rules, execute rules and monitor rules.
2. Actors consist of the following:
    - Accounting Officer is an officer having precise and accurate knowledge and understanding of an accrual basis.
    - MU Finance Processes are external process related to account recording, for instance, debts set-up accounting from voucher reimbursing expenses in the budgeting system, or money reception accounting in the financial system's cheque reception, or payment made for cheque paid to accounts payable in the financial system, etc.

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Table 4.1 Use Case Specification of Create Rule

Name	**Create Rule**	
Actors	Accounting Officer	
Entry Condition	When there is an addition of core data or new rules, rule analysis and design which is a manual process has to be made first. In case of added events, registration of the process using rules has to be made.	
Flow of Events	**Actor**	**System**
	1. Select data type required. 2. Fill in data detail. 3. Verify rule conditions, data accuracy and completeness, and record data.	4. Verify accuracy and completeness of data recorded. In case they are not correct, display warning message. 5. Collect data in a related table.
Exit Condition	Rules are recorded and can be executed when triggered or rules can be modified.	
Exceptions	In case data are incorrectly or incompletely recorded, they have to be corrected, for example, when events are added, registration has to be made for the process using rules via those events.	
Special Requirements	-	

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Table 4.2 Use Case Specification of Maintain Rule

Name	**Maintain Rule**	
Actors	Accounting Officer	
Entry Condition	Modify data or cancel accounting rules.	
Flow of Events	**Actor**	**System**
	1. Search data based on conditions.	
		2. Display data based on conditions.
	3. In case of modification, fill in details of modified data. 4. In case of cancellation, fill in reasons for cancellation. 5. Verify accuracy & completeness of data and record data.	
		6. Monitor the status of data retrieval and display message when modified or cancelled rules are in working status. 7. Verify accuracy and completeness of data recorded, for example, in case of cancellation, reasons for cancellation have to be identified. 8. Record data and modify data status in a related table in the database.

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Table 4.2 Use Case Specification of Maintain Rule (cont.)

Name	**Execute Rule**
Exit Condition	Rules are modified or cancelled and recorded, and can be executed when triggered, or data can be retrieved for modification.
Exceptions	In case data have to be modified or cancelled, such as rules in the "executed" status, a notified a message will be display.
Special Requirements	-

Table 4.3 Use Case Specification of Execute Rule

Name	**Execute Rule**	
Actors	MU-Finance Process	
Entry Condition	Retrieve Rules based on Events happening in various processes of the system, for instance, when data are recorded on making a voucher for reimbursed expenses in the budgeting system, or when data are recorded for cheque reception-payment in the financial system, etc.	
Flow of Events	**Actor**	**System**
	1. Send a parameter via an event happening in the system's processes.	2. Verify completeness and accuracy of the parameter received. In case of incorrectness, display a warning message. 3. Verify defined conditions, based on events, and retrieve rules.

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Table 4.3 Use Case Specification of Execute Rule (cont.)

Name	**Execute Rule**	
Flow of Events	**Actor**	**System**
		4. Record in general journal, based on rules obtained from a related table. 5. Display accounting rules entries on the screen.
	6. Verify completeness and accuracy of accounting data.	display a warning message.
Exit Condition	Rules are executed and accounting data are recorded based on derived rules, and MU-Finance Processes can retrieve accounting data in order to print out a voucher.	
Exceptions	In case rules execution faces a problem, such as rules are not found, a message will be displayed.	
Special Requirements	-	

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Table 4.4 Use Case Specification of Monitor Rule

Name	**Monitor Rule**	
Actors	Accounting Officer	
Entry Condition	Inquire data in order to monitor and follow up data.	
Flow of Events	**Actor**	**System**
	1. Select data type or report required based on conditions. 4. Verify data on screen and/or printout via a printer.	2. Search, monitor and process data based on defined conditions. 3. Display data on screen.
Exit Condition	Obtain data or a report based on conditions.	
Exceptions	In case data are not found under conditions, display a message.	
Special Requirements	-	

4.1.1 Accounting Rules Authoring is a function used to manage accounting rules data, consisting of three functions : data preparation, rules generation and registration of events occurring in a working system's processes. Figure 4-3 illustrates the use case diagram of author rule.

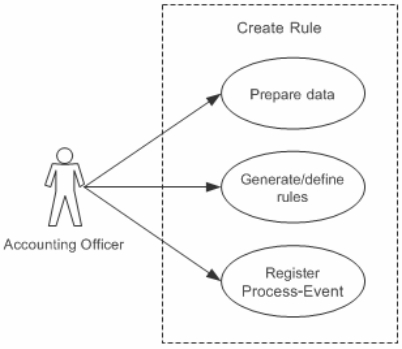

Figure 4-3 A Use Case Diagram of Create Rule

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Table 4.5 Use Case Specification of Prepare Data

Name	**Prepare Data**	
Actors	Accounting Officer	
Entry Condition	Add core data such as events or conditions to be verified in expenses-revenue category.	
Flow of Events	**Actor**	**System**
	1. Select data type need to be added. 2. Fill in data detail. 3. Verify accuracy and completeness of data, and record data.	4. Verify accuracy and completeness of data. In case of incorrect data, display a message. 5. Record data in a related table in the database.
Exit Condition	Data are recorded and can be retrieved for modification, or used to generate rules.	
Exceptions	In case data are incorrectly or incompletely recorded, they have to be corrected.	
Special Requirements	-	

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Table 4.6 Use Case Specification of Generate/Define Rules

Name	**Generate/Define Rules**	
Actors	Accounting Officer	
Entry Condition	Before new rules are added, rule analysis and design which is a manual process has to be made.	
Flow of Events	**Actor**	**System**
	1. Select events. 2. Define conditions. 3. Define double accounting entries that have to be recorded. 4. Verify accuracy and completeness of data, and record data.	5. Verify accuracy & completeness of data recorded. In case of incomplete or incorrect data, display a message. 6. Record data in a related table in the database.
Exit Condition	Rules are recorded and can be executed when triggered, or can be retrieved for modification.	
Exceptions	In case rules are incorrectly or incompletely defined, they will be monitored and corrected so that they are in accordance with events, conditions and double accounting entries that have to be recorded.	
Special Requirements	-	

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Table 4.7 Use Case Specification of Registration of Process-Event

Name	**Registration of Process-Event**	
Actors	Accounting Officer	
Entry Condition	When there is an addition of events or processes which have to make accounting entries.	
Flow of Events	**Actor**	**System**
	1. Fill in data detail of processes. 3. Select events. 4. Verify accuracy & completeness of data, and record data.	2. Display event data based on conditions. 5. Verify accuracy & completeness of data. In case of incorrect or incomplete data, display a message. 6. Record data in a related table in the database.
Exit Condition	Data are recorded or can be retrieved for modification.	
Exceptions	In case data are incorrectly or incompletely recorded, they have to be corrected.	
Special Requirements	-	

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4.1.2 Accounting Rules Maintenance is a function used to maintain accounting rules, consisting of two functions, namely, modify rules and cancel rules. Figure 4-4 illustrates a use case diagram of maintain rules.

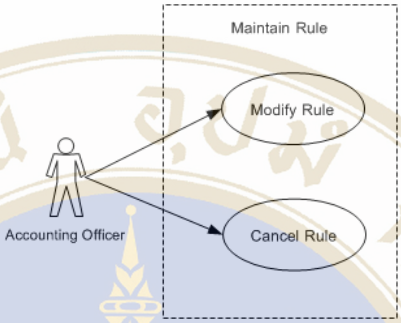

Figure 4-4 A Use Case Diagram of Maintain Rule

Table 4.8 Use Case Specification of Modify Rule

Name	**Modify Rules**	
Actors	Accounting Officer	
Entry Condition	Modify Accounting Rules data	
Flow of Events	**Actor**	**System**
	1. Retrieve data based on conditions.	
		2. Display data based on conditions.
	3. Fill in details of data that need to be modified.	
	4. Verify accuracy & completeness of data, and record data.	
		5. Monitor the status of data retrieval and display a message when modified rules are in working status.

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Table 4.8 Use Case Specification of Modify Rule (cont.)

Name	**Modify Rules**	
Flow of Events	**Actor**	**System**
		6. Verify accuracy & completeness of data modified. 7. Record data in a related table in the database.
Exit Condition	Rules are modified and recorded and can be executed when triggered, or data can be retrieved for modification.	
Exceptions	In case data need to be modified, for instance, rules are in the "executed" status, a message will be displayed.	
Special Requirements	-	

Table 4.9 Use Case Specification of Cancel Rule

Name	**Cancel Rules**	
Actors	Accounting Officer	
Entry Condition	Cancel Accounting rules.	
Flow of Events	**Actor**	**System**
	1. Search data based on conditions. 3. Fill in details of rules cancellation. 4. Verify accuracy & completeness of data, and record data.	2. Display data based on conditions.

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Table 4.9 Use Case Specification of Cancel Rule (cont.)

Name	**Cancel Rules**	
Flow of Events	**Actor**	**System**
		5. Monitor the status of data retrieval and display a message when cancelled rules are in working status. 6. Verify accuracy & completeness of data recorded. In case of incorrect or incomplete data, display a message. 7. Record data in a related table in the database.
Exit Condition	Rules are cancelled and recorded and cannot be executed when trigged.	
Exceptions	In case data that need to be cancelled, for example, rules are in the "executed" status, a notified message will be displayed.	
Special Requirements	-	

4.1.3 Accounting Rules Execution is a function used to process and retrieve rules through events occurring in the system's various processes, comprising two functions : execute rules and post journal. The testing is conducted via processes and data simulated from a real working system, only for the part related to the research project, composed of data on a voucher for expenses reimbursement not via purchase/hire process in the budgeting system, and data on money reception-payment of the financial system. A use case diagram of execute rules is illustrated in Figure 4-5.

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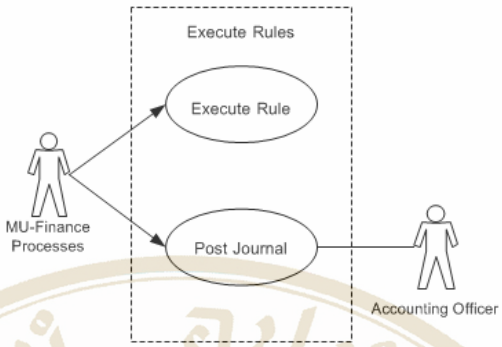

Figure 4-5 A Use Case Diagram of Execute Rules

Table 4.10 Use Case Specification of Execute Rules

Name	**Execute Rules**	
Actors	MU-Finance Process	
Entry Condition	Retrieve rules corresponding to events happening in the system's processes, for instance, when the cheque reception-payment of the financial system is recorded, etc.	
Flow of Events	**Actor**	**System**
	1. Send parameters via events occurring in the system's processes.	2. Verify data with parameters sent through in order to be used to execute rules. 3. Verify conditions defined, based on events, and execute rules. 4. Pass on rule number obtained to the next process.
Exit Condition	Rules are executed and can be retrieved based on events happening in MU-Finance Process.	
Exceptions	In case of problems in rule execution, such as no rules found, a message will be displayed.	
Special Requirements	-	

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Table 4.11 Use Case Specification of Post Journal

Name	**Post Journal**	
Actors	MU-Finance Process	
Entry Condition	Already receive rules executed based on events.	
Flow of Events	**Actor**	**System**
	5. Verify accounting data.	1. Obtain data on rule number received from the previous process. 2. Retrieve data or a double entries based on rules derived. 3. Record in a general journal, based on rules received, in the database. 4. Display accounting data on screen.
Exit Condition	Record in a general journal, while MU-Finance Processes can retrieve data so as to print out a voucher.	
Exceptions	In case of problems in rule execution, for example, rules are not found, it will not be recorded in a general daily account book.	
Special Requirements	-	

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4.1.4 Accounting Rules Monitoring is a function used to inquire accounting rules in different viewpoints in order to verify and follow up data. Figure 4-6 illustrates a use case diagram of monitor rules.

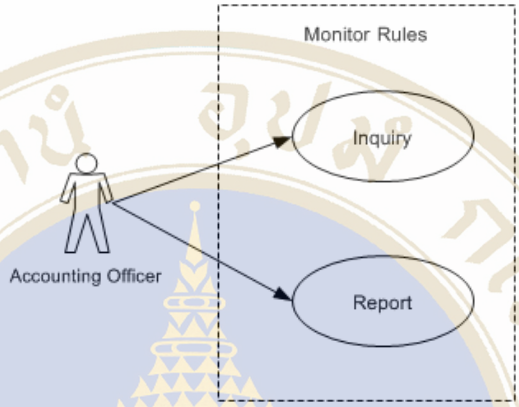

Figure 4-6 A Use Case Diagram of Monitor Rules

Table 4.12 Use Case Specification of Inquiry

Name	**Inquiry**	
Actors	Accounting Officer	
Entry Condition	Inquire data in order to be used to monitor and follow up data.	
Flow of Events	**Actor**	**System**
	1. Select required data type, based on conditions. 4. Monitor data on screen.	2. Monitor data based on conditions. 3. Display data on screen.
Exit Condition	Accounting Officer can monitor searched data, based on conditions, on screen.	
Exceptions	In case data are not found, based on conditions searched, a message will be displayed.	
Special Requirements	-	

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Table 4.13 Use Case Specification of Report

Name	**Report**	
Actors	Accounting Officer	
Entry Condition	Inquire data in order to be used to monitor and follow up data.	
Flow of Events	**Actor**	**System**
	1. Select report type required, based on conditions. 4. Monitor the report on screen and/or print out by a printer.	2. Monitor and process data based on conditions. 3. Display a report on screen.
Exit Condition	Accounting Officer can monitor a report on screen based on conditions, and print out the report by a printer.	
Exceptions	In case data are not found, based on conditions searched, a message will be displayed.	
Special Requirements	-	

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4.2 Process Modeling

Based on a study and analysis, we can design the (performance) function of the Accounting Rules Management System (ARMS) consisting of four main functions. Figure 4-7 illustrates the functional structure chart of the ARMS.

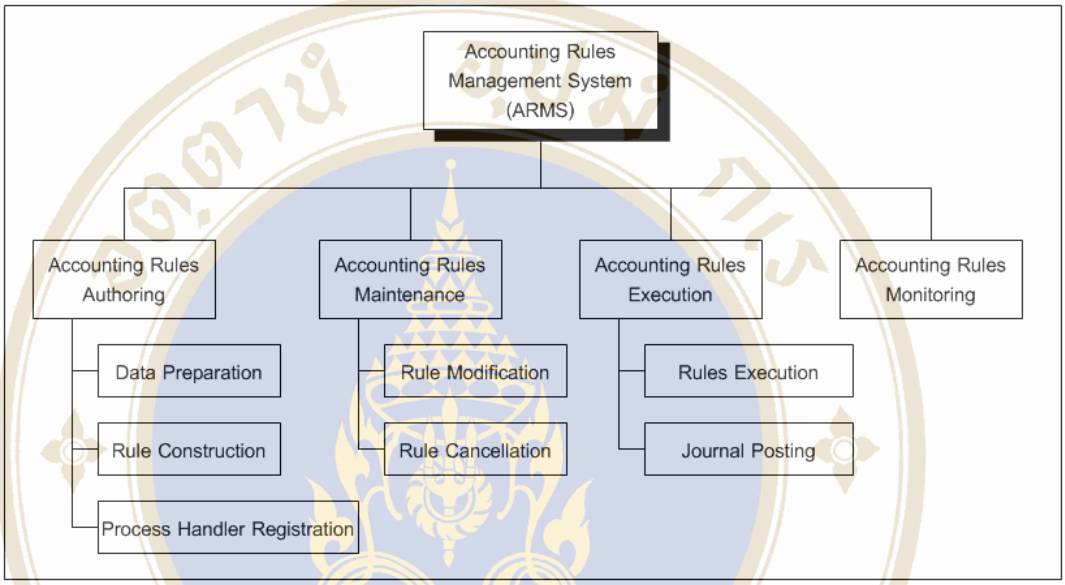

Figure 4-7 Major Functional Processes of the Accounting Rules Management System (ARMS)

Figure 4-7 displays all major (performance) functions of the ARMS, which can be explained in the form of a data flow diagram as the following :

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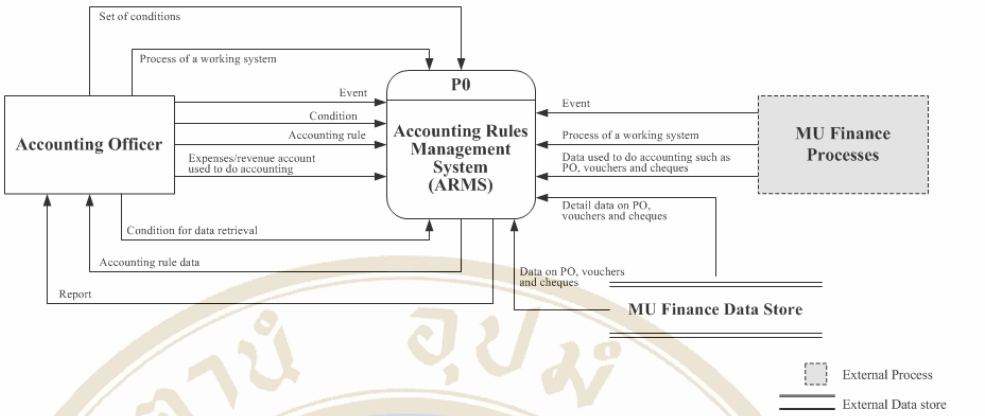

Figure 4-8 A Context Diagram of the Accounting Rules Management System (ARMS)

From Figure 4-7, level 1 of the data flow diagram indicating the system's core performance functions, is shown in Figure 4-9.

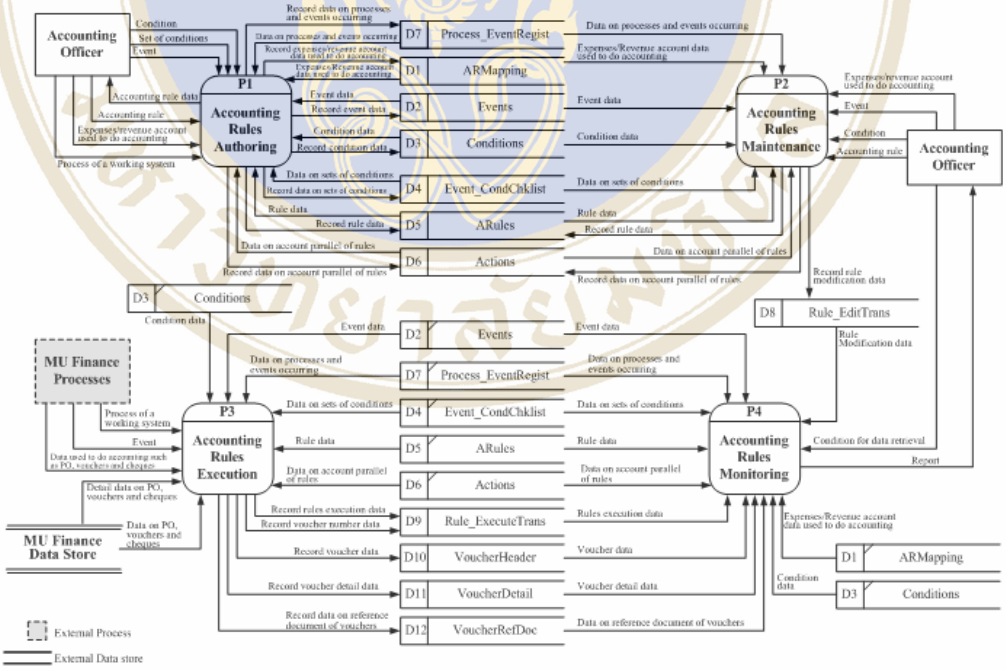

Figure 4-9 Data Flow Diagram Level 1 of the Accounting Rules Management System (ARMS)

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Based on Figure 4-9, the system's core performance functions include the following :

- **P1 Accounting Rules Authoring** is a function used to manage accounting rules. The performance comprises three significant parts, namely, data preparation, rules construction and process handler registration.
- **P2 Accounting Rules Maintenance** is a function used to oversee the accounting rules database, consisting of rules modification and cancellation. The system will record details of rules modification so as to be used as data for monitoring and following up data.
- **P3 Accounting Rules Execution** is a function used to execute rules happening based on events in the system's processes, including journal posting.
- **P4 Accounting Rules Monitoring** is a function used to inquire data in different viewpoints to monitor data such as core data, data for accounting rules retrieval or conditions that have to be monitored for each data type in each event, including producing related reports.

4.2.1 Accounting Rules Authoring

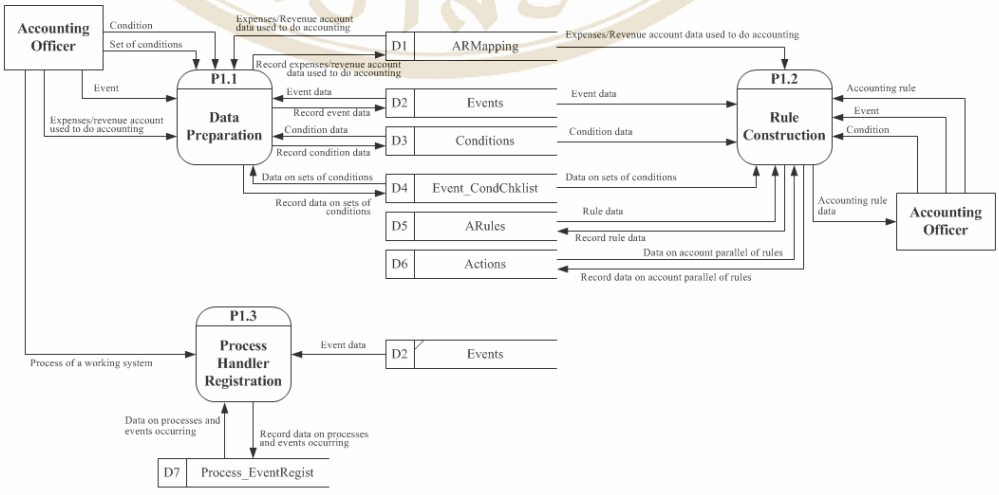

Figure 4-10 Data Flow Diagram Level 2 of the Accounting Rules Authoring

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From Figure 4-10, performance functions of the accounting rules authoring are mainly responsible for managing accounting rules, including related core data so that data are accurate and up-to-date. The functions include the following :

- **P1.1 Data Preparation** is a function used to prepare main data related to the accounting rules determination, consisting of data on mapping the account with expenses or revenue group, event data, and conditions that need to be monitored for each event, etc.
- **P1.2 Rules Construction** is a function used to define accounting rules classified by event, expenses or revenue group, and work unit, for example, debts set-up rule to reimburse compensation expenses, rule of public revenue reception, rule of cheque payment to creditors, etc.
- **P1.3 Process Handler Registration** is a function used to register data on events happening in the working system's processes so as to be used to retrieve rules in the process, which can retrieve only the event that has been registered. This allows for a control, follow-up and monitoring of data to verify the processes impacted from a change in accounting rules. Or when accounting rules are erroneous, they can retrospect to find process and rule through which data have been recorded.

4.2.2 Accounting Rules Maintenance is a function used to modify accounting rules. The function includes rules modification and cancellation. The system will keep details related to modification in order to be used as referenced data for subsequent monitoring.

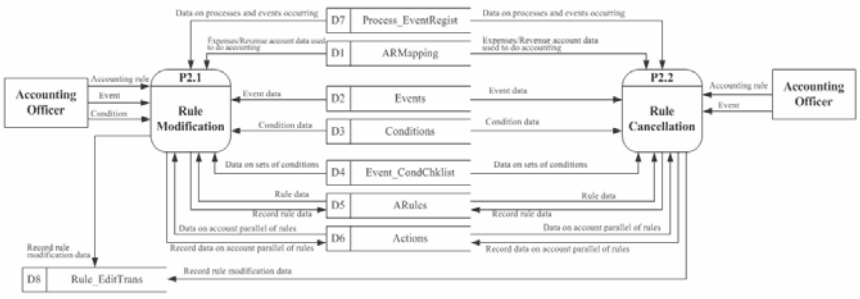

Figure 4-11 Data Flow Diagram Level 2 of the Accounting Rules Maintenance

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4.2.3 Accounting Rules Execution

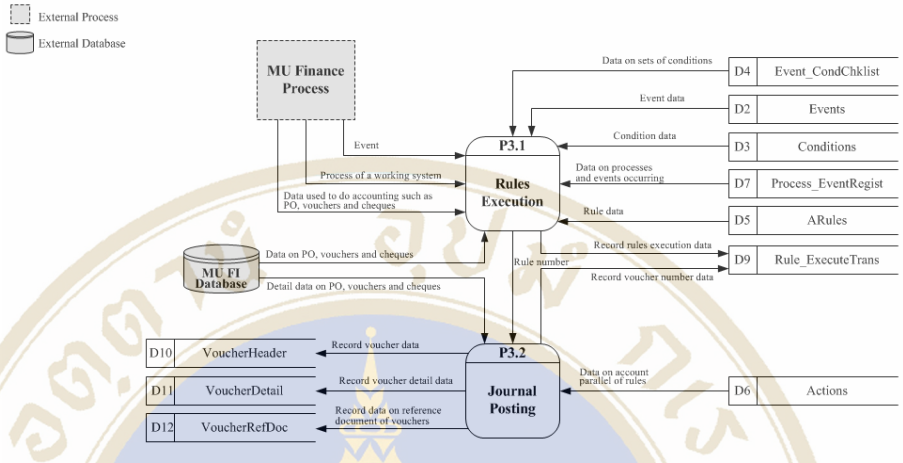

Figure 4-12 Data Flow Diagram Level 2 of the Accounting Rules Execution

From Figure 4-12, the accounting rules execution is a process used to execute rules, based on events occurring in the system's processes. For this research project, the process is used to monitor the accuracy of accounting rules retrieval. The performance testing is conducted via rules retrieval, and based on a simulation of data in related working systems, through various events. The functions include the following :

- **P3.1 Rules Execution** is a function used to execute rules. It consists of following major performance. Receive defined parameters, such as data type, financial sources, document number like voucher number, etc. Then, the program will verify the defined conditions retrieve rules, and pass on data to the next process, consequently.
- **P3.2 Journal Posting** is a function used to obtain accounting rules derived from the stage of rules execution, retrieve rules and book in a general journal via a voucher corresponding with the event type, and then record data in a related table in the database.

4.2.4 Accounting Rules Monitoring from Figure 4-9, the rules monitoring is a function for data inquiry to monitor data in different viewpoints, including making related reports.

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4.3 Data Modeling

Based on the analysis of functional stages of the Accounting Rules Management System (ARMS), this section explains data modeling using an entity-relationship (E-R) diagram to display the working system's conceptual design. Here, the data are divided into two parts as follows :

1. Data of the financial system of MU (see details in an appendix C)
2. Data of the Accounting Rules Management System (ARMS)

4.3.1 Design of Database of Accounting Rules Management System (ARMS)

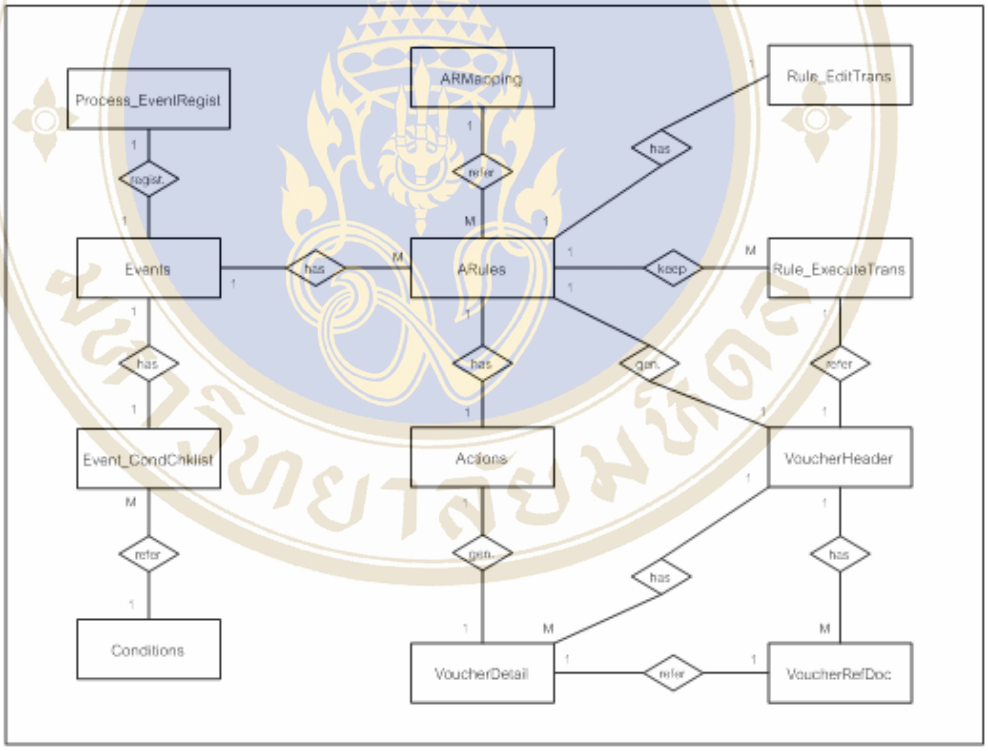

Figure 4-13 An E-R Diagram of the Accounting Rules Management System (ARMS)

Figure 4-13 illustrates an E-R diagram of rules data of the ARMS. A summary table of data showing relationship, classified into ๓ groups of data, which are master files, transaction files and table files, are given in Table 4.14.

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Table 4.14 Names of Tables of Data Related to ARMS

Table File

Order	Table Name	Explanation
1	ARMAPPING	Data file of account code mapping in the revenue-expenses category.
2	EVENTS	Data file of events
3	CONDITIONDS	Data file of conditions
4	EVENT_CONDCHKLIST	Data file of sets of conditions to be monitored in each event.
5	ARULES	Data file of accounting rules.
6	ACTIONS	Data file of details of accounting rules.
7	PROCESS_EVENTREGIST	Data file of registration of incurred events in the system's processes, needs a booking.

Transaction File

Order	Table Name	Explanation
1	RULE_EDITTRANS	Data file of details of a change in accounting rules.
2	RULE_EXECUTETRANS	Data file of details of rules execution.
3	VOUCHERHEADER	Data file of vouchers to be recorded.
4	VOUCHERDETAIL	Data file of details of accounting items made in a general journal.
5	VOUCHERREFDOC	Data file of document controlled registration used in accounting booking.

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4.3.2 Database Schema of Accounting Rules Management System (ARMS)

From Figure 4-13, an E-R diagram can be mapped toward the relational database schema, which reveals components of each table in the form of fields (the underlined attribute means a primary key while italic attribute means a foreign key) shown below. The schema details are explained in section 4.3.3.

Table Name : ARMAPPING

RMAINCODE	**RSUBCODE**	**RTYPE**	MONEYTYPE
BUDGETYEAR	DESCRIPTION	INCOME_ ACCID	EXPENSE_ ACCID
CURSTATUS	VERSION	STARTDATE	EXPRIREDATE
CREATEDATE	CREATEBY		

Table Name : EVENTS

EVENTID	EVENTTYPE	EVENTNAME	DESCRIPTION
MONEYTYPE	OWNER	CURSTATUS	CREATEDATE
CREATEBY			

Table Name : CONDITIONS

CONDITIONID	CONDITION NAME	ACCTID	PAYCODE
MONEYTYPE	CURSTATUS	CREATEDATE	CREATEBY

Table Name : EVENT_CONDCHKLIST

EVENTID	**CONDITIONID**	NOTE	CURSTATUS
CREATEDATE			

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Table Name : ARULES

ARULEID	**VERSION**	ACTIONBY	EVENTID
MONEYTYPE	OWNER	OWNERDOC	EFFECTDEPT
EFFECTDOC	CURSTATUS	DESCRIPTION	STARTDATE
EXPIREDATE	CREATEDATE	CREATEBY	

Table Name : ACTIONS

ARULEID	**VERSION**	**OWNER**	**DOCTYPE**
POSTORDER	POSTTYPE	POSTBY	DESCRIPTION

Table Name : PROCESS_EVENTREGIST

PROCESSID	**EVENTID**	PROCESSNAME	APPLNAME
MODULENAME	CURSTATUS	DESCRIPTION	STARTDATE
EXPIREDATE	CREATEDATE	CREATEBY	

Table Name : RULE_EDITTRANS

ARULEID	**VERSION**	TRANSTYPE	DESCRIPTION
APPROVEBY	OLDDATA	CREATEDATE	CREATEBY

Table Name : RULE_EXECUTETRANS

TRANSID	PROCESSID	EVENTID	ARULEID
EXECUTESTS	VOUTYPE	VOUCHERID	VOUCHER DATE
DESCRIPTION	DATAREF	CREATEDATE	CREATEBY

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Table Name : VOUCHERHEADER

VOUCHER DATE	**VOUCHERID**	MONEYTYPE	CURSTATUS
PREPARER	VOUREFNO	VOUFROM	PRINTEDDATE
DESCRIPTION	DATAREF	CREATEDATE	CREATEBY

Table Name : VOUCHERDETAIL

VOUCHER DATE	**VOUCHERID**	**DOCREFNO**	**ORDERID**
TYPE	ACCTCODE	SUBACCTCODE	AMOUNT
DEPTCODE	FUND_ID	CAP_ID	YEARCAP
MAINCOST	EXP_ID	PLAN_ID	JOB_ID
ACT_ID	TASK_ID	NOTE	

Table Name : VOUCHERREFDOC

BGYEAR	**TRANSNO**	**VOUTYPE**	**VOUCHER DATE**
VOUCHERID	**DOCREFNO**	DOCREFBG YEAR	DOCREFFA YEAR
CURSTATUS			

4.3.3 Structure of Data File of the Accounting Rules Management System (ARMS)

Based on the design of an E-R diagram and relational database schema of the Accounting Rules Management System (ARMS), details of data file structure are shown below.

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File Name : ARMAPPING

Description: Record data on mapping account code in revenue- expenses category

File Type : Master File

Primary key : RMAINCOD, RSUBCODE

No.	Field Name	Description	Type	Length	Key
1	RMAINCODE	Code of major group of expenses / revenue	Varchar	4	PK
2	RSUBCODE	Code of minor group of expenses / revenue	Varchar	4	PK
3	RTYPE	Type	Varchar	2	
4	MONEYTYPE	Financial source	Varchar	3	
5	BUDGET YEAR	Fiscal year	Varchar	2	
6	DESCRIPTION	Details or explanations	Varchar	100	
7	INCOME_ ACCID	Code of account recorded for income reception	Varchar	9	FK
8	EXPENSE_ ACCID	Code of account recorded for expenses	Varchar	9	FK
9	CURSTATUS	Data status	Varchar	1	
10	VERSION	Version	Tinyint	1	
11	STARTDATE	Start date	Datetime	8	
12	EXPRIRE DATE	End date	Datetime	8	
13	CREATEDATE	Date on which data are recorded	Datetime	8	
14	CREATEBY	Name of data recorder	Varchar	5	

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File Name : EVENTS

Description: Record event data

File Type : Master File

Primary key : EVENTID

No.	Field Name	Description	Type	Length	Key
1	EVENTID	Event code	Varchar	3	PK
2	EVENTTYPE	Event type	Varchar	2	
3	EVENTNAME	Event name	Varchar	70	
4	DESCRIPTION	Details or explanations	Varchar	100	
5	MONEYTYPE	Financial source	Varchar	3	
6	OWNER	Code of fines deducted	Varchar	2	
7	CURSTATUS	Data status	Varchar	1	
8	CREATEDATE	Date on which data are recorded	Datetime	8	
9	CREATEBY	Name of data recorder	Varchar	5	

File Name : CONDITIONS

Description: Record condition data

File Type : Master File

Primary key : CONDITIONID

No.	Field Name	Description	Type	Length	Key
1	CONDITIONID	Condition code	Varchar	2	PK
2	CONDITION NAME	Condition name or explanations	Varchar	70	
3	ACCTID	Account code used for accounting	Varchar	9	
4	PAYCODE	Code of fines deducted	Varchar	2	FK
5	MONEYTYPE	Financial source	Varchar	3	
6	CURSTATUS	Data status	Varchar	1	

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No.	Field Name	Description	Type	Length	Key
7	CREATEDATE	Date on which data are recorded	Datetime	8	
8	CREATEBY	Name of data recorder	Varchar	5	

File Name : EVENT_CONDCHKLIST

Description: Record data on sets of conditions to be monitored in each event

File Type : Master File

Primary key : EVENTID , CONDITIONID

No.	Field Name	Description	Type	Length	Key
1	EVENTID	Event code	Varchar	2	PK
2	CONDITIONID	Condition code	Varchar	2	PK
3	CURSTATUS	Data status	Varchar	1	
4	NOTE	Details	Varchar	50	

File Name : ARULES

Description: Record accounting rules data

File Type : Master File

Primary key : ARULEID, VERSION

No.	Field Name	Description	Type	Length	Key
1	ARULEID	Rule number	Varchar	4	PK
2	VERSION	Version	Tinyint	1	PK
3	ACTIONBY	Accounting made by	Varchar	1	
4	EVENTID	Event code	Varchar	3	
5	MONEYTYPE	Financial source	Varchar	3	
6	OWNER	Work unit where events occurred	Varchar	2	
7	OWNERDOC	Type of document used for account recording	Varchar	2	

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No.	Field Name	Description	Type	Length	Key
8	EFFECTDEPT	Inter-units	Varchar	2	
9	EFFECTDOC	Type of document used to record reciprocal transaction	Varchar	2	
10	CURSTATUS	Data status	Varchar	1	
11	DESCRIPTION	Details or explanations	Varchar	100	
12	STARTDATE	Start date	Datetime	8	
13	EXPRIRE DATE	End date	Datetime	8	
14	CREATEDATE	Date on which data are recorded	Datetime	8	
15	CREATEBY	Name of data recorder	Varchar	5	

File Name : ACTIONS

Description: Record details of accounting rules data

File Type : Master File

Primary key : ARULEID, VERSION, OWNER, DOCTYPE, POSTORDER

No.	Field Name	Description	Type	Length	Key
1	ARULEID	Rule number	Varchar	4	PK
2	VERSION	Version	Tinyint	1	PK
3	OWNER	Work unit where events occur	Varchar	2	PK
4	DOCTYPE	Document type	Varchar	2	PK
5	POSTORDER	Order	Tinyint	1	PK
6	POSTTYPE	Recording type	Varchar	1	
7	POSTBY	Data recorded	Varchar	9	
8	DESCRIPTION	Details or explanations	Tinyint	100	

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File Name : PROCESS_EVENTREGIST

Description: Record data on registration of events that need to record accounting entries in the systems' process

File Type : Master File

Primary key : PROCESSID, EVENTID

No.	Field Name	Description	Type	Length	Key
1	PROCESSID	Process number	Varchar	4	PK
2	EVENTID	Event code	Varchar	4	PK
3	PROCESS NAME	Process name	Varchar	50	
4	APPLNAME	System name	Varchar	50	
5	MODULE NAME	Module name	Varchar	50	
6	CURSTATUS	Data status	Varchar	1	
7	DESCRIPTION	Details or explanations	Varchar	100	
8	STARTDATE	Start date	Datetime	8	
9	EXPRIRE DATE	End date	Datetime	8	
10	CREATEDATE	Date on which data are recorded	Datetime	8	
11	CREATEBY	Name of data recorder	Varchar	5	

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File Name : RULE_EDITTRANS

Description: Record detail data of a change in accounting rules

File Type : Transaction File

Primary key : ARULEID, VERSION

No.	Field Name	Description	Type	Length	Key
1	ARULEID	Rule number	Varchar	4	PK
2	VERSION	Version	Tinyint	1	PK
3	TRANSTYPE	Maintenance type	Varchar	1	
4	DESCRIPTION	Details or explanations	Varchar	100	
5	APPROVEBY	Name of person approving maintenance	Varchar	5	
6	OLDDATA	Original data before maintenance	Varchar	100	
7	CREATEDATE	Date on which data are recorded	Datetime	8	
8	CREATEBY	Name of data recorder	Varchar	5	

File Name : RULE_EXECUTETRANS

Description: Record detail data of rules execution

File Type : Transaction File

Primary key : TRANSID

No.	Field Name	Description	Type	Length	Key
1	TRANSID	Order of transaction	Int	4	PK
2	PROCESSID	Process number	Varchar	4	FK
3	EVENTID	Event code	Varchar	4	FK
4	ARULEID	Rule number	Varchar	4	FK
5	EXECUTESTS	Status/Result of rules execution	Varchar	2	
6	VOUTYPE	Type of voucher recorded	Varchar	1	
7	VOUCHERID	Voucher number	Varchar	5	

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No.	Field Name	Description	Type	Length	Key
8	VOUCHER DATE	Date in voucher	Datetime	8	
9	DESCRIPTION	Details	Varchar	100	
10	DATAREF	Type of referenced data	Varchar	1	
11	CREATEDATE	Date on which data are recorded	Datetime	8	
12	CREATEBY	Name of data recorder	Varchar	5	

File Name : VOUCHERHEADER

Description: Record data on voucher in which accounting is made

File Type : Transaction File

Primary key : VOUCHERDATE, VOUCHERID

No.	Field Name	Field Name	Type	Length	Key
1	VOUCHER DATE	Date in the voucher	Datetime	8	PK
2	VOUCHERID	Voucher number	Varchar	5	PK
3	MONEYTYPE	Financial source	Varchar	3	
4	CURSTATUS	Data status	Varchar	1	
5	PREPARER	Name of person making a voucher	Varchar	5	
6	VOUREFNO	Number of voucher for reciprocal transaction	Varchar	11	
7	VOUFROM	System recording a voucher	Varchar	1	
8	PRINTED DATE	Printing date	Datetime	8	
9	DESCRIPTION	Details	Varchar	100	
10	DATAREF	Type of reference data	Varchar	1	
11	CREATEDATE	Date on which data are recorded	Datetime	8	
12	CREATEBY	Name of data recorder	Varchar	5	

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File Name : VOUCHERDETAIL

Description: Record detail data of accounting items made in a general journal

File Type : Transaction File

Primary key : VOUCHERDATE, VOUCHERID, DOCREFNO, ORDERID

No.	Field Name	Description	Type	Length	Key
1	VOUCHER DATE	Date in a voucher	Datetime	8	PK
2	VOUCHERID	Voucher number	Varchar	5	PK
3	DOCREFNO	Number of referenced document in which accounting is made	Varchar	10	PK
4	ORDERID	Order of recording	Tinyint	1	PK
5	TYPE	Accounting type (D=Debit,C=Credit)	Varchar	1	
6	ACCTCODE	Account code	Varchar	9	
7	SUBACCT CODE	Sub-account code	Varchar	2	
8	AMOUNT	Amount of money	Money	8	
9	DEPTCODE	Work unit code	Varchar	2	
10	FUND_ID	Fund code	Datetime	2	
11	CAP_ID	Capital account code	Varchar	9	
12	YEARCAP	Fiscal year of capital account	Varchar	2	
13	MAINCOST	Code of main expenses-revenue group	Varchar	4	
14	EXP_ID	Code of minor expenses-revenue group	Varchar	4	
15	PLAN_ID	Fund code	Varchar	2	
16	JOB_ID	Work/project code	Varchar	2	
17	ACT_ID	Target code	Varchar	2	

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No.	Field Name	Description	Type	Length	Key
18	TASK_ID	Product code	Varchar	13	
19	NOTE	Additional details or explanations	Varchar	100	

File Name : VOUCHERREFDOC

Description: Record data on document controlled registration used in accounting

File Type : Transaction File

Primary key : BGYEAR, VOUTYPE, VOUCHERDATE, VOUCHERID , DOCREFNO

No.	Field Name	Description	Type	Length	Key
1	BGYEAR	Fiscal year	Datetime	8	PK
2	TRANSNO	Sequence of transaction	Int	4	
3	VOUTYPE	Voucher type	Varchar	1	PK
4	VOUCHER DATE	Date in a voucher	Datetime	8	PK
5	VOUCHERID	Voucher number	Varchar	5	PK
6	DOCREFNO	Number of reference document in which accounting is made	Varchar	10	PK
7	DOCREFBG YEAR	Fiscal year of reference documents	Tinyint	2	
8	DOCREFFA YEAR	Fiscal year of reference documents were created	Varchar	2	
9	CURSTATUS	Data status	Varchar	1	

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4.4 Input/Output design

The Accounting Rules Management System (ARMS) has designed its input/output into five parts listed below.

1. User Verification is to verify users and their right to access or manage data.
2. Rules Authoring is to construct accounting rules.
3. Rules Maintenance is to modify or cancel rules.
4. Rules Execution based on events occurring in the system's processes to test data accuracy and completeness, by means of modeling processes via all possible events that may happen, including (modeling) data from real working systems.
5. Rules Monitoring is to inquire accounting rules in different viewpoints.

The design of interface with respect to accounting rules construction includes the following main interfaces.

4.4.1 User Verification

Figure 4-14 illustrates an interface of login into the system.

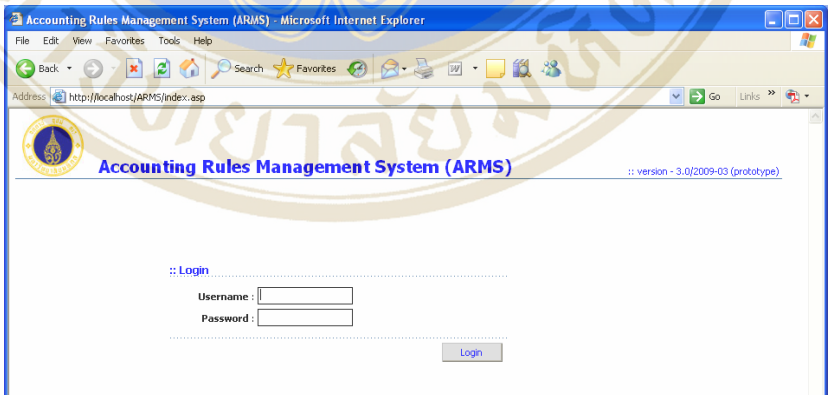

Figure 4-14 An Interface of Login into the System

Figure 4-15 Main Interface of the System

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Based on Figure 4-15, main menus include the following.

- **Rules Authoring** is used to manage data related to accounting rules. It principally serves to construct or define accounting rules. The performance includes data preparation to prepare core data related to accounting rules based on happening events, and process handler registration to define events occurring in the system's processes.
- **Rules Maintenance** is used to maintain accounting rules. The performance includes rules modification and cancellation. The reasons for rules modification and cancellation have to be identified in order to be able to follow up and monitor data in retrospect.
- **Rules Execution** is used to process and retrieve accounting rules of events happening in the working system's processes. For this research project, the retrieval of rules is tested via data simulated from real working systems, comprising purchase order data-inventory reception system, work unit's voucher data-budgeting system, and cash reception/payment data-financial system.
- **Rules Monitoring** is used to inquire data and make related reports in different viewpoints so as to be used to follow up and monitor data.
- Exit is used to exit the system.

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4.4.2 Rules Authoring is a function used to construct rules. The performance includes three parts core data preparation, rules construction and process handler registration. Interfaces are illustrated in Figures 4-16 through 4-18, respectively.

❑ **Data Preparation**

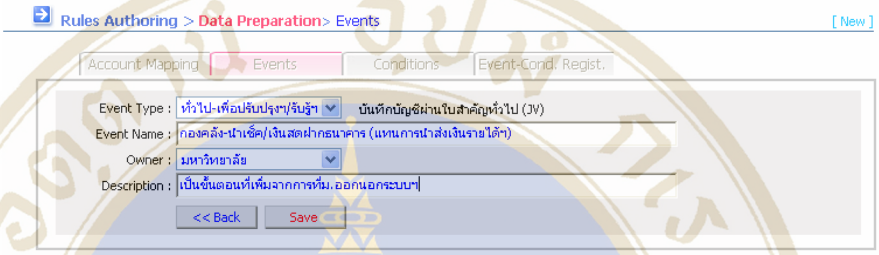

Figure 4-16 Data Preparation before Accounting Rules Determination

Figure 4-16 illustrates core data items related to accounting rules determination as follow :

- Accounting Mapping is used to define or tie account with revenue or expenses group to record accounts in a general journal.
- Events is used to define various events.
- Conditions is used to define conditions and items in conditions to be monitored in each event for making accounting.
- Event-Cond. Regist. Is used to define conditions to be monitored in each event.

The system performance includes the following stages.

1. Select the required data type. The interface will display data in the database,
2. Select the performance type including
   - Add new data, press on New Record button, or
   - Inquire data, define conditions needed and process and press on Search button to display data.
3. Click to select data required to display data details or modify or cancel data.
4. Record data that are added, modified or cancelled.

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❑ Rules Construction

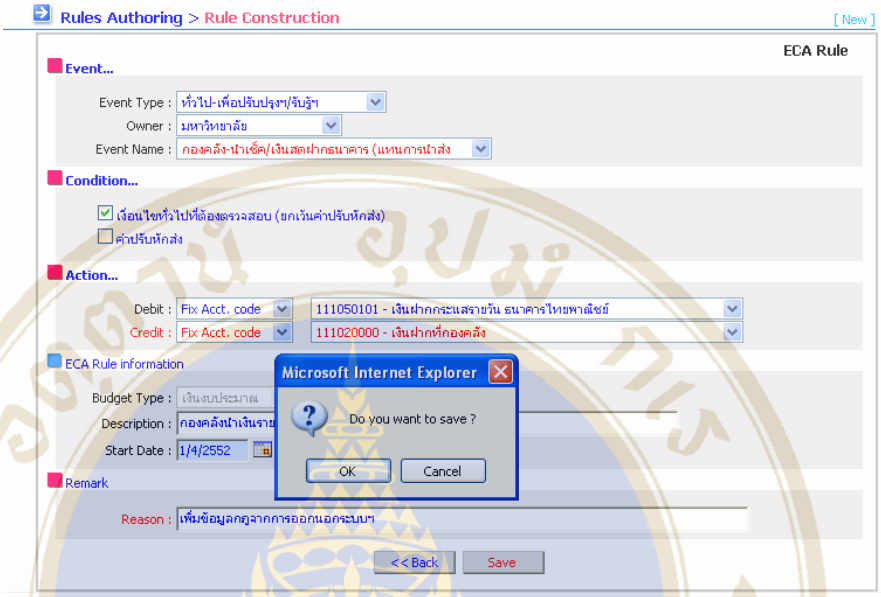

Figure 4-17 An Interface for Rules Construction

❑ Processes Handler Registration

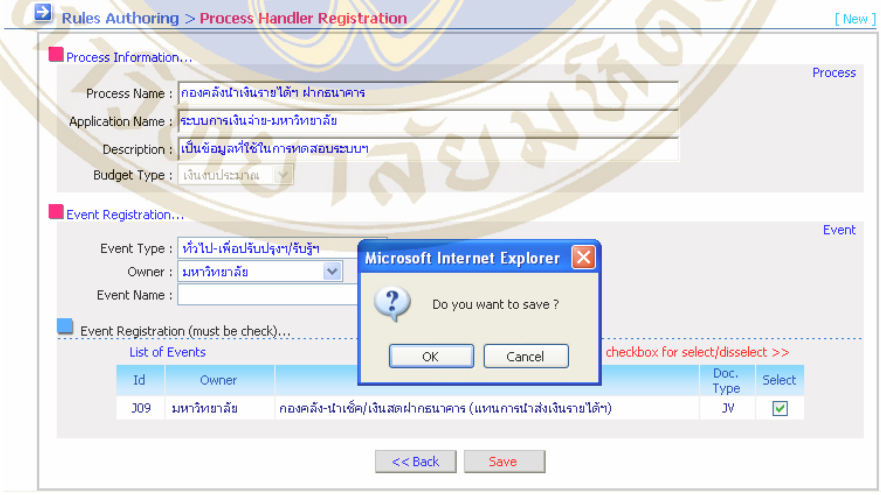

Figure 4-18 An Interface for Process Handler Registration

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- Testing of Rules Execution via Simulation of data from a real working system

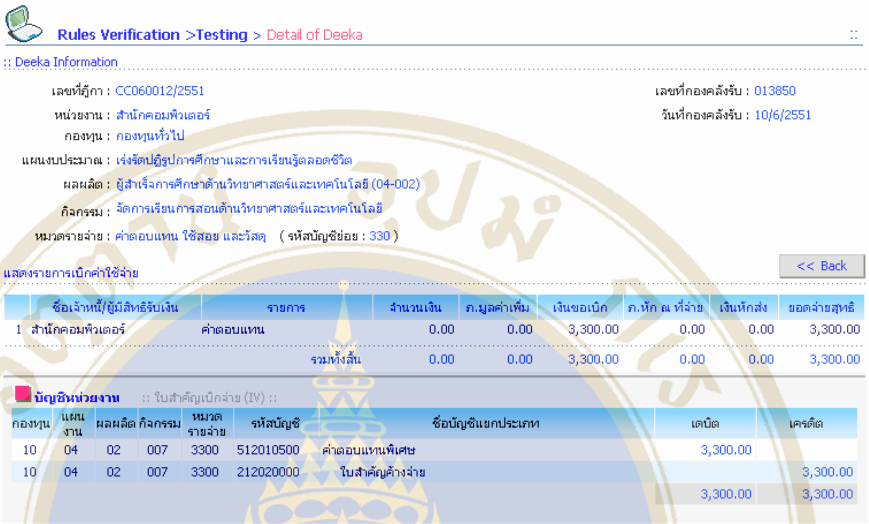

Figure 4-19 An Interface for Voucher Data for Testing of Rules Execution

4.4.3 Rules Maintenance is a function used to maintain rule, comprising rules modification and cancellation.

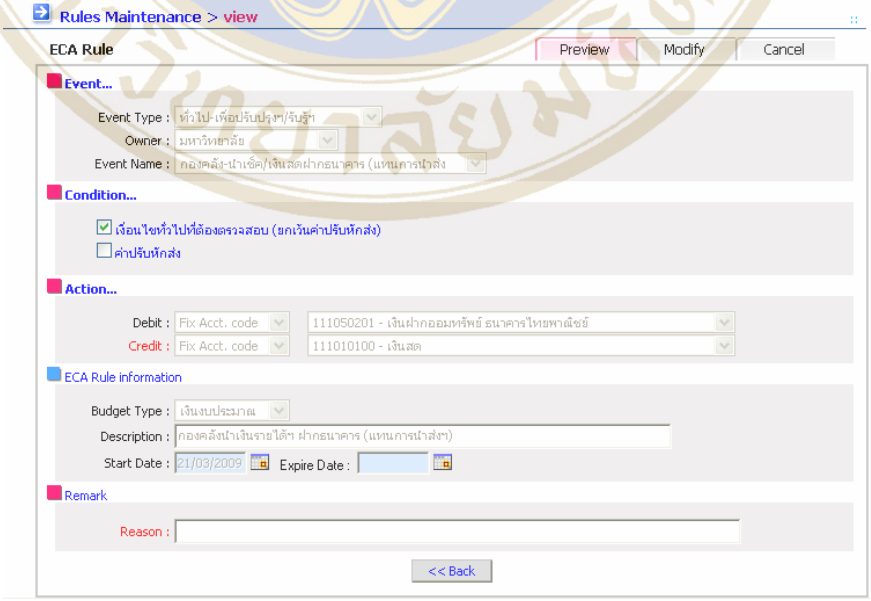

Figure 4-20 An Interface for Rules Maintenance

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The system performance includes the following stages.

1. Search for data based on defined conditions.
2. Click to select data required to display data detail.
3. Select Tab on work needed, comprising modify, cancel or preview data.
4. Modify or cancel data and record data in the database.

4.4.4 Rules Execution is a function used to process and use rules to test the accuracy of rules construction or modification before real use. For this research project, it uses data simulated from real working systems of all possible events of those data.

❑ **Data on Public Revenue Reception**

It is to monitor the accuracy and completeness of accounting rules execution related to cash reception-payment of the financial system in every event that has to be recognized and booking, for example, public revenue reception.

Figure 4-21 An Interface for Receipt Data of Public Revenue Reception

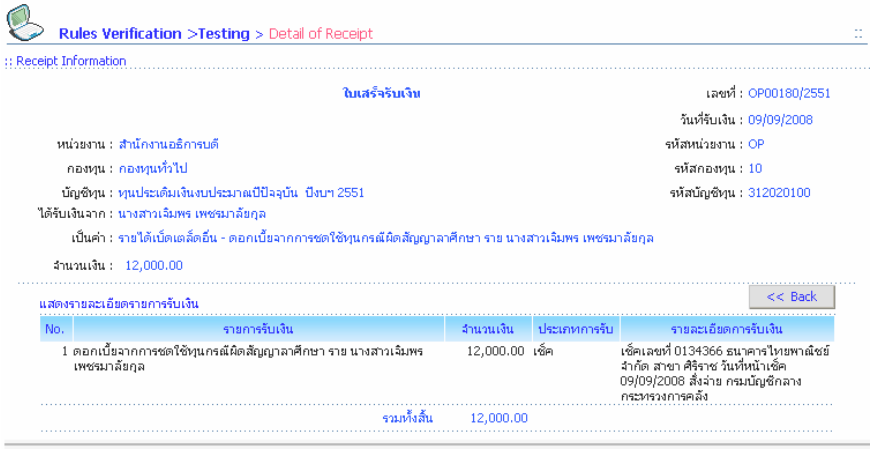

Figure 4-22 An Interface for Details of Receipt Data

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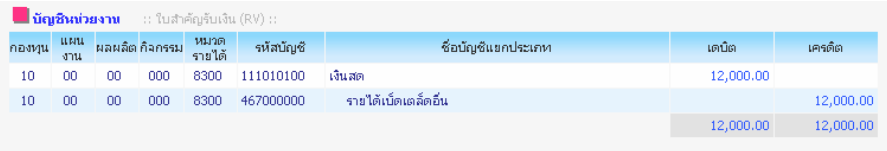

Figure 4-23 An Interface for Rules Execution Classified by Event

4.4.5 Rules Monitoring is a function used to search for and inquire data and make reports needed. It has the following performance stages.

1. Select data type or report required.
2. Search data based on conditions defined.

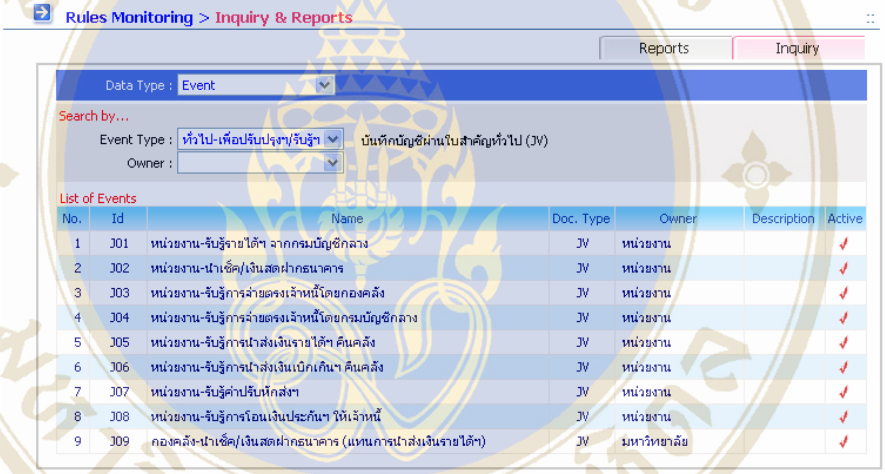

Figure 4-24 An Interface for Inquiry/Report

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CHAPTER V
SYSTEM IMPLEMENTATION AND TESTING

This chapter discusses the environment for the system development and testing to show that the prototype of a system, developed based on the principle and concept proposed in this research project, can be truly applied to work and is correct in its working process. In particular, the accounting rules data management and restoration of rules corresponding with events occurring in the system's processes have the accounting rules database of Mahidol University's monetary system, as a centralized database for all processes to jointly use the rules. Apparently, this enables the accounting rules data management to change and be verified automatically, and to support a constant change of accounting rules while the system developed can be applied for a solution to the problems of the current working system, as discussed in chapter 1, based on the principle of business rules management system (BRMS) and ECA rules. A system evaluation will display advantages derived from use of the system, in the pattern proposed, in terms of automation, swiftness and accuracy.

5.1 System Implementation

The development of system prototype is under the following environment.

- **Client**
  1. Hardware is a PC with the following properties.
     - Processor : Pentium(R) D
     - RAM : 2 Gigabytes
     - Hard Disk : 40 Gigabytes
  2. Operating System uses Microsoft Windows XP.
  3. Software uses ASP (Active Server Page) program as a tool for the program development.

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4. Database Management System uses Microsoft SQL Server version 2000.
5. Network communicates through a local area network (LAN). A client contacts the database at a server using ADO (Activex Data Object).

- **Server**
  1. Hardware
  2. Operating System uses Microsoft Windows XP 2003.

5.2 Test Objectives

The system testing is divided into three types based on the objective.

1. To test the performance of all functions of the system.
2. To test the accuracy of the results generated from the rules that serve the Accounting Rules Execution.
3. To test the efficiency of the system performance that is automatic, convenient and quick, in accounting rules data management. An increase or change in rules of the ARMS system uses less time and fewer workers than that in rules of the current system.

5.3 Test Data

Data used to test Mahidol University's accounting rules management system (ARMS) are derived from the data of the monetary system, only data related to budgetary source accounting, of which details are given in Table 5.1.

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Table 5.1 Type of Data Used for Testing, Classified by Function

Function	**Data Type**
1. Accounting Rules Authoring	1. Core data include, 1.1 revenue and expenses account code. 1.2 Event data. 1.3 Condition data. 1.4 Grouped data of event's checked condition. 2. Accounting rules data. 3. Data on events occurring in the system's processes.
2. Accounting Rules Maintenance	1. Accounting rules.
3. Accounting Rules Execution	1. Accounting rules. 2. System's core data such as event data, condition data, etc. 3. Data of Mahidol University's monetary system.
4. Accounting Rules Monitoring	1. System's core data such as event data, condition data, etc. 2. Accounting rules. 3. Data incurred by a test of the system performance, testing for example, data on account items recorded in a general journal via a voucher, data on rules retrieval, etc.

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5.4 Test Method

This section discusses details of the working system testing stages, classified by the test objectives listed in section 5.2.

5.4.1 Functional Test

For functional test, a test case is created based on the system's performance functions, of which details are shown in Table 5.2.

Table 5.2 Type of Test Case Used for Testing, Classified by Function

Function	**Type of Test Case Used for Testing**	**Number of Test Cases**
- Accounting Rules Authoring	1. Test preparation of new data of core data (classified by data type). 2. Test preparation of repetitive data of core data (classified by data type). 3. Test construction of new rules. 4. Test construction of repetitive rules. 5. Test registration of events occurring in the working system's processes.	1 1 1 1 2
- Accounting Rules Maintenance	1. Test modification of accounting rules. - Modify account recorded. - Modify conditions or groups of conditions verified. - Modify rule details. 2. Test accounting rules cancellation.	1 1

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Table 5.2 Type of Test Case Used for Testing, Classified by Function (cont.)

Function	**Type of Test Case Used for Testing**	**Number of Test Cases**
- Accounting Rules Execution	1. Test accounting rules execution events occurring in the process of *Withdrawal for payment not via purchase/hire*. Processes related to working system's accounting include, - Set up debts – A work unit prepares a voucher for expense reimbursement. - Receive money – MU finance division receives budgetary money, transferred via a bank, from the Comptroller-General's Department. - Pay cheque – MU finance division pays cheque to a work unit. - Deposit cheques in a bank – A work unit deposits cheques in a bank. - Pay cheque – A work unit pays cheques to its creditors.	5
	2. Test execution of rules newly constructed, from an increase in core data. - Increase rules from a rise in expenses group. - Increase rules from a rise in events that need to do accounting.	2

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Table 5.2 Type of Test Case Used for Testing, Classified by Function (cont.)

Function	Type of Test Case Used for Testing	Number of Test Cases
- Accounting Rules Execution	3. Test execution of rules modified.	1
	4. Test execution of rules cancelled.	1
	5. Pass through events occurring in the process of *Withdrawal for payment via purchase/hire* – pay directly to creditors, on behalf of a work unit, by the Comptroller-General's Department. Processes related to working systems' accounting include, - Set up debts – A work unit records data on goods reception. - MU finance division records acknowledgement of direct payment to creditors by the Comptroller-General's Department on behalf of a work unit.	2
	6. Pass through events occurring in the process of *Withdrawal for payment not via purchase/hire* – pay directly to creditors, on behalf of a work unit, by MU finance division. Processes related to working systems' accounting include, - Set up debts – A work unit records data on goods inspection for reception.	3

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Table 5.2 Type of Test Case Used for Testing, Classified by Function (cont.)

Function	**Type of Test Case Used for Testing**	**Number of Test Cases**
- Accounting Rules Execution	- MU finance division receives budgetary money obtained from the Comptroller-General's Department. - Pay cheque – MU Finance division pays cheque on behalf of a work unit to creditors. 7. Pass through events occurring in the process of *Reception of public revenue.* Processes related to working systems' accounting include, - A work unit receives public revenue. - A work unit submits public revenue to MU Finance division. - MU Finance division obtains public revenue from a work unit. - MU Finance division submits public revenue to the Finance Ministry. 8. Pass through events occurring in the process of *Reception of money overdrawn and returned.* Processes related to working systems' accounting include,	4 4

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Table 5.2 Type of Test Case Used for Testing, Classified by Function (cont.)

Function	**Type of Test Case Used for Testing**	**Number of Test Cases**
- Accounting Rules Execution	- A work unit receives overdrawn money. - A work unit submits overdrawn money to MU finance division. - MU finance division obtains overdrawn money from a work unit. - MU finance division submits overdrawn money to the Finance Ministry.	
- Accounting Rules Monitoring	1. Test retrieval of data based on conditions.	1
	Total	**31**

Table 5.2 reveals test cases used for system testing, classified by function, as analyzed in chapter 3, for example, author rules, maintain rules, and execute rules. Test cases are not arranged in order, of which details are given in Table 5.3.

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Table 5.3 Test Case Specification

Test Case Name	**Description**	**Input**	**Expected Output**
Test 1	Construction of rules data and data related to rules construction & execution.		
Test 1.1	Test preparation of new data of core data, classified by data type as follows: - Event data - Condition data - Data on sets of conditions - Data on revenue/expenses account	Core data classified by data type. - Event data - Condition data - Data on sets of conditions - Data on revenue/expenses account	Get core data that can be executed and modified, and are core data to be used with other functions of the system, such as used to construct or define rules.
Test 1.2	Test preparation of core data with repetitive data, classified by data type as follows: - Event data - Condition data - Data on sets of conditions - Data on revenue/expenses account	Core data classified by data type. - Event data - Condition data - Data on sets of conditions - Data on revenue/expenses account	Display reported message of preparation of repetitive data.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	**Description**	**Input**	**Expected Output**
Test 1.3	Test construction / increase in new rules.	Event data, condition data or sets of conditions to be verified (if any) and revenue / expenses account.	Get accounting data that can execute rules when there are events in the process, and rules can be retrieved, modified or cancelled.
Test 1.4	Test construction / increase in rules with repetitive data in a database.	Data on event / condition to be verified (if any) and revenue / expenses account that repeats with those in the database.	Display reported message of repetitive data preparation.
Test 1.5	Test determination of or new process handler registration.	Event data and process data of MU monetary system, only those related to accounting rules.	Data on groups of events that can occur in a working system's processes.
Test 1.6	Test determination of repetitive events in the process.	Event data and process data of MU monetary system, only those related to accounting rules.	Display notification message of repetitive data preparation.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	**Description**	**Input**	**Expected Output**
Test 2	Rules maintenance		
Test 2.1	Test rules data modification.	Rules data to be modified	- Results of monitoring current status of rules. In case they are in a working status, data cannot be modified. A notification message will be displayed. - Rules that have been modified and can be executed when there are events in the working system's processes, and rules can be retrieved, modified or cancelled.
Test 2.2	Test rules cancellation	Rules data that need to be cancelled.	- Results of monitoring current status of rules. If the rules are in use and cannot be cancelled, a notification message will be displayed.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	**Description**	**Input**	**Expected Output**
Test 2.2 (cont.)	Test rules cancellation		- Rules that have been cancelled and cannot be executed or modified any longer.
Test 3	Test accounting rules execution based on events occurring in a working system's processes, and doing accounting entries in a general journal, corresponding with the rules obtained.		
Test 3.1	Test rules execution through events occurring in the process of *Withdrawal for payment not via purchase/hire.*		
Test 3.1.1	Test rules execution – of the process of Set up debts – A work unit prepares vouchers for expense withdrawn	- Data on vouchers preparation of the budgeting system. - Core data. - Accounting rule data.	Data on debts set-up, of which accounting entry is done in a general journal, and corresponding to verified rules and conditions
Test 3.1.2	Test rules execution – of the process of Receives money – MU Finance Division receives transferred from the Comptroller-General's Department.	- Data on reception of transferred money of the financial system. - Core data. - Accounting rules data.	Data on money reception, of which accounting is done in a general journal, and corresponding to verified rules and conditions.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	Description	Input	Expected Output
Test 3.1.3	Test rules execution – of the process of Pay cheque – MU finance division pays cheques to a work unit.	- Data on cheque payment of the financial system. - Core data. - Accounting rules data.	Data on cheque payment, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.1.4	Test rules execution – of the process of Deposit cheques in a bank – A work unit deposits cheques in a bank.	- Data on money deposit of the financial system. - Core data. - Accounting rules data.	Data on money deposit in a bank, of which accounting is done in a general journal, and which corresponding to rules.
Test 3.1.5	Test rules execution – of the process of Pay cheques – A work unit pays cheques to creditors.	- Data on cheque payment of the financial system. - Core data. - Accounting rules data.	Data on cheque payment, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.2	Test execution of rules newly constructed or increased, from a rise in core data.		

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Table 5.3 Test Case Specification (cont.)

Test Case Name	**Description**	**Input**	**Expected Output**
Test 3.2.1	Test execution of rules newly constructed or increased, from a rise in expenses category.	- Data on MU monetary system. - Core data. - Accounting rules data.	- Accounting rules data. - Data on accounting done in a general daily account book, which are correct, corresponding with rules and conditions verified.
Test 3.2.2	Test execution of rules newly constructed or increased, from a rise in events that need to book entries.	- Data on MU monetary system. - Core data. - Accounting rules data.	- Accounting rules data. - Data on accounting done in a general journal, which are corresponding to verified rules and conditions.
Test 3.3	Test execution of rules modified.	- Data on MU monetary system. - Core data. - Accounting rules data.	- Accounting rules data. - Data on accounting done in a general journal, which are corresponding to verified rules and conditions.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	Description	Input	Expected Output
Test 3.4	Test execution of rules cancelled.	- Data on MU monetary system. - Core data. - Accounting rules data.	- Cannot execute rules and do not do book an entry in a general journal. - A notification message.
Test 3.5	Test rules execution – of the process of Withdrawal for payment via purchase/hire and pay directly to creditors by the Comptroller-General's Department.	- Data on goods reception of the purchase/hire system. - Core data. - Accounting rules data.	Data on debts set-up, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.6	Test rules execution – of the process of Withdrawal for payment not via purchase/hire and pay directly to creditors by MU Finance division.	- Data on direct payment to creditors of the receiving financial system. - Core data. - Accounting rules data.	Data on direct payment on behalf of a work unit to creditors, of which accounting is done in a general journal, and corresponding to verified rules and conditions.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	**Description**	**Input**	**Expected Output**
Test 3.7	Test rules execution via events occurring in the process of *Reception of public revenue.*		
Test 3.7.1	Test rules execution – of the process of A work unit – receives public revenue.	- Data on public revenue reception of the receiving financial system. - Core data. - Accounting rules data.	Data on money reception, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.7.2	Test rules execution – of the process of A work unit – submits public revenue.	- Data on submission of public revenue of the paying financial system. - Core data. - Accounting rules data.	Data on payment, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.7.3	Test rules execution – of the process of MU Finance division – receives public revenue.	- Data on national revenue reception of the receiving financial system. - Core data. - Accounting rules data.	Data on money reception, of which accounting is done in a general journal, and corresponding to verified rules and conditions.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	**Description**	**Input**	**Expected Output**
Test 3.7.4	Test rules execution – of the process of MU Finance division – submits public revenue.	- Data on submission of public revenue of the paying financial system. - Core data. - Accounting rules data.	Data on payment, of which accounting is done in a general journal, and which corresponding to verified rules and conditions.
Test 3.8	Test rules execution via events occurring in the process of *Reception of money overdrawn and returned.*		
Test 3.8.1	Test rules execution – of the process of A work unit – receives overdrawn money.	- Data on overdrawn money reception of the receiving financial system. - Core data. - Accounting rules data.	Data on money reception, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.8.2	Test rules execution – of the process of A work unit – submits overdrawn money.	- Data on overdrawn money submission of the paying financial system. - Core data. - Accounting rules.	Data on payment, of which accounting is done in a general journal, and corresponding to verified rules and conditions.

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Table 5.3 Test Case Specification (cont.)

Test Case Name	Description	Input	Expected Output
Test 3.8.3	Test rules execution – of the process of MU Finance division – receives overdrawn money.	- Data on overdrawn money reception of the receiving financial system. - Core data. - Accounting rules data.	Data on money reception, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 3.8.4	Test rules execution – of the process of MU finance division– submits overdrawn money.	- Data on overdrawn money submission of the paying financial system. - Core data. - Accounting rules data.	Data on payment, of which accounting is done in a general journal, and corresponding to verified rules and conditions.
Test 4	Test data retrieval and reporting based on conditions defined.		
Test 4.1	Test data retrieval based on conditions defined.	- Data type and conditions defined. - Rules data and core data. - Accounting rules data.	Retrieve and display data, based on defined conditions, in a correct and complete manner.

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5.4.2 Test of the accuracy of the results generated from the Accounting Rules Execution

The test aims to evaluate the accuracy of the final results generated from the accounting rules that serve for the 20 process covered from 6 sub-systems. The evaluated data was collected from the existing system in the budget year 2008 of the inventory system used for the Mahidol University. The test systematically performs by using the same data set for every related process. Hence, each data set will be tested for more than one process, i.e. the expenses withdrawn (IV) will keep track of the revenue records and feed the information to the work unit. Then the work unit deposits the cheque in a bank and records the data on the deposit in the work unit's receiving financial system.

Table 5.4 The summarized test results for each sub-system

Sub-System	Number of Process	Number of Data sets	Results	
			Correct Rules	Incorrect Rules
1. Inventory System	1	10	10	-
2. Budget System	3	30	30	-
3. Work Unit Financial System-Receiption	3	30	30	-
4. Work Unit Financial System-Payment	4	40	40	-
5. MU Financial System-Receiption	4	40	40	-
6. MU Financial System-Payment	5	50	50	-
Total	**20**	**200**	**200**	**-**

Table 5.4 shows the results of the Accounting Rules Execution function. The results represent the outstanding correct rules that outperform the incorrect rules. It means that the correct rules provide the correctness and completeness of the results without the incorrect rules.

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5.4.3 Test of System Performance Efficiency

With respect to the system performance efficiency test, we evaluate and compare consequences derived from the performance of a work unit's paying financial system, between a new system developed and the current working system. A comparison is made on working stages, time spent , and the number of systems or programs that need to be increased or modified when there is a change or increase in accounting rules. Various stages are displayed in Table 5.1. Details of modification in each stage are displayed in Tables 5.5 and 5.6, respectively.

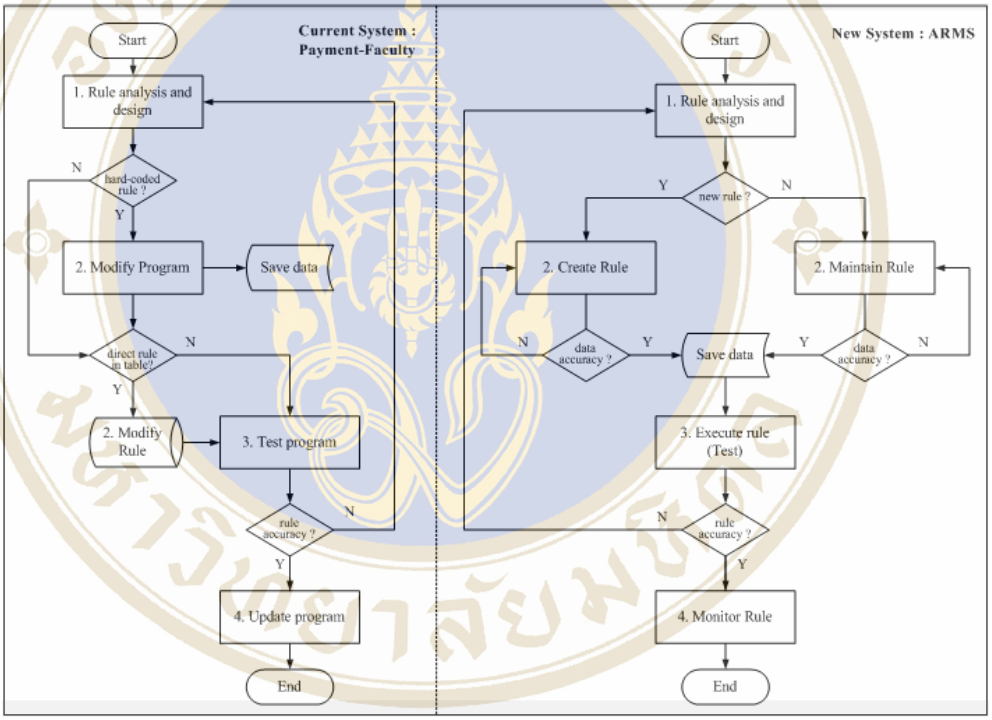

Figure 5-1 Stages of Change in Accounting Rules Data for a Comparison between the Current Working System and a New Working System

An efficiently test is divided into three cases as follows :

1. Test case 1 Increase rules due to expenses group augmentation which is an example of accounting rules modification of which stages are uncomplicated.
2. Test case 2 Increase / Modification of rules due to deducted fine condition augmentation (that an account has to be booked) for

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accounting rules modification of which stages are moderately complicated.

3. Test case 3 Increase / Modification of rules due to a change in processes and rules that have to be acknowledged and book an account for modification of which stages are rather complicated.

Keeping on time spent in a test of an increase and change in rules for the three test cases was approximately carried out and had a unit in minute. Keeping time started with execute program the program until completion of the process of each test stage, for both the current working system and a new working system developed (ARMS). Details are given in Table 5.5 and 5.6.

Table 5.5 Stages and Time Spent on Changing or Increasing Accounting Rules of the Current Working System – A Work Unit's Paying Financial System

Increase/Modify rules – A work unit's paying financial system	**Approximate Time Spent (Minute)**		
	Test Case 1	**Test Case 2**	**Test Case 3**
1. Perform the stage of rules analysis & design.	1	3	5
2 Increase/modify rules. Modification is divided into three types as follows : 2.1 Store data as a hard-coded program. - Execute program the program used for modification and go to the process which needs to be modified. - Add the code of conditions in the program to verify the expenses group once again and define rules or account pair that needs to be recorded in a general journal for every related process, and then save the program.	5	10	20

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Table 5.5 Stages and Time Spent on Changing or Increasing Accounting Rules of the Current Working System – A Work Unit's Paying Financial System (cont.)

Increase/Modify rules – A work unit's paying financial system	**Approximate Time Spent (Minute)**		
	Test Case 1	**Test Case 2**	**Test Case 3**
2.2 Record rules data in a table stored in the database. Storage and management of data are carried out directly through the data table. - Open the program that stores the rules database and open the table recording rules data. - Add expenses group and rules data in related tables. Monitor its accuracy and completeness.	2	3	3
2.3 Store rules data using both above methods combined, namely, as a hard-coded program and in tables in a database. In case there is an increase in or modification of rules, it has to be carried out through both items 2.1 and 2.2.	3	7	13

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Table 5.5 Stages and Time Spent on Changing or Increasing Accounting Rules of the Current Working System – A Work Unit's Paying Financial System (cont.)

Increase/Modify rules – A work unit's paying financial system	**Approximate Time Spent (Minute)**		
	Test Case 1	**Test Case 2**	**Test Case 3**
3 Test the accuracy of the program after an increase/modification of rules, by running the program via the current working system, of related processes.	2	2	2
4 Update the program in a real working system.	1	1	1
Total time spent for Hard-Coded rules (referred to section 1,2.1,3,4)	**9**	**16**	**28**
Total time spent for Manual rules (referred to section 1,2.2,3,4)	**6**	**9**	**11**
Total time spent for both Hard-coded and manual rules (referred to section 1,2.3,3,4)	**7**	**13**	**21**

Remark: times for testing will vary by the modification of the manipulated accounting rules for the second step of the system.

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Table 5.6 Stages and Time Spent on Changing or Increasing Accounting Rules of the ARMS System

Increase/Modify rules – ARMS system	**Approximate Time Spent (Minute)**		
	Test Case 1	**Test Case 2**	**Test Case 3**
1. Perform the stage of rules analysis & design.	1	3	5
2. Increase/modify rules as follows : 2.1 A case of an increase in new rules has the following stages. - Increase core data at the menu *Rules Authoring/Data Preparation* as follows : Test case 1 – Increase expenses group data, and Test case 2 – Increase data on conditions of the fine deducted item. - Construct or define accounting rules at the menu *Rules Authoring/Rule Construction.* - Define events that need to book accounts, which occur in a working system's processes at the menu *Rules Authoring/Process Handler Registration*.	0.3	0.5	0.9
2.2 A case of original rules modification has the following stages. - Increase core data at the menu *Rules Authoring/Data Preparation* (if any). - Retrieve accounting rules that need to be modified, at the menu "Rules Maintenance". - Modify rule details and identify the reason for modification. Store the data.	0.3	0.5	0.7

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Table 5.6 Stages and Time Spent on Changing or Increasing Accounting Rules of the ARMS System (cont.)

Increase/Modify rules – ARMS system	**Approximate Time Spent (Minute)**		
	Test Case 1	**Test Case 2**	**Test Case 3**
3. Test the accuracy of an increase/modification of rules at the menu *Rule Execution* by selecting a working system, events and data that need a test. Verify accounting rules data.	0.5	0.5	0.5
4. Inquire to monitor and increase/modification of rules or searching for data to be used to follow up and verify data.	0.5	0.5	0.5
Total time spent (New Rule)	**2.3**	**4.5**	**6.9**
Total time spent (Rule Modification)	**2.3**	**4.5**	**6.7**

In summary, the comparative results of the time spent for changing or increasing the accounting rules of the current working system and the ARMS are summarized into three test cases: the least, moderate and most complexity, respectively. Table 5.4 reveals the time spent for each sub-system of the current working system. The results show that the hard-coded rules use the time spent more than others rules method because it needs to modify the program and the method for storing the data. However, the manual rules method spends the least time for performing the process. Based on the ARMS mechanism, time spent can be reduced and provided the outperformed time usage, because the change of the program can take the modification without any effected results.

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5.5 Results

This part explains test consequences. The system test is divided based on the test objectives mentioned in section 5.2 as the following:

5.5.1 Functional Results

For the system's functional results, a test is conducted corresponding to test cases defined in table 5.3, with test consequences described below.

1. Details of Test 1

It is a test of preparing all officials' name list data against rules and conditions, and is divided into six test cases as follows:

- **Details of Test 1.1**

It is a test of preparation of a new data of core data, classified by data type. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.
2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details. The repeated data with those stored in the database are recorded.
3. Record data. The system will monitor data recording. In case data have already been recorded, the system will display a reported message and not record those data in the database.

All working stages are illustrated in Figure 5-2 through 5-10, respectively.

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- **Data on Revenue/Expenses Account**

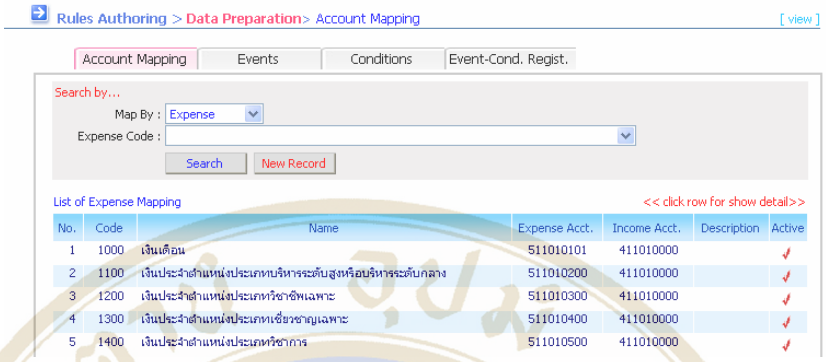

Figure 5-2 An Interface for Retrieval of Data on Revenue/Expenses Account Based on Conditions, for Monitoring

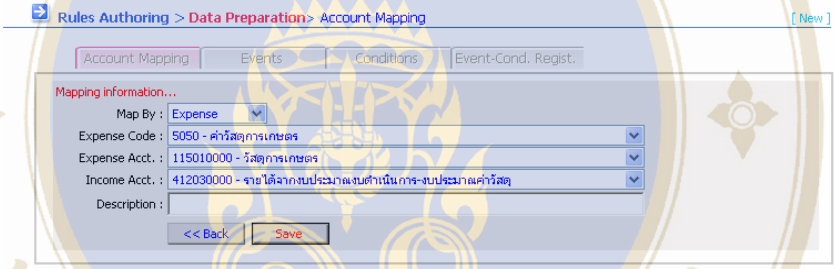

Figure 5-3 An Interface for Preparation of Data on Revenue/Expenses Account

- **Event Data**

Figure 5-4 An Interface for Retrieval of Event Data Based on Conditions, for Monitoring before Data Preparation

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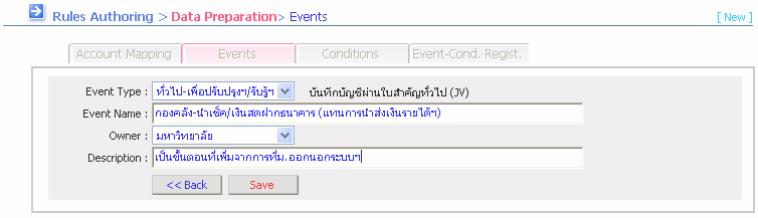

Figure 5-5 An Interface for Event Data Preparation

- **Condition Data**

Figure 5-6 An Interface for Retrieval of Condition Data for Monitoring before Data Preparation

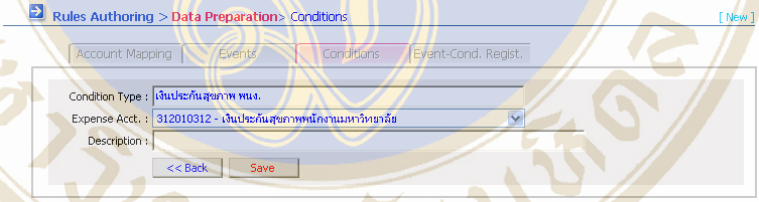

Figure 5-7 An Interface for Condition Data Preparation

- **Data on Sets of Conditions**

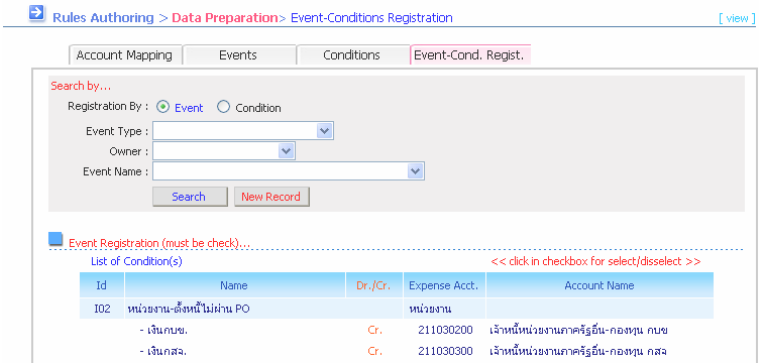

Figure 5-8 An Interface for Retrieval of Data on Sets of Conditions for Monitoring before Data Preparation

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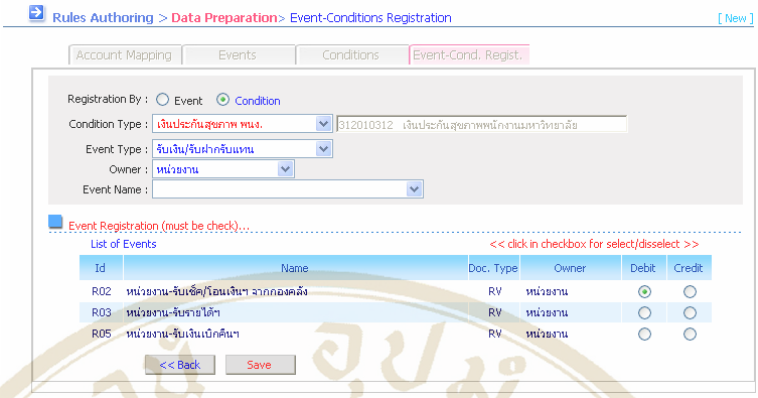

Figure 5-9 An Interface for Preparation of Data on Sets of Conditions in the Viewpoint of Conditions

Figure 5-10 An Interface for Preparation of Data on Sets of Conditions in the Viewpoint of Events

❑ Details of Test 1.2

It is a test of preparation of repetitive data of core data, classified by data type. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.
2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for

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recording data details. The repeated data with those stored in the database are recorded.

3. Record data. The system will monitor data recording. In case data have already been recorded, the system will display a notification message and reject the recording in the database.

All working stages are illustrated in Figure 5-11 through 5-14, respectively.

- **Data on Revenue/Expenses Account**

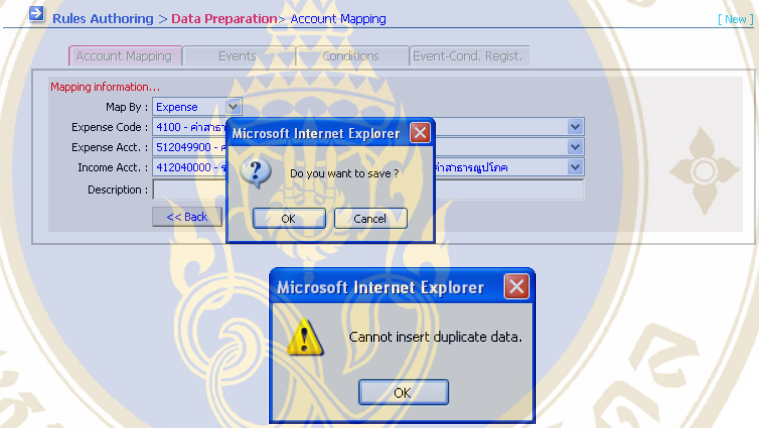

Figure 5-11 An Interface for Preparation of Data on Revenue/ Expenses Account – A Case of Repetitive Data Preparation

- **Event Data**

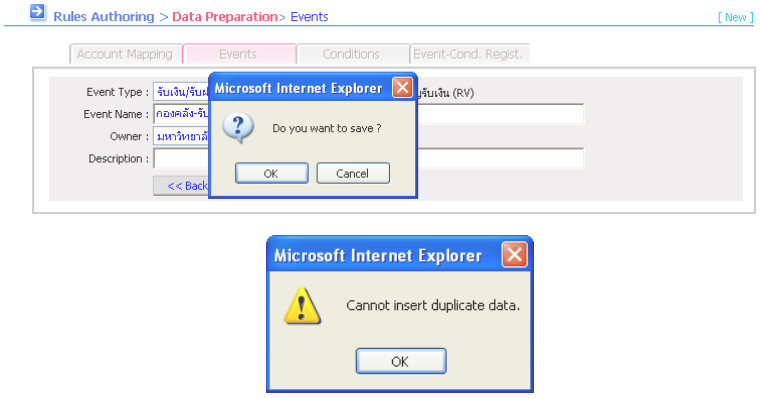

Figure 5-12 An Interface for Preparation of Event Data – A Case of Repetitive Data Preparation

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- **Condition Data**

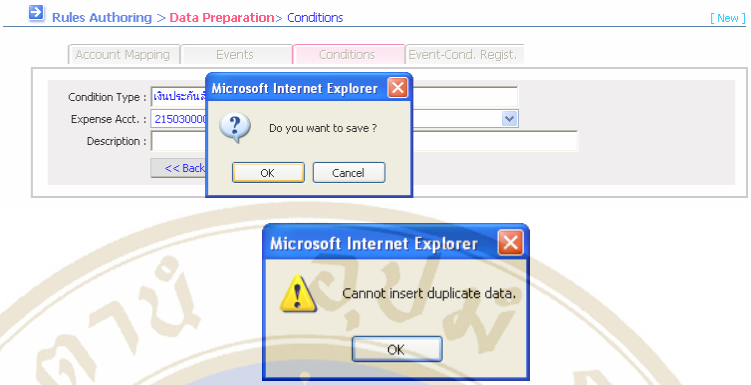

Figure 5-13 An Interface for Preparation of Condition Data – A Case of Repetitive Data Preparation

- **Data on Sets of Conditions**

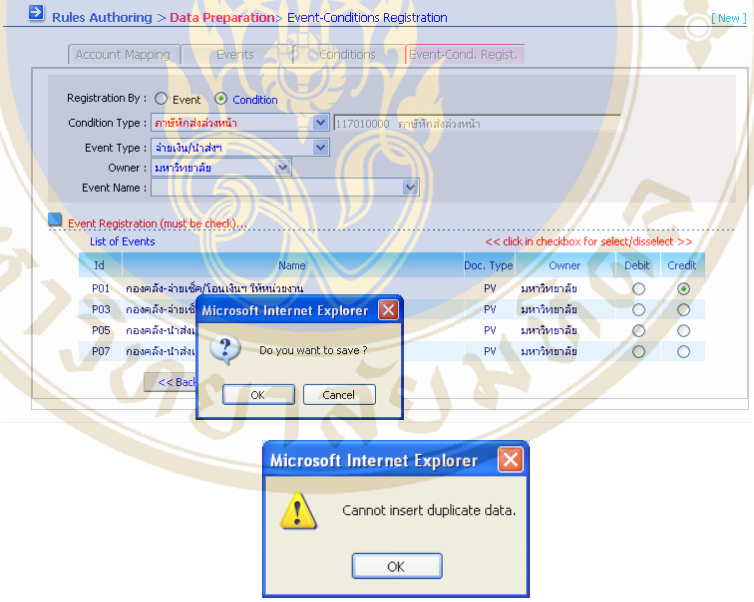

Figure 5-14 An Interface for Preparation of Data on Sets of Conditions – A Case of Repetitive Data Preparation

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❑ Details of Test 1.3

It is a test of construction/increase in new rules. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.
2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details. The repeated data with those stored in the database are recorded.
3. Record data. The system will monitor data recording. In case data have already been recorded, the system will display a notification message and not record those data in the database.

All working stages are illustrated in Figures 5-15 through 5-16, respectively.

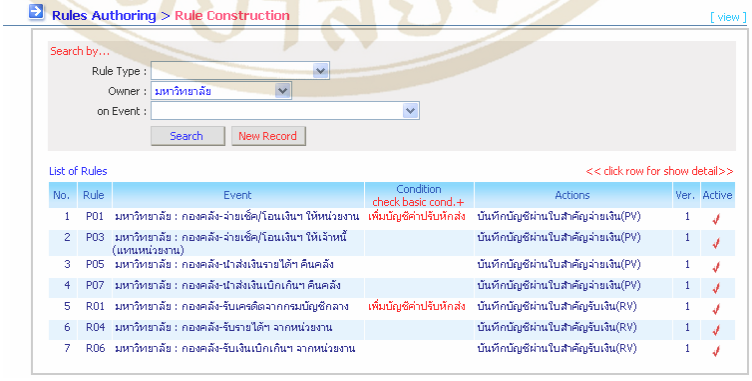

Figure 5-15 An Interface for Preparation of Rule Data Based on Conditions, for Monitoring before Data Preparation

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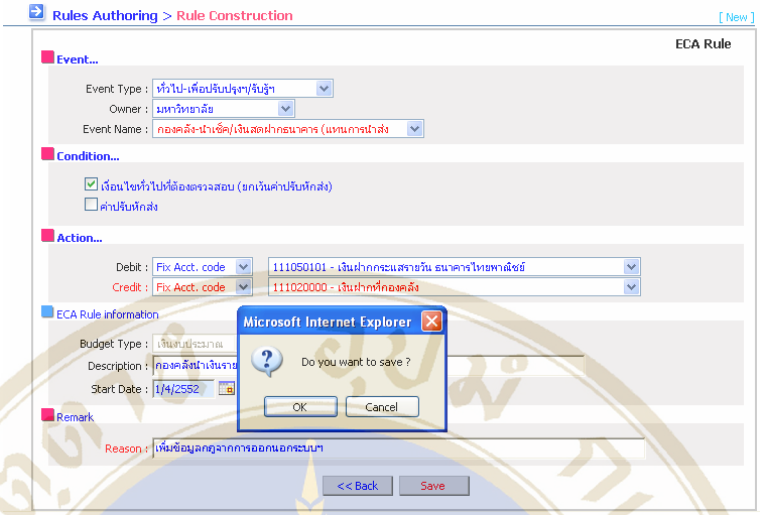

Figure 5-16 An Interface for Rule Data Preparation

❑ **Details of Test 1.4**

It is a test of construction/increase in rules with repetitive data in database. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.
2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details. The repeated data with those stored in the database are recorded.
3. Record data. The system will monitor data recording. In case data have already been recorded, the system will display a notification message and not record those data in the database.

All working stages are illustrated in Figure 5-17.

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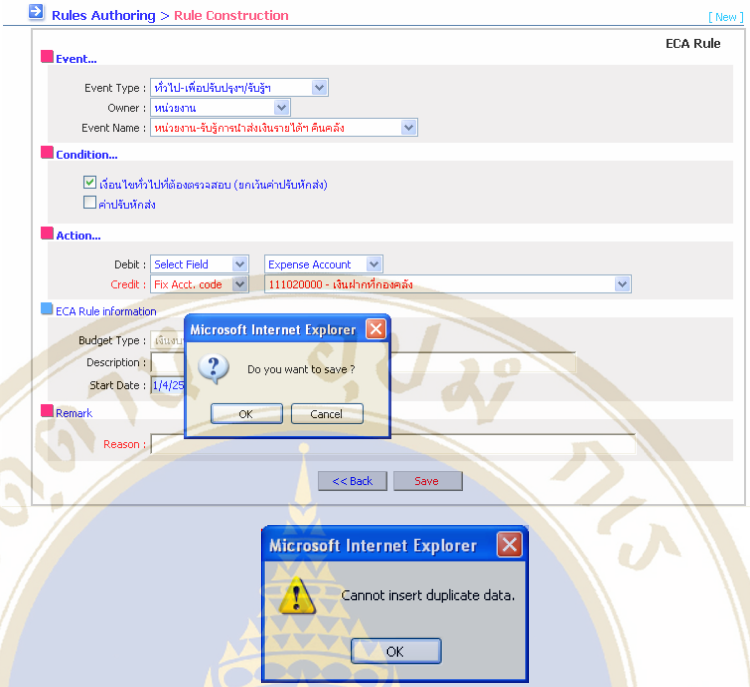

Figure 5-17 An Interface for Preparation of Rule Data – A Case of Repetitive Data Preparation

❑ Details of Test 1.5

It is a test of defining events or new process handler registration. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.
2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details. The repeated data with those stored in the database are recorded.
3. Record data. The system will monitor data recording. In case data have already been recorded, the system will

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display a notification message and not record those data in the database.

All working stages are illustrated in Figure 5-18 and 5-19, respectively.

Figure 5-18 An Interface for Retrieval of Data on Process Handler Registration

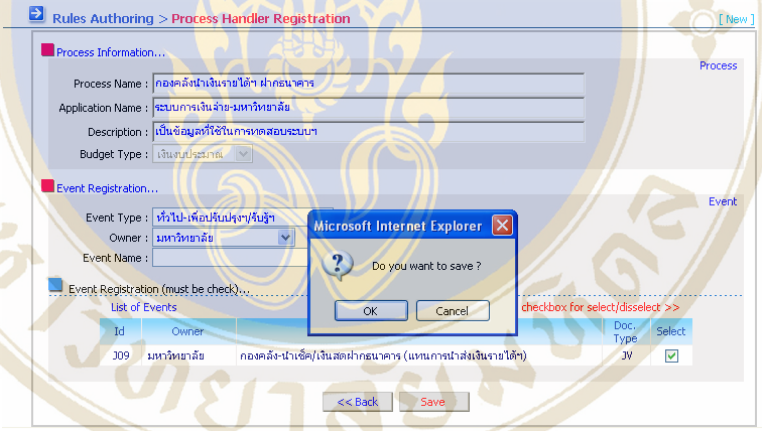

Figure 5-19 An Interface for Preparation of Data on Process Handler Registration

❑ Details of Test 1.6

It is a test of defining repetitive events in the process. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.

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2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details. The repeated data with those stored in the database are recorded.
3. Record data. The system will monitor data recording. In case data have already been recorded, the system will display a notification message and not record those data in the database.

All working stages are illustrated in Figure 5-20.

Figure 5-20 An Interface for Preparation of Data on Process Handler Registration – A Case of Repetitive Data Preparation

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2. Details of Test 2

It is a test of rule maintenance and is divided into two test cases, each of which is described below.

❑ **Details of Test 2.1**

It is a test of rule modification. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.
2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details.
3. Record data. The system will monitor data recording. In case data have never been recorded, the system will record those data until completion.

All working stages are illustrated in Figures 5-21 through 5-23, respectively.

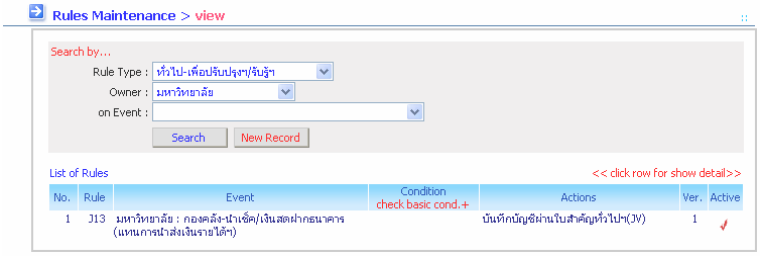

Figure 5-21 An Interface for Retrieval of Rules Data Based on Defined Conditions, for Monitoring before Rule Modification

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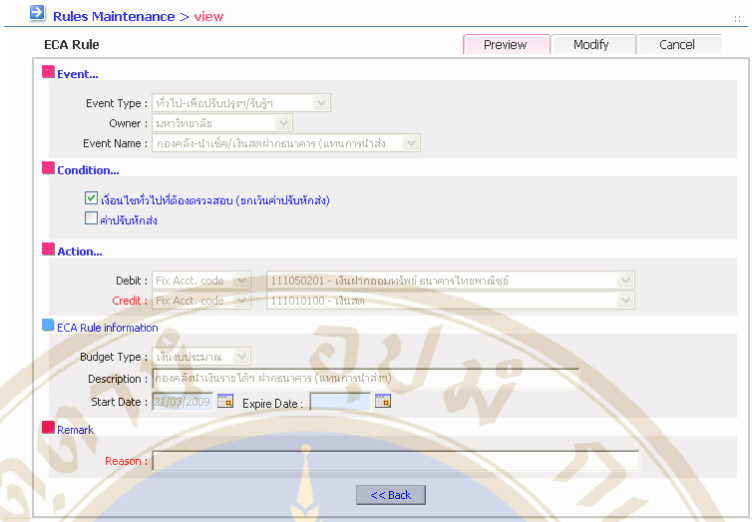

Figure 5-22 An Interface for Details of Rules Needed to be Modified

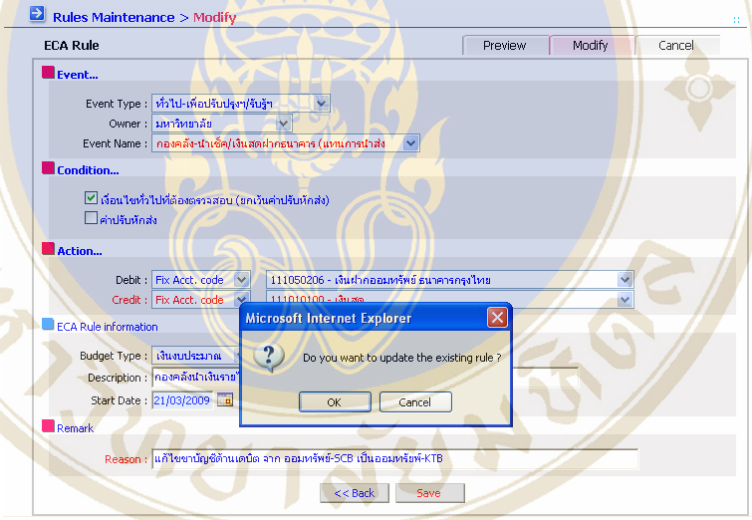

Figure 5-23 An Interface for Rules Modification

❑ Details of Test 2.2

It is a test of rule cancellation. Test stages include the following.

1. Select core data type needed to increase/construct new data, consisting of event data, condition data, data on sets of conditions, and data on revenue/expenses account, by clicking the tab of required data. Then, the system will retrieve all data or based on defined conditions, which are stored in the database.

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2. Increase or construct new data by clicking on the button New Record, and the system will display a new form for recording data details.
3. Record data. The system will monitor data recording. In case data have never been recorded, the system will record those data until completion.

All working stages are illustrated in Figure 5-24 through 5-26, respectively.

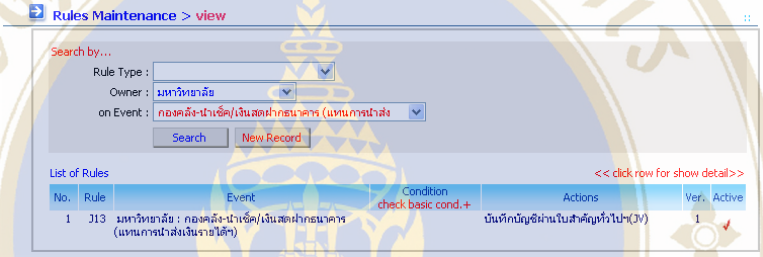

Figure 5-24 An Interface for Retrieval of Rules Data Based on Defined Conditions, for Monitoring before Rule Cancellation

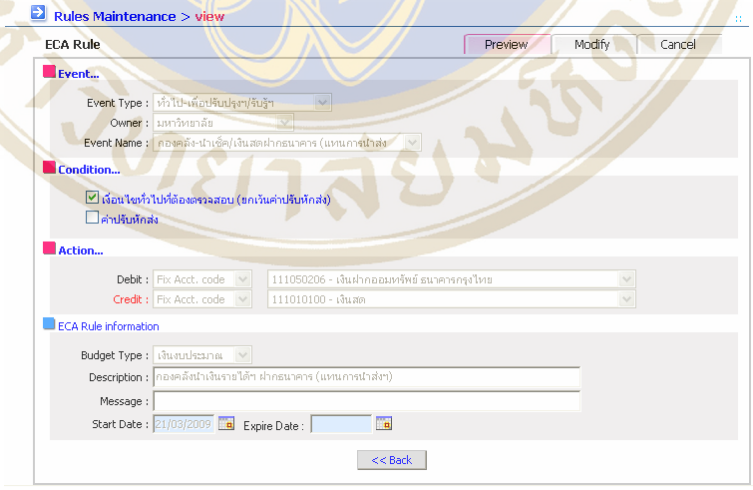

Figure 5-25 An Interface for Details of Rules Needed to Before Cancelled

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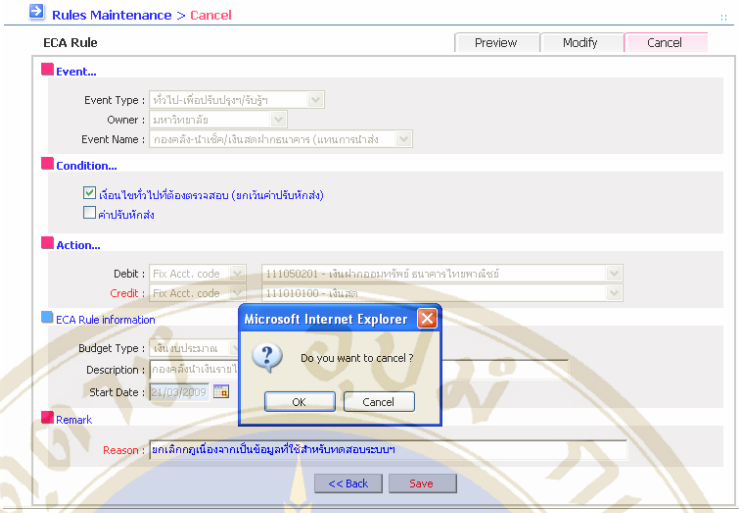

Figure 5-26 An Interface for Details of Rules Cancellation

3. Details of Test 3

It is a test of rule execution based on events occurring in a working system's processes, and accounting done in a general journal based on the rules obtained. The test is divided into eight test cases, each of which is described below.

❑ Details of Test 3.1

It is a test of rule execution via events occurring in the process of *Withdrawal for payment not via purchase/hire* for all processes related to accounting, starting from a process of debts set-up for withdrawal of expenses until completion of the process, which is debts payment to creditors. Test stages include the following.

- **Details of Test 3.1.1**

  It is a test of rule execution via a process of *Set up debts – A work units prepares vouchers for withdrawal of expenses* of the budgeting system. Test stages include the following:

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1. At the menu Rules Execution, select a system by clicking at the tab of the budgeting system.
2. Select the system process and define conditions to retrieve data. Details are given in Figure 5-27.
3. Verify accuracy and completeness of debts set-up data recorded, of which accounting is done in a general journal expenses withdrawn voucher (IV).

All working stages are displayed Figures 5-27 through 5-29, respectively.

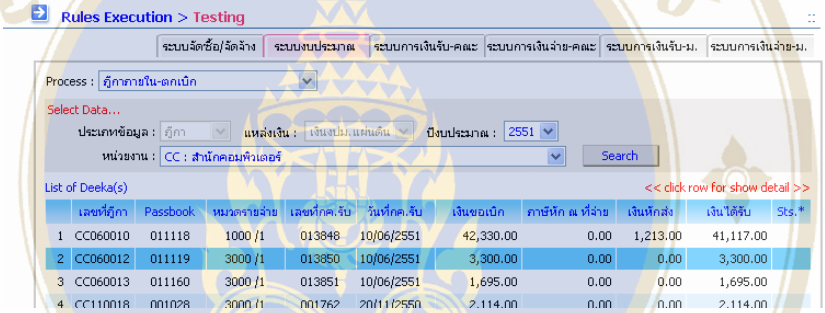

Figure 5-27 An Interface for Retrieval of Voucher Data Based on Conditions Defined

Figure 5-28 An Interface for Details of Data on Debts Set-up Voucher

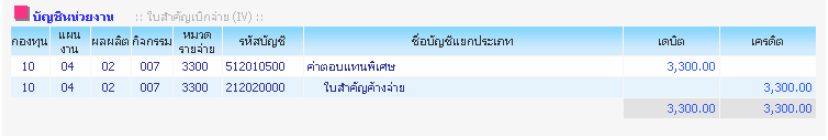

Figure 5-29 An Interface for Accounting of Debts Set-up in a General Journal

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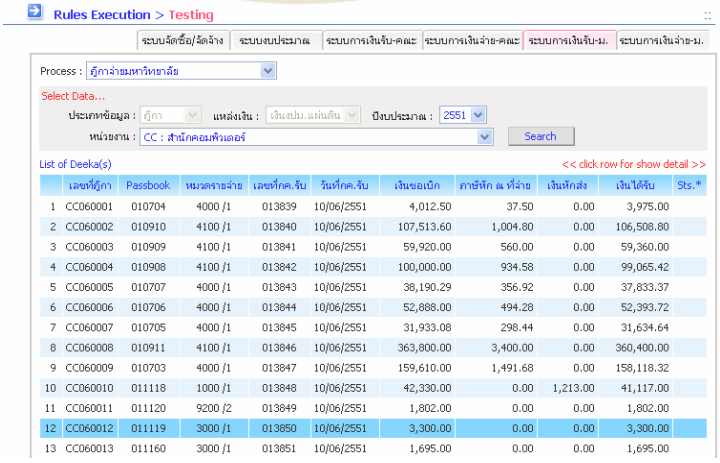
- **Details of Test 3.1.2**

It is a test of rule execution via a process of *Money reception – MU Finance division receives money transferred from the Comptroller-General's Department,* which is an event to be recognized between the Finance division and a work unit. Test stages include the following.

1. At the menu Rules Execution, select a system by clicking at the tab of the receiving financial system-MU.
2. Select the system process and define conditions to retrieve data. Details are given in Figure 5-30.
3. Verify accuracy and completeness of data on money reception recorded in a general journal, which is reciprocal accounting as follows:
   - MU account via a money reception voucher (RV), and
   - A work unit account, of which accounting is done via a general voucher (JV) to acknowledge the revenue.

All working stages are displayed Figures 5-30 and 5-31, respectively.



	เลขที่ฎีกา	Passbook	หมวดรายจ่าย	เลขที่กค.รับ	วันที่กค.รับ	เงินขอเบิก	ภาษีหัก ณ ที่จ่าย	เงินหักส่ง	เงินได้รับ	Sts.*
1	CC060001	010704	4000 /1	013839	10/06/2551	4,012.50	37.50	0.00	3,975.00	
2	CC060002	010910	4100 /1	013840	10/06/2551	107,513.60	1,004.80	0.00	106,508.80	
3	CC060003	010909	4100 /1	013841	10/06/2551	59,920.00	560.00	0.00	59,360.00	
4	CC060004	010908	4100 /1	013842	10/06/2551	100,000.00	934.58	0.00	99,065.42	
5	CC060005	010707	4000 /1	013843	10/06/2551	38,190.29	356.92	0.00	37,833.37	
6	CC060006	010706	4000 /1	013844	10/06/2551	52,888.00	494.28	0.00	52,393.72	
7	CC060007	010705	4000 /1	013845	10/06/2551	31,933.08	298.44	0.00	31,634.64	
8	CC060008	010911	4100 /1	013846	10/06/2551	363,800.00	3,400.00	0.00	360,400.00	
9	CC060009	010703	4000 /1	013847	10/06/2551	159,610.00	1,491.68	0.00	158,118.32	
10	CC060010	011118	1000 /1	013848	10/06/2551	42,330.00	0.00	1,213.00	41,117.00	
11	CC060011	011120	9200 /2	013849	10/06/2551	1,802.00	0.00	0.00	1,802.00	
12	CC060012	011119	3000 /1	013850	10/06/2551	3,300.00	0.00	0.00	3,300.00	
13	CC060013	011160	3000 /1	013851	10/06/2551	1,695.00	0.00	0.00	1,695.00	

Figure 5-30 An Interface for Data Retrieval Based on Conditions Detailed of Voucher Data Obtaining Credit

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Based on Figure5-30, when clicking to select an item, the upper interface will display details of voucher data, as seen in Figure 5-28.

Figure 5-31 An Interface for Inter-Related Accounting of Credit Reception in a General Journal

- **Details of Test 3.1.3**

  It is a test of rule execution via a process of *Pay cheque – MU finance division pay cheques to a work unit*, which is an event to be recognized between the Finance division and a work unit. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the paying financial system-MU.
  2. Select the system process and define conditions to retrieve data. Details are given in Figure 5-32.
  3. Verify accuracy and completeness of payment data recorded in a general journal, which is reciprocal accounting as follows:
     - MU account via a payment voucher (PV), and
     - A work unit account, of which accounting is done via a general voucher (JV) to acknowledge the revenue.

  All working stages are displayed Figures 5-32 and 5-33, respectively.

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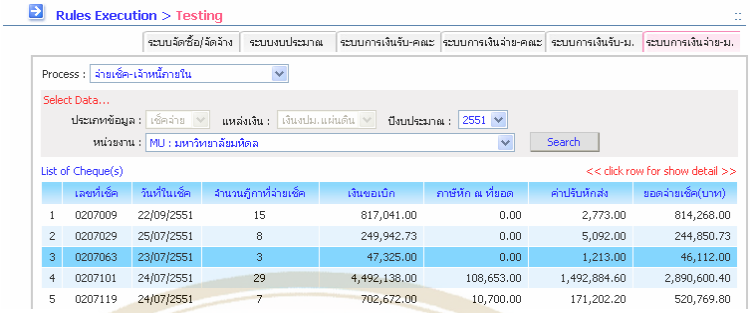

Figure 5-32 An Interface for Inter-Retrieval of Data on Cheques Paid Based on Conditions Defined

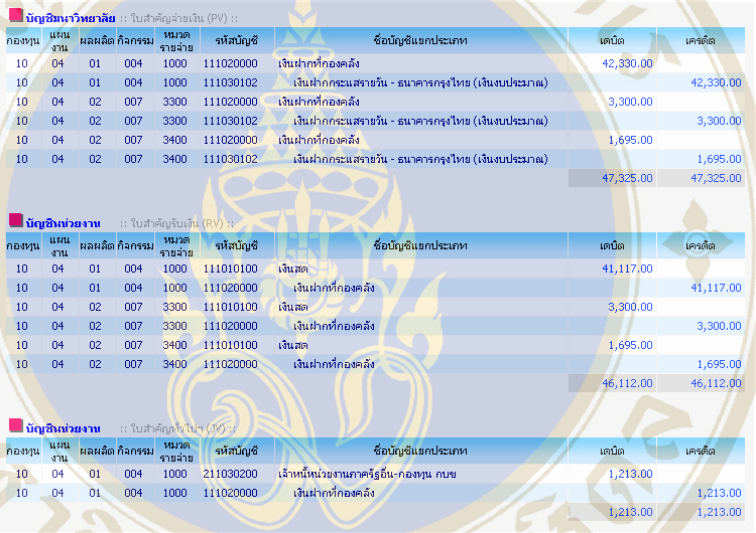

Figure 5-33 An Interface for Inter-Related Accounting of Cheques Payment in a General Journal

- **Details of Test 3.1.4**

  It is a test of rule execution via a process of *Deposit cheques in a bank – A work unit deposits cheques in a bank of the receiving financial system – a faculty*. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the receiving financial system-faculty.
  2. Select the system process and define conditions to retrieve data. Details are given in Figure 5-34.

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3. Verify accuracy and completeness of data on debts set-up recorded in a general journal via a general voucher (JV).

All working stages are displayed Figures 5-34 through 5-36, respectively.

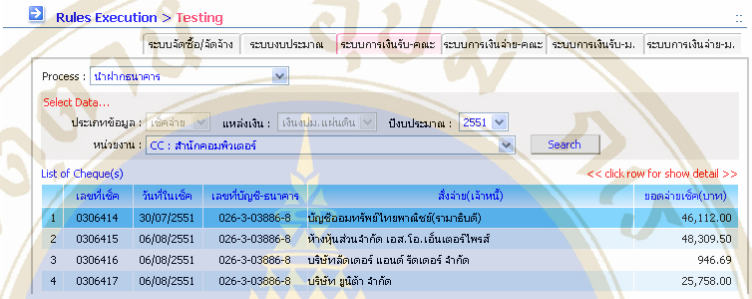

Figure 5-34 An Interface for Retrieval of Data on Derived Cheques Based on Conditions Defined

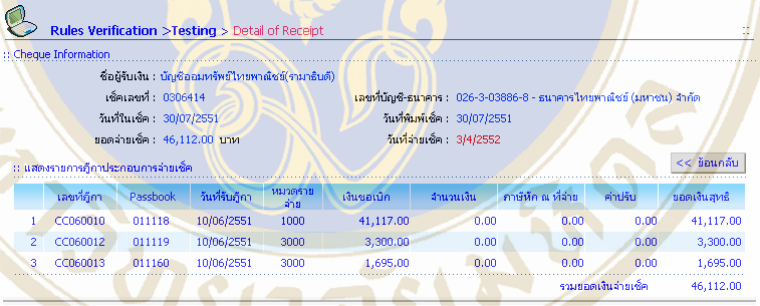

Figure 5-35 An Interface for Details of Cheques Data

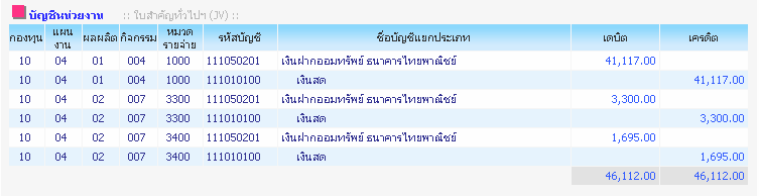

Figure 5-36 An Interface for Accounting of Money Reception in a General Journal

- **Details of Test 3.1.5**

It is a test of rule execution via a process of *Pay cheques – A work unit pays cheques to creditors* of the paying

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financial system – faculty. Test stages include the following.

1. At the menu Rules Execution, select a system by clicking at the tab of the paying financial system-faculty.
2. Select the system process and define conditions to retrieve data. Details are given in Figure 5-37.
3. Verify accuracy and completeness of data on debts set-up recorded in a general journal via a payment voucher (PV).

All working stages are displayed Figures 5-37 and 5-38, respectively.

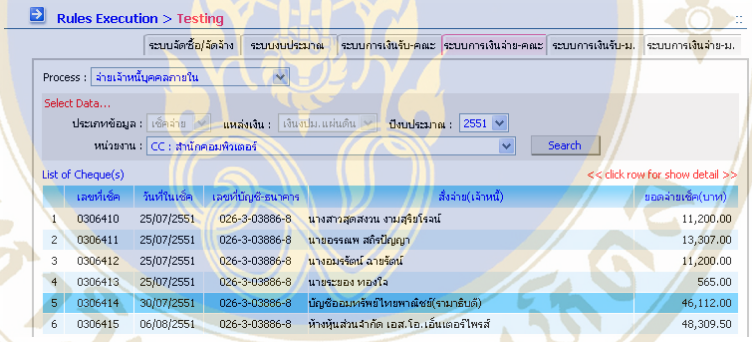

Figure 5-37 An Interface for Retrieval of Data on Cheques Paid Based on Conditions Defined, of the Paying Financial System - Faculty

Based on Figure 5-37, After clicking to select an item, an upper interface will display details of cheques paid, as seen in Figure 5-35.

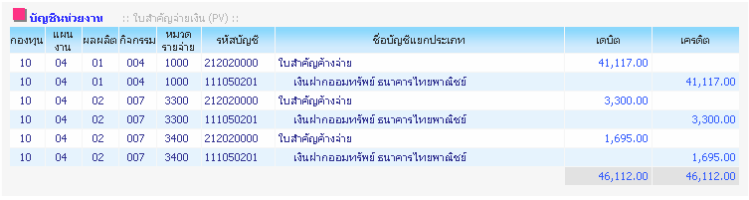

Figure 5-38 An Interface for Accounting of Payment in a General Journal

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❑ **Details of Test 3.2**

It is a test of rule execution of newly constructed or increased rules from a rise in core data, such as an increase in expenses group or events occurring in a working system's processes that need to be recognized and book entries. It is divided into two test cases as follows.

- **Details of Test 3.2.1**

It is a test of rule execution of rules newly constructed or increased resulting from an augmentation of expenses group, which has to be registered or matched the code of revenue/expenses account with expenses category data for account booking.

A test in this case has an assumption that we need to book remaining material account at the level of material classification, the same as durable article items. Thus, the working systems concerned increase data on sub-expenses groups and accounts in MU account chart, as well as register expenses data in the accounting rules management system (ARMS). Test stages include the following.

1. Increase data on matching the code of revenue/expenses account with expenses group data. At the menu Rules Authoring/Data Preparation, select data type by clicking at the tab of Account Mapping. Details are given in Figure 5-39.
2. Test rules accuracy via a debts set-up process as follows:
   - At the menu Rules Execution, select a system by clicking at the tab of the paying financial system – faculty. Select the system process and define conditions to retrieve data. Details are given in Figure 5-40.

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- Verify accuracy and completeness of debts set-up data recorded in a general journal via a expenses withdrawn voucher (IV).

All working stages are displayed in Figures 5-39 through 5-42, respectively.

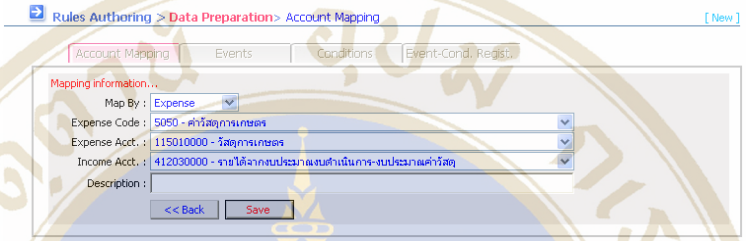

Figure 5-39 An Interface for Preparation of Data on Revenue/Expenses Account

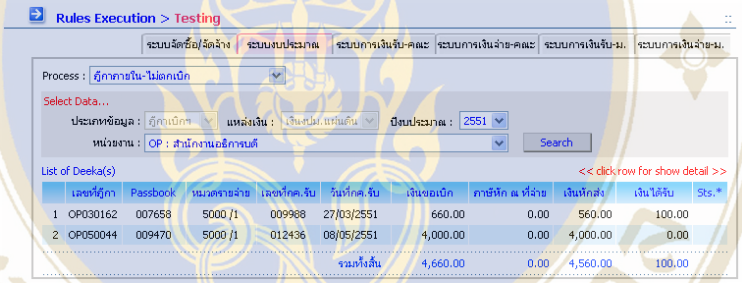

Figure 5-40 An Interface for Retrieval of Voucher Data Based on Conditions defined

Figure 5-41 An Interface for Details of Data on a Voucher for Withdrawal of Expenses

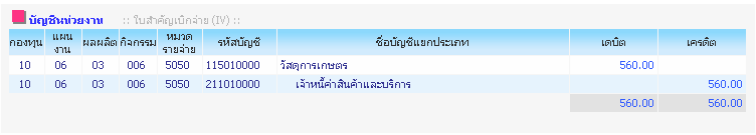

Figure 5-42 An Interface for Accounting of Debts Set-Up in a General Journal

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- **Details of Test 3.2.2**

  It is a test of execution of rules newly constructed or increased from rise in events to be recognized and do accounting.

  A test in this case has an assumption that MU's financial management is changed due to its status changed to be outside the state supervision in order to maintain flexibility and independence. Therefore, MU former policy on submission of public revenue to the Finance Ministry is changed. Currently, the revenue is regarded to belong to MU and not have to be submitted to the Finance Ministry. Based on the above assumption, it has an impact on accounting rules and accounting processes of the paying financial system-MU (In this test we do not mention a process of modification of data on previous process handler registration). Test stage include the following.

  1. Increase data on matching the code of revenue/expenses account with expenses group data. At the menu Rules Authoring/Data Preparation, select data type by clicking at the tab of Account Mapping. Details are given in Figure 5-43.
  2. Increase accounting rules data at the menu Rules Authoring/Rules Construction. Details are given in Figure 5-44
  3. Do the process handler registration to execute rules. Details are given in Figure 5-45.
  4. Test accuracy of rules via a process of deposit of revenue in a bank as the following
     - At the menu Rules Execution, select a system by clicking at the tab of the paying financial system – MU.

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- Select the system process and define conditions to retrieve data. Details are given in Figure 5-46.
- Verify accuracy and completeness of data on deposit of money in a bank, recorded in a general journal via a general voucher (JV).

All working stages are displayed in Figures 5-43 through 5-48, respectively.

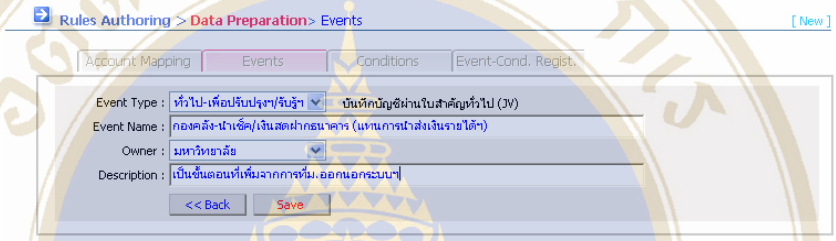

Figure 5-43 An Interface for Preparation of Event Data

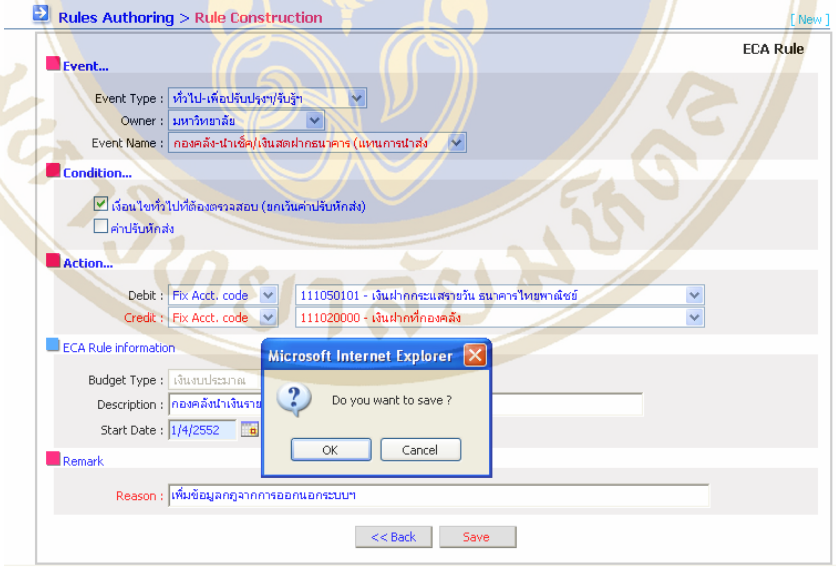

Figure 5-44 An Interface for Preparation of Rules Data

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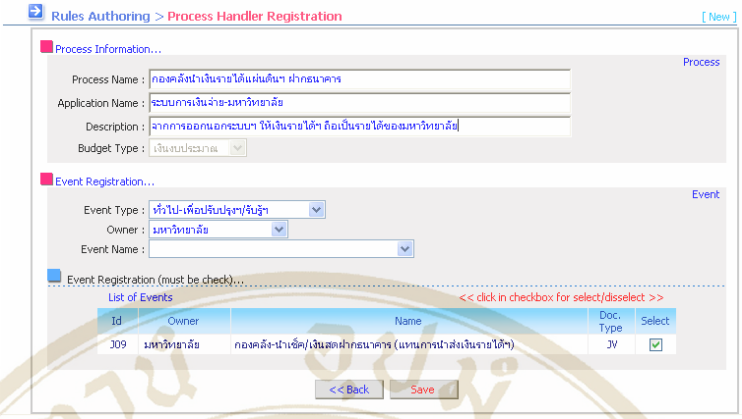

Figure 5-45 An Interface for Preparation of Data on Process Handler Registration

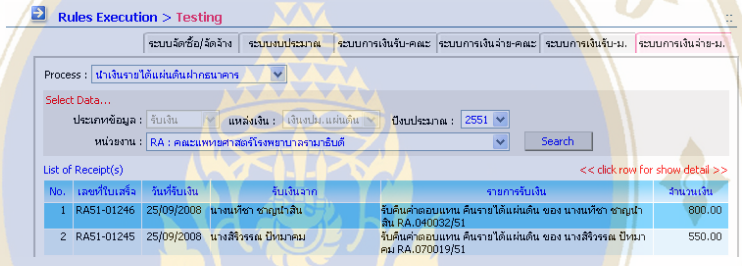

Figure 5-46 An Interface for Retrieval of Receipt Data Based on Conditions Defined

Figure 5-47 An Interface for Details of Data on Money Reception

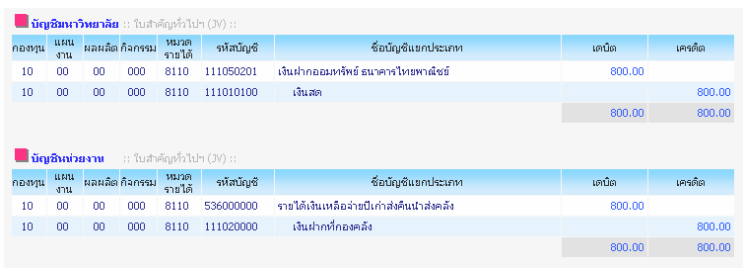

Figure 5-48 An Interface for Accounting of Money Reception in a General Journal

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❑ **Details of Test 3.3**

It is a test of execution of modified rules, which may be the modification of rules data that need to book accounts or of core data, such as matching the code of revenue/expenses account of an expenses group. It is divided into two test cases as follows:

- **Details of Test 3.3.1**

It is a test of execution of rules of which core data are modified, which affects the accounting. A test in this case has an assumption that there is an alteration to the code of expenses account attached to an expenses group. Test stages include the following.

1. Display accounting data in a general journal in the case that rules have not been modified. Details are given in Figures 5-49 and 5-50.
2. Modify data on the code of expenses account of an expenses group required. Details are given in Figure 5-51 and 5-52.
3. Test execution of modified rules (Data on revenue/expenses account of an expenses group) via a debts set-up process. Details are given in Figure 5-53.

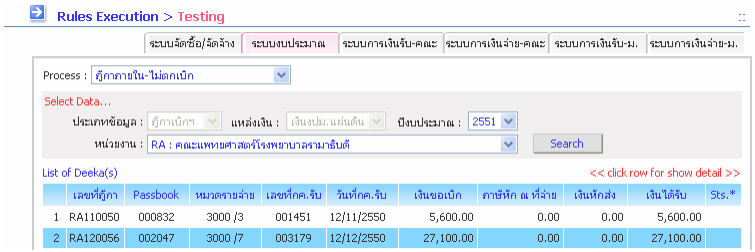

Figure 5-49 An Interface for Retrieval of Voucher Data Based on Conditions Defined

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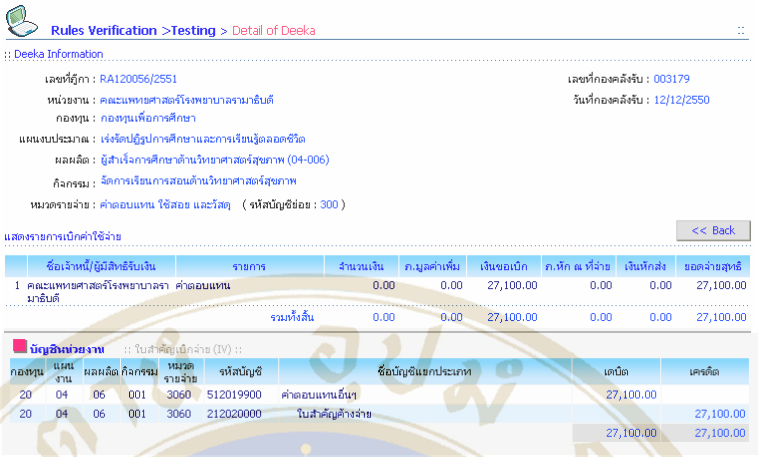

Figure 5-50 An Interface for Details of Voucher and Debts Set-up Accounting in a General Journal

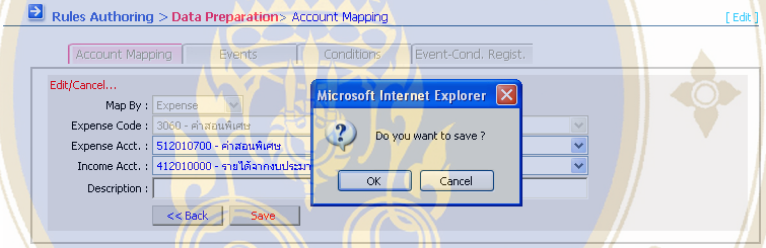

Figure 5-51 An Interface for Modification of Data on Revenue/Expenses Account

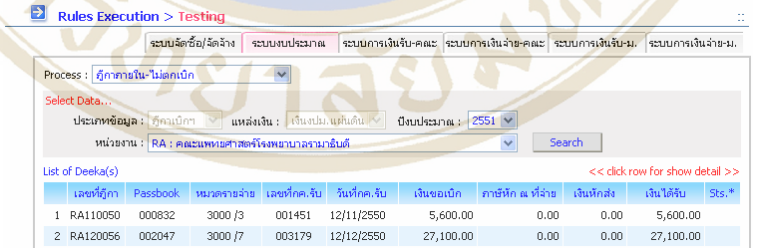

Figure 5-52 An Interface for Retrieval of Voucher Data Based on Conditions Defined

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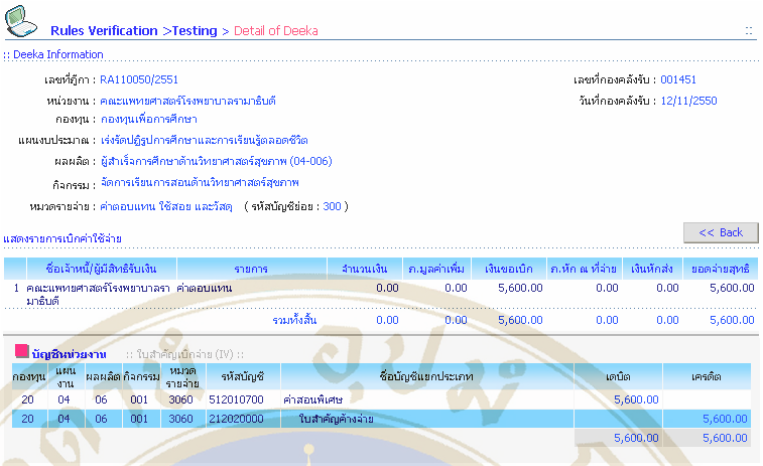

Figure 5-53 An Interface for Details of Voucher and Debts Set-up Accounting in a General Journal

- **Details of Test 3.3.2**

  It is a test of execution of rules of which accounting data are modified. A test in this case has an assumption that MU Finance division wants to change the bank where it pays cheques/transfers money to its creditors. Test stages include the following.

  1. Display payment data in a general journal in the case rules have not been modified. Details are given in Figures 5-54.
  2. Modify accounting rules data in a process of overdrawn money reception of a work unit. Details are given in Figure 5-55.
  3. Test execution of modified rules via a payment process of the paying financial system-MU. Details are given in Figure 5-56 and 5-57.

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Figure 5-54 An Interface for Cheque and Accounting of Payment in a General Journal

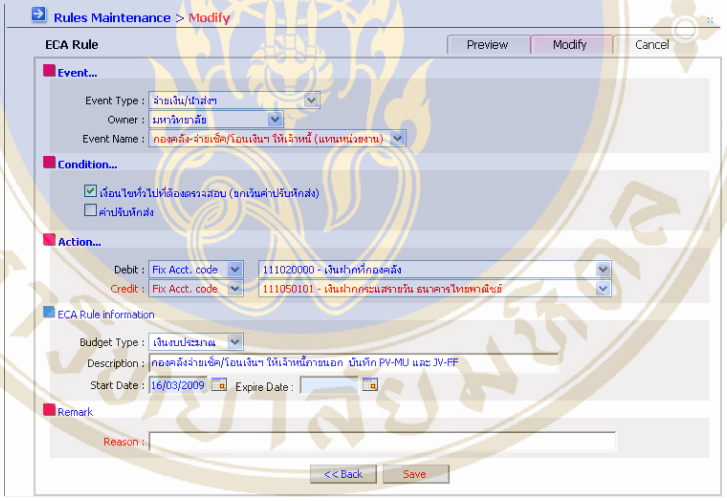

Figure 5-55 An Interface for Modification of Accounting Rules Data

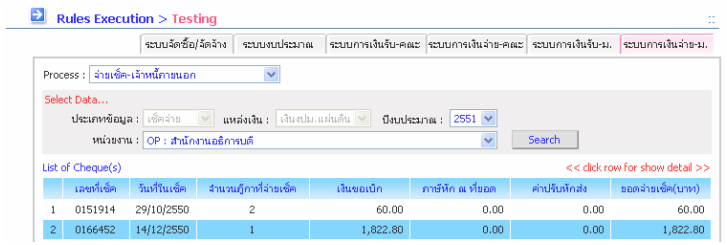

Figure 5-56 An Interface for Retrieval of Data on Cheques Paid Based on Conditions Defined

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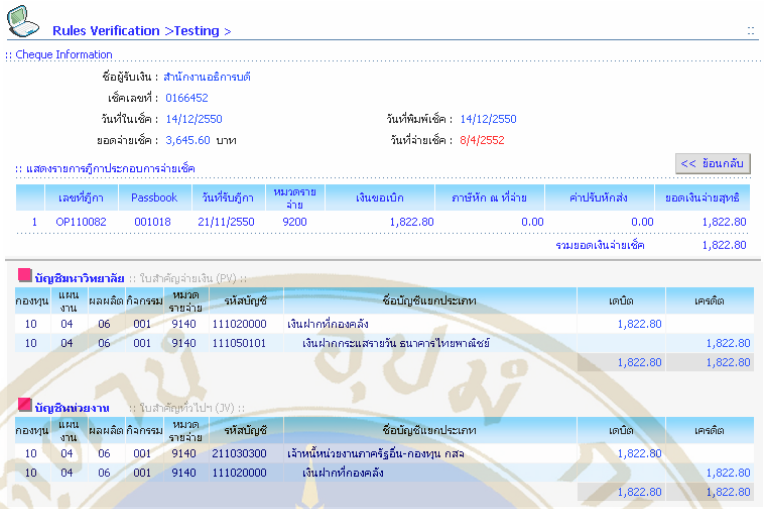

Figure 5-57 An Interface for Details of Cheque and Accounting of Payment in a General Journal

- **Details of Test 3.4**

  It is a test of execution of cancelled rules but a process of execution of cancelled rules is not cancelled. A test in this case has an assumption that Mahidol University's former policy on submission of public revenue to Finance Ministry is changed due to going out of a normal system. Currently, the revenue is regarded as belong to MU and so does not have to be submitted to the Finance Ministry. Such an assumption affects accounting rules and an accounting process of the paying financial system – MU. Test stages include the following.

  1. Cancel the rule on submission of public revenue to the Finance Ministry of the paying financial system-MU. Details are given in Figures 5-58 and 5-59.
  2. Test execution of cancelled rules via a process of submission of public revenue to the Finance Ministry. Details are given in Figure 5-60 and 5-61.

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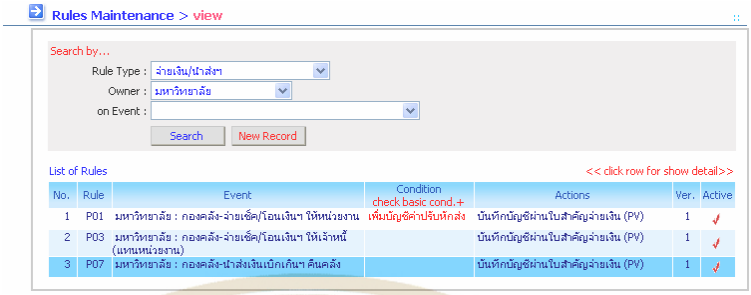

Figure 5-58 An Interface for Retrieval of Rules Data Based on Conditions Defined

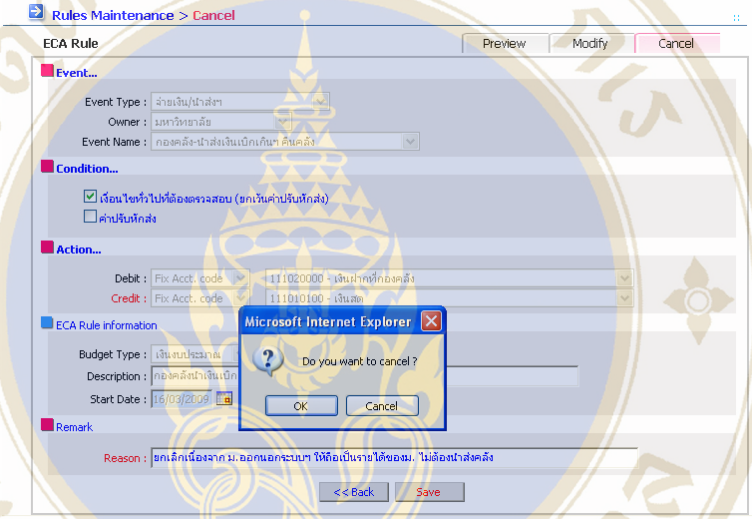

Figure 5-59 An Interface for Cancellation of Rules Data

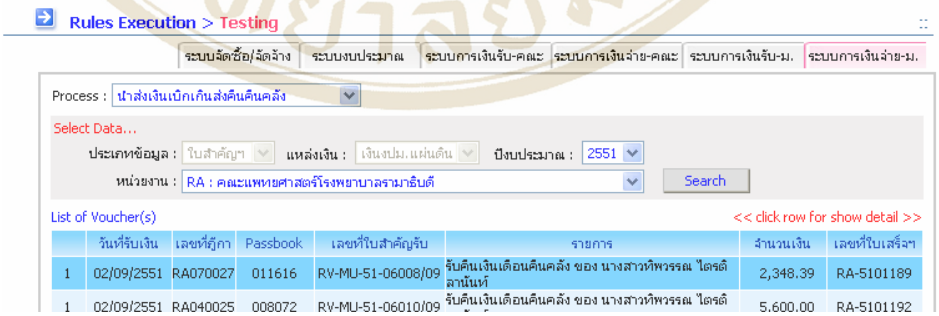

Figure 5-60 An Interface for Retrieval of Receipt Data Based on Conditions Defined

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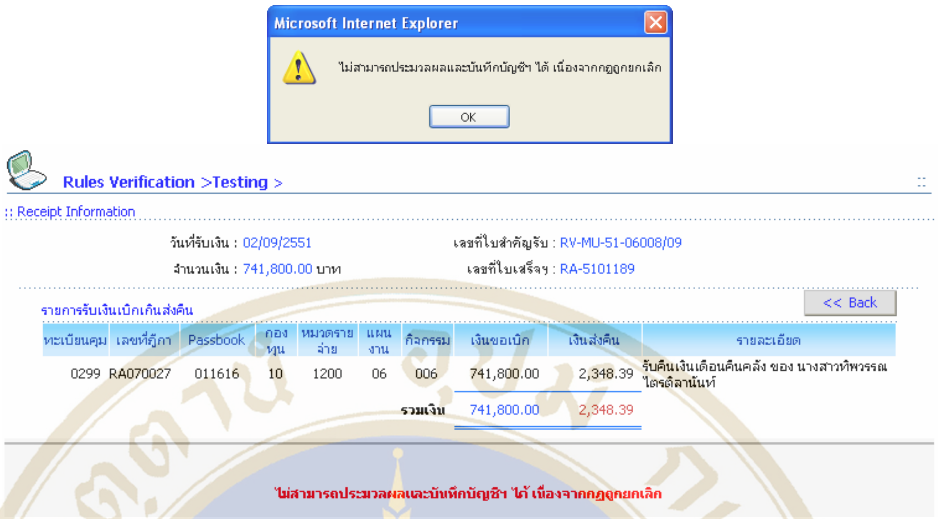

Figure 5-61 An Interface for Payment Accounting in a General Journal

❑ Details of Test 3.5

It is a test of rules execution via an event occurring in the process of *Withdrawal for Payment via Puchase/Hire – pay directly to creditors by the Comptroller-General's Department* on behalf of a work unit. It is divided into two test cases as follows:

- **Details of Test 3.5.1**

  It is a test of rules execution via a process of *Debts set-up – a work unit records data on goods inspection for reception* of the purchase/hire system. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the purchase/hire system.
  2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-62.
  3. Verify accuracy and completeness of debts set-up data recorded in a general journal via a expense reimbursement voucher for expenses withdrawal (IV).

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All working stages are displayed in Figures 5-62 through 5-64, respectively.

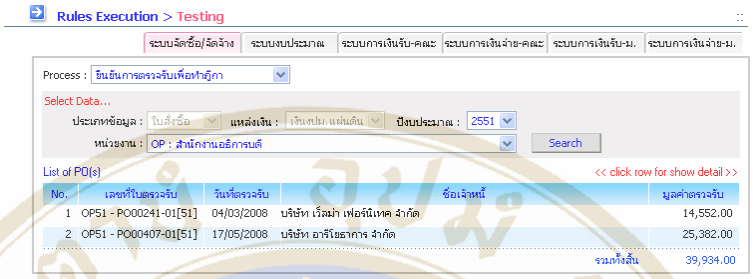

Figure 5-62 An Interface for Retrieval of Data on Goods Inspection for Reception Based on Conditions Defined

Figure 5-63 An Interface for Details of Purchase Order Data

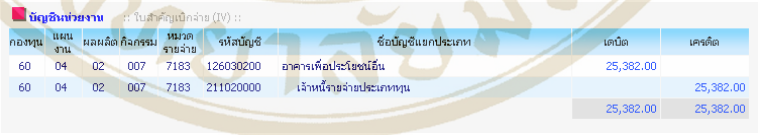

Figure 5-64 An Interface for Debts Set-up Accounting in a General Journal

- **Details of Test 3.5.2**

  It is a test of rules execution via an event occurring in the process of *MU Finance division records an item on registration of direct payment to creditors, on behalf of a work unit, by the Comptroller-General's Department.* Test stages include the following.

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1. At the menu Rules Execution, select a system by clicking at the tab of the receiving financial system-MU.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-65.
3. Verify accuracy and completeness of data on direct payment to creditors, recorded in a general journal, via a payment voucher (PV).

All working stages are displayed in Figures 5-65 through 5-67, respectively.

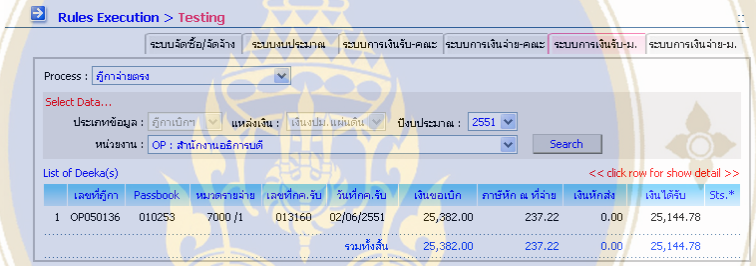

Figure 5-65 An Interface for Retrieval of Voucher Data Based on Defined Conditions of the Receiving Financial System-MU

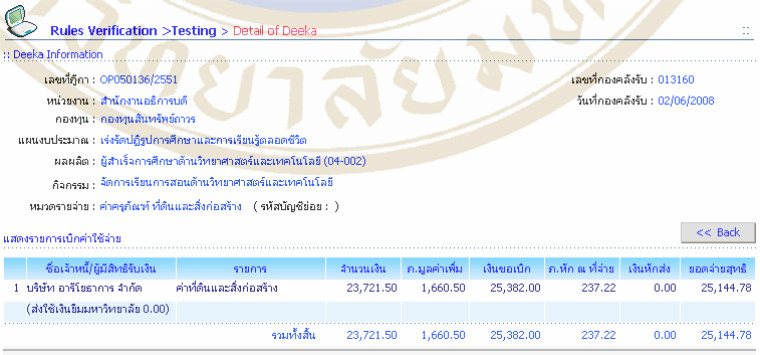

Figure 5-66 An Interface for Details of Voucher Data

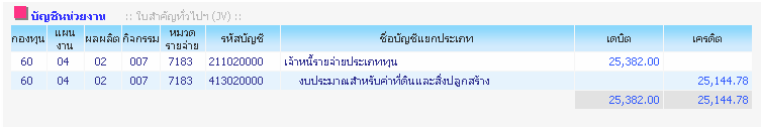

Figure 5-67 An Interface for Accounting to Acknowledge Direct Payment to Creditors on Behalf of a Work Unit in a General Journal

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❑ **Details of Test 3.6**

It is a test of rules execution via an event occurring in the process of *Withdrawal for Payment via Puchase/Hire*. It is divided into three following test cases.

- **Details of Test 3.6.1**

It is a test of rules execution via a process of *Debts set-up – a work unit prepares a voucher for withdrawal of expenses* of the budgeting system. Test stages include the following.

1. At the menu Rules Execution, select a system by clicking at the tab of the budgeting system.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-68.
3. Verify accuracy and completeness of debts set-up data recorded in a general journal via a expense reimbursement voucher for expenses withdrawal (IV).

All working stages are displayed in Figures 5-68 through 5-70, respectively.

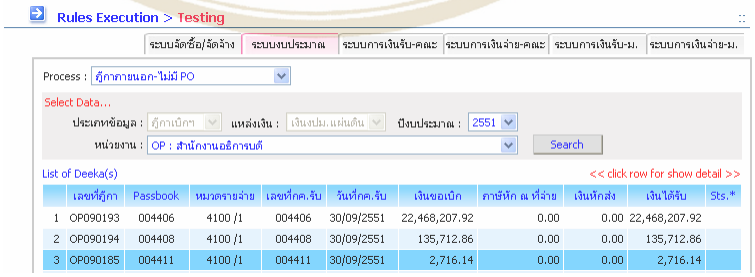

Figure 5-68 An Interface for Retrieval of Voucher Data Based on Conditions Defined

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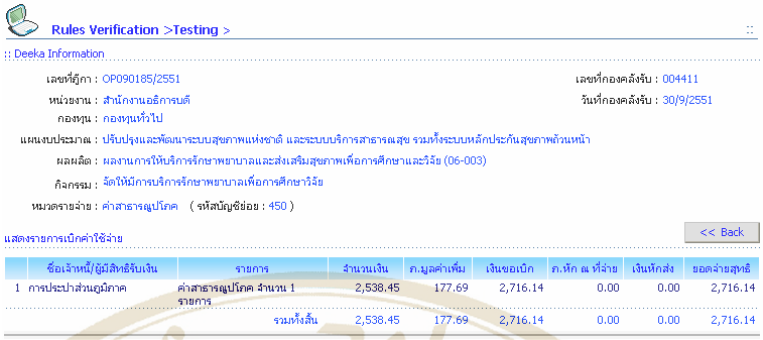

Figure 5-69 An Interface for Details of Voucher Data

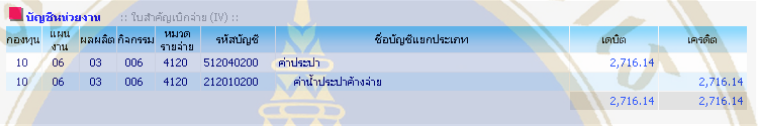

Figure 5-70 An Interface for Accounting of Debts Set-up in a General Journal

- **Details of Test 3.6.2**

  It is a test of rules execution via a process of *Money reception – MU finance division receives money transferred from the Comptroller-General's Department,* which is an event to be recognized between MU finance division and a work unit. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the receiving financial system-MU.
  2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-71.
  3. Verify accuracy and completeness of data on money reception recorded in a general journal, which is reciprocal accounting as follows:
     - MU account via a money reception voucher (RV), and

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- A work unit account, of which accounting is done via a general voucher (JV) to acknowledge the revenue.

All working stages are displayed in Figures 5-71 and 5-72, respectively.

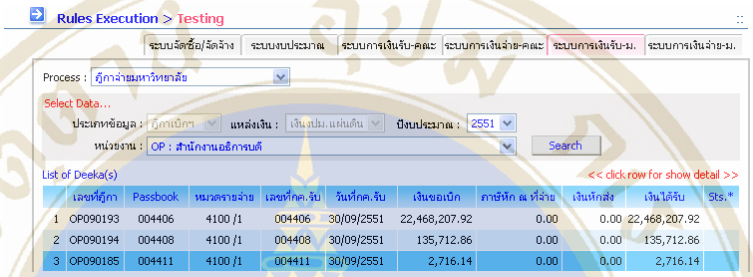

Figure 5-71 An Interface for Retrieval of Data Based on Defined Conditions of Data on Voucher Obtaining Credit

Based on Figure 5-71, when clicking to select an item, an upper interface will display details of voucher data, as seen in Figure 5-69.

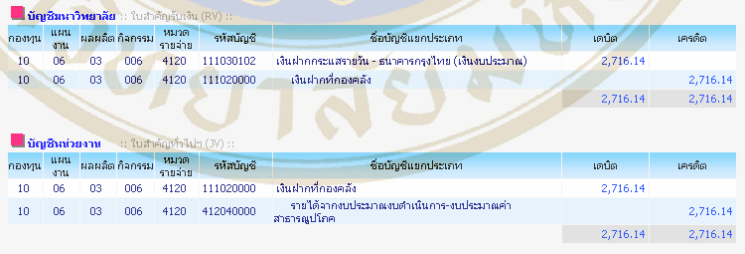

Figure 5-72 An Interface for Inter-Related Accounting of Receiving Credit in a General Journal

- **Details of Test 3.6.3**

It is a test of rules execution via a process of *Cheque payment – MU Finance division pays cheques to external creditors*, which is an event to be recognized between MU Finance division and a work unit. Test stages include the following.

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1. At the menu Rules Execution, select a system by clicking at the tab of the paying financial system-MU.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-73.
3. Verify accuracy and completeness of payment data recorded in a general journal, which is reciprocal accounting as follows:
   - MU account via a payment voucher (PV), and
   - A work unit account, of which accounting is done via a general voucher (JV) to acknowledge revenue.

All working stages are displayed in Figures 5-73 through 5-75, respectively.

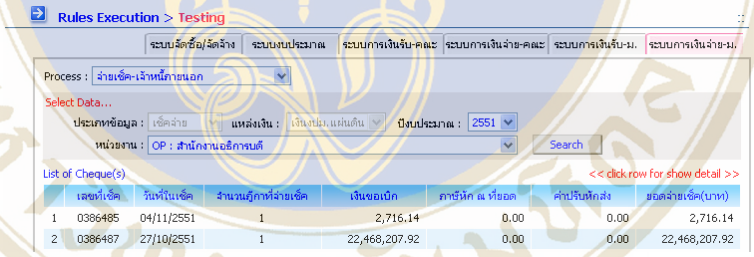

Figure 5-73 An Interface for Retrieval of Data on Cheque Paid Based on Conditions Defined

Figure 5-74 An Interface for Details of Cheque Data

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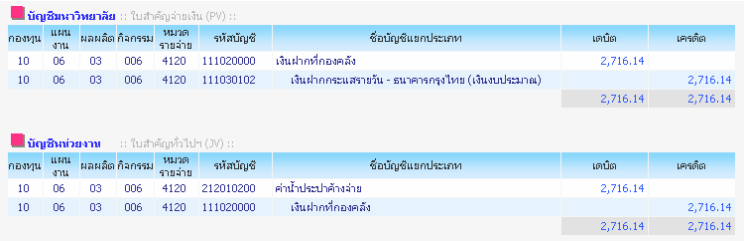

บัญชีมหาวิทยาลัย :: ใบสำคัญจ่ายเงิน (PV) ::

กองทุน	แผนงาน	ผลผลิต	กิจกรรม	หมวดรายจ่าย	รหัสบัญชี	ชื่อบัญชีแยกประเภท	เดบิต	เครดิต
10	06	03	006	4120	111020000	เงินฝากที่กองคลัง	2,716.14	
10	06	03	006	4120	111030102	เงินฝากกระแสรายวัน - ธนาคารกรุงไทย (เงินงบประมาณ)		2,716.14
							2,716.14	2,716.14

บัญชีหน่วยงาน :: ใบสำคัญทั่วไปฯ (JV) ::

กองทุน	แผนงาน	ผลผลิต	กิจกรรม	หมวดรายจ่าย	รหัสบัญชี	ชื่อบัญชีแยกประเภท	เดบิต	เครดิต
10	06	03	006	4120	212010200	ค่าน้ำประปาค้างจ่าย	2,716.14	
10	06	03	006	4120	111020000	เงินฝากที่กองคลัง		2,716.14
							2,716.14	2,716.14

Figure 5-75 An Interface for Inter-Related Accounting of Cheque Payment in a General Journal

❑ **Details of Test 3.7**

It is a test of rules execution via an event occurring in the process of *Reception of public revenue*, for all processes related to accounting, ranging from a process of revenue reception till the completion of the process, which is submission of revenue to the Finance Ministry. Test stages include the following.

- **Details of Test 3.7.1**

  It is a test of rules execution via a process of *Money reception – a work unit receives public revenue* of the receiving financial system – faculty. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the receiving financial system-faculty.
  2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-76.
  3. Verify accuracy and completeness of data on money reception recorded in a general journal via a money reception voucher (RV).

  All working stages are displayed in Figures 5-76 through 5-78, respectively.

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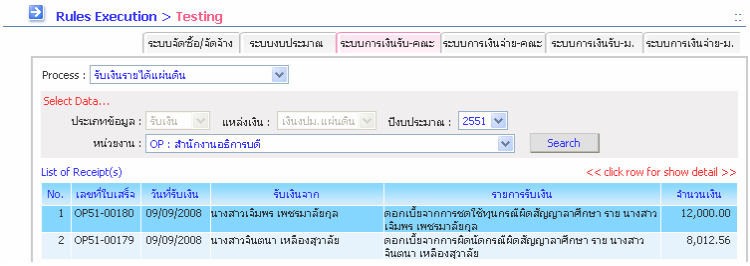

Figure 5-76 An Interface for Retrieval of Data on Money Reception Based on Defined Conditions of the Receiving Financial System-Faculty

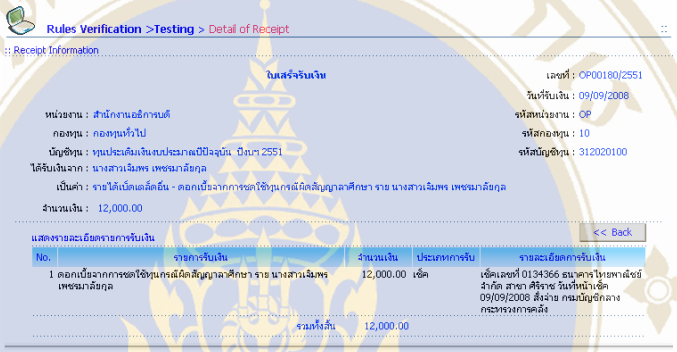

Figure 5-77 An Interface for Details of a Receipt

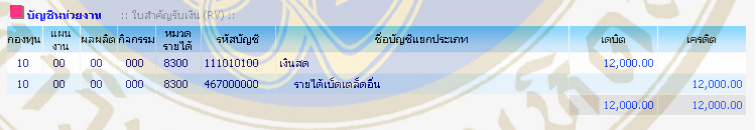

Figure 5-78 An Interface for Accounting of Money Reception in a General Journal

- **Details of Test 3.7.2**

  It is a test of rules execution via a process of *Revenue submission – a work unit submits public revenue to MU Finance division* of the paying financial system – faculty. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the paying financial system-faculty.
  2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-79.

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3. Verify accuracy and completeness of payment data recorded in a general journal via a payment voucher (PV).

All working stages are displayed in Figures 5-79 through 5-80, respectively.

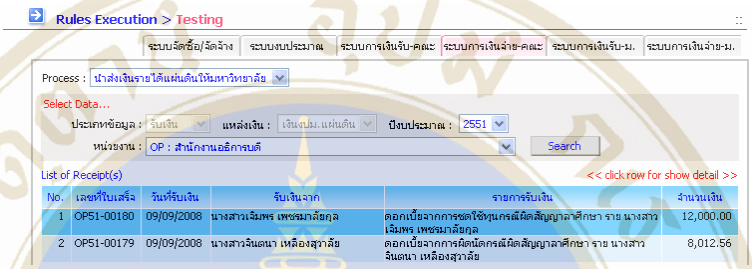

Figure 5-79 An Interface for Retrieval of Receipt Data Based on Defined Conditions of the Paying Financial System-Faculty

Based on Figure 5-79, when clicking to select an item, an upper interface will display details of data on public revenue reception, as seen in Figure 5-77.

Figure 5-80 An Interface for Accounting of Payment in a General Journal

- **Details of Test 3.7.3**

It is a test of rules execution via a process of *Money reception – MU Finance division receives public revenue from a work unit* of the receiving financial system – MU. Test stages include the following.

1. At the menu Rules Execution, select a system by clicking at the tab of the receiving financial system-MU.

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2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-81.
3. Verify accuracy and completeness of money reception data recorded in a general journal via a money reception voucher (RV).

All working stages are displayed in Figures 5-81 and 5-82, respectively.

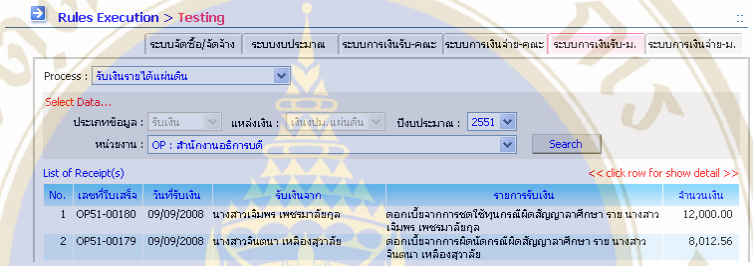

Figure 5-81 An Interface for Retrieval of Receipt Data Based on Defined Conditions of the Receiving Financial System-MU

Based on Figure 5-81, when clicking to select an item, an upper interface will display details of revenue reception data, as seen in Figure 5-77.

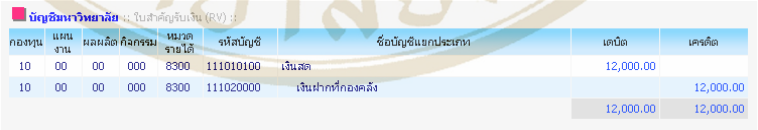

Figure 5-82 An Interface for Accounting of Money Reception in a General Journal

- **Details of Test 3.7.4**

It is a test of rules execution via a process of *Submission of public revenue to the Finance Ministry – MU Finance division submits public revenue to the Finance Ministry* of the paying financial system – MU. Test stages include the following.

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1. At the menu Rules Execution, select a system by clicking at the tab of the paying financial system-MU.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-83.
3. Verify accuracy and completeness of money reception data recorded in a general journal, which is reciprocal accounting as follows:
   - MU account via a payment voucher (PV), and
   - A work unit account, of which accounting is done via a general voucher (JV) to acknowledge revenue.

All working stages are displayed in Figures 5-83 and 5-84, respectively.

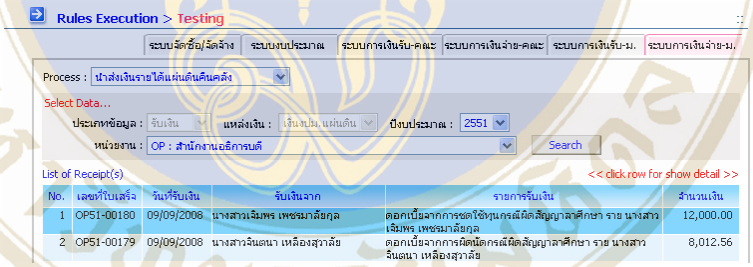

Figure 5-83 An Interface for Retrieval of Receipt Data Based on Defined Conditions of the Paying Financial System-MU

Based on Figure 5-83, when clicking to select an item, an upper interface will display details of data on revenue reception, as seen in Figure 5-77.

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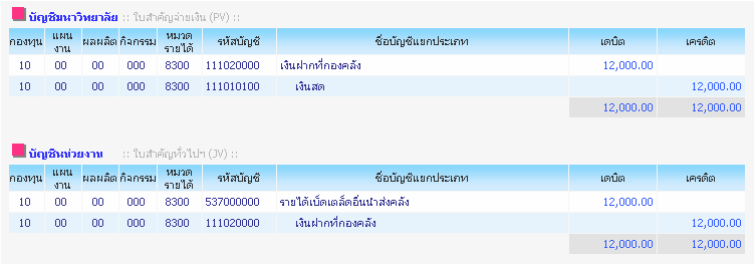

Figure 5-84 An Interface for Inter-Related Accounting of Submission of Public Revenue in a General Journal

❑ **Details of Test 3.8**

It is a test of rules execution via a process of *Reception of money overdrawn and returned* for all processes related to accounting, ranging from a process of reception of money overdrawn and returned till completion of the process, which is submission of revenue to the Finance Ministry. Test stages include the following.

- **Details of Test 3.8.1**

It is a test of rules execution via a process of *Money reception – a work unit receives money overdrawn and returned* of the receiving financial system – faculty. Test stages include the following.

1. At the menu Rules Execution, select a system by clicking at the tab of the budgeting system.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-85.
3. Verify accuracy and completeness of money overdrawn and returned, recorded in a general journal via a money reception voucher (RV).

All working stages are displayed in Figures 5-85 through 5-87, respectively.

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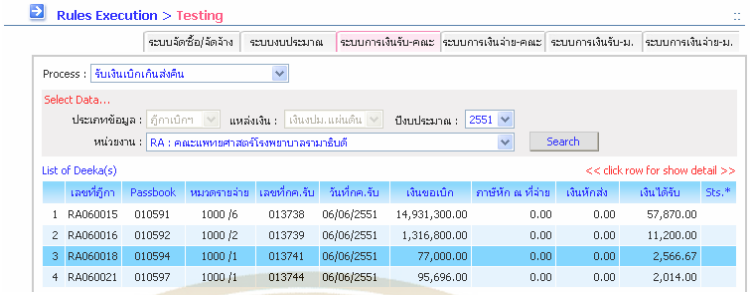

Figure 5-85 An Interface for Retrieval of Money Reception Data Based on Conditions Defined

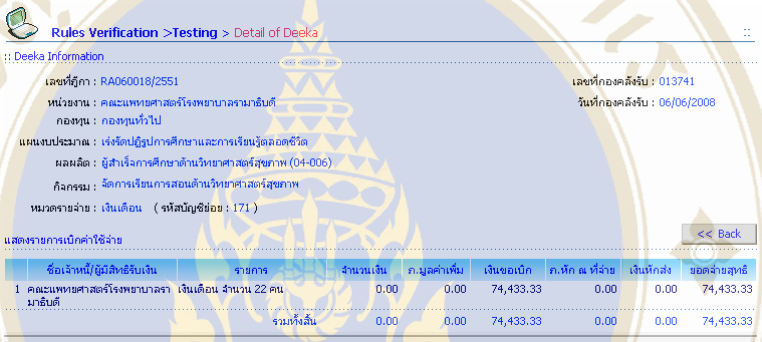

Figure 5-86 An Interface for Details of Money Reception Data

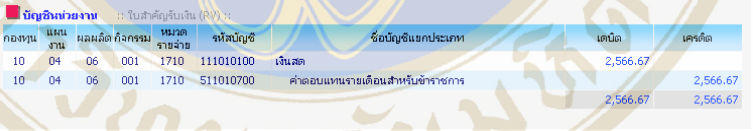

Figure 5-87 An Interface for Accounting of Money Reception in a General Journal

- **Details of Test 3.8.2**

  It is a test of rules execution via a process of *Submission of money – a work unit submits overdrawn money to MU Finance division* of the paying financial system – faculty. Test stages include the following.

  1. At the menu Rules Execution, select a system by clicking at the tab of the budgeting system.
  2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-88.

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3. Verify accuracy and completeness of payment data recorded in a general journal via a payment voucher (PV).

All working stages are displayed in Figures 5-88 through 5-90, respectively.

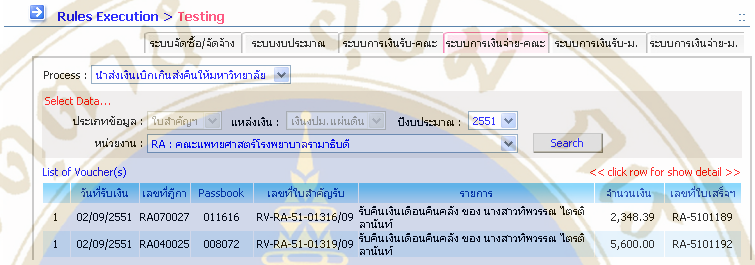

Figure 5-88 An Interface for Retrieval of Data on Voucher for Money Reception Based on Conditions Defined

Figure 5-89 An Interface for Details of Voucher for Money Reception

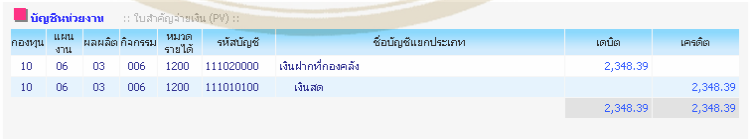

Figure 5-90 An Interface for Accounting of Payment in a General Journal

- **Details of Test 3.8.3**

It is a test of rules execution via a process of *Money Reception – MU Finance division receives overdrawn money from a work unit* of the receiving financial system – MU. Test stages include the following.

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1. At the menu Rules Execution, select a system by clicking at the tab of the budgeting system.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-91.
3. Verify accuracy and completeness of money reception data recorded in a general journal via a money reception voucher (RV).

   All working stages are displayed in Figures 5-91 and 5-92, respectively.

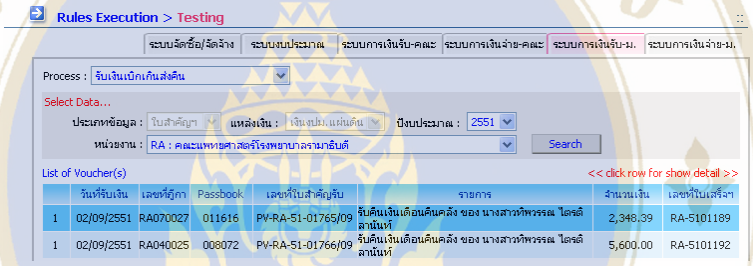

Figure 5-91 An Interface for Retrieval of Data on Payment Voucher Based on Conditions Defined

Based on Figure 5-91, when clicking to select an item, an upper interface will display details of data on reception of overdrawn money, as seen in Figure 5-89.

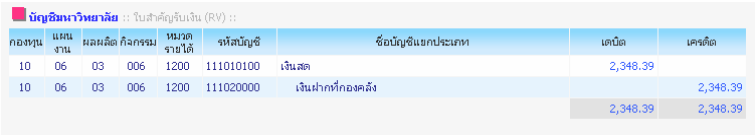

Figure 5-92 An Interface for Accounting of Money Reception in a General Journal

- **Details of Test 3.8.4**

  It is a test of rules execution via a process of *Submission of overdrawn money to the Finance Ministry - MU Finance division submits overdrawn money to the Finance Ministry*

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of the paying financial system – MU. Test stages include the following.

1. At the menu Rules Execution, select a system by clicking at the tab of the budgeting system.
2. Select the system process and define conditions for data retrieval. Details are given in Figure 5-93.
3. Verify accuracy and completeness of money reception data recorded in a general journal, which is reciprocal accounting as following:
   - MU account via a payment voucher (PV), and
   - A work unit account, of which accounting is done via a general voucher (JV) for revenue acknowledgement.

All working stages are displayed in Figures 5-93 and 5-94, respectively.

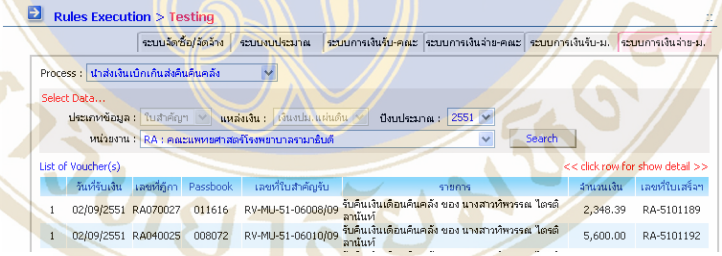

Figure 5-93 An Interface for Retrieval of Data on Voucher for Money Reception Based on Conditions Defined

Based on Figure 5-93, when clicking to select an item, an upper interface will display details of data on overdrawn money reception, as seen in Figure 5-89.

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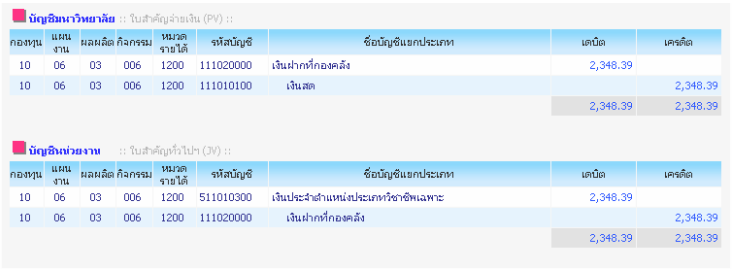


บัญชีมหาวิทยาลัย :: ใบสำคัญจ่ายเงิน (PV) ::

กองทุน	แผนงาน	ผลผลิต	กิจกรรม	หมวดรายได้	รหัสบัญชี	ชื่อบัญชีแยกประเภท	เดบิต	เครดิต
10	06	03	006	1200	111020000	เงินฝากที่กองคลัง	2,348.39	
10	06	03	006	1200	111010100	เงินสด		2,348.39
							2,348.39	2,348.39

บัญชีหน่วยงาน :: ใบสำคัญทั่วไปฯ (JV) ::

กองทุน	แผนงาน	ผลผลิต	กิจกรรม	หมวดรายได้	รหัสบัญชี	ชื่อบัญชีแยกประเภท	เดบิต	เครดิต
10	06	03	006	1200	511010300	เงินประจำตำแหน่งประเภทวิชาชีพเฉพาะ	2,348.39	
10	06	03	006	1200	111020000	เงินฝากที่กองคลัง		2,348.39
							2,348.39	2,348.39

Figure 5-94 An Interface for Inter-Related Accounting in a General Journal

4. Details of Test 4

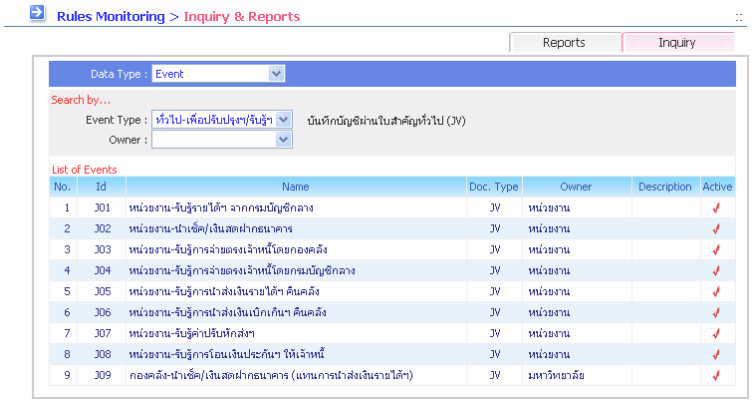
It is a test of data retrieval and reporting based on conditions defined, to be used to follow up and verify data, as the following.

❑ Details of Test 4.1

It is a test of data retrieval based on conditions. Test stages include the following.

1. At the menu Rules Monitoring, select the type of data inquiry by clicking at the tab of inquiry.
2. Select data type.
3. Define conditions for data retrieval. The conditions will depend on data type.

All working stages are displayed in Figures 5-95 through 5-98, respectively.



Rules Monitoring > Inquiry & Reports

Reports | Inquiry

Data Type : Event

Search by...

Event Type : หัวไป-เพื่อปรับปรุงฯ/รับรู้ฯ — บันทึกบัญชีผ่านใบสำคัญทั่วไป (JV)

Owner :

List of Events

No.	Id	Name	Doc. Type	Owner	Description	Active
1	J01	หน่วยงาน-รับรู้รายได้ฯ จากกรมบัญชีกลาง	JV	หน่วยงาน		√
2	J02	หน่วยงาน-นำเช็ค/เงินสดฝากธนาคาร	JV	หน่วยงาน		√
3	J03	หน่วยงาน-รับรู้การจ่ายตรงเจ้าหนี้โดยกองคลัง	JV	หน่วยงาน		√
4	J04	หน่วยงาน-รับรู้การจ่ายตรงเจ้าหนี้โดยกรมบัญชีกลาง	JV	หน่วยงาน		√
5	J05	หน่วยงาน-รับรู้การนำส่งเงินรายได้ฯ คืนคลัง	JV	หน่วยงาน		√
6	J06	หน่วยงาน-รับรู้การนำส่งเงินเบิกเกินฯ คืนคลัง	JV	หน่วยงาน		√
7	J07	หน่วยงาน-รับรู้ค่าปรับหักส่งฯ	JV	หน่วยงาน		√
8	J08	หน่วยงาน-รับรู้การโอนเงินประกันฯ ให้เจ้าหนี้	JV	หน่วยงาน		√
9	J09	กองคลัง-นำเช็ค/เงินสดฝากธนาคาร (แทนการนำส่งเงินรายได้ฯ)	JV	มหาวิทยาลัย		√

Figure 5-95 An Interface for Retrieval of Event Data on Based on Conditions Defined

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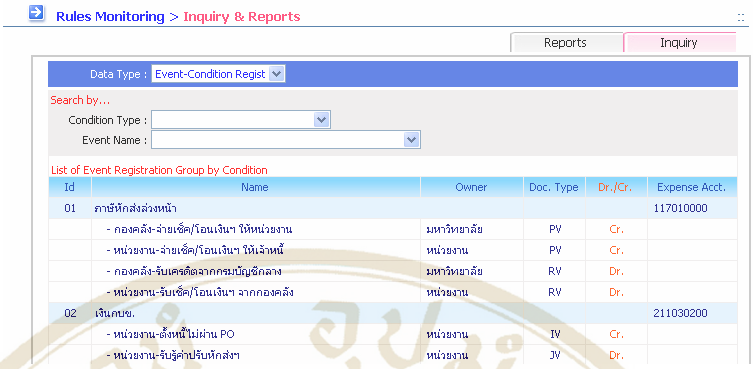

Figure 5-96 An Interface for Retrieval of Data on Set of Conditions Verified Based on Conditions Defined

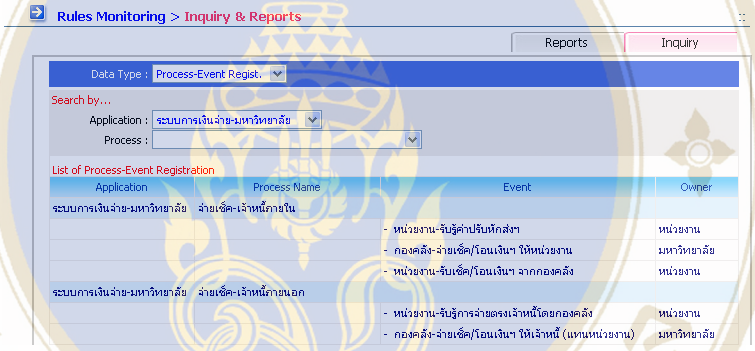

Figure 5-97 An Interface for Retrieval of Data on Process Handler Registration Based on Conditions Defined

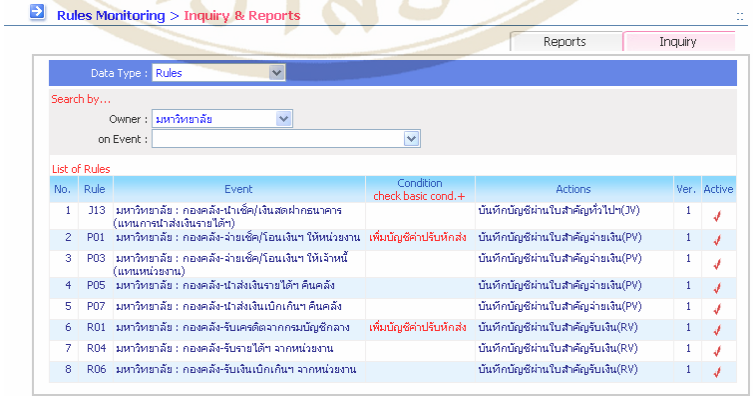

Figure 5-98 An Interface for Retrieval of Rules Data Based on Conditions Defined

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CHAPTER VI
DISCUSSION AND CONCLUSION

This chapter concludes the proposed research project. It summarizes the benefits derived from an application of the ECA rules technique and the business rules management system (BRMS) to the solution of accounting rules management problems. The limitation of the system prototype and suggestions for further research are also discussed.

6.1 Conclusion

The principles of ECA rules and BRMS that have been studied are applied to the accounting rules management system (ARMS) of Mahidol University's financial and accounting system as a case study for this research project in order to help solving the problem of accounting rules management. This is due to the fact that MU lacks a sound ARMS because there are a number of receive-pay accounting rules and conditions to be verified. In addition, the accounting rules data management of related working system is independent and separated from one another, for instance, hard-coded rules, a manual process of accounting rules data storage in a database, or execution of both hard-coded rules and rules stored in a database. Thus, an alteration to accounting rules, which happens all the time, of work units both inside and outside MU forces to modify the program or data in the database manually, which is difficult, complicated and takes time. Similarly, it is hard to audit and control to ensure that modification of accounting rules data of various systems is accurate and complete. This makes data not up-to-date while accounting data are incorrect and incongruous. In this regard, a prototype program has been developed, as described in chapter 3, to test the concept of the proposed research project. The consequence of system prototype development may be summarized as the following

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- The results of the research project in term of the data perspective are summarized below:
    1. Working stages are more convenient and rapid because there is a system helping to manage accounting rules data so that such management is automatic while the performance is convenient and rapid. Furthermore, there is also a system which assists in monitoring and following up data in different viewpoints and a quick manner. The centralized storage of accounting rules data in the format of ECA rules enables all systems to jointly use data while accounting rules data management can be done at a single point when there is an alteration to rules. Apparently, this enhances swift and convenient data modification and assures accurate and updated data.
    2. Data are more accurate since the storage of accounting rules data is centralized and there is the accounting rules management system (ARMS) through which rules modification can be made, resulting in accurate, complete and congruous accounting rules data.
    3. Data are complete since there is a monitoring system to ensure that related data are completely recorded or defined.
    4. Reduce a duplication of working stages. Storage of accounting rules is centralized and related working systems execute data from the same source.

- The results of the research project in term of the system perspective that can be applied not only for other organizations usage, but also for enhancing the process to be more convenience are described below:
    1. The proposed framework, the Accounting Rules Management Framework (ARMF), is the general process aimed for developing the accounting management rules. It can be used for applying with the accounting system in various organizations.

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2. The new system architecture serves for the managing of the rules of the centralized accounting which comprises of two main functions: the Accounting Rules Management (for up-to-date rules management) and the Accounting Rules Execution (for retrieving and manipulating the rules)

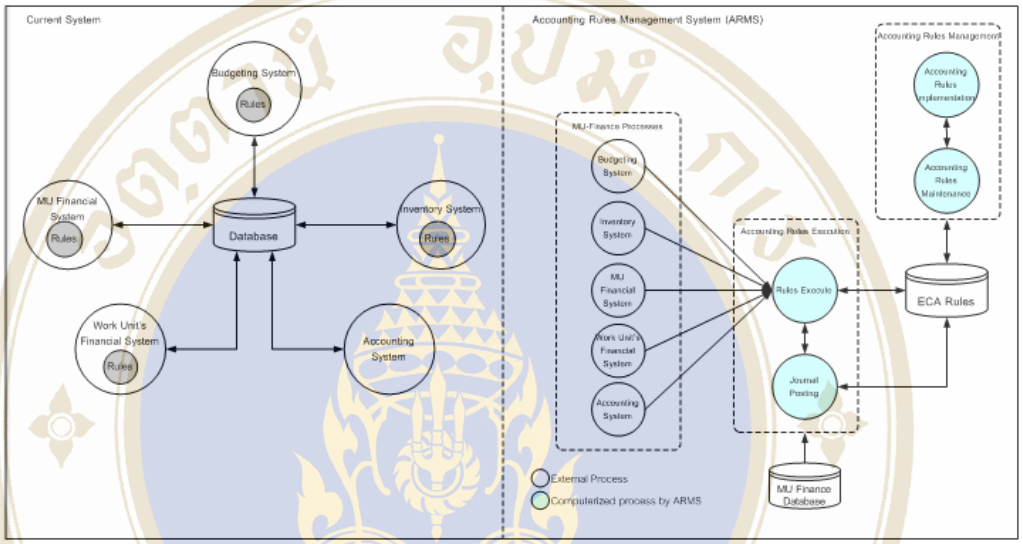

Figure 6-1 The comparison of the system architecture of the rule management between the current system and the ARMS

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3. The new working process provides the semi-automated mechanism because some process of the rules analysis and design still need the manual process due to the determination and decision of the workers. The process aims to manipulate the accounting rules when exists the chances of the rules. It will alter the modified rules via the ARMS without the effect of existing system.

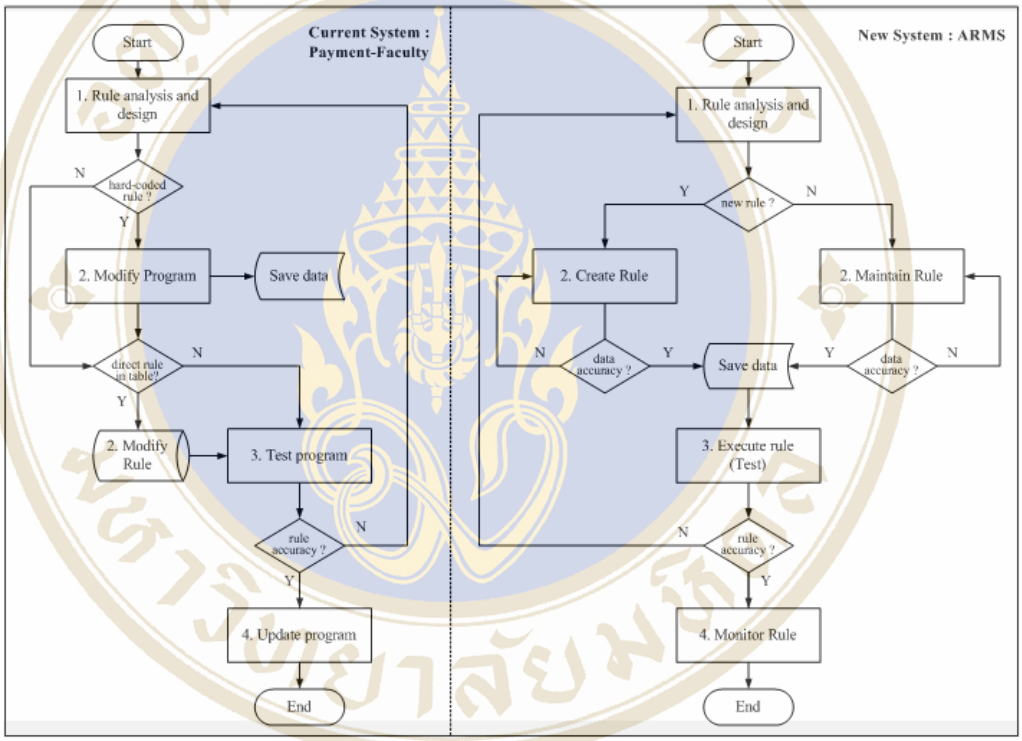

Figure 6-2 The comparison of the working process of the rules manipulation between the current system and the ARMS

4. The Accounting Rules Database is the central database for manipulating the accounting rules contained 979 rules. The related sub-process of the system can share and use this database

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Table 6.1 A Comparison of the Accounting Rules Management between the Current Working System and the ARMS

Comparative Item	**Original Rule Management System**	**New Rule Management System (ARMS)**
1. Rules Database	Independent, separated, and scattered in various system. Problem : Duplication of rules data storage, for example, the same rule is stored in more than one place, or inconsistent data persisted in the same rule, etc.	Centralized data storage by all systems jointly uses.
2. Rules Data Management	Manual accounting rules implementation applied to rules management. Problem : Alteration to rules data may not be made at all places and/or rules modification may be incongruous, for example, the same rule but its data are not modified congruously or at all places. Modification is complicated and takes time. It is hard to follow up, control and verify accuracy and completeness of data.	Data management is done through the accounting rules management system (ARMS), based on the principle of separating rules from the program, which independent and flexible performance is maintained while data modification can be made at one source. This results in congruous data, and data follow-up and monitoring are easy. Data are correct, complete and up-to-date.

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Table 6.1 A Comparison of the Accounting Rules Management between the Current Working System and the ARMS (Cont.)

Comparative Item	Original Rule Management System	New Rule Management System (ARMS)
3. Rules Execution	Execution of accounting rules, which are varied, may be summarized as follows: - Write hard-coded rules. - Execution of rules directly from database. - Use a combination of both methods, which are written hard-coded rules and rules execution direct from database.	Rules execution is centralized. All systems can jointly use rules data. Major working stages include parameter reception, monitoring, rules execution and doing accounting recording in a general journal.
4. Data follow-up, Control and Monitoring	Difficult to do since data storage, modification, and rules execution are varied and distributed in different systems.	Easy, convenient and quick to do since storage, management and execution of rules are centralized.

6.2 System Limitation

Prototyping development of MU's accounting rules management system (ARMS) has the following limitations.

1. This research project focuses only on the prototyping development of the budget module in MU's accounting rules management system. Accounting rules of revenue and subsidy budget (block grant) are not included in this prototype.
2. The system prototype does not cover accounting rules of the annual account closure and year-end account revision.

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3. The ARMS is developed for supporting the Inventory System used in the Mahidol University. It is not suitable for other organizations.
4. The test of rules correctness is conducted for verifying the frequently occurrent rules and the related sub-process solely. It is not covered all the rules in the whole system which contains 979 rules.

6.3 Future Work

This research concentrates only on the development of the prototype of the receive-pay accounting rules management system (ARMS), with respect to public budget source by using the technique of ECA rules for the design of accounting rules database, and using the principle of business rules management system (BRMS) for accounting rules data management to ensure up-to-date data. The system may be further enhanced to achieve higher efficiency and completeness by the following channels.

1. The storage and management of accounting rules data cover all financial sources such as revenue, subsidy (block grant), etc. Additionally, it should be able to support financial sources regarding MU's shifting from state's supervision.
2. All related working systems can execute accounting rules from the same database, with the ARMS system serving to manage accounting rules to ensure that data are always up-to-date.
3. The future work for this research project aims to study, design, develop and modify the proposed framework, ARMS, to be covered the standard that can be applied to perform the accrual basis of the accounting system in the various organizations without any modifications.

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REFERENCES

1. Barbara von Halle. “Business Rules Applied Business Better System Using the Business Rules Approach” , John Wiley & Sons, Inc., New York, 2002.
2. Marko Bajec, Marjan Krisper: “A methodology and tool support for managing business rules in organizations”. Available online at www.sciencedirect.com
3. Marko Bajec, Marjan Krisper: “Manageing business rules in enterprises”, University of Ljubljana, Faculty of Computer and Information Science, Trzaska 25, SI-1000 Ljubljana, Slovenia.
4. Matthew L. Nelson, Robert L. Rariden, Illinois State University, Ravi Sen, Texas A & M University : “A lifecycle Approach towards Business Rules Management”, Proceedings of the 41st Hawaii International Conference on System Sciences -2008. Available from :
5. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4438816&isnumber=4438696
6. Sangseung Kang, Minus Jang, Joochan Sohn, “Design of Rule Object Model for Business System”, Electronics and Telecommunications Research Institute pp. 818-822.
7. Barbara von Halle. “Building a Business Rules System”. Available from : http://www.dmreview.com, 2001.
8. The Business Rules and SDLC Series. Available form : http://qrdn.brmsblog.com/2007/04/04/the-business-rules-and-sdlc-series/
9. Liudas Motiejunas, Rimantas Butleris, “Business Rules Manipulation Model”, ISSN 1392-24X Information Technology And Control, 2007, Vol.36, No.3.
10. Paul Harmon, “Business Rules : An Introduction”, Business Process Trends, Vol.1, No.7, July 2003.
11. Business Rules Management System . Available form : http://usecases. brmsblog.com/brms-introduction /
12. A Structural Model of ECA Rules in Active Database. Available form : http://www.springerlink.com/content/3mkbgjpvxfcbyalp/fulltext.pdf

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APPENDIX

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APPENDIX A
PRECESS DESCRIPTIONS

Process Description of Accounting Rules Management System (ARMS)

Process 0

Name **Accounting Rules Management System (ARMS)**

Description A system used to manage accrual accounting rules data of MU in order that data are accurate and up-to-date, including rules execution based on events occurring in a working system's processes.

Input
- Accounting Officer
  Events, conditions, accounting rules, sets of conditions, expenses/revenue account used in recording accounts, a working system's processes, and conditions for data retrieval.
- MU Finance Processes
  Events, a working system's processes, data used in account recording such as PO voucher, cheque, data on PO, voucher and cheque, detail data of PO, voucher and cheque.

Output Accounting rules data, report

Process 1

Name **Accounting Rules Authoring**

Description A (working) function used to manage accounting rules data, consisting of data preparation, rules construction, and process handler registration.

Input
- Accounting Officer
  Events, conditions, accounting rules, sets of conditions, expenses/revenue account used in account recording, a working system's processes.

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Input (cont.) - Data Store

Event data, condition data, data on sets of conditions, rule data, data on double entries of rules, data on expenses/revenue account used in account recording, and data on processes and events occurring.

Output Accounting rules data, event data stored, condition data stored, stored data on sets of conditions, rule data stored, stored data on double entries of rules, stored data on expenses/revenue account used in account recording, and stored data on processes and events occurring.

Process 2

Name **Accounting Rules Maintenance**

Description A function used to maintain accounting rules data, composed of rules modification and rules cancellation.

Input - Accounting Officer

Accounting rules, events, conditions, expenses/revenue account used in account recording.

- Data Store

Rule data, data on double entries of rules, event data, condition data, data on sets of conditions, data on expenses/revenue account used in account recording, and data on processes and events occurring.

Output Stored data on rule modification, rule data stored, and stored data on double entries of rules.

Process 3

Name **Accounting Rules Execution**

Description A function used to execute data via an event occurring in a system's processes, and accounting cone in a general journal via post journal.

Input - MU Finance Processes

Event, a working system's processes, and data used in account recording such as PO, vouchers, and cheques.

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Input (cont.) - Data Store

Rule data, data on double entries of rules, event data, condition data, data on sets of conditions, data on processes and events occurring such as PO, vouchers and cheques, and detail data on PO, vouchers and cheques.

Output Stored data on rule execution, stored data on detail voucher number, stored data on vouchers, stored detail data on voucher, and stored data on reference document of voucher.

Process 4

Name **Accounting Rules Monitoring**

Description A function used to inquire and make a report so as to be used to monitor and follow up data.

Input - Accounting Officer

Conditions for data retrieval.

- Data Store

Rule data, data on double entries of rules, event data, condition data, data on sets of conditions, data on expenses/revenue account used in account recording, data on processes, data on rule modification, voucher data, voucher detail data, and data on reference document of vouchers.

Output A report

Process 1.1

Name **Data Preparation**

Description A function used to prepare core data related to accounting rules determination such as event data and conditions.

Input - Accounting Officer

Events, conditions, sets of conditions, and expenses/revenue account used in account recording.

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Input (cont.) - Data Store

Rule data, data on double entries of rules, event data, condition data, data on sets of conditions, data on expenses/revenue account used in account recording, data on processes, data on rule modification, voucher data, voucher detail data, and data on reference document of vouchers.

Output Event data stored, condition data stored, stored data on sets of conditions, and stored data on expenses/revenue account in account recording.

Logic Summary

1. Receive parameters of the type of core data that need to be displayed.
2. Display data from a table classified by the type of core data based on conditions defined (if any).
3. Receive variable values of data management (initial value=searching)
   - 3.1 Search data
     - Receive condition values.
     - Read data from database based on the conditions defined.
     - Display data on the screen.
   - 3.2 Add data
     - Display a blank form.
   - 3.3 Modify or cancel data
     - Receive values of data that need to be modified, such as event code.
     - Read data from database based on conditions of data selected.
     - Display data on the screen in order to modify or cancel.
     - In case of cancellation, reasons have to be identified.

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Logic Summary (cont.)	3.4 Record data - Verify accuracy and completeness of data. - In case of incorrect or incomplete data, a notification message is displayed. - In case of correct and complete data, record the data in the database.

Process 1.2

Name	**Rule Construction**
Description	A function used to construct accounting rules, classified by work unit, event and condition defined.
Input	- Accounting Officer Events, conditions and accounting rules. - Data Store Event data, condition data, data on sets of conditions, rule data, data on account parallel of rules and expenses/revenue account used in account recording.
Output	Rule data stored, stored data on double entries of rules, and accounting data stored.
Logic Summary	1. Receive parameters of the type of core data that need to be displayed. 2. Construct new rules. 3. Read core data related to rules construction. 4. Monitor selection of events, conditions, work units and defined rules. 5. Verify accuracy and completeness of data. 6. In case of incorrect or incomplete data, a notification message is displayed. 7. In case of correct and complete data, verify data in the database. - Found/repetitive, a notification message is displayed. - Not found, record data in a related table. 8. Display a blank form to wait for an addition of new rules data.

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Process 1.3

Name	**Process Handler Registration**
Description	A function used to register data on events occurring in a working system's processes.
Input	- Accounting Officer A working system's processes - Data Store Event data, and data on processes and events occurring.
Output	Stored data on processes and events occurring.
Logic Summary	1. Record detail data on the system's processes. 2. Retrieve event data based on conditions defined. 3. Monitor an event selected. In case of no selection, a notification message will be displayed. 4. Record data in a related table.

Process 2.1

Name	**Rule Modification**
Description	A function used to modify accounting rules data.
Input	- Accounting Officer Accounting rules, events and conditions. - Data Store Rule data, data on double entries of rules, event data, condition data, data on sets of conditions, data on expenses/revenue account used in account recording, and data on processes and events occurring.
Output	Stored data on rule modification, rule data stored, and stored data on double entries of rules.
Logic Summary	1. Receive value of number of rule that needs to be modified. 2. Monitor working status. If it is in working status, a notification message is displayed. 3. Verify accuracy and completeness of modified data. In case of incorrect or incomplete data, a notification message is displayed. 4. Record data in a related table.

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Process 2.2

Name	**Rule Cancellation**
Description	A function used to cancel accounting rules data.
Input	- Accounting Officer Accounting rules and events. - Data Store Rule data, data on double entries of rules, event data, condition data, data on sets of conditions, data on expenses/revenue account used in account recording, and data on processes and events occurring.
Output	Stored data on rule modification, rule data stored, and stored data on double entries of rules.
Logic Summary	1. Receive value of number of rule that needs to be canceled. 2. Monitor working status. If it is in working status, a notification message is displayed. 3. Monitor details of cancellation status in a related table. 4. Record cancellation status in a related table.

Process 3.1

Name	**Rules Execution**
Description	A function used to cancel accounting rules data.
Input	- MU Finance Processes Events, a working system's processes and data used in account recording such as PO, vouchers and cheques. - Data Store Rule data, event data, condition data, data on sets of conditions, data on processes and events occurring, and data on PO, vouchers and cheques.
Output	Rule number and stored data and rule execution.

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Logic Summary
1. Receive parameter values defined such as systems, events and data of the system used in account recording.
2. Verify parameters obtained. If incorrect, a notification message is displayed.
3. Verify accuracy of processes and events whether they are registered or not. If not, a notification message is displayed.
4. Read data from the financial system. Monitor conditions defined of events.
5. Execute rules and forward values to the next function.

Process 3.2

Name **Journal Posting**

Description A function used in account recording is a preliminary general journal via a voucher based on a rule derived.

Input
- Rules Execution Process
  Rule number
- Data Store
  Data on double entries of rules, and detail data on PO, vouchers and cheques.

Output Stored data on voucher number, voucher data stored, stored detail data on vouchers, and stored data on reference document of vouchers.

Logic Summary
1. Receive values of rule number and data on documents used to do accounting.
2. Read account parallel data that need to be recorded based on rules derived.
3. Read detail data related to accounting in vouchers from the financial system based on data type and document number.
4. Record voucher number data and accounting data in a general journal via vouchers in a related table.

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APPENDIX B
DATA FLOW DESCRIPTIONS

Data Flow Description of Accounting Rules Management System (ARMS)

Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Accounting rule	Accrual basis rules	Accounting Officer	P0 Accounting Rules Management System P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation
Event	Events that have record accounts	Accounting Officer MU Finance Processes **External Processe**	P0 Accounting Rules Management System P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P1.1 Data Preparation P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation P0 Accounting Rules Management System P3 Accounting Rules Execution P3.1 Rules Execution

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Condition	Conditions that have to be verified	Accounting Officer	P0 Accounting Rules Management System P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P1.1 Data Preparation P1.2 Rule Construction P2.1 Rule Modification
Set of conditions	Items of conditions that have to be verified, classified by event	Accounting Officer	P0 Accounting Rules Management System P1 Accounting Rules Authoring P1.1 Data Preparation
Expenses/revenue account used to do accounting	Data on the code of expenses/revenue account of which accounting is done.	Accounting Officer	P0 Accounting Rules Management System P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P1.1 Data Preparation

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Process of a working system	Processes of each working system, in which events occur and have to be recognized and record accounts	Accounting Officer MU Finance Processes **External Processe**	P0 Accounting Rules Management System P1 Accounting Rules Authoring P1.3 Process Handler Registration P0 Accounting Rules Management System P3 Accounting Rules Execution P3.1 Rules Execution
Accounting rule data	Accounting rules constructed and recorded in a database	P0 Accounting Rules Management System P1 Accounting Rules Authoring P1.2 Rule Construction	Accounting Officer
Report	A report derived from the system	P0 Accounting Rules Management System P4 Accounting Rules Monitoring P4.0 Inquiry & Report	Accounting Officer

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Data used to do accounting such as PO, vouchers and cheques	Data from the financial system, in which events occur and have to be recognized and record accounts	MU Finance Processes **External Processe**	P0 Accounting Rules Management System P3 Accounting Rules Execution P3.1 Rules Execution
Data on PO, vouchers and cheques	Retrieve data on PO, vouchers or cheques from a database to execute rules	MU FI Database **External Database**	P0 Accounting Rules Management System P3 Accounting Rules Execution P3.1 Rules Execution
Detail data on PO, vouchers and cheques	Retrieve detail data on PO, vouchers or cheques from a database, to be used to record voucher details	MU FI Database **External Database**	P0 Accounting Rules Management System P3 Accounting Rules Execution P3.2 Journal Posting
Rule number	Pass on numbers of the rules obtained from rules execution, to record accounts	P3.1 Rules Execution	P3.2 Journal Posting
Condition for data retrieval	Conditions used to retrieve data required	Accounting Officer	P0 Accounting Rules Management System P4 Accounting Rules Monitoring P4.0 Inquiry & Report

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Record expenses/revenue account data used to do accounting	Save expenses/revenue account data used in account recording in a table	P1 Accounting Rules Authoring P1.1 Data Preparation	D1 ARMapping
Expenses/Revenue account data used to do accounting	Retrieve data on the code of expenses/revenue account from a database	D1 ARMapping	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P4 Accounting Rules Monitoring P1.1 Data Preparation P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation P4.0 Inquiry & Report
Record event data	Save event data in a table	P1 Accounting Rules Authoring P1.1 Data Preparation	D2 Events
Event data	Retrieve event data from a database	D2 Events	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P3 Accounting Rules Execution P4 Accounting Rules Monitoring

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Event data	Retrieve event data from a database	D2 Events	P1.1 Data Preparation P1.2 Rule Construction P1.3 Process Handler Registration P2.1 Rule Modification P2.2 Rule Cancellation P3.1 Rules Execution P4.0 Inquiry & Report
Record condition data	Save condition data in a table	P1 Accounting Rules Authoring P1.1 Data Preparation	D_3 Conditions
Condition data	Retrieve condition data from a database	D_3 Conditions	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P3 Accounting Rules Execution P4 Accounting Rules Monitoring P1.1 Data Preparation P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation P3.1 Rules Execution P4.0 Inquiry & Report
Record data on sets of conditions	Save data on sets of conditions in a table	P1 Accounting Rules Authoring P1.1 Data Preppara.	D4 Event_CondChklist

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Data on sets of conditions	Retrieve data on sets of conditions that have to be verified in each event from a database	D4 Event_CondChklist	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P3 Accounting Rules Execution P4 Accounting Rules Monitoring P1.1 Data Preparation P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation P3.1 Rules Execution P4.0 Inquiry & Report
Record rule data	Save rules data in a table	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation	D5 ARules
Rule data	Retrieve rule data from a database	D5 ARules	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Rule data		D5 ARules	P3 Accounting Rules Execution P4 Accounting Rules Monitoring P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation P3.1 Rules Execution P4.0 Inquiry & Report
Record data on account parallel of rules	Save data on double entries of rules in a table	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P1.2 Rule Construction P2.1 Rule Modification P2.2 Rule Cancellation	D5 Actions
Data on account parallel of rules	Retrieve data on double entries of rules from a database	D6 Actions	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P3 Accounting Rules Execution P4 Accounting Rules Monitoring P1.2 Rule Construction P2.1 Rule Modification

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Data on account parallel of rules		D6 Actions	P2.2 Rule Cancellation P3.2 Journal Posting P4.0 Inquiry & Report
Record data on processes and events occurring	Save data on processes and events occurring in a table	P1 Accounting Rules Authoring P1.3 Process Handler Registration	D6 Process_EventRegist
Data on processes and events occurring	Retrieve data on processes and events occurring from a database	D6 Process_EventRegist	P1 Accounting Rules Authoring P2 Accounting Rules Maintenance P3 Accounting Rules Execution P4 Accounting Rules Monitoring P1.3 Process Handler Registration P2.1 Rule Modification P2.2 Rule Cancellation P3.1 Rules Execution P4.0 Inquiry & Report
Record rule modification data	Save rule modification data in a table	P2 Accounting Rules Maintenance P2.1 Rule Modification P2.2 Rule Cancellation	D8 Rule_EditTrans

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Data Flow Name	**Description**	**From Process/ Data Store/ Source**	**To Process/ Data Store/ Source**
Rule Modification data	Retrieve details of rule modification data from a database	D8 Rule_EditTrans	P4 Accounting Rules Monitoring P4.0 Inquiry & Report
Record rules execution data	Save rules execution data in a table	P3 Accounting Rules Execution P3.1 Rules Execution	D9 Rule_ExecuteTrans
Record voucher number data	Update voucher number of accounting derived from rules execution	P3 Accounting Rules Execution P3.2 Journal Posting	D9 Rule_ExecuteTrans
Rules execution data	Retrieve detail data on rules execution from a database	D9 Rule_ExecuteTrans	P4 Accounting Rules Monitoring P4.0 Inquiry & Report
Record voucher data	Save voucher data in a table	P3 Accounting Rules Execution P3.2 Journal Posting	D10 VoucherHeader
Voucher data	Retrieve voucher data from a database	D10 VoucherHeader	P4 Accounting Rules Monitoring P4.0 Inquiry & Report
Record voucher detail data	Save voucher detail data in a table	P3 Accounting Rules Execution P3.2 Journal Posting	D11 VoucherDetail
Voucher detail data	Retrieve voucher detail data from a database	D11 VoucherDetail	P4 Accounting Rules Monitoring P4.0 Inquiry & Report

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Data Flow Name	Description	From Process/ Data Store/ Source	To Process/ Data Store/ Source
Record data on reference document of vouchers	Save data on reference document of vouchers in a table	P3 Accounting Rules Execution P3.2 Journal Posting	D12 VoucherRefDoc
Data on reference document of vouchers	Retrieve data on reference document of vouches from a database	D12 VoucherRefDoc	P4 Accounting Rules Monitoring P4.0 Inquiry & Report

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APPENDIX C
MU FINANCE DATABASE

1. MU Financial System

Based on the analysis of functional stages of MU Financial System, this section explains modeling of data using an entity-relationship (E-R) diagram for a display of the working system's conceptual design.

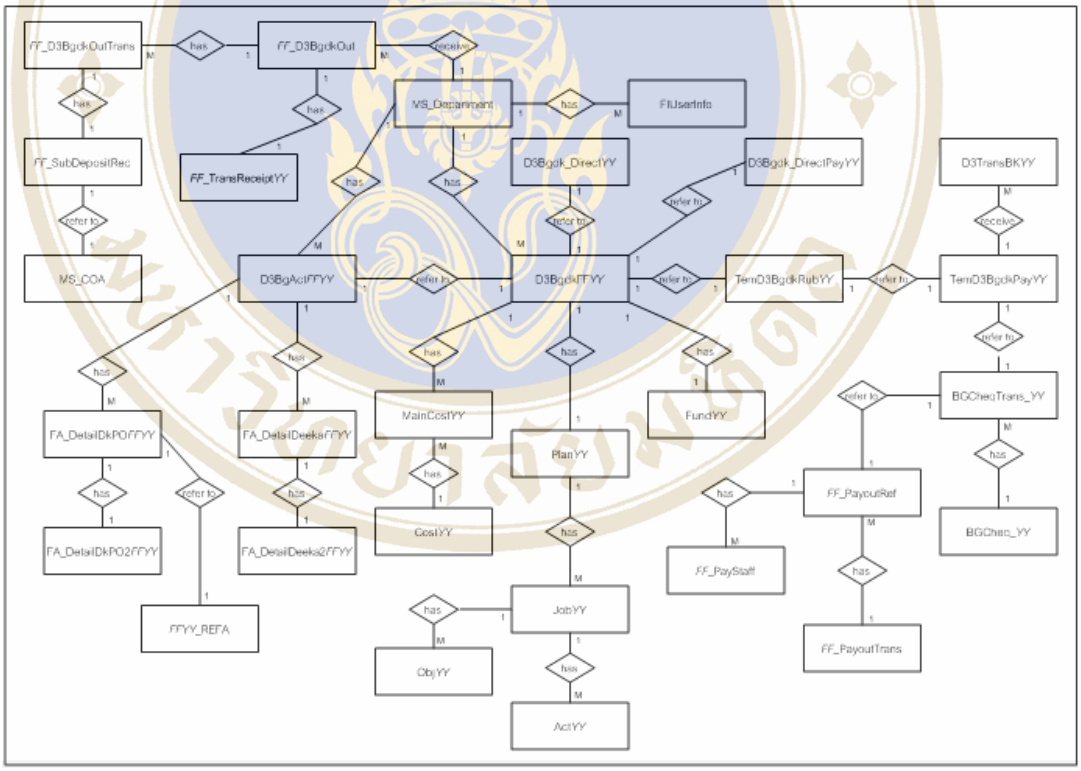

Figure 1 An E-R Diagram of the Financial System of MU

The functional stage of MU Financial System is analyzed and modeled its data by using an entity-relationship (E-R) diagram as conceptual design.

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Figure 1 illustrates an E-R diagram of rules data of MU Financial system. A summary of data tables showing relationship, classified into two groups of data, table files, transaction files and table files, is given in Table 1.

Table 1. Names of Tables of Data Related to MU Financial System

Master File

Order	Table Name	Description
1	MS_DEPARTMENT	Work unit data file
2	PLAN*YY*	Work plan data file
3	JOB*YY*	Work/project data file
4	ACT*YY*	Activity data file
5	FUND*YY*	Fund data file
6	OBJ*YY*	Product/target data file
7	MAINCOST*YY*	Major expenses group data file
8	COST*YY*	Sub expenses group data file
9	MS_COA	Major account chart data file
10	*FF*_SUBDEPOSITREC	Data file of registration controlling sub book of a bank

Transaction File

Order	Table Bame	Description
1	FIUSERINFO	User data file
2	D3BGACTFF*YY*	Data file of faculty voucher in the viewpoint of fund and activity
3	D3BGDK*FFYY*	Data file of work unit voucher getting an approval by MU finance division
4	D3BGDK_DIRECT*YY*	Data file of direct payment to MU by the Comptroller-General's Department

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Transaction File

Order	Table Bame	Description
5	D3BGDK_DIRECTPAY*YY*	Data file of acknowledgement of direct payment by the Comptroller-General's Department
6	TEMD3BGDKRUB*YY*	Data file of item on money (credit) reception from the Comptroller-General's Department
7	TEMD3BGDKPAY*YY*	Data file of vouchers receiving money from MU-wait for payment
8	D3TRANSBK*YY*	Data file of reception of money overdrawn and returned
9	FA_DETAILDKPO*FFYY*	Data file of purchase order
10	FA_DETAILDKPO2*FFYY*	Data file of details of purchase order
11	FA_DETAILDEEKA*FFYY*	Voucher data file
12	FA_DETAILDEEKA2 *FFYY*	Voucher details data file
13	*FFYY*_REFA	Data file of inspection for reception
14	*FF*_PAYOUTTRANS	Data file of item on creditors for which a payment inspection certificate is made
15	*FF*_PAYOUTREF	Data file of item on vouchers for which a payment inspection certificate is made
16	*FF*_PAYSTAFF	Data file of payment to creditors on payment inspection
17	*FF*_D3BgdkOut	Data file of national revenue reception
18	*FF*_D3BgdkOutTrans	Data file of national revenue reception details
19	*FF*_TRANSRECEIPTYY	Receipt data file
20	BGCHEQ_*YY*	Cheque payment data file
21	BGCHEQTRANS_*YY*	Data file of cheque payment details of work unit voucher

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2. Database Schema of MU Financial System

Based on Figure 1, an E-R diagram can be mapped toward the relational database schema, which reveals components of each table in the form of fields (the underlined attribute means a primary key while italic attribute means a foreign key) shown below. The schema details are explained in section 3.

Table : MS_Department

DEPT_CODE	DEPT_TNAME	DEPT_ENAME	DEPT_TYPE

Table : PlanYY

PLNCOD	PLNME	DISPLNME

Table : : JobYY

JOBCOD	JOBNAME

Table : FundYY

FUNDCODE	FUNDNAME

Table : ActYY

JOBCOD	**ACTCODE**	ACTNAME

Table : ObjYY

JOBCOD	**OBJCOD**	OBJNAME

Table : MainCostYY

MCOSCOD	MCOSNME	ACC1	ACC2
ACC3	ACC4	ACC5	ACC6
ACCNAME			

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Table : CostYY

MCOSCOD	GF	**SCOSCOD**	COSNME
STATUS			

Table : MS_COA

ACC1	**ACC2**	**ACC3**	**ACC4**
ACC5	**ACC6**	ACCNAME	DISPLAYNAME
ACCDESC	ACCLEVEL	CREATEDDATE	CREATEDBY

Table : FF_SubDepositRec

ACC1	**ACC2**	**ACC3**	**ACC4**
ACC5	**ACC6**	**SUBACCID**	BANKID
BANKNAME	BANKDEP	BANKACC NAME	MONEY
DEPT_CODE	BUDGETTYPE	STATUS	BANKTYPE
DATEOPEN			

Table : FIUserInfo

USER ACCOUNT	PREFIXCODE	USERTNAME	USERENAME
POSITION NAME	FACTCODE	USERLEVEL	USERPWD
USERSTATUS	EXPDATE	POSITIONID	PRIORITY
IPNO	LASTUSED	LOGINSTS	

Table : D3BgActFFYY

FACCOD	MAINCOST	**COSTCOD**	**ACRUN**
PLNCOD	JOBCOD	FUNDCODE	ACTCODE
OBJCOD	MUPO	GFMISPO	

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Table : D3BgdkFFYY

FACCOD	MAINCOST	**COSTCOD**	**ACRUN**
PLNCOD	*JOBCOD*	*FUNDCODE*	*ACTCODE*
OBJCOD	ACDTE1	ACAMT1	ACAMT2
ACDTE2	**ACDKF**	ACAMT4	ACAMT5
ACDTE3	ACDNO	ACPASSBOOK	ACPBDATE
ACAMT6	ACAMT7	ACDTE4	ACCNO1
ACCNO2	ACAMT8	ACAMT9	ACAMT10
ACPOINTER	LU_DATE	ACBCNO	ACBCDATE
ACCTR	ACPTR	ACBCDATE	DK_TYPE
ACCQSTATUS	CRADITNO	CRADIT_DATE	ACTAX
ACADJ	GF_MONEY_ SUB_FINE	GF_TAX	GF_MONEY_ NET
GF_PAY_DOC	GF_PAY_DATE	GF_PAY_FILE_ DATE	CHK_BAR CODE
DIRECTPAY	STATUS_PO		

Table : D3Bgdk_DirectYY

FAYEAR	DKYEAR	**FACCOD**	MAINCOST
COSTCOD	**ACRUN**	*PLNCOD*	*JOBCOD*
OBJCOD	*FUNDCODE*	*ACTCODE*	ACDTE1
ACDKF	ACAMT4	ACDTE3	ACDNO
LU_DATE	ACBCNO	ACBCDATE	**CRADITNO**
CRADIT_DATE	ACTAX	ACADJ	STATUSPRINT
USERPRINT	DATEPRINT	MVOUCHERNO	FVOUCHERNO
POSTSTATUS	USERACC	REDUCE	ACPASSBOOK
ACPBDATE	GF_MONEY	GF_TAX	GF_FINE
GF_MONEY_ NET	SEND_STATUS	GF_DOC_NO	GFMIS_DOC_ DATE

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Table : D3Bgdk_DirectPayYY

FAYEAR	DKYEAR	**FACCOD**	MAINCOST
COSTCOD	**ACRUN**	*PLNCOD*	*JOBCOD*
OBJCOD	*FUNDCODE*	*ACTCODE*	ACDTE1
ACDKF	ACAMT4	ACDTE3	ACDNO
LU_DATE	ACBCNO	ACBCDATE	**CRADITNO**
CRADIT_DATE	ACTAX	ACADJ	STATUSPRINT
USERPRINT	DATEPRINT	MVOUCHERNO	FVOUCHERNO
POSTSTATUS	USERACC	REDUCE	ACPASSBOOK
ACPBDATE	GF_MONEY	GF_TAX	GF_FINE
GF_MONEY_ NET	SEND_STATUS	GF_DOC_NO	GFMIS_DOC_ DATE

Table : TemD3BgdkRubYY

FAYEAR	DKYEAR	**FACCOD**	MAINCOST
COSTCOD	**ACRUN**	*PLNCOD*	*JOBCOD*
OBJCOD	*FUNDCODE*	*ACTCODE*	ACDTE1
ACDKF	ACAMT4	ACDTE3	ACDNO
LU_DATE	ACBCNO	ACBCDATE	**CRADITNO**
CRADIT_DATE	ACTAX	ACADJ	STATUSPRINT
USERPRINT	DATEPRINT	MDATEPRE PARER	MVOUCHERNO
FVOUCHERNO	TVOUCHERNO	JVOUCHERNO	POSTSTATUS
USERACC	REDUCE	ACPASSBOOK	ACPBDATE
GF_MONEY	GF_TAX	GF_FINE	GF_MONEY_ NET
SEND_STATUS	GF_DOC_NO		

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Table : TemD3BgdkPayYY

FAYEAR	DKYEAR	**FACCOD**	MAINCOST
COSTCOD	**ACRUN**	*PLNCOD*	*JOBCOD*
OBJCOD	*FUNDCODE*	*ACTCODE*	ACDTE1
ACDKF	ACAMT4	ACDTE3	ACDNO
LU_DATE	ACBCNO	ACBCDATE	**CRADITNO**
CRADIT_DATE	ACTAX	ACADJ	STATUSPRINT
USERPRINT	DATEPRINT	MDATEPRE PARER	VOUCHERNO
FVOUCHERNO	TVOUCHERNO	JVOUCHERNO	POSTSTATUS
USERACC	REDUCE	ACPASSBOOK	ACPBDATE
GF_MONEY	GF_TAX	GF_FINE	GF_MONEY_ NET
SEND_STATUS	GF_DOC_NO		

Table : D3TransBKYY

BGYEAR	**TransNo**	ReceiptNo	MuReNo
FACCOD	MAINCOST	COSTCOD	ACRUN
PLNCOD	JOBCOD	FUNDCODE	CAPCODE
ACTCODE	OBJCOD	CAPYEAR	ACDKF
ACAMT4	ACDTE3	ACAMT10	DES_CRIPT
ACDNO	ACPASSBOOK	ACPBDATE	CRADITNO
CRADIT_DATE	LU_DATE	DK_TYPE	USERACC
RVFFNO	PVFFNO	RVMUNO	PVMUNO
PAYINNO	PAYINDATE	PAYINUSER	PAYINVOUNO
CLOSEUSER	CLOSEDATE	CLOSESTATUS	BGSTATUS
PAYIN_STATUS	PVFFDATE	RVMUDATE	PVMUDATE
JVFFNO	RVFFDATE	CANCELED DATE	REMARK
CANCELEDBY	FLAG		

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Table : DetailDKPOFFYY

VENDORID	**ADDRID**	**FACCOD**	MAINCOST
COSTCOD	**ACRUN**	**ACDKF**	**CODE**
MONEY1	STATUS	LU_DATE	TAX_TYPE

Table : FA_DetailDKPO2FFYY

VendorID	**AddrID**	**FACCOD**	MAINCOST
COSTCOD	**ACRUN**	**ACDKF**	NUM_ITEMS
STATUS	LU_DATE	TYPE_ID	UNIT

Table : FA_DetailDeekaFFYY

FACCOD	MAINCOST	**COSTCOD**	**ACRUN**
ACDKF	**CODE**	MONEY1	

Table : FA_DetailDeeka2FFYY

FACCOD	MAINCOST	**COSTCOD**	**ACRUN**
ACDKF	NUM_PERSON	FAIL_SALALY	UNIT

Table : FFYY_Refa

PO_NO	**RUN_NO**	**LIST_NO**	**BGYEAR**
FABGYEAR	**FACCOD**	**COSTCOD**	**ACRUN**
PO_ID	AMOUNT	VAT	FINE
DISCOUNT	PRECEDE	DATEPRE PARER	VOUCHERID
PE_ID	WHO_UPDATE	DATE_UPDATE	

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Table : FF_PayoutTrans

PSID	**MTYPE**	**VENDOR**	PSREF
VENTYPE	ACDKFAMT	MONEY	VAT
TAX	FINE	TOTAL	CURSTATUS
PAIDTYPE	PAIDAMOUNT	PAIDSTS	PAIDDATE
BANKAC_ID	CHQNO	CHQDATE	ACPSTS
CHQPRNDATE	CHQPRNBY	RECEBY	PVID
PVDATE	PVPRINT		

Table : FF_PayoutRef

PSID	**MTYPE**	**PSREF**	ACDKF
FACCOD	DETAIL	ACDKFAMT	MONEY
VAT	TAX	FINE	TOTAL
FAIL_SALALY	FLAG	PVID	PVDATE
PVPRINT	BGYEAR	RESERVESTS	

Table : FF_PayStaff

BGYEAR	**ACDKF**	**FACCOD**	**MAINCOST**
COSTCOD	RECENAME	PLNCOD	JOBCOD
OBJCOD	FUNDCODE	ACTCODE	MONEY
PAIDTYPE	FLAG	PSID	MTYPE
PAIDDATE	BANKAC_ID	CHQNO	CHQDATE
ACPSTS	CHQPRNDATE	CHQPRNBY	FAYEAR
FAIL_SALALY	DKTYPE		

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Table : FF_D3BgdkOut

BGYEAR	**TRANSNO**	RECEIPTNO	FACCOD
TypeReceive	PLNCOD	JOBCOD	FUNDCODE
CAPCODE	ACTCODE	OBJCOD	CAPYEAR
ACAMT4	ACDNO	LU_DATE	DK_TYPE
USERACC	RVFFNO	PVFFNO	RVMUNO
PVMUNO	PAYINNO	PAYINDATE	PAYINUSER
CLOSEUSER	CLOSEDATE	CLOSESTATUS	FLAG
PAYINVOUNO	MURENO	PVFFDATE	RVMUDATE
PVMUDATE	JVFFNO	RVFFDATE	CANCELED DATE
REMARK	CANCELEDBY		

Table : FF_D3BgdkOutTrans

BGYEAR	**TRANSNO**	**ACRUN**	ACAMT4
ACTAX	ACADJ	DES_CRIPT	TYPEMONEY
DUEDATE	CHEQUENO	BANKCODE	BRANCHCODE
RECEIPTCH	DEPOSITDATE	DEPOSITACNO	DEPOSITAC NAME
DEPOSITBANK	DEPOSIT BRANCH	POSTOF	POSTCODE
POSTRECEIVE	POSTADDR	PAYIN_STATUS	

Table : FF_TransReceiptYY

RE_NO	RE_DATE	RE_FACCOD	RE_PAY MONEY
RE_ DESCRIPTION	RE_MONEY	RE_USER RECEIVE	RE_FLAG
RE_PRINT	RDOCNO	RNOFF	CANCELED DATE
REMARK	CANCELEDBY		

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Table : BGCheQ_YY

CHEQ_NO	FACCOD	VENDORID	PAY_CODE
DATE	DATE_PAY	DATE_PRINT	AMOUNT
STATUS	TYPE	DATE PREPARER	PVVOUCHERID
USER_UPDATE	DATE_UPDATE	DATE_ RECEIVE	USER_RECEIVE
RVVOUNO	PAYINNO	PAYINDATE	PAYINUSER
PAYINVOUNO	CLOSEUSER	CLOSEDATE	CLOSESTATUS
PAYIN_STATUS			

Table : BGCheQ Trans_YY

TS_RUN	**FACCOD**	**ACDKF**	**MAINCOST**
COSTCOD	CHEQ_NO	ACDNO	ACDTE3
ACPASSBOOK	CRADITNO	ACAMT4	TAX
DISMONEY	GF_MONEY_ NET	STATUS	VENDORID
DIRECTPAY	USER_UPDATE	DATE_UPDATE	FACPAYOUT DATE

3. Table Structure

Based on an E-R diagram of MU financial system (shown in Figure 1), we can display details of components of related data files in the system, for example, master table and transaction table, each of which comprises field name, field description, length, type, null value, primary key and foreign key as the following:

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- **List of Master Table**

Order	Table Name	Description
1	MS_DEPARTMENT	Work unit data file
2	PLAN*YY*	Workplan data file
3	JOB*YY*	Work/project data file
4	ACT*YY*	Activity data file
5	FUND*YY*	Fund data file
6	OBJ*YY*	Product/target data file
7	MAINCOST*YY*	Major expenses group data file
8	COST*YY*	Sub expenses group data file
9	MS_COA	Major account chart data file
10	*FF*_SUBDEPOSITREC	Data file of registration controlling sub book of a bank

- **List of Transaction Table**

Order	Table Name	Description
1	FIUSERINFO	User data file
2	D3BGACTFF*YY*	Data file of faculty voucher in the viewpoint of fund and activity
3	D3BGDK*FFYY*	Data file of work unit voucher getting an approval by MU finance division
4	D3BGDK_DIRECT*YY*	Data file of direct payment to MU by the Comptroller-General's Department
5	D3BGDK_DIRECTPAY*YY*	Data file of acknowledgement of direct payment by the Comptroller-General's Department
6	TEMD3BGDKRUB*YY*	Data file of item on money (credit) reception from the Comptroller-General's Department

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Order	Table Name	Description
7	TEMD3BGDKPAY*YY*	Data file of vouchers receiving money from MU-wait for payment
8	D3TRANSBK*YY*	Data file of reception of money overdrawn and returned
9	FA_DETAILDKPO*FFYY*	Data file of purchase order
10	FA_DETAILDKPO2*FFYY*	Data file of details of purchase order
11	FA_DETAILDEEKA*FFYY*	Voucher data file
12	FA_DETAILDEEKA2*FFYY*	Voucher details data file
13	*FFYY*_REFA	Data file of inspection for reception
14	*FF*_PAYOUTTRANS	Data file of item on creditors for which a payment inspection certificate is made
15	*FF*_PAYOUTREF	Data file of item on vouchers for which a payment inspection certificate is made
16	*FF*_PAYSTAFF	Data file of payment to creditors on payment inspection
17	*FF*_D3BgdkOut	Data file of national revenue reception
18	*FF*_D3BgdkOutTrans	Data file of national revenue reception details
19	*FF*_TRANSRECEIPTYY	Receipt data file
20	BGCHEQ_*YY*	Cheque payment data file
21	BGCHEQTRANS_*YY*	Data file of cheque payment details of work unit voucher

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File Name : MS_DEPARTMENT
Description : To store data on work unit
File Type : Master File
Primary Key : DEPT_CODE

No.	Field name	Description	Type	Length	Key
1	DEPT_CODE	Code of work unit	Varchar	10	PK
2	DEPT_TNAME	Work unit's Thai name	Varchar	255	
3	DEPT_ENAME	Work unit's English name	Varchar	255	
4	DEPT_TYPE	Code of work unit type	Varchar	1	

File Name : PLANYY
Description : To store data on workplan
File Type : Master File
Primary Key : PLNCOD

No.	Field name	Description	Type	Length	Key
1	PLNCOD	Workplan code	Varchar	2	PK
2	PLNME	Workplan name	Varchar	255	
3	DISPLNME	Workpan name displayed	Varchar	100	

File Name : JOBYY
Description : To store data on work/project
File Type : Master File
Primary Key : JOBCOD

No.	Field name	Description	Type	Length	Key
1	JOBCOD	Work/project code	Varchar	4	PK
2	JOBNAME	Work/project name	Varchar	90	

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File Name : FUNDYY
Description : To store data on fund
File Type : Master File
Primary Key : FUNDCODE

No.	Field name	Description	Type	Length	Key
1	FUNDCODE	Fund code	Varchar	2	PK
2	FUNDNAME	Fund name	Varchar	200	

File Name : ACTYY
Description : To store data on activity
File Type : Master File
Primary Key : JOBCOD, ACTCODE

No.	Field name	Description	Type	Length	Key
1	JOBCOD	Work/project code	Varchar	4	PK
2	ACTCODE	Activity code	Varchar	2	PK
3	ACTNAME	Activity name	Varchar	200	

File Name : OBJYY
Description : To store data on product/target
File Type : Master File
Primary Key : JOBCOD, OBJCOD

No.	Field name	Description	Type	Length	Key
1	JOBCOD	Work/project code	Varchar	4	PK
2	OBJCOD	Product/target code	Varchar	6	PK
3	OBJNME	Product/target name	Varchar	250	

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File Name : MAINCOSTYY
Description : To store data on major expenses group
File Type : Master File
Primary Key : MCOSCOD

No.	Field name	Description	Type	Length	Key
1	MCOSCOD	Major expenses group code	Varchar	4	PK
2	MCOSNME	Major expenses group name	Varchar	40	
3	ACC1	Account code, level 1	Varchar	2	
4	ACC2	Account code, level 2	Varchar	2	
5	ACC3	Account code, level 3	Varchar	2	
6	ACC4	Account code, level 4	Varchar	2	
7	ACC5	Account code, level 5	Varchar	2	
8	ACC6	Account code, level 6	Varchar	2	
9	ACCNAME	Account name	Varchar	80	

File Name : COSTYY
Description : To store data on sub expenses group
File Type : Master File
Primary Key : MCOSCOD, SCOSCOD

No.	Field name	Description	Type	Length	Key
1	MCOSCOD	Major expenses group code	Varchar	4	PK
2	GF	Expenses code by GF	Varchar	4	
3	SCOSCOD	Sub expenses code	Varchar	4	PK
4	COSNME	Sub expenses group name	Varchar	255	
5	STATUS	Current status of data	Char	1	

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File Name : MS_COA

Description : To store major account chart data

File Type : Master File

Primary Key : ACC1, ACC2, ACC3, ACC4, ACC5, ACC6

No.	Field name	Description	Type	Length	Key
1	ACC1	Account code, level 1	Varchar	1	PK
2	ACC2	Account code, level 2	Varchar	1	PK
3	ACC3	Account code, level 3	Varchar	1	PK
4	ACC4	Account code, level 4	Varchar	2	PK
5	ACC5	Account code, level 5	Varchar	2	PK
6	ACC6	Account code, level 6	Varchar	2	PK
7	ACCNAME	Account name	Varchar	200	
8	DISPLAY NAME	Account name displayed	Varchar	200	
9	ACCDESC	Description of account items	Varchar	200	
10	ACCLEVEL	Level in account chart	Tinyint	1	
11	CREATED DATE	Date of data storage	Datetime	8	
12	CREATEDBY	Code of persons storing data	Varchar	5	

File Name : *FF*_SUBDEPOSITREC

Description : To store data on registration controlling subbook of bank accounts of each work unit

File Type : Master File

Primary Key : ACC1, ACC2, ACC3, ACC4, ACC5, ACC6, SUBACCID

No.	Field name	Description	Type	Length	Key
1	ACC1	Account code, level 1	Varchar	1	PK
2	ACC2	Account code, level 2	Varchar	1	PK
3	ACC3	Account code, level 3	Varchar	1	PK

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No.	Field name	Description	Type	Length	Key
4	ACC4	Account code, level 4	Varchar	2	PK
5	ACC5	Account code, level 5	Varchar	2	PK
6	ACC6	Account code, level 6	Varchar	2	PK
7	SUBACCID	Subbook code	Varchar	2	PK
8	ACCNAME	Account name (deposit pair book)	Varchar	100	
9	BANKID	Bank account number	Varchar	13	
10	BANKDEP	Bank branch	Varchar	30	
11	BANKACC NAME	Account name corresponding with account chart	Varchar	100	
12	BANKTYPE	Type of account book	Varchar	50	
13	OPENING-BALANCE	Total amount of account opening	Money	8	
14	DEPT_CODE	Code of work unit	Varchar	10	
15	BUDGETTYPE	Financial source	Varchar	3	
16	STATUS	Current status of data	Varchar	1	
17	DATEOPEN	Date of account opening	Datetime	8	
18	BANK	Bank name	Varchar	50	

File Name : FIUSERINFO
Description : To store user data
File Type : Master File
Primary Key : USERACCOUNT

No.	Field name	Description	Type	Length	Key
1	USER ACCOUNT	User code	Varchar	8	PK
2	PREFIXCODE	Title code	Varchar	3	
3	USERTNAME	User's Thai name	Varchar	70	

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No.	Field name	Description	Type	Length	Key
4	USERENAME	User's English name	Varchar	70	
5	FACTCODE	Work unit code	Varchar	2	
6	USERLEVEL	Usage authorization level	Tinyint	1	
7	USERPWD	User password	Varchar	15	
8	USERSTATUS	User's current status	Varchar	1	
9	EXPDATE	Expiry date of system use	Datetime	8	
10	POSITIONID	Position code	Varchar	2	
11	PRIORITY	Priority	Tinyint	1	
12	LASTUSED	Date and time of system use	Datetime	8	
13	LOGINSTS	Current status of system use	Varchar	1	

File Name : D3BGACTFFYY
Description : To store data on faculty voucher in the viewpoint of fund and activity
File Type : Transaction File
Primary Key : FACCOD, COSTCOD, ACRUN

No.	Field name	Description	Type	Length	Key
1	FACCOD	Work unit code	Varchar	6	PK
2	MAINCOST	Major expenses group code	Varchar	5	
3	COSTCOD	Sub expenses group code	Varchar	5	PK
4	ACRUN	Running number	Varchar	4	PK
5	PLNCOD	Workplan code	Varchar	2	
6	JOBCOD	Work/project code	Varchar	2	
7	FUNDCODE	Fund code	Varchar	2	
8	ACTCODE	Activity code	Varchar	3	
9	OBJCOD	Product/target code	Varchar	6	
10	MUPO	Status of PO data	Varchar	1	
11	GFMISPO	Number of PO for send GF	Varchar	10	

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File Name : D3BGDKFFYY

Description : To store data on faculty voucher getting an approval from MU finance division

File Type : Transaction File

Primary Key : FACCOD, COSTCOD, ACRUN

No.	Field name	Description	Type	Length	Key
1	FACCOD	Work unit code	Varchar	6	PK
2	MAINCOST	Major expenses group code	Varchar	5	
3	COSTCOD	Sub expenses group code	Varchar	5	PK
4	ACRUN	Running number	Varchar	4	PK
5	PLNCOD	Workplan code	Varchar	2	
6	JOBCOD	Work/project code	Varchar	2	
7	FUNDCODE	Fund code	Varchar	2	
8	ACTCODE	Activity code	Varchar	3	
9	OBJCOD	Product code	Varchar	6	
10	ACDTE1	Date of approval	Datetime	8	
11	ACAMT1	Budget money obtained this time	Money	8	
12	ACAMT2	Money outside the budget	Money	8	
13	ACDKF	Work unit voucher number	Varchar	6	PK
14	ACAMT4	Voucher amount (total)	Money	8	
15	ACAMT5	Subtracted amount	Money	8	
16	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
17	ACDNO	Number of voucher reception of MU finance division	Varchar	6	
18	ACPASS BOOK	Passbook number	Varchar	6	

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No.	Field name	Description	Type	Length	Key
19	ACPBDATE	Date of submission to the Comptroller-General's Department	Datetime	8	
20	ACAMT6	Amount of cheque 1 payment	Money	8	
21	ACAMT7	Amount of cheque 2 payment	Money	8	
22	ACDTE4	Date of cheque issuance	Datetime	8	
23	ACCNO1	Number of cheque 1	Varchar	10	
24	ACCNO2	Number of cheque 2	Varchar	10	
25	ACAMT8	Amount set aside	Money	8	
26	ACAMT9	Amount which a voucher sets aside	Money	8	
27	ACAMT10	Amount returned to MU finance division	Money	8	
28	ACPOINTER	Establish a voucher no.	Tinyint	1	PK
29	LU_DATE	Date of latest transaction	Datetime	8	
30	ACBCNO	The Comptroller-General's Department number	Varchar	10	
31	ACBCDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
32	ACCTR	Approval of periodic withdrawal type no.	Tinyint	13	
33	ACPTR	Voucher data modification no.	Tinyint	13	
34	ACDKSTATUS	Current status of voucher	Varchar	1	
35	DK_TYPE	Code of voucher type	Varchar	1	
36	ACCQSTATUS	Cheque status	Varchar	1	

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No.	Field name	Description	Type	Length	Key
37	CRADITNO	Number of credit report from GF	Varchar	25	
38	CRADIT_ DATE	Date of credit report from GF	Datetime	8	
39	ACTAX	Tax amount deducted on payment (total) of voucher	Money	8	
40	ACADJ	Fine deducted (total) of voucher	Money	8	
41	GF_MONEY_ SUB_FINE	Deducted fine received from GF	Money	8	
42	GF_TAX	Tax amount deducted on payment derived from GF	Money	8	
43	GF_MONEY _NET	Net amount derived from GF	Money	8	
44	GF_PAY_ DOC	Number of payment document of GF	Varchar	15	
45	GF_PAY_ DATE	Date of payment of GF	Datetime	8	
46	GF_PAY_FILE _DATE	Date of submission of data file of GF	Datetime	8	
47	CHK_ BARCODE	Status of barcode printing	Varchar	1	
48	DIRECTPAY	Status of direct payment	Varchar	1	
49	STATUS_PO	Status of PO data	Varchar	15	

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File Name : D3BGDK_DIRECTYY

Description : To store data on direct payment from the Comptroller-General's Department, which MU has acknowledged.

File Type : Transaction File

Primary Key : FAYEAR, DKYEAR, FACCOD, COSTCOD, ACRUN, ACDKF

No.	Field name	Description	Type	Length	Key
1	FAYEAR	Fiscal year when FA is prepared	Varchar	2	PK
2	DKYEAR	Fiscal year when vouchers are prepared	Varchar	2	PK
3	FACCOD	Code of work unit	Varchar	6	PK
4	MAINCOST	Code of major expenses groups	Varchar	5	
5	COSTCOD	Sub expenses group code	Varchar	5	PK
6	ACRUN	Running number	Varchar	4	PK
7	PLNCOD	Workplan code	Varchar	2	
8	JOBCOD	Work/project code	Varchar	2	
9	OBJCOD	Product code	Varchar	6	
10	FUNDCODE	Fund code	Varchar	2	
11	ACTCODE	Activity code	Varchar	3	
12	ACDTE1	Date of approval	Datetime	8	
13	ACDKF	Work unit voucher number	Varchar	6	PK
14	ACAMT4	Voucher amount (total)	Money	8	
15	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
16	ACDNO	Number of voucher reception of MU finance division	Varchar	6	
17	LU_DATE	Date of latest transaction	Datetime	8	
18	ACBCNO	The Comptroller-General's Department number	Varchar	10	

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No.	Field name	Description	Type	Length	Key
19	ACBCDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
20	CRADITNO	Number of credit report from GF	Varchar	25	PK
21	CRADIT_ DATE	Date of credit report from GF	Datetime	8	
22	ACTAX	Tax amount deducted on payment (total) of voucher	Money	8	
23	ACADJ	Fine deducted (total) of voucher	Money	8	
24	STATUS PRINT	Status of voucher (JV) printing	Varchar	1	
25	USERPRINT	Maker of general vouchers	Varchar	50	
26	DATEPRINT	Date of general voucher printing	Datetime	8	
27	MVOUCHER NO	Number of MU voucher	Varchar	13	
28	FVOUCHER NO	Number of work unit voucher	Varchar	13	
29	POSTSTATUS	Status of voucher making	Varchar	1	
30	USERACC	Transaction maker	Varchar	10	
31	REDUCE	Amount deducted	Money	8	
32	ACPASSBOOK	Number of passbook	Varchar	6	
33	ACPBDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
34	GF_MONEY	Amount received from GF	Money	8	
35	GF_TAX	Tax amount deducted on payment derived from GF	Money	8	

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No.	Field name	Description	Type	Length	Key
36	GF_FINE	Deducted fine received from GF	Money	8	
37	GF_MONEY_ NET	Net amount derived from GF	Money	8	
38	SEND_ STATUS	Status of submission	Varchar	1	
39	GF_DOC_NO	Number of document of GF	Varchar	15	
40	GFMIS_DOC_D ATE	Date in documentof GF	Datetime	8	

File Name : D3BGDK_DIRECTPAYYY

Description : To store data on direct payment from the Comptroller-General's Department, which MU has acknowledged.

File Type : Transaction File

Primary Key : FAYEAR, DKYEAR, FACCOD, COSTCOD, ACRUN, ACDKF

No.	Field name	Description	Type	Length	Key
1	FAYEAR	Fiscal year when FA is prepared	Varchar	2	PK
2	DKYEAR	Fiscal year when vouchers are prepared	Varchar	2	PK
3	FACCOD	Code of work unit	Varchar	6	PK
4	MAINCOST	Code of major expenses groups	Varchar	5	
5	COSTCOD	Sub expenses group code	Varchar	5	PK
6	ACRUN	Running number	Varchar	4	PK
7	PLNCOD	Workplan code	Varchar	2	
8	JOBCOD	Work/project code	Varchar	2	
9	OBJCOD	Product code	Varchar	6	
10	FUNDCODE	Fund code	Varchar	2	

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No.	Field name	Description	Type	Length	Key
11	ACTCODE	Activity code	Varchar	3	
12	ACDTE1	Date of approval	Datetime	8	
13	ACDKF	Work unit voucher number	Varchar	6	PK
14	ACAMT4	Voucher amount (total)	Money	8	
15	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
16	ACDNO	Number of voucher reception of MU finance division	Varchar	6	
17	LU_DATE	Date of latest transaction	Datetime	8	
18	ACBCNO	The Comptroller-General's Department number	Varchar	10	
19	ACBCDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
20	CRADITNO	Number of credit report from GF	Varchar	25	PK
21	CRADIT_ DATE	Date of credit report from GF	Datetime	8	
22	ACTAX	Tax amount deducted on payment (total) of voucher	Money	8	
23	ACADJ	Fine deducted (total) of voucher	Money	8	
24	STATUS PRINT	Status of voucher (JV) printing	Varchar	1	
25	USERPRINT	Maker of general vouchers	Varchar	50	
26	DATEPRINT	Date of general voucher printing	Datetime	8	
27	MVOUCHER NO	Number of MU voucher	Varchar	13	

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No.	Field name	Description	Type	Length	Key
28	FVOUCHER NO	Number of work unit voucher	Varchar	13	
29	POSTSTATUS	Status of voucher making	Varchar	1	
30	USERACC	Transaction maker	Varchar	10	
31	REDUCE	Amount deducted	Money	8	
32	ACPASSBOOK	Number of passbook	Varchar	6	
33	ACPBDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
34	GF_MONEY	Amount received from GF	Money	8	
35	GF_TAX	Tax amount deducted on payment derived from GF	Money	8	
36	GF_FINE	Deducted fine received from GF	Money	8	
37	GF_MONEY_ NET	Net amount derived from GF	Money	8	
38	SEND_ STATUS	Status of submission	Varchar	1	
39	GF_DOC_NO	Number of document of GF	Darchar	15	
40	GFMIS_DOC_ DATE	Date in documentof GF	Datetime	8	

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File Name : TEMD3BGDKRUBYY

Description : To store data on money (credit) reception by MU from the Comptroller-General's Department

File Type : Transaction File

Primary Key : FAYEAR, DKYEAR, FACCOD, COSTCOD, ACRUN, ACDKF

No.	Field name	Description	Type	Length	Key
1	FAYEAR	Fiscal year when FA is prepared	Varchar	2	PK
2	DKYEAR	Fiscal year when vouchers are prepared	Varchar	2	PK
3	FACCOD	Code of work unit	Varchar	6	PK
4	MAINCOST	Code of major expenses groups	Varchar	5	
5	COSTCOD	Sub expenses group code	Varchar	5	PK
6	ACRUN	Running number	Varchar	4	PK
7	PLNCOD	Workplan code	Varchar	2	
8	JOBCOD	Work/project code	Varchar	2	
9	OBJCOD	Product code	Varchar	6	
10	FUNDCODE	Fund code	Varchar	2	
11	ACTCODE	Activity code	Varchar	3	
12	ACDTE1	Date of approval	Datetime	8	
13	ACDKF	Work unit voucher number	Varchar	6	PK
14	ACAMT4	Voucher amount (total)	Money	8	
15	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
16	ACDNO	Number of voucher reception of MU finance division	Varchar	6	
17	LU_DATE	Date of latest transaction	Datetime	8	
18	ACBCNO	The Comptroller-General's Department number	Varchar	10	

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No.	Field name	Description	Type	Length	Key
19	ACBCDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
20	CRADITNO	Number of credit report from GF	Varchar	25	PK
21	CRADIT_ DATE	Date of credit report from GF	Datetime	8	
22	ACTAX	Tax amount deducted on payment (total) of voucher	Money	8	
23	ACADJ	Fine deducted (total) of voucher	Money	8	
24	STATUS PRINT	Status of voucher (JV) printing	Varchar	1	
25	USERPRINT	Maker of general vouchers	Varchar	50	
26	DATEPRINT	Date of general voucher printing	Datetime	8	
27	MDATEP-REPARER	Date of reception by MU	Datetime	8	
28	MVOUCHER NO	Number of MU voucher	Varchar	13	
29	FVOUCHER NO	Number of work unit voucher	Varchar	13	
30	POSTSTATUS	Status of voucher making	Varchar	1	
31	TVOUCHER NO	Number of faculty's general voucher	Varchar	13	
32	JVOUCHER NO	Number of general voucher (JV) – month-end	Varchar	13	
33	USERACC	Transaction maker	Varchar	10	
34	REDUCE	Amount deducted	Money	8	
35	ACPASSBOOK	Number of passbook	Varchar	6	

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No.	Field name	Description	Type	Length	Key
36	ACPBDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
37	GF_MONEY	Amount received from GF	Money	8	
38	GF_TAX	Tax amount deducted on payment derived from GF	Money	8	
39	GF_FINE	Deducted fine received from GF	Money	8	
40	GF_MONEY _NET	Net amount derived from GF	Money	8	
41	SEND_ STATUS	Status of submission	Varchar	1	
42	GF_DOC_NO	Number of document of GF	Varchar	15	
43	GFMIS_DOC_ DATE	Date in document of GF	Datetime	8	

File Name : TEMD3BGDKPAYYY
Description : To store data on money (credit) reception for payment Comptroller-General's Department
File Type : Transaction File
Primary Key : FAYEAR, DKYEAR, FACCOD, COSTCOD, ACRUN, ACDKF

No.	Field name	Description	Type	Length	Key
1	FAYEAR	Fiscal year when FA is prepared	Varchar	2	PK
2	DKYEAR	Fiscal year when vouchers are prepared	Varchar	2	PK
3	FACCOD	Code of work unit	Varchar	6	PK
4	MAINCOST	Code of major expenses groups	Varchar	5	

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No.	Field name	Description	Type	Length	Key
5	COSTCOD	Sub expenses group code	Varchar	5	PK
6	ACRUN	Running number	Varchar	4	PK
7	PLNCOD	Workplan code	Varchar	2	
8	JOBCOD	Work/project code	Varchar	2	
9	OBJCOD	Product code	Varchar	6	
10	FUNDCODE	Fund code	Varchar	2	
11	ACTCODE	Activity code	Varchar	3	
12	ACDTE1	Date of approval	Datetime	8	
13	ACDKF	Work unit voucher number	Varchar	6	PK
14	ACAMT4	Voucher amount (total)	Money	8	
15	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
16	ACDNO	Number of voucher reception of MU finance division	Varchar	6	
17	LU_DATE	Date of latest transaction	Datetime	8	
18	ACBCNO	The Comptroller-General's Department number	Varchar	10	
19	ACBCDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
20	CRADITNO	Number of credit report from GF	Varchar	25	PK
21	CRADIT_ DATE	Date of credit report from GF	Datetime	8	
22	ACTAX	Tax amount deducted on payment (total) of voucher	Money	8	
23	ACADJ	Fine deducted (total) of voucher	Money	8	

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No.	Field name	Description	Type	Length	Key
24	STATUS PRINT	Status of voucher (JV) printing	Varchar	1	
25	USERPRINT	Maker of general vouchers	Varchar	50	
26	DATEPRINT	Date of general voucher printing	Datetime	8	
27	MDATE-PREPARER	Date of reception by MU	Datetime	8	
28	MVOUCHER NO	Number of MU voucher	Varchar	13	
29	FVOUCHER NO	Number of work unit voucher	Varchar	13	
30	POSTSTATUS	Status of voucher making	Varchar	1	
31	TVOUCHER NO	Number of faculty's general voucher	Varchar	13	
32	JVOUCHER NO	Number of general voucher (JV) – month-end	Varchar	13	
33	USERACC	Transaction maker	Varchar	10	
34	REDUCE	Amount deducted	Money	8	
35	ACPASSBOOK	Number of passbook	Varchar	6	
36	ACPBDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
37	GF_MONEY	Amount received from GF	Money	8	
38	GF_TAX	Tax amount deducted on payment derived from GF	Money	8	
39	GF_FINE	Deducted fine received from GF	Money	8	
40	GF_MONEY_ NET	Net amount derived from GF	Money	8	

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No.	Field name	Description	Type	Length	Key
41	SEND_ STATUS	Status of submission	Varchar	1	
42	GF_DOC_NO	Number of document of GF	Varchar	15	
43	GFMIS_DOC_ DATE	Date in document of GF	Datetime	8	

File Name : D3TRANSBKYY

Description : To store data on item of voucher for money overdrawn and returned

File Type : Transaction File

Primary Key : BGYEAR, TRANSNO

No.	Field name	Description	Type	Length	Key
1	BGYEAR	Fiscal year	Varchar	2	PK
2	TRANSNO	Number of transaction	Int	4	PK
3	RECEIPTNO	Number of work unit receipt	Varchar	5	
4	MURENO	Number of MU receipt	Varchar	5	
5	FACCOD	Code of work unit	Varchar	6	
6	MAINCOST	Code of major expenses groups	Varchar	5	
7	COSTCOD	Sub expenses group code	Varchar	4	
8	ACRUN	Running number	Varchar	4	
9	PLNCOD	Workplan code	Varchar	2	
10	JOBCOD	Work/project code	Varchar	2	
11	FUNDCODE	Fund code	Varchar	2	
12	CAPCODE	Capital account	Varchar	9	
13	ACTCODE	Activity code	Varchar	3	
14	OBJCOD	Product code	Varchar	6	
15	CAPYEAR	Fiscal year of capital account	Varchar	2	

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No.	Field name	Description	Type	Length	Key
16	ACDKF	Work unit voucher number	Varchar	6	
17	ACAMT4	Voucher amount (total)	Money	8	
18	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
19	ACAMT10	Amount returned to the Finance Ministry	Money	8	
20	DES_CRIPT	Item description	Varchar	250	
21	ACDNO	The Comptroller-General's Department number	Varchar	6	
22	ACPASSBOOK	Number of passbook	Varchar	6	
23	ACPBDATE	Date of reception of the Comptroller-General's Department number	Datetime	8	
24	CRADITNO	Number of credit report from GF	Varchar	25	
25	CRADIT_ DATE	Date of credit report from GF	Datetime	8	
26	LU_DATE	Date of latest transaction	Datetime	8	
27	DK_TYPE	Type of work unit voucher	Varchar	3	
28	USERACC	Transaction maker	Varchar	10	
29	RVFFNO	Number of work unit RV	Varchar	13	
30	PVFFNO	Number of work unit PV	Varchar	13	
31	RVMUNO	Number of MU RV	Varchar	13	
32	PVMUNO	Number of MU PV	Varchar	13	
33	PAYINNO	Number of deposit in a bank	Varchar	6	FK
34	PAYINDATE	Date of deposit in a bank	Datetime	8	
35	PAYINUSER	Bank depositor	Varchar	5	
36	PAYINVOU NO	Number of general voucher (JV) of deposit in a bank	Varchar	13	

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No.	Field name	Description	Type	Length	Key
37	CLOSEUSER	Name of daily closer	Varchar	50	
38	CLOSEDATE	Date of daily closer	Datetime	8	
39	CLOSE STATUS	Status of daily closer	Varchar	1	
40	BGSTATUS	Status of FA067	Varchar	1	
41	PAYIN_ STATUS	Status of deposit	Varchar	1	
42	PVFFDATE	Date of making payment voucher of faculty	Datetime	8	
43	RVMUDATE	Date of making reception voucher-MU	Datetime	8	
44	PVMUDATE	Date of making payment voucher of MU	Datetime	8	
45	JVFFNO	Number of work unit JV	Varchar	13	
46	RVFFDATE	Date of making reception voucher of faculty	Datetime	8	
47	CANCELED DATE	Date of cancellation	Datetime	8	
48	REMARK	Reason for cancellation	Varchar	250	
49	CANCELED BY	Name of a person who cancels	Varchar	10	
50	Flag	Status of cancellation	Varchar	1	

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File Name : FA_DETAILDKPOFFYY
Description : To store data on purchase order
File Type : Transaction File
Primary Key : VENDORID, ADDID

No.	Field name	Description	Type	Length	Key
1	VENDORID	Vendor code	Char	6	PK
2	ADDRID	Code of Address's vendor	Char	2	PK
3	FACCOD	Work unit code	Varchar	6	PK
4	MAINCOST	Code of major expenses group	Varchar	5	
5	COSTCOD	Sub expenses group code	Varchar	5	PK
6	ACRUN	Running number	Varchar	4	PK
7	ACDKF	Work unit voucher number	Varchar	6	PK
8	CODE	Code of payment item	Varchar	2	PK
9	MONEY1	Amount by item data	Money	8	
10	STATUS	Current status of data	Char	1	
11	LU_DATE	Date of latest transaction	Datetime	8	
12	TAX_TYPE	Code of tax	Varchar	1	

File Name : FA_DETAILDKPO2FFYY
Description : To store data on details of purchase order
File Type : Transaction File
Primary Key : VENDORID, ADDRID, FACCOD, COSTCOD, ACRUN, ACDKF

No.	Field name	Description	Type	Length	Key
1	VENDORID	Vendor code	Char	6	PK
2	ADDRID	Code of Address's vendor	Char	2	PK
3	FACCOD	Work unit code	Varchar	6	PK
4	MAINCOST	Code of major expenses group	Varchar	5	

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No.	Field name	Description	Type	Length	Key
5	COSTCOD	Sub expenses group code	Varchar	5	PK
6	ACRUN	Running number	Varchar	4	PK
7	ACDKF	Work unit voucher number	Varchar	6	PK
8	NUM_ITEMS	Amount of item.	Int	4	
9	STATUS	Current status of data	Char	1	
10	LU_DATE	Date of latest transaction	Datetime	8	
11	TYPE_ID	Type of data	Char	4	
12	UNIT	Unit by item	Varchar	50	

File Name : FA_DETAILDEEKAFFYY
Description : To store data on voucher
File Type : Transaction File
Primary Key : FACCOD, COSTCOD, ACRUN, ACDKF, CODE

No.	Field name	Description	Type	Length	Key
1	FACCOD	Work unit code	Varchar	6	PK
2	MAINCOST	Code of major expenses group	Varchar	5	
3	COSTCOD	Sub expenses group code	Varchar	5	PK
4	ACRUN	Running number	Varchar	4	PK
5	ACDKF	Work unit voucher number	Varchar	6	PK
6	CODE	Code of payment item	Varchar	2	PK
7	MONEY1	Amount by item data	Money	8	

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File Name : FA_DETAILDEEKA2FFYY
Description : To store data on voucher details
File Type : Transaction File
Primary Key : FACCOD, COSTCOD, ACRUN, ACDKF

No.	Field name	Description	Type	Length	Key
1	FACCOD	Work unit code	Varchar	6	PK
2	MAINCOST	Major expenses group code	Varchar	5	
3	COSTCOD	Sub expenses group code	Varchar	5	PK
4	ACRUN	Running number	Varchar	4	PK
5	ACDKF	Work unit voucher number	Varchar	6	PK
6	NUM_ PERSON	Amount of person	Int	4	
7	FAIL_ SALALY	Type of Salary code	Varchar	1	
8	UNIT	Unit by item	Varchar	25	

File Name : FFYY_REFA
Description : To store data on inspection for reception
File Type : Transaction File
Primary Key : PO_NO, RUN_NO, LIST_NO, BGYEAR, FABGYEAR, FACCOD, COSCOD, ACRUN

No.	Field name	Description	Type	Length	Key
1	PO_NO	Number of purchase order	Varchar	5	PK
2	RUN_NO	Running number	Varchar	2	PK
3	LIST_NO	Number of item	Int	4	PK
4	BGYEAR	Fiscal year	Varchar	2	PK
5	FABGYEAR	Fiscal year when vouchers are prepared	Varchar	2	PK
6	FACCOD	Code of work unit	Varchar	10	PK

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No.	Field name	Description	Type	Length	Key
7	COSTCOD	Sub expenses group code	Varchar	4	PK
8	ACRUN	Running number	Varchar	4	PK
9	PO_ID	Number of purchase order	Varchar	12	
10	AMOUNT	Amount of purchase order	Money	8	
11	VAT	Vat	Money	8	
12	FINE	Deducted fine of item	Money	8	
13	DISCOUNT	Discount of item	Money	8	
14	PRECEDE	Discount of item before deducted fine	Money	8	
15	DATE PREPARER	Date of inspection for reception	Datetime	8	
16	VOUCHERID	Number of voucher	Varchar	5	
17	PE_ID	Number of voucher	Varchar	6	
18	WHO_ UPDATE	Transaction maker	Varchar	5	
19	DATE_ UPDATE	Date of data modification	Datetime	8	

File Name : FF_PAYOUTTRANS

Description : To store data on item of creditors for which a payment inspection certificate is made

File Type : Transaction File

Primary Key : PSID, MTYPE, VENDOR

No	Field name	Description	Type	Length	Key
1	PSID	Number of payment inspection report	Varchar	6	PK
2	MTYPE	Money source	Varchar	2	PK
3	VENDOR	Creditor name	Varchar	100	PK
4	VENTYPE	Type of creditors	Varchar	1	

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No	Field name	Description	Type	Length	Key
5	ACDKFAMT	Voucher amount request	Money	8	
6	MONEY	Goods amount	Money	8	
7	VAT	Vat amount	Money	8	
8	TAX	Tax amount deducted on payment	Money	8	
9	FINE	Fine deducted	Money	8	
10	TOTAL	Reception amount (total)	Money	8	
11	CURSTATUS	Current status of data	Varchar	1	
12	PAIDTYPE	Type of payment	Varchar	1	
13	PAID AMOUNT	Amount of payment	Money	8	
14	PAIDSTS	Status of payment	Varchar	1	
15	PAIDDATE	Date of payment	Datetime	8	
16	BANKAC_ID	Number of bank account	Varchar	13	
17	CHQNO	Cheque number	Varchar	7	
18	CHQDATE	Date on the cheque	Datetime	8	
19	ACPSTS	Status of AC	Varchar	1	
20	CHQPRN DATE	Date of cheque printing	Datetime	8	
21	CHQPRNBY	Name of cheque printing	Varchar	10	
22	RECEBY	Name of cheque reception	Varchar	50	
23	PVID	Number of payment voucher (PV)	Varchar	5	
24	PVDATE	Date of payment voucher (PV)	Datetime	8	

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File Name : FF_PAYOUTREF

Description : To store data on item of vouchers for which a payment inspection certificate is made

File Type : Transaction File

Primary Key : PSID, MTYPE, FACCOD

No.	Field name	Description	Type	Length	Key
1	PSID	Number of payment inspection report	Varchar	6	PK
2	MTYPE	Money source	Varchar	2	PK
3	ACDKF	Work unit voucher number	Varchar	12	
4	FACCOD	Work unit code	Varchar	6	PK
5	DETAIL	Description	Varchar	6	
6	ACDKFAMT	Request amount	Varchar	100	
7	MONEY	Goods amount	Money	8	
8	VAT	Vat amount	Money	8	
9	TAX	Tax amount deducted on payment	Money	8	
10	FINE	Fine deducted	Money	8	
11	TOTAL	Reception amount (total)	Money	8	
12	FAIL_ SALALY	Status of salary	Varchar	1	
13	FLAG	Current status of data	Varchar	1	
14	BGYEAR	Fiscal year	Varchar	2	
15	RESERVESTS	Status of voucher	Varchar	1	

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File Name : FF_PAYSTAFF
Description : To store data on payment to creditors on payment inspection
File Type : Transaction File
Primary Key : ACDKF, FACCOD, RECENAME

No.	Field name	Description	Type	Length	Key
1	BGYEAR	Fiscal year	Varchar	2	
2	ACDKF	Work unit voucher number	Varchar	6	PK
3	FACCOD	Work unit code	Varchar	6	PK
4	RECENAME	Name of reception money	Varchar	100	PK
5	MONEY	Reception money	Money	8	
6	PAIDTYPE	Type of payment code	Varchar	1	
7	FLAG	Current status of data	Varchar	1	
8	PSID	Number of payment inspection report	Varchar	6	
9	MTYPE	Money source	Varchar	2	

File Name : FF_D3BGDKOUT
Description : To store data on national revenue reception
File Type : Transaction File
Primary Key : BGYEAR, TRANSNO

No.	Field name	Description	Type	Length	Key
1	BGYEAR	Fiscal year	Varchar	2	PK
2	TRANSNO	Number of transaction	Varchar	5	PK
3	RECEIPTNO	Number of receipt	Varchar	5	FK
4	FACCOD	Work unit code	Varchar	6	FK
5	TYPE RECEIVE	Reception item group	Varchar	9	FK
6	PLNCOD	Workplan code	Varchar	2	FK
7	JOBCOD	Work/project code	Varchar	2	FK

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No.	Field name	Description	Type	Length	Key
8	FUNDCODE	Fund code	Varchar	2	FK
9	CAPCODE	Capital account	Varchar	9	FK
10	ACTCODE	Activity code	Varchar	3	FK
11	OBJCOD	Product/target code	Varchar	6	
12	CAPYEAR	Fiscal year of capital account	Varchar	2	
13	ACAMT4	Voucher amount (total)	Money	8	
14	ACDNO	Number of voucher reception of MU finance division	Varchar	6	
15	LU_DATE	Date of latest transaction	Datetime	8	
16	DK_TYPE	Type of work unit voucher	Varchar	3	
17	USERACC	Transaction maker	Varchar	10	
18	RVFFNO	Number of work unit RV	Varchar	13	
19	PVFFNO	Number of work unit PV	Varchar	13	
20	RVMUNO	Number of MU RV	Varchar	13	
21	PVMUNO	Number of MU PV	Varchar	13	
22	PAYINNO	Number of deposit in a bank	Varchar	6	
23	PAYINDATE	Date of deposit in a bank	Datetime	8	
24	PAYINUSER	Bank depositor	Varchar	5	
25	CLOSEUSER	Name of daily closer	Varchar	50	
26	CLOSEDATE	Date of daily closer	Datetime	8	
27	CLOSE STATUS	Status of daily closer	Varchar	1	
28	PAYIN VOUNO	Number of deposit reference-JV	Varchar	13	
29	MURENO	Number of general voucher (JV) of deposit in a bank	Varchar	5	
30	PVFFDATE	Date of doing payment account PV-FF	Datetime	8	

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No.	Field name	Description	Type	Length	Key
31	RVMUDATE	Date of doing reception account RV-MU	Datetime	8	
32	PVMUDATE	Date of doing payment account PV-MU	Datetime	8	
33	JVFFNO	Number of work unit JV	Varchar	13	
34	RVFFDATE	Date of doing reception account RV-FF	Datetime	8	
35	CANCELED DATE	Date of cancellation	Datetime	8	
36	REMARK	Reason for cancellation	Varchar	250	
37	CANCELED BY	Name of a person who cancels	Varchar	10	
38	FLAG	Status of cancellation	Varchar	1	

File Name : FF_D3BGDKOUTTRANS
Description : To store data on item for national revenue reception
File Type : Transaction File
Primary Key : BGYEAR, TRANSNO, ACRUN

No.	Field name	Description	Type	Length	Key
1	BGYEAR	Fiscal year	Varchar	2	PK
2	TRANSNO	Transaction number	Varchar	5	PK
3	ACRUN	Running number	Varchar	4	PK
4	ACAMT4	Voucher amount (total)	Money	8	
5	ACTAX	Tax amount deducted on payment (total) of voucher	Money	8	
6	ACADJ	Fine deducted (total) of voucher	Money	8	
7	DES_CRIPT	Item description	Varchar	250	
8	TYPEMONEY	Type of money reception	Varchar	1	

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No.	Field name	Description	Type	Length	Key
9	DUEDATE	Date of cheque	Datetime	8	
10	CHEQUENO	Cheque number	Varchar	10	
11	BANKCODE	Bank code	Varchar	10	
12	BRANCH CODE	Branch code	Varchar	10	
13	RECEIPTCH	Name of cheque receiver	Varchar	250	
14	DEPOSIT DATE	Date of bank deposit	Datetime	8	
15	DEPOSIT ACNO	Number of bank for deposit	Varchar	10	
16	DEPOSITAC NAME	Name of deposit account	Varchar	250	
17	DEPOSIT BANK	Bank of deposit	Varchar	10	
18	DEPOSIT BRANCH	Bank branch of deposit	Varchar	10	
19	POSTOF	Post office branch	Varchar	250	
20	POSTCODE	Postal code	Varchar	5	
21	POST RECEIVE	Name of receiver	Varchar	250	
22	POSTADDR	Address	Varchar	250	
23	PAYIN_ STATUS	Status of deposit	Varchar	1	

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File Name : FF_TRANSRECEIPTYY

Description : To store data on receipt

File Type : Transaction File

Primary Key : RE_NO

No.	Field name	Description	Type	Length	Key
1	RE_NO	Receipt number	Varchar	5	PK
2	RE_DATE	Date of reception	Datetime	8	
3	RE_FACCOD	Work unit of receipt printing	Varchar	20	
4	RE_PAY MONEY	Name of payment	Varchar	100	
5	RE_DESCRIP TION	Item description	Varchar	250	
6	RE_MONEY	Amount receiver	Money	8	
7	RE_USER RECEIVE	Name of receiver	Varchar	5	
8	RE_FLAG	Current status	Varchar	1	
9	RE_PRINT	copy of print	Varchar	1	
10	RDOCNO	Receipt book number	Varchar	10	
11	RNOFF	Receipt number - work unit	Varchar	250	
12	CANCELED DATE	Date of cancellation	Datetime	8	
13	REMARK	Reason for cancellation	Varchar	250	
14	CANCELED BY	Name of a person who cancel	Varchar	10	

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File Name : BGCHEQ_YY

Description : To store data on cheque payment

File Type : Transaction File

Primary Key : CHEQ_NO

No.	Field name	Description	Type	Length	Key
1	CHEQ_NO	Cheque number	Varchar	7	PK
2	FACCOD	Code of work unit	Varchar	2	
3	VENDORID	Code of creditor	Varchar	6	
4	PAY_CODE	Code of payment item	Varchar	2	
5	DATE	Date on the cheque	Datetime	8	
6	DATE_PAY	Date of cheque payment	Datetime	8	
7	DATE_PRINT	Date of cheque printing	Datetime	8	
8	AMOUNT	Amount on the cheque	Money	8	
9	STATUS	Cheque status (N, P, C)	Varchar	1	
10	TYPE	Payment type (N,V,M)	Varchar	1	
11	DATE PREPARER	Date of PV payment to MU	Datetime	8	
12	PVVOUCHER ID	Number of PV payment to MU	Char	5	
13	USER_ UPDATE	Name of data storer	Varchar	5	
14	DATE_ UPDATE	Date of data storage	Datetime	8	
15	DATE_ RECEIVE	Date of faculty records cheque reception	Datetime	8	
16	USER_ RECEIVE	Name of cheque reception recorder	Varchar	5	
17	RVVOUNO	Number of RV reception of work unit	Varchar	13	

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No.	Field name	Description	Type	Length	Key
18	PAYINNO	Number of deposit in a bank	Varchar	6	
19	PAYINDATE	Date of deposit in a bank	Datetime	8	
20	PAYINUSER	Bank depositor	Varchar	5	
21	PAYINVOUNO	Number of general voucher (JV) of deposit in a bank	Varchar	13	
22	CLOSEUSER	Name of daily closer	Varchar	50	
23	CLOSEDATE	Date of daily closer	Datetime	8	
24	CLOSE STATUS	Status of daily closer	Varchar	1	
25	PAYIN_ STATUS	Status of deposit	Varchar	1	

File Name : BGCHEQTRANS_YY
Description : To store data on cheque payment details
File Type : Transaction File
Primary Key : TS_RUN, FACCOD, ACDKF, MAINCOST, COSTCOD

No.	Field name	Description	Type	Length	Key
1	TS_RUN	Number of payment inspection report	Varchar	6	PK
2	FACCOD	Work unit code	Varchar	6	PK
3	ACDKF	Number of voucher	Varchar	6	PK
4	MAINCOST	Major expense group code	Varchar	4	PK
5	COSTCOD	Sub expense group code	Varchar	4	PK
6	CHEQ_NO	Cheque number	Varchar	7	
7	ACDNO	The Comptroller-General's Department number	Varchar	6	
8	ACDTE3	Date of voucher reception of MU finance division	Datetime	8	
9	ACPASSBOOK	Number of passbook	Varchar	7	

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No.	Field name	Description	Type	Length	Key
10	CRADITNO	Number of credit report from GF	Varchar	10	
11	ACAMT4	Voucher amount (total)	Money	8	
12	TAX	Tax amount deducted on payment	Money	8	
13	DISMONEY	Fine deducted	Money	8	
14	GF_Money_Net	Net amount derived from GF	Money	8	
15	STATUS	Data status	Varchar	1	
16	VENDORID	Code of creditor	Varchar	6	
17	DIRECTPAY	Payment type	Varchar	1	
18	USER_ UPDATE	Name of data recorder	Varchar	5	
19	DATE_ UPDATE	Date of data recording	Datetime	8	
20	FACPAYOUT DATE	Date of faculty pays cheque	Datetime	8	

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BIOGRAPHY

NAME	Miss Phayao Tiwaporn
DATE OF BIRTH	15 August 1972
PLACE OF BIRTH	Prachuapkhirikhan, Thailand
INSTITUTIONS ATTENDED	Mahidol University, 1997-1999
	Bachelor of Science
	(Computer Science)

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