Risks in Implementing Product-Cost Management Systems: A Case Study of Blood Centers in Thailand

Orapan Khongmalai, Varaporn Pothipala, and Anyanitha Distanont

***Abstract*—Effective development of a product-cost management system (PCMS) requires accurate data to make decisions and improve the quality of practical organizational processes. Activity-based costing (ABC) is a costing system that provides more accurate data than former costing systems, especially for healthcare organizations. ABC uses costing system principles, activities, and data collection processes; thus, there are risks to its application. This research investigated risk factors of using the PCMS at blood centers in Thailand and evaluated risk response strategies using a mixed methodology. The study identified risks during four phases: 1) the conceptual phase, 2) development phase, 3) execution phase, and 4) finishing phase, to inform users who wish to apply ABC in similar organizations.**

***Index Terms*—Project risk, product cost management system, activity-based costing.**

I. Introduction

The product-cost management system (PCMS) is a financial management system that provides administrators with the exact cost of products [1] and allows an understanding of costing sources and activities [2]. It continuously increases the effectiveness of cost management [3]. Activity-based costing (ABC) is a popular costing system used in product-cost management because it reflects cost and resources. It is useful for health service organizations and is used for costing data services. Applications of time-driven ABC in developing countries with limited resources or for health service cost presentations illustrate its usefulness in providing accurate data for various expenses and process development [4], [5].

Blood centers use complicated production processes and services, incorporating various research, production, service, and support organizations and large expenses for supplies and durable articles. Thus, the calculation of product costs for blood centers is complicated, and clear calculations of service costs are necessary to determine fair service pricing [6]. This also enables administrators to apply data to decision-making processes about investment policies for services or to buying new machines based on understanding of background information and investment changes [7].

Although the product-cost management system (PCMS) is based on ABC and is a highly useful technique for cost management, it is also high risk because staff must understand the tasks and principles of ABC, which includes time-consuming data collection and instruments [4], [8], [9].

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II. Literature Review

ABC emphasizes allocation of indirect product costs based on production activities and appropriate push factors [8], [10]. Cost management based on ABC is complicated; appropriate technical factors are necessary, such as uncomplicated cost management, appropriate programs [11], costs specific to an operation [12], and sufficient information technology (IT) staff [13]. Appropriate administrative factors are also important, such as encouragement of executives and training and professional development programs for staff to ensure they apply ABC in their work [11], [13]. Organizations with complicated production processes and high demands for accuracy tend to use ABC for cost management [14].

Medical services offered by hospitals and blood centers have indirect costs that require accurate allocating techniques for cost management. Campanale *et. al*. (2014) [15] stated that the calculation of cost per unit in the field of health and medical services is based on cooperation between accountants and medical staff. This is facilitated by innovative accounting tools that ensure fairness and effectiveness when utilizing limited resources based on health services data and accounting techniques. It is necessary to use specialists in both fields to ensure effective costing, and a lack of specialists creates higher risk projects that might not be successful.

Few international studies have investigated the risks of product-cost management in blood centers, even in developed countries such as the United States [16]. Some research indicates that such costs are based on the calculation of blood components for blood transfusions for particular diseases, such as cancer or for specific applications, such as blood transportation to hospitals [6]. The study of risk management during the PCMS for blood service organizations expands risk management knowledge and provides appropriate ways to deal with risk during the blood service product-cost management process.

III. Research Methodology

This research investigated risk factors for the PCMS using a case study of blood centers in Thailand and a mixed methodology to determine the three main steps of risk management.

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A. Risk Identification

To identify risk factors, a qualitative technique called methodological triangulation was used, consisting of participant observations, documentation, and interviews with administrators or managers. The results provided risk factors for the PCMS. This program was divided into four phases: conceptual, development, execution, and finishing phases.

B. Risk Assessment

Risk assessment involves evaluating risk opportunities and effects. For the PCMS, 108 samples of the risk evaluation process were obtained during the case study of blood services, including samples from administrators, representatives of central departments, and representatives of blood service departments acrossThailand. An evaluation form was generated based on risk factors identified during the first step to assess risk levels for each risk factor. Then, the results were analyzed using an exploratory factor analysis (EFA), which is a technique that categorizes relative factors and removes unimportant variables [17] to prioritize risk factors during each phase of a project.

C. Risk Response Strategy

A strategy is developed to respond to prospective risks after sharing the results of the EFA with specialists from each department of an organization.

IV. Research Findings

Based on the EFA, the Kaiser-Meyer-Olkin measure (KMO) of each phase was found to be different (i.e., 0.813, 0.847, 0.791, and 0.858, respectively), and all were higher than 0.5. The results of Bartlett's test of sphericity provided a sig. value for all phases of 0.000; thus, the existing data were appropriate for conducting an EFA [18]. The data are shown in Table I.

TABLE I: KMO and Bartlett's Test of Sphericity

Phase	KMO	Approx. Chi-Square	df.	Sig.
1. Conceptual	0.813	333.648	15	.000
2. Development	0.847	845.267	28	.000
3. Execution	0.791	414.891	15	.000
4. Finishing	0.858	414.817	15	.000

According to the EFA, the Varimax method was used to identify risk factors during the four-phase project. Holistically, the variables responding to the risks were mainly based on the highest factor loading, which is described in the following sections.

Phase 1: Conceptual Phase-The initial phase of the PCMP was used to investigate the conceptual framework and components of the project. The research findings presented six risk factors, with the two most significant risks being inapprehensible technical or costing data during the production process, which are shown in Table II.

TABLE II: Factor Loading during the Conceptual Phase

Phase 1: Conceptual	Factor Loading
Inapprehensible technical data during the production process of the PCMS	.796
Inapprehensible technical data related to ABC	.782
Unclear and inappropriate project operation scope specification	.732
Experts developing a production process, accounting system, and inventory system to be used by the PCMS team	.725
Incomplete data collection	.706
Insufficient time scheduled for staff assigned to the PCMS	.657
Note : Total Variance Explained = 53.510 Percent	

Phase 2: Development Phase-During this phase, the conceptual framework of the PCMS was developed to reflect the practical operations of the organization. This phase is associated with eight risks. The two most significant risks were cost drivers that did not conform to activities or drivers that were difficult to identify for data collection, as presented in Table III.

TABLE III: Factor Loading during the Development Phase

Phase 2: Development	Factor Loading
Cost drivers that do not conform to activities	.855
Cost drivers that are difficult to specify and collect data for	.822
Stakeholders who are not able to send data in a specified time	.787
Stakeholders who understand organizational errors for cost calculation	.784
Incomplete data tested in the cost calculation table	.770
PCMS team's lack of understanding of product transportation and structure	.770
Pilot units do not understand data filling methods	.730
Formula corrections using data fillers	.721
Note : Total Variance Explained = 61.027 Percent	

Phase 3: Execution-This involves the collection and calculation of product costs. The findings showed that there were eight risks associated with this phase, with the two most significant risks being the lack of data following-up mechanisms and inappropriate content comparisons with practical applications, as shown in Table IV.

TABLE IV: Factor Loading during the Execution Phase

Phase 3: Execution	Factor Loading
Lack of data following-up mechanics	.819
Manual and inappropriate content comparison of practical applications	.800
Formula corrections using data fillers	.756
Using numbers from several databases does not affect accuracy	.744
Less opportunity to explain data-filling methods to organizations in remote areas	.722
Staff do not understand data-filling methods and cannot return it	.708
Note : Total Variance Explained = 57.612 Percent	

Phase 4: Finishing-This phase closes the project via practical systems based on the initial objective. There are six

risks associated with this phase. The two most significant risks are unskilled PCMS users and trainees or changing users, as presented in Table V.

TABLE V: FACTOR LOADING DURING THE FINISHING PHASE

Phase 4: Finishing	Factor Loading
Unskillful PCMS users	.823
Trainees and changing users	.784
Unwanted use of new calculation method	.764
Insufficient knowledge transformation for users' needs	.759
Incorrect identification for important data access	.756
Formula adjustment using data fillers	.725

Note : Total Variance Explained = 57.612 Percent

V. DISCUSSION AND CONCLUSION

This research investigated the risks of the PCMS in blood centers in Thailand to determine risk response strategies. The research findings presented significant issues during each phase of the project, which are described below.

During the initial conceptual phase, a conceptual framework was identified using the PCMS components. The research findings showed that the highest risk during this phase was technical data that the PCMS team could not clearly understand because of the complexity of blood service organizations and the fact that the team consisted of accountants and programmers.

The case study included 17 departments and 13 blood service sectors to assess the product transportation process. The departments were divided in to three groups. Tier 1 included the main departments produced blood components and provided special operations. Tier 2 consisted of the departments indirectly supporting the products, such as blood stockers, blood product distributors and quality assurance. Tier 3 included administrative and supporting departments, such as administrative departments, finance and accounting, and public relations. These groups were categorized as the cost of the product and services.

There were three main groups, 12 sub-groups, and 115 product lists. Each product was formed through a complicated process, involved several parts, and was linked to specific blood services, such as whole blood or leukocyte-poor red cell. The second risk in phase 1 was inapprehensible technical data related to ABC, such as direct cost, indirect cost, and cost drivers, which affect incomplete and inaccurate data.

Results of risk for these two factors caused the PCMS team to disconnect from the design and practical working process of the organization. This agreed with the results of past research, which found that cost management development was difficulty for system [14] and made it difficult to identify appropriate programs [11] because staff lacked training, interest in cost management systems, and understanding of such systems [13]. This did not encourage feelings of possession and dedication by the PCMS team, which consisted of both accountants and staff from other departments [14].

The development phase used data collected during phase one to develop the PCMS in a way that reflected practical working processes of the organization. The research findings indicated that the two most significant risks were cost drivers that were not relevant to activities and cost push factors and drivers not specific to the data collection process. These risks resulted unclear technical data during the production process and unclear data associated with ABC, which caused irrelevant cost push factors related to activities. The production process was also difficult, which caused data collection limitations.

To be successful during phase two, the organization should build knowledge of cost management by educating stakeholders about ABC technical data or appropriate cost management techniques. Whenever staffs understand cost management techniques, they are able to apply technical data during production processes to identify cost push factors and conform to activities. In terms of data collection difficulties stemming from push factors, the organization can use appropriate databases to store data based on an understanding of ABC techniques.

During the execution phase, the PCMS is applied by collecting data and calculating product costs. The research findings showed that the two most significant risks during this phase were lack of data follow-up mechanisms within a specific timeframe and insufficient content for practical application due to staffs that were not comfortable with the developed cost management system, despite workshop training programs and written instructions. Moreover, there was no follow-up process for data collection from each sector in the system, which made data recording for products and service cost calculations time consuming. The research findings confirmed past studies in that training and knowledge development for cost management calculation programs among stakeholders could be improved [14] by expanding the length of time [11].

The finishing phase was the closing phase of the project and ensured that the developed system could be used as planned. The research findings revealed that the two most significant risk factors during this phase were unskilled product-cost calculation program users and trainers and changing users. These risks were similar to those found for other system development projects because training provides limited time for operation, resulting in users who are not skillful or able to solve basic application problems.

According to statistical data and interviews, specialists could propose appropriate risk response strategies for each phase of project. For example, the conceptual phase should specify staff components so that internal staff, accountants, IT personnel and other organizations can understand the transformation system, including the complete requirements for the checking process to ensure the needs of the organization are met.

The development phase should encourage knowledge and understanding of cost drivers so that staff from each organization understand and are able to specify cost drivers that conform to activities and collect data. The execution phase should provide technical consultants with suggestions from other organizations to ensure successful data recording, including systematic progress follow-up planning. The

finishing phase should specify the names of trainees to maintain consistency, to record organizational costs, and to provide technical consultants with suggestions and recommendation from associated organizations.

Additionally, at each stage, mentioned above, there is a risk similarity which relating to data collection. Incomplete data will cause the failure to implement PCMS. The technology of Accounting Information System (AIS) can help to enhance the data collection. AIS is a system to collect, process and store the accounting data for user's decision making. AIS provides the advantage of cooperation in term that it serves as a data pool for all departments in the organization [19]. This data pool mitigates the risk of incomplete data collection in conceptual phase and lack of data following up in execution phase. In addition to AIS, other Information Technology (IT) can provide the complete data collection, such as human resource information system and material planning system. These Information Technology systems would also help to improve the completeness and accuracy of the data in order to implement PCMS.

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