



Optimization of Accounting Information System for O Manufacturing Company Based on the REAL Model

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Abstract. Due to the spread of COVID-19, manufacturing companies are confronted with an increasingly intense market competition in the present day. In order to survive this challenging environment, many manufacturing companies are investing in smart manufacturing factories and introducing information management systems to promote their development of the entities. Accounting information system is an important component of the business information management system. The present study analyzes a Chinese manufacturing company O as an example. This company is in the process of transforming into a smart manufacturing company, and the company's existing accounting information system cannot support its development. To solve this problem, an accounting information system based on the REAL model (Resources, Events, Agents and Locations) is proposed to help the company gain competitive advantages in the market. The results suggest that the proposed system has the compacity to address the major challenges of the current practices, data duplication and decentralized data storage. Furthermore, production cost estimation can be improved using an activity-based costing method. Overall, the REAL model can be adapted into an effective accounting information system to enhance business data management.

Keywords: accounting information system · REAL model · Activity-Based Costing

1 Introduction

Accounting information systems allow a company to collect, store, manage, process, retrieve, and report its financial information so that the management and stakeholders of the company can make use of such data [1]. Manufacturing company O, based in Zhuhai, China, is a medium-sized entity that manufactures and sells box-type substations. Additionally, it also conducts independent research and development to upgrade existing products. The company makes customized products in small batches according to orders received from costumers. Figure 1 outlines the core operation processes of the company.

Currently, the company uses employs the iScala system and Crystal Reports as its accounting information system and financial reporting system. The iScala financial accounting system uses double-entry bookkeeping and follows the rules of debit and

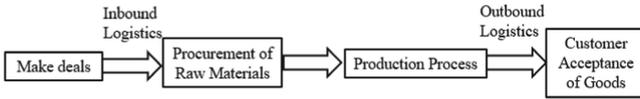


Fig. 1. Core operation processes of company O

credit [2]. Crystal Reports is a business intelligence application used mainly for designing and generating financial reports. While these two systems provide reliable accounting platforms, as the competition becomes increasingly intense, the company aims to improve profitability by implementing cost control strategies. Several issues with the current accounting information system prevent it from meeting the company's growing demands, which will be discussed in more details in the following section before new solutions are proposed.

2 The Existing Accounting Information System

2.1 Duplicate Business Data Storage

Different business departments at company O are set up according to their functions, and each department conducts its own information processing in accordance with its unique needs. For the same operational activity, each department records, processes and outputs its information, accordingly, reflecting each department's unique responsibilities, as a certain subset of the database for the entire entity. When the entity receives orders from customers, the sales department first records sales data, including the transaction amount, quantity and type of the products sold. This data allows them to perform market analysis and help improve sales performance. The production department then requests detailed information from the customers in order to arrange the production schedule. Once the company and the client agree to proceed with contract signing, the financial department needs the customer's information and the payment settlement information. Currently, each department of company O practices its own information system management to handle diversified information needs.

Company O introduced an Enterprise Resource Planning (ERP) system in 2013 in order to meet its development needs. The ERP system is a management platform that utilizes information technology to integrate information technology with advanced management techniques. It provides employees and decision-makers with effective tools for making more informed decisions using professional management ideas [3]. However, since the ERP system has relatively high implementation costs, company O selectively introduced the production management and accounting functions of iScala ERP system only for the production department and the financial department, prioritizing the cost-benefit principle. Figure 2 displays the current practice of information system management of company O. Now, the financial department only uses iScala for bookkeeping, and then exports the financial data from iScala to Crystal Reports to generate financial statements. Warehouse operations are managed by an inventory management system and sales activities by an sales management system. Both systems have been built by company O itself to handle the practical daily operational activities. As a result, for the same

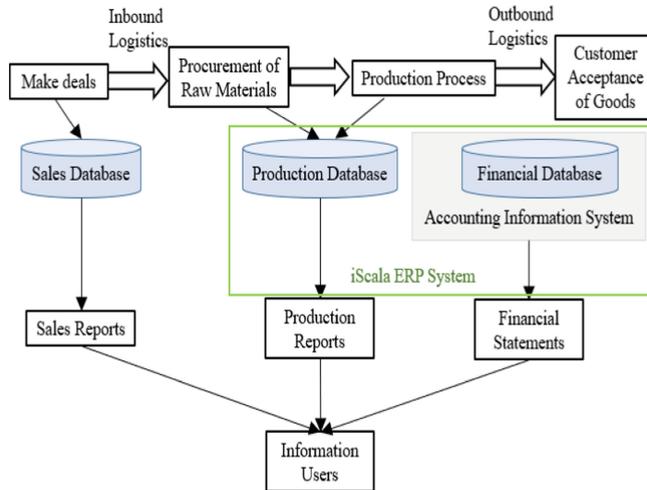


Fig. 2. Organizational Structure of information systems of company O.

order, its business data is stored repeatedly in three information systems of company O, including the sales information database, inventory management information and the iScala system. Because information is managed differently in multiple systems, this leads to duplicate data storage, resulting in increased costs of information management.

2.2 Decentralized Storage of Business Data

The company has relatively independent information management systems including a sales management system, an inventory management system, iScala ERP system and Crystal Reports. This means that the degree of information management integration in the company is relatively low. Consequently, having the same order's information stored in four different databases can easily lead to inconsistencies between the databases. To ensure data accuracies, departments regularly make scheduled reconciliations to ensure the accuracy of their data to avoid discrepancies. For the sales cycle, the sales department needs to create a "Monthly Sales Report" every month, and then reconcile its figures with the warehouse's receipt and delivery records. In addition, the financial department will review whether the same information is presented differently by different departments. If the data is consistent across all departments, accountants will record the sales revenue in accounts. If any discrepancy is found, the financial department will further investigate this discrepancy together with the sales department and update the correct sales revenue after the discrepancy is revised.

Meanwhile, at the end of each month, the financial department should reconcile the figures in the accounting records with the warehouse's records of receipts and deliveries. During the accounting process for material costs of production, accountants calculated the weighted average unit price of materials using the receipts recorded in inventory management system, unit prices of the purchase orders, opening balance of materials and amount. This figure is then reconciled with the weighted average unit price of materials

calculated by the iScala system. Afterwards, this reconciled figure is gathered into the production cost account. At the end of each month, the accounting departments calculate the manufacturing costs allocation rate for finished goods and allocate manufacturing costs into the total production costs. After the accounting information is transferred from iScala system to Crystal Reports, the production costs are recalculated by taking the weighted average. At the end, the costs calculated by accountants are reconciled with the costs calculated by Crystal Reports. As a result of these reconciliation processes, company O's accounting process becomes increasingly complex and costly.

2.3 Inaccurate Production Cost Calculation

The production costs of company O are calculated using the actual cost method [4], that is, all costs of resources employed in production process are recorded in iScala. Direct material and labor costs are included in the costs of corresponding finished products in accordance with their production order number. The calculation of indirect costs is based on the following equation:

$$\text{allocation rate} = \frac{\text{manufacturing expenses for the current period} + \text{opening balance of manufacturing expenses in inventory}}{\text{cost of sales for the current period} + \text{closing balance of inventory}} \quad (1)$$

$$\beta = \frac{\sum X_{1,t}X_{2,t} - nX_{1,t}X_{2,t}}{\sum X_{1,t}^2 - nX_{1,t}} \quad (2)$$

Company O established a research and development (R&D) department in 2018 and began to provide customers with customized products. Custom-made products require different amounts of manufacturing expenses, which means company O should not allocate the same amount of manufacturing costs to all types of products. If all products are allocated with the same allocation rate, the cost of production may be distorted. Additionally, since R&D costs are increasing with the development of enterprises, which are currently accounted for in the management expenses account instead of the production costs account, the exclusion of R&D costs from production costs will result in lower estimates of costs for each product. The company is unable to control costs effectively in this case. Due to the distorted production costs, the company is inclined to set lower sales prices to remain competitive, which is disadvantageous to the company's growth and development.

2.4 An Over-Reliance on the Charts of Accounts

Accounting data processing is essentially the process of processing the data generated by the enterprise's capital movements and convert it into accounting information useful for business decision-making. Processing data involves classifying the data, which may reflect economic activities by group and converting it into insightful accounting information. The classification process is based primarily on a chart of accounts. A business occurs is reflected in multiple accounts, and these records are linked together by charts

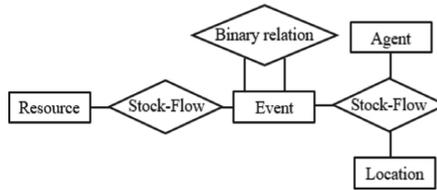


Fig. 3. The framework of the REAL model.

of accounts to generate financial statements. For company O, Crystal Reports generates financial reports to meet the needs of management accountants, while iScala generates accounting reports. The charts of accounts used by financial accountants and management accountants differ significantly. In order to maintain data consistency, companies have to pay higher costs to support multiple charts of accounts.

2.5 Information Lag

In the current accounting system of company O, data is recognized after transactions take place. There is a time lag when data is generated in the business departments and transferred to the finance department. The data needs to be processed to become the information needed for management. Major data processing includes that the finance department needs to reconcile the accounts with other departments on a monthly basis to make ledger, and the data in iScala needs to be transferred to Crystal Reports to generate financial statements. Sales incurred during the month will be reflected in the accounts at the end of that month.

3 Proposed Accounting Information System

3.1 REAL-Based Accounting Information System

The REAL model [5] was developed based on the REA model first proposed by American scholar Bill McCarthy [6]. REAL denotes the four key factors including events, resources, agents and locations. By implementing the REAL model, the company’ economic activities can be fully captured and stored in databases in their original form without being processed. Furthermore, users can customize their own data reports, including financial and non-financial data, to meet the diversified needs of different departments can be fulfilled. Figures 3 shows the framework of the REAL model.

The main events and their basic characteristics are described within the context of the company O’s core business process. In addition, the roles of agents, the locations of events and their relationships are identified. Figure 4 illustrates the REAL model built based on the core business processes of company O.

Afterwards, a company-level accounting information system is established according to the REAL model, as shown in Fig. 5.

This information system requires a data structure model converted for the REAL model. A relational database is designed for company O, as shown by Fig. 6.

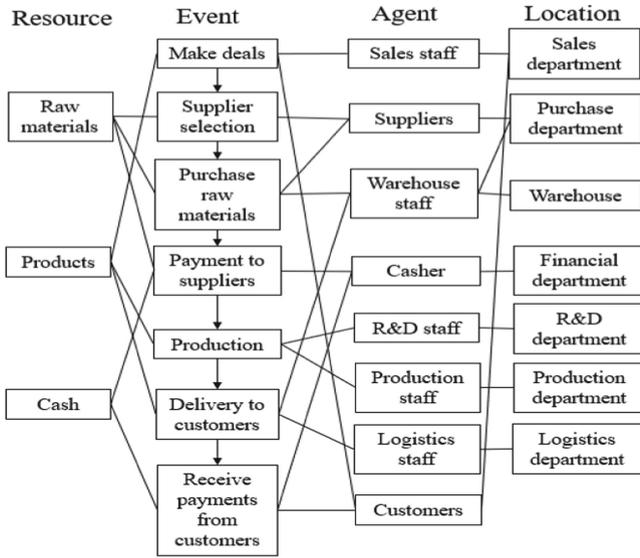


Fig. 4. The Workflow based on the REAL model of Company O across all Departments.

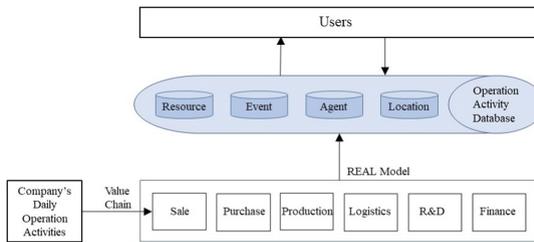


Fig. 5. The Proposed Accounting Information System.

The proposed system can integrate all business information and centralize them in a single logical database, instead of being scattered and repeatedly stored across multiple systems. This helps to ensure consistency and eliminate the need for reconciliation. Furthermore, this system can meet the different data requirements of multiple departments at the same time. The financial department no longer requires a separate application to generate financial statements. The Real model records the business data for the enterprise based on events. Consequently the REAL model supports the storage of both financial and non-financial information of business activities in one system, which allows for fulfilling a wide range of information needs. The proposed system makes it easier for management of the company to make business decisions and to optimize business processes.

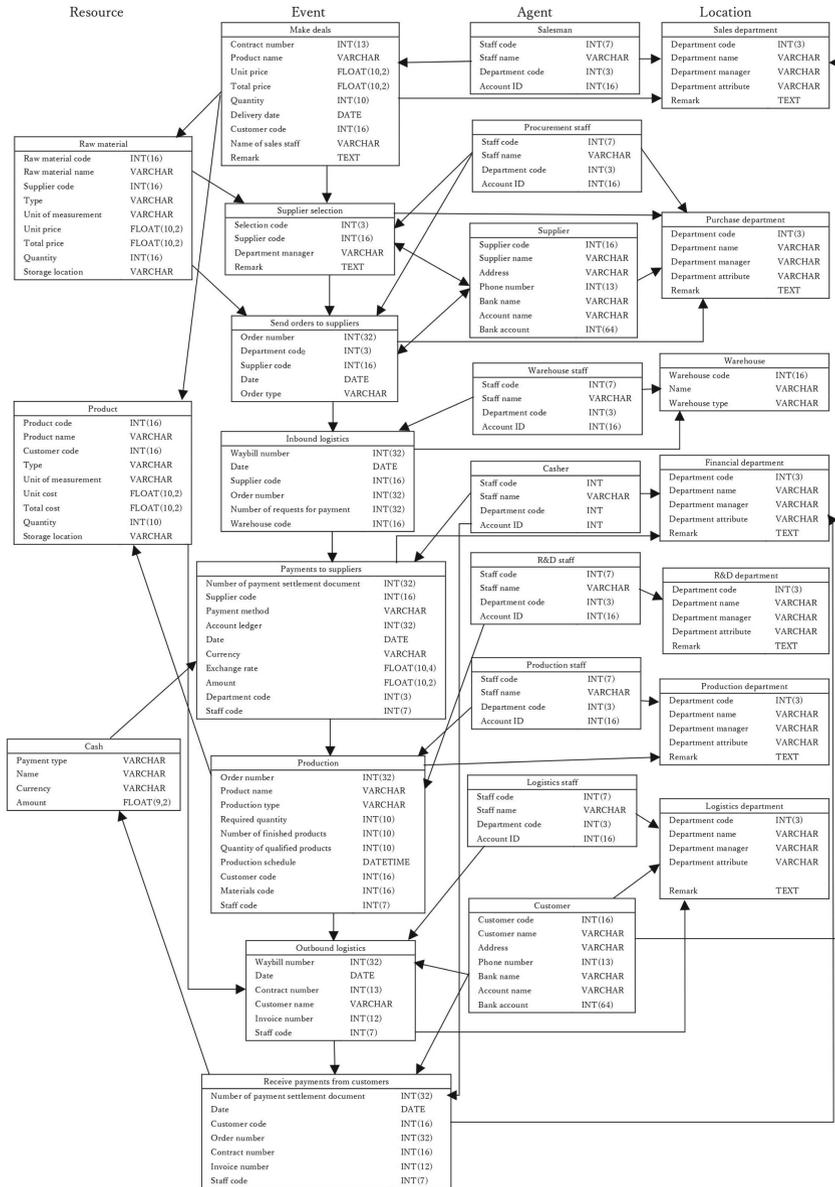


Fig. 6. The Relational Database for the Proposed Accounting Information System.

3.2 Activity-Based Costing Method

An activity-based costing method assigns overhead and indirect costs to related products and services. According to this costing method, indirect costs are assigned to products in a more rational manner than traditional costing methods, accounting for the relationship between costs, overhead expenses, and manufactured products [7]. The present study

Table 1. Activity-based costing Method for Company o

Cost Pool	Cost Driver	Cost Driver Rate	Cost Driver Volume		
			Type A	Type B	Type C
Research and Development	Labor hours	309.58	2,223.43	565.73	810.84
Procurement and Warehouse	Purchase costs	20.00	7,000	7,700	4,500
Production	Machine hours	51.20	1,143,320.25	1,154,478.69	624,740.33

estimates the activity-based costs including the cost driver volumes and cost driver rates of 2020 (Table 1). These cost pools and cost drivers are determined based on the company’s business and financial information for 2020, and company O manufactured and sold three types of products in 2020.

According to activity-based costing method, the production costs are calculated by (3)–(4), where n is the number of cost pools and i is an integer index representing each cost pool. Table 2 shows the recalculated production costs of company O in 2020 using activity-based costing method, and the results are compared with the results from the existing method.

$$\begin{aligned}
 \text{production cost} &= \text{direct labor cost} + \text{direct material cost} \\
 &+ \text{Allocated Indirect Cost}
 \end{aligned}
 \tag{3}$$

$$\text{allocated indirect cost} = \sum_{i=1}^n \text{cost drive volume} \times \text{cost drive rate}
 \tag{4}$$

According to the calculation results, it can be seen that the unit production costs calculated by the activity-based costing method are higher than those calculated by the actual cost method. This is largely due to the fact that company O adopts a sales-based production model to deliver customized products according to clients’ needs. The essential difference between these two methods lies in the allocation of R&D expenses. The existing costing method does not allocate R&D into production costs, which results in an underestimation of the total production costs. The activity-based costing method, on the other hand, is based on the production process of the product. As a result of the tracking of resource consumption, managers are not only able to clarify the specific formation process of product costs, but also more importantly, the calculated cost is closer to reality, which is beneficial to the enterprise. Estimating production costs more accurately can help the management of the company keep costs under control, thereby resulting in a competitive advantage in product pricing.

Table 2. A Comparison of Production costs calculated by the Existing vs. Proposed

Accounting Method	Item	Type A	Type B	Type C
Existing Cost Method	Direct Material Costs	1,668,964.69	1,749,196.68	1,007,846.87
	Direct Labor Costs	1,098,697.90	960,239.75	541,904.36
	Quantity of Finished Products	30	22	6
	Manufacturing Expenses	1,710,278.93	1,254,204.55	342,055.79
	Total Production Costs	4,477,941.52	3,963,640.98	1,891,807.01
	Unit Production Costs	149,264.72	180,165.50	315,301.17
Activity-Based Costing Method (Proposed)	Direct Material Costs	1,668,964.69	1,749,196.68	1,007,846.87
	Direct Labor Costs	1,098,697.90	960,239.75	541,904.36
	Quantity of Finished Products	30	22	6
	Costs of R&D	688,319.00	175,136.00	251,015.10
	Costs of Procurement and Warehouse	140,000	154,000	90,000
	Production Expenses	1,143,320.25	1,154,478.69	624,740.33
	Total Production Costs	4,739,301.84	4,193,051.12	2,515,506.66
	Unit Production Costs	157,976.73	190,593.23	419,251.11

4 Conclusion

This paper first analyzes the existing accounting information system of company O and address its shortcomings. Then, a new accounting information system is proposed according to the REAL model. The proposed system has the potential to resolve the problems of information duplication and decentralized storage. In addition, the “location” aspect of the REAL model can be easily utilized as cost pools for activity-based costing method. An activity-based costing method can be effectively applied to help company O generate more accurate calculations of production costs, so as to conduct more accurate cost analysis and control. This proposed system has the capacity to provide the management with more comprehensive, multi-angle and diversified information, which can help them to formulate more effective business strategies to improve the operation efficiency of the enterprise and increasing its competitiveness.

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