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Integrating ABC and IDEF0 Techniques for the Evaluation of Workflow Management Systems

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Abstract: - This paper addresses the problem of the actual cost of a Workflow Management System that is implemented in order to support a business process in a company. In order to specify this cost, we employ the IDEF0 function modelling method in combination with the Activity-Based Costing (ABC) technique. A workflow is comprised of the activities which are assigned a cost in the context of the implementation of a Workflow Management System. This cost per activity is analysed to its particular elements that refer to all aspects of the system, that is, hardware, software and organisational resources' costs.

Key-Words: - Enterprise modelling, Activity-Based Costing, Workflow Management System

1 Introduction

Nowadays, computer applications, such as electronic commerce and collaborative commerce, have been driving changes in the traditional relationship among companies. This fact intensifies competition and also it facilitates mutual collaboration. These changes have resulted in more complex business processes in companies. Consequently, it has been conceived that efficient execution and management of the complicated processes are essential for empowering enterprise competitiveness.

A WorkFlow Management System (WFMS) [1] executes complex business processes efficiently and manages the processes effectively. The system is capable of formally modeling a business process, and scheduling the constituent tasks to automatically deliver the tasks to relevant task performers. Furthermore, it can automatically identify documents and application programs required for a task, and provide them to right users [2]. A WFMS comprises of a software system to automate the execution and management of business processes [3].

Existing WFMSs can assure that an individual process is executed in the right order exactly following the process model. However, it does not guarantee that all the processes function efficiently [4]. Task performers usually take part in a number of different processes, and often deal with a plural number of process instances that belong to an identical process model. Therefore, it is very usual that each user possesses multiple work items at a point of time. In such a setting, the user has to decide which task to proceed first. This task priority setting problem is important because the efficiency of overall processes is determined depending on the decision. However, the existing WFMS lacks proper methods of solving the problem.

Workflow is a business process, automated in whole or part, during which documents, information or tasks are passed to an appropriate task performer according to a set of procedural rules. WFMS is a software system to execute, control and manage the workflow automatically.

This paper firstly presents the two modelling techniques used for the evaluation of Workflow Management Systems and then the proposed methodology is described. Finally, certain conclusions are drawn based on the complementarity of the two methods.

2 The IDEF0 Modelling Tool

The IDEF0 modelling method is designed to model the decisions, actions, and activities of an organisation or system. It is not only the most widely used, but also the most field proven function modelling method for analysing and communicating the functional perspective of a system [5]. IDEF0 was derived from a well-established graphical language, the Structured Analysis and Design Technique – SADT [6]. The IDEF0 modelling method establishes the scope of analysis either for a particular functional analysis or for future analyses from another perspective. As a communication tool, IDEF0 enhances domain expert involvement and consensus decision-making through simplified graphical devices. As an analysis tool, IDEF0

supports the identification of the functions performed and what is needed to perform them.

The basic activity element of an IDEF0 model diagram is represented by a simple syntax. A verb-based label placed in a box describes each activity. Inputs are shown as arrows entering the left side of the activity box while the outputs are shown as exiting arrows on the right side of the box. Controls are displayed as arrows entering the top of the box and mechanisms are displayed as arrows entering from the bottom of the box. Inputs, Controls, Outputs and Mechanisms (ICOMs) are all referred to as concepts.

An IDEF0 model diagram is then composed of several activity boxes and related concepts to capture the overall activity. IDEF0 not only captures the individual activities, but also reveals the relationships among activities through the activities' related concepts. For example, the output of one activity may in turn become the input, control or even a mechanism of another activity within the same model.

A strategy for organising the development of IDEF0 models is the notion of hierarchical decomposition of activities. A box in an IDEF0 model represents the boundaries of an activity. Inside that box is the breakdown of that activity into smaller activities, which together comprise the box at the higher level, as shown in Figure 1. This hierarchical structure helps the analyst keep the scope of the model within the boundaries represented by the decomposition of the activity. This organisation strategy is also useful for hiding unnecessary complexity from view until a more in-depth understanding is required.

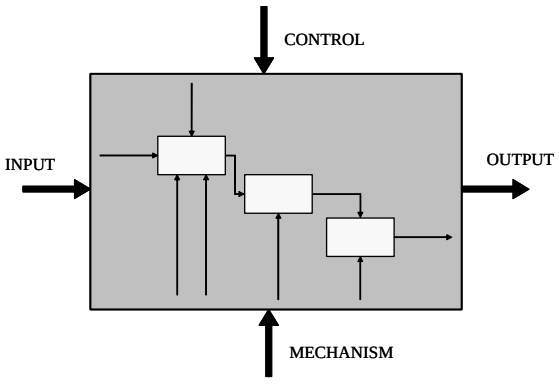

Figure 1: Hierarchical decomposition of IDEF0

3 Activity-Based Costing

Activity-based costing (ABC) was introduced by [7] as an alternative to traditional accounting methods. It models the relationships between products/services and the resources used in their production at all stages, as depicted in Figure 2. In recent years, academics and management accountants have demonstrated a great interest in ABC [8]. However, surveys have shown that the diffusion process for ABC has not been intense [9], [10], [11].

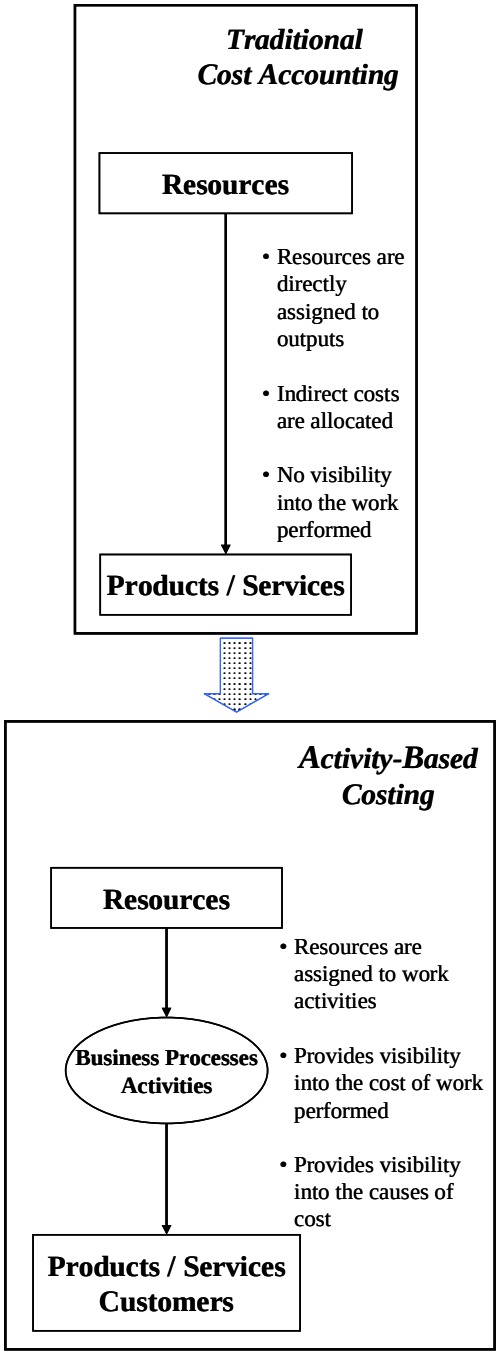

Figure 2: Comparison of ABC and traditional accounting

The ABC paradox lies in the fact that even though it has demonstrated strong benefits and advantages, it has not been employed by the majority of the organisations comprising both the private and public sectors [11], [12], [13]. A plethora of parameters have been tested in the literature in order to explain this paradox. These parameters include strategic posture and organisational structure [12], environmental uncertainty [14], the role of demand factors (e.g. percentage of overhead and product complexity) or supply factors (e.g. consultants and firm size), as well as factors that influence the diffusion of innovations, considering ABC as a form of administrative innovation (e.g. efficient choice, forced selection, fad and fashion perspectives) or the perception of relative advantage of the innovation over previous practices.

ABC is a technique that measures the cost and performance of activities, resources and costs objects, including overhead. The task of differentiating the organisation's activities as either value-added or non value-added is perhaps the most important theme in ABC. Non value-added activities are those that cause delay, excess, or variation, and therefore are targets for elimination or reduction in improving the business process. On the other hand, value added activities become targets for improvement, perhaps through streamlining or automated support.

4 Integrating IDEF0 and ABC

It is impractical to create an ABC model without a proper design tool that clearly identifies all the individual activities that take place in a system from the beginning to the end. Such a tool can greatly help to reduce time used for modelling and overcome the difficulties present in creating a cost model [15].

Documenting and understanding activities is necessary in order to calculate the cost of a business process, since activities are the building blocks of business processes. When employees understand the activities they perform, they can better understand costs based on the activities. Traditional financial information is reorganised by ABC into a form that makes sense to the functional user: in addition to the information that tells them how they allocate resources, it also tells them what to do with these resources. This ability to place costs on activities and their outputs provides a clear metric for depicting the real cost of the system and serves as a reference level for continuous improvement, whether for determining improvement priorities in the long-term or for measuring near-term success. ABC allows functional users to characterise the value of, or need for, each activity, eliminating the waste before automating (or reengineering) business processes.

A structured approach for the identification and analysis of the activities performed in the context of a certain business process can be provided by the IDEF0 function modelling technique. Even though ABC can be attempted without the use of IDEF0 modelling, it accomplishes the most complex task of identifying discrete activities and then defining the primary output measure for each activity.

Resources are assigned to activities so that they can be carried out: performing the activity results in a cost that can be priced, which can be assigned to the primary output. It is through ABC, that an organisation can visualise actual costs against individual activities, and find opportunities to streamline or reduce the costs, or eliminate the entire activity, especially if there is no added value.

The framework for calculating the cost of WFMSs, based on the complementary application of the functional modelling tool IDEF0 and the ABC technique, is comprised of the following steps: analysis of activities, cost collection, costs to activities assignment, definition of output measures and cost calculation.

4.1 Analysis of Activities

In the beginning, the scope of the activities to be analysed must be clearly defined. The depth and detail of analysis should be determined by activity decomposition, since the latter is complete when one common or homogeneous primary output per activity is reached. The IDEF0 function modelling tool is employed in this step to perform activities' analysis. Various data collection methods should be used (interviews, documentation, archives, data mining, etc.) in order to provide the model with the accurate functional input.

A decision is then made if an activity is value-added or non value-added. Additionally, whether the activity is primary or secondary, and required or not needed. An activity is considered as value-added when the output of the activity is directly related to the service requirements. Primary activities directly support the organisation's mission, while secondary activities support primary activities. Required activities are those that must always be performed while discretionary activities are performed only when allowed by the operating management.

4.2 Cost Collection

During this step costs are gathered for the activities which concern the enterprise activities supported by the WFMS. These costs should be salaries, expenditures for software development, hardware infrastructure, leasing of communication lines, depreciation of fixed assets, etc. These costs are used as the baseline activity costs. When documents for the costs incurred are not available, cost assignment formulas should be used. A classification of these cost elements is described in Table 1.

Hardware – Computing Platforms – Networking Devices – Security Devices – Data Storage Devices
Software – Development – Security – Monitoring & Management – Data Access & Storage
Facility Expenses – Physical Modifications for Hosting or Security – Electricity, Plumbing, Heating & Cooling
Service Provider Costs – System Development – Application Hosting – Telecommunications – Transaction Processing
Organisation Labour Costs – System Manager(s) – System Developer(s) – System Operator(s) & Maintainer(s) – User Support Staff – Customer Support Staff – Functional Manager(s) – Administrative & Contracting Support

Table 1: Baseline activity costs

4.3 Costs to Activities Assignment

The input for this step comes on the one hand from the results of activities' analysis based on the constructed IDEF0 models and on the other hand from the gathered organisational inputs and costs. Bringing all these elements together, results to the assignment of the input cost per activity. A simple formula for costs is used: outputs consume activities that in turn have consumed costs associated with resources. This leads to a simple method to calculate total costs consumed by an activity - multiply the percent of time expended by an organisational unit, e.g. branch, division, on each activity by the total input cost for that entity. It is important to point out that during this phase of the methodology, the origin of the costs takes places and not their calculation.

4.4 Definition of Output Measures

In this step the actual activity unit cost is calculated. Even though activities may have multiple outputs, only one is identified as the primary output. Activity unit cost is calculated by dividing the total input cost, including assigned costs from secondary activities, by the primary activity output volume: the primary output must be measurable and its volume or quantity obtainable. From this, a bill of activities can then be calculated which contains or lists a set of activities and the amount of each activity consumed. The amount of each activity consumed is extended by the activity unit cost and is added up as a total cost for the bill of activities.

4.5 Cost Calculation

In the final step, the calculated activity unit costs and bills of activities are used to identify the actual costs. A Pareto analysis is recommended to follow, in order to calculate the percentage of activities that consume the majority of costs. The confirmation of the previously identified non value-added activities occurs during this step with a clarity that allows us to eliminate them. Furthermore, this classification of activities permits the WFMS to operate with greater efficiency.

5 Conclusions

We have proposed a methodology for calculating the cost of workflow management systems. Having focused mainly on the activities supported by the WFMSs we identified all the cost elements that should be taken into account when a company attempts to justify an investment in such systems. The ABC technique proved to be compatible with the IDEF0 Function modelling method.

There are several interesting issues that require further research. First of all, it is very important to

take into account various factors, such as users' level of skill, number of users of a workflow, involvement of automated tasks, dynamic variation of business processes, and different patterns of process networks. In order to address these issues it is essential to apply this methodology to a pilot enterprise that will undertake such a project.

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