This chapter describes a data warehouse planning project to develop a large-scale management information system for a Taiwan government agency in managing a nationwide multi-billion science and technology project management and control process. The planning and consulting period lasted through the time period of 1997 and 1998. The outsourcing and implementation tasks are expected to continue through 2000. In this chapter, we present the framework and model of the data warehouses developed by the committee during the planning and consulting stage. Our focus is on the data design and module design for a multi-dimensional database system. The data design aims to provide an integral model for the internal and external data sources. A core view of the multi-dimensional database is developed. The module design attempts to give an analytic model of the field, division, project, and agent performance along the dimension hierarchies. Actual versus budget and actual versus forecast analysis along with the time series analysis and ad hoc analysis are supported in the systems.
INTRODUCTION

The science and technology project management (STPM) agency at the Ministry of Economy (MOE) in Taiwan manages a nationwide mission of multi-billion US dollar science and technology project formulation, implementation, and execution process. Starting the time period of 1997-1998 and continued through the time period of 1999-2000, STPM is undertaking a multi-year development of a large-scale project management information system in order to automate and streamline the decision making and performance evaluation process of STPM. We were on a planning and consulting committee with the mission to propose a Web-based data warehouse information system for a contemporary STPM. The goal of this project management information system is to integrate the information resources in current STPM agency and to improve the information sharing among all STPM internal and external units nationwide.

STPM office is responsible for the formulation, implementation, and execution of the national science and technology projects (STP). Project formulation involves internal administrators and external expert representatives from the industry, government, and university. Project execution requires the involvement of a large number of outside contractors such as the universities, research institutes, Taiwan companies, approximately one thousand throughout the country. Documents such as proposals, minutes, contracts, reviews, and manuals are bulky and lengthy and represent the main data input of information resources to be processed and stored. Decision support, data analysis, and management reports represent the main data output to be produced and generated.

However, under the current legacy information system, the data service performance is far below the desired acceptance level of quality and functionality. Every time when the management needs a new report, staff has to ask each of the contractors and agencies to re-prepare the original data sources in order to generate the new report. Next time when the same request comes up with a slight change, staff has to go through the same process and re-request help from the contractors and agencies. Staff has to re-enter the same data and re-design the same report with the change. The waste of time and effort is unimaginable and unacceptable in today's information technology (IT) operation. Under the legacy information system, whatever the preparation for the prior report is lost or cannot be re-used because the system is disparate, heterogeneous, and non-database-centric. Business performance of STPM is hence far below the desired acceptance level.

The key issue faced by STPM is mainly data management and design. These data issues include (1) too many redundant data entry, (2) inconsistent data content, (3) too much time-consuming report preparation and generation, (4) ineffi-
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