DISTRIBUTION OF COST OVER THE APPLICATION LIFECYCLE - A MULTI-CASE STUDY

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Abstract

IT management focuses on planning and developing new IT solutions. The importance of production (operation, support, maintenance) and further development of existing solutions is often neglected, although these tasks are responsible for the majority of today's IT costs. The paper presents the results of a survey of the life cycle costs of 30 IT application systems. Within the survey, the distribution of costs over the application life cycle was recorded and evaluated. The results show the central importance of recurring costs for production and further development. For a production time of 5 years these costs amounted to 79% of all life cycle costs, whereas only 21% of the costs were incurred during the planning and initial development stages. Further findings include an evaluation of the poor quality of the cost data and the important role of business units as service providers.

Keywords: IT management, life cycle management, life cycle costs, IT production, IT application systems.

1 INTRODUCTION

Increasing competition, decreasing profit margins, and economic stagnation force companies to reconsider their investments in information technology (IT). IT projects are increasingly subject to profitability considerations. Having analyzed their IT cost structures, many companies come to realize that investments into new IT solutions are representing an ever smaller part of their total IT cost. For example, only 27% of Deutsche Bank's IT budget for 2002 was spent on new IT solutions (Lamberti 2002). 73% of the IT budget was spent on operating, supporting and maintaining existing solutions.

One important reason for the high percentage of these costs is that every new IT solution not only incurs one-time costs for initial development and implementation, but also recurring costs for production (operations, support, and maintenance) and further development over a number of years (a definition of each task will be given below). This basic relation between non-recurring and recurring costs is a well known fact and lead to the development of concepts such as Total Cost of Ownership or Life-Cycle-Costing. However, on a practical level, it does not play an important role as far as analysis, evaluation, and development of IT application systems are concerned. Within IT portfolio management, for example, the assessment of new applications systems is often based primarily on non-recurring development costs. At best, recurring costs are taken into account by means of a percentage-based surcharge (Balzert 2000). Data on the actual recurring costs of an application system is neither systematically gathered nor evaluated. As a consequence, there is only a limited awareness within companies regarding the significance of recurring costs. This is also reflected in the lack of methods and tools for planning recurring costs. Whereas a significant number of methods and tools for the planning of software development costs is available (Boehm et al. 1998), the planning of production costs is limited to rough estimations.

In the literature, only a few papers address the total costs of IT application systems. The ratio of non-recurring to recurring costs over the total application life cycle is not examined. This paper presents the results of a survey in which the life cycle costs of 30 application systems within three large companies were examined. The survey's main goal was to evaluate the distribution of actual costs over the various stages of the application life cycle, thus gaining knowledge about the importance of non-recurring planning and initial development costs on the one side and recurring operations, support, and maintenance cost on the other side.

The paper is structured as follows. The following section places the survey in the general context of IT management, describes the basic concept of life cycle costs, and gives an overview of related literature. The next section focuses on the research questions, research methodology and basic characteristics of the surveyed application systems. Afterwards the evaluation of the data and the survey's main findings are presented. Finally conclusions for research and practice are drawn.

2 BASIC PRINCIPLES

2.1 IT management and application systems

IT management deals with the identification and implementation of information and communication technologies, and has established itself as a major management task (Galliers & Leidner 2003, McKeen & Smith 2003, Ward & Peppard 2002). Traditionally, IT management tasks can be divided into the three main areas of planning, development, and production of information systems and IT infrastructures (Laudon & Laudon 2003). Application systems represent a key element of information systems and offer solutions to functional problems.

The required planning, development and operation services for IT application systems can be provided by different organizations or organizational units. In the survey the importance of different service

providers within specific life cycle stages were examined. Three types of service providers were distinguished:

- Business units,
- Internal IT service providers or IT departments,
- External IT service providers.

2.2 Life cycle and life cycle costs

The life cycle concept was originally developed in the area of product marketing and describes the various stages of a product throughout its life cycle (Levitt 1965). The actual life cycle stages may vary. From a market-oriented perspective, the life cycle can be divided into introduction, growth, maturity, and decline stages (Polli & Cook 1969). From a manufacturer-oriented perspective the stages might include product innovation, product planning, product implementation, product monitoring, and product control (Eversheim & Schuh 1999).

The basic life cycle concept manifests itself through a variety of concepts and methods, especially within accounting. These include Total-Cost-of-Ownership (TCO), Life Cycle Costs, Zero-Based-Pricing, All-in-Costs, or Cost-Ratio-Method (Ellram & Siferd 1998). This paper uses the concept of life cycle costs. Life cycle costs include the total cost of an asset over its operating life, including initial acquisition costs, and subsequent running costs (Corrie & Atkins 1991). Thus, life cycle costs include all costs of the producer and the user of a product (Shields & Young 1991). On a practical level, life cycle costs are used mainly within purchasing decisions to evaluate different product alternatives. Thus, not only the initial purchasing price, but also the subsequent recurring costs for a company, which incur through the use of a product, should be taken into account.

2.3 Life cycle of IT application systems

IT application systems are subject to life cycles in the same way as traditional products. From a manufacturer-oriented perspective the application life cycle is made up of the stages depicted in Figure 1.

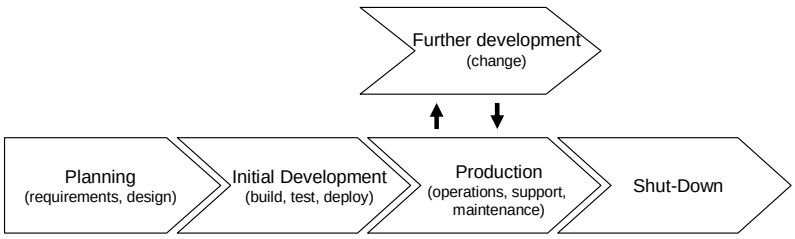

Figure 1. Life cycle of IT application systems

New application systems undergo a planning and initial development stage. Initial development also includes system testing and deployment. With the completion of initial development, the application system is put into production. Production includes the operation of the application system, the application support (e.g. user support) and the application maintenance (e.g. updates and error control). While in production, application systems typically undergo further development. In contrast to maintenance tasks, that do not functionally enhance the application system, further development implements new customer requirements and functional enhancements, usually in the form of new application releases. No application system is made for eternity and therefore, at some point, it has to be shut down or replaced by a new application system. The shut-down of an application system represents the final stage of its life cycle.

Although IT management is familiar with life cycle concepts, to date these concepts refer mostly to the management of the software development life cycle, i.e. they cover just the first stages of the life cycle as described in Figure 1. Life cycle cost evaluations are rarely used. They are typically taken into account in TCO analyses to evaluate desktop systems, hardware platforms or system software. As far as application systems are concerned, most attempts to systematically calculate life cycle costs fail due to such fundamental problems as divergent cost units, different types of costs, and separate cost centres within the development and the production stage.

3 RELATED RESEARCH

A number of publications address the use of life cycle costs within the manufacturing and service sectors (Ellram & Siferd 1998, Ferrin & Plank 2002, Calvinato 1991, Jackson & Ostrom 1980, Shields & Young 1991). Life cycle cost research in IT is mainly confined to the use of TCO analyses for the evaluation of desktop systems (David et al. 2002, Opfer 2001). Furthermore, research focuses on the development of cost estimation methods for the software development stage (Boehm et al. 1998, Tate & Verner 1990, Lederer & Prasad 1993). From a practical point of view, two of the most significant methods in this context are the COCOMO 2 method (Boehm et al. 1995) and Function Point Analysis initially developed by IBM (Cote et al. 1988).

Only a few papers either directly or indirectly address the subject of life cycle costs for application systems. Keen (1991) analyzed various types of costs for application systems, distinguishing between costs for the initial development project, organizational costs for training and consulting, and life cycle costs for operations and maintenance. He concluded that the initial development costs for in-house developed software must be multiplied by a factor of 2.4 to obtain the actual life cycle costs, whereas off-the-shelf software must be multiplied by a factor of 0.9. Furthermore, he came to the conclusion that in case of in-house developed software only 70% of the costs incurred in the course of the initial development project had been pre-planned. In the case of off-the-shelf software, as few as 30% of the costs incurred were pre-planned.

Several surveys focus on budget planning. Jahn et al. (2002) interviewed insurance companies in German-speaking countries about the structure of their IT costs and came to the conclusion that on average 55% of a company's IT budget was spent on non-optional tasks (operations and maintenance of existing infrastructures), 35% on optional tasks (new IT solutions) and 10% on planning, controlling, and administration. According to Thiel (2002), IT budgets can typically be divided into 50-60% running costs, 30-40% development costs, and 10% general costs (e.g. controlling and architecture design). Another survey conducted by Strassmann (1997) showed that even leading companies in the field of IT invest, on average, some 60% of their IT budget on the development of new application systems. A recent study on IT trends for 2003, conducted by consulting firm Cap Gemini Ernst & Young, comes to the conclusion that significant portions of IT expenditure are already predetermined due to past decisions, and that only some 30% of the budgets are available for new projects (Cap Gemini 2003). Approximately 20% of the companies that were interviewed had less than 10% of their IT budget at their disposition.

These surveys indicate the cost significance of individual areas in IT management. However, the conclusions that can be drawn for life cycle costs of application systems are limited due to their general focus on IT budgets.

4 RESEARCH METHODOLOGY

4.1 Research Questions

This survey addressed three major research questions.

- Question 1: How are the total costs of IT application systems distributed over the various stages of the application life cycle? Special attention was paid to the importance of recurring production and further development costs.
- Question 2: What degree of cost transparency has been achieved in the area of application systems? By evaluating the extent and the quality of the cost data that could be obtained in the survey, the quality of cost accounting for individual application systems was to be determined. Another goal was to ascertain whether cost control is exercised throughout the entire application life cycle.
- Question 3: Which role do business units, internal, and external IT service providers play in the various stages of the application life cycle?

4.2 Research design

The survey was conducted using 45 application systems in three large European companies. Special attention was paid to including heterogeneous applications systems in the sample. The sample included application systems of different sizes, both in-house developed and off-the-shelf solutions, batch-oriented and dialogue-oriented systems, as well as host and client/server solutions. The reason for including heterogeneous applications was to minimize the impact of specific application categories on the survey results.

The data for the survey was gathered by means of a structured questionnaire to which application managers and system administrators responsible for the application systems responded. For the collection of cost data, IS accounting was also involved. The data collection phase was completed with additional telephone interviews of the participants, in which the provided data was verified and open questions were resolved.

Besides collecting general and technical data related to the application systems, the questionnaire focused on recording life cycle costs. For this purpose, each stage of the life cycle as outlined in Figure 1 was subdivided into a number of core activities. All costs in a life cycle stage had to be assigned to one of these core activities. Thus, for example, within the initial development stage costs for analysis, project planning, design, development, testing and installation had to be assessed.

The survey was conducted over a period of ten months from August 2002 to May 2003. Thirty of the 45 original questionnaires were returned containing basic data on the life cycle costs of the application system. Fourteen of these 30 questionnaires did not provide full cost data for all life cycle stages, which left 16 application systems to be included in the actual life cycle analysis.

4.3 Characteristics of the sample

Figure 2 shows the basic characteristics of the application systems evaluated, sorted by application age. It illustrates the differences among the individual application systems. The number of users ranges from 160 to 135’500 and the number of business transactions per year from 23’000 to 91 billion. There is also a notable difference in the individual age of the application systems, ranging from 2 years to 16.4 years with an average age of 5.6 years. This figure primarily affects production time, which ranges from 0.4 years to 12.4 years.

Furthermore, Figure 2 shows the actual costs for application systems, distributed over the individual life cycle stages. The cost data demonstrates the differences in size of the application systems. For example, the total cost for the application systems ranges from EURO 0.5 million to EURO 137.33 million. In most cases, the costs for shutting down the application systems were unknown, as they were currently still in operation.

Status: June 2003			*Time (in years)*			*Actual cost (in Mill. €)*					
	Number of users	Number of business trans-actions per year	Total age	Initial develop-ment	Pro-duction	Total cost	Planning	Initial develop-ment	Further develop-ment	Pro-duction	Shut-Down
Application 1	221	-	2.0	2.0	-	-	1.64	-	-	-	-
Application 2	-	-	2.4	1.6	0.6	63.99	2.07	30.00	24.10	7.82	-
Application 3	350	-	2.4	0.9	-	-	3.00	-	-	-	-
Application 4	600	6'000'000	2.8	2.1	-	-	2.60	19.21	1.02	-	0.00
Application 5	2'400	17'600'000	2.9	2.0	0.9	4.86	0.10	1.37	0.00	3.39	-
Application 6	160	29'200	2.9	0.9	1.4	0.50	0.13	0.13	0.10	0.14	-
Application 7	-	360'000'000	3.1	0.6	2.2	16.33	0.39	1.02	9.50	5.42	-
Application 8	250	183'960	3.2	0.3	1.8	3.44	0.36	0.41	1.30	1.37	-
Application 9	50'000	-	3.3	1.0	0.8	2.96	0.13	2.08	0.00	0.75	-
Application 10	650	200'000	3.3	0.8	1.4	5.49	0.72	1.96	0.50	2.31	-
Application 11	1'200	705'000	3.3	1.0	0.8	9.56	0.29	7.20	0.67	1.30	0.10
Application 12	40'000	16'500'000	3.4	1.8	0.8	-	-	14.00	4.90	5.48	-
Application 13	200	-	3.4	0.4	2.4	0.64	0.13	0.21	0.12	0.18	-
Application 14	300	-	3.8	0.8	2.4	-	0.10	2.40	-	0.71	-
Application 15	1'500	540'000	4.0	0.8	2.5	-	-	0.58	0.39	0.20	-
Application 16	1'700	-	4.9	2.9	0.4	-	0.20	0.90	-	-	-
Application 17	1'000	2'190'000	5.0	2.9	-	-	0.20	6.00	-	-	-
Application 18	1'500	75'500	5.3	1.0	2.4	1.87	0.11	0.64	0.32	0.80	-
Application 19	2'200	1'177'300	5.8	0.3	4.8	0.90	0.01	0.19	0.06	0.64	-
Application 20	570	750'000	6.4	1.9	2.5	8.09	1.07	1.07	2.67	3.15	0.13
Application 21	135'500	8'004'000	7.2	2.0	3.9	137.33	1.80	24.71	2.72	108.10	-
Application 22	550	1'200'000	7.3	2.3	3.7	3.36	0.27	1.13	0.67	1.22	0.07
Application 23	19'000	25'000'000	7.4	-	4.8	-	-	85.00	38.00	117.80	-
Application 24	200	23'900	8.3	2.9	3.4	-	-	2.30	2.96	1.57	-
Application 25	4'000	1'884'000	8.4	2.9	3.4	31.20	2.40	13.00	3.50	12.30	-
Application 26	500	5'219'500	9.3	1.8	5.9	-	-	3.30	25.40	-	-
Application 27	200	-	9.4	1.3	4.2	19.35	0.70	0.55	2.50	15.60	-
Application 28	732	-	9.4	3.0	3.9	-	-	13.00	-	-	-
Application 29	36'000	41'800'000	11.4	2.9	6.3	-	50.00	80.00	-	52.08	-
Application 30	13'500	91'250'000'000	16.4	3.0	12.4	-	-	-	-	-	-
Minimum	**160**	**23'900**	**2.0**	**0.3**	**0.4**	**0.50**	**0.01**	**0.13**	**0.00**	**0.14**	**0.00**
Maximum	**135'500**	**91'250'000'000**	**16.4**	**3.0**	**12.4**	**137.33**	**50.00**	**85.00**	**38.00**	**117.80**	**0.13**
Average			**5.6**	**1.7**	**3.1**	**19.37**	**2.97**	**11.57**	**5.52**	**15.56**	**0.08**

Figure 2. Basic characteristics of the surveyed application systems

5 DATA EVALUATION

5.1 Distribution of life cycle costs

The total actual cost as set forth in Figure 2 is only of limited use for calculating the pro-rata costs for a specific stage of the life cycle, largely due to the variations in age. Young application systems that have only recently been put into production show a relatively high percentage of initial development costs in comparison to their total costs, because at this stage hardly any production and further development costs have been incurred. Older application systems, on the other hand, have a relatively high percentage of production and further development costs. Only after shutdown, i.e. at the end of the life cycle, is it possible to assess the final cost distribution. As the majority of application systems included in this survey were still in production, such a final cost assessment was not possible. Instead, Figure 3 shows the projected life cycle costs for a presumed production time of 5 years. The costs were projected for the presumed production time based on the actual cost data. Planning costs and initial development costs are non-recurring costs that are incurred irrespective of the total production time. Further development and production costs on the other hand increase with production time. Therefore, the total costs must be adjusted to the presumed production time, i.e. increased or decreased accordingly. The standardization of application systems to a uniform total production time makes it possible to compare the individual cost structures. To calculate recurring costs, a linear distribution of production and further development cost over the production time was presumed. Although this approach does not totally reflect reality, especially when it comes to further development costs, an analysis of the data provided showed that this assumption does not affect the survey results in a

significant way. However, it must be said that, in reality, both further development and production costs are not distributed linearly over the production time.

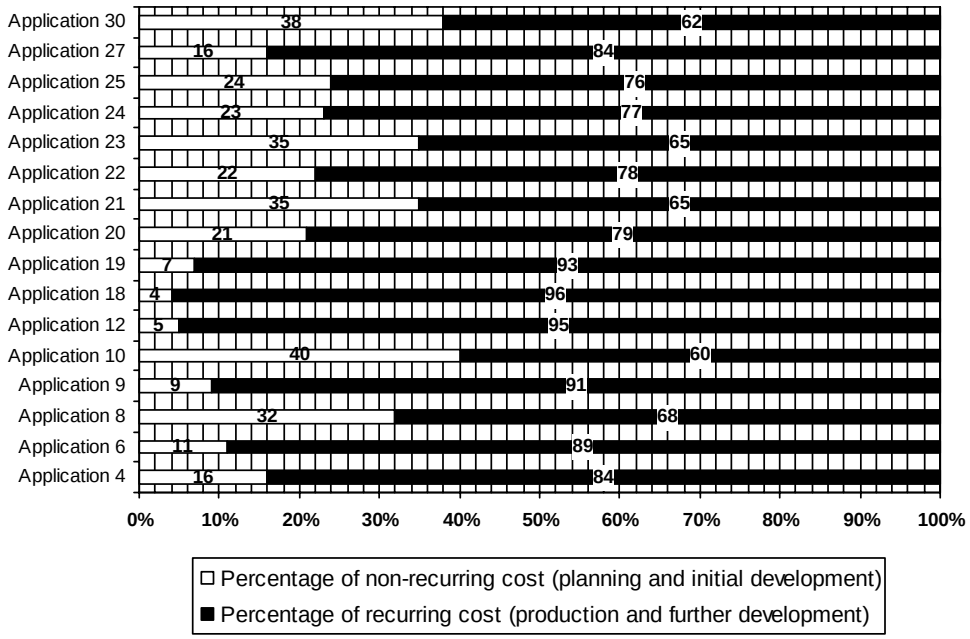

Figure 3. Cost distribution for a projected production time of 5 years

Figure 3 shows the cost distribution across the life cycle based on a projected total production time of 5 years. Only those application systems for which complete cost data was collected were included.

The calculations are based on the following formula:

$$\text{non-recurring cost} = \text{planning cost} + \text{initial development cost}$$

$$\text{recurring cost} = \frac{\text{production cost} + \text{further development cost}}{\text{actual production time}} * \text{presumed production time}$$

$$\text{total cost} = \text{non-recurring cost} + \text{recurring cost}$$

For a total production time of 5 years, the percentage of non-recurring costs amounts on average to 21% of the total life cycle costs. Therefore, 79% of the total costs are recurring costs, i.e. are further development and production costs. For a projected production time of 8 years, the ratio changes to 15% vs. 85%. The ratio differs significantly among application systems. In the case of a five-year production time horizon the percentage of non-recurring costs ranges from 4% to 50%. The percentage of recurring costs varies correspondingly, ranging from 60% to 96%.

5.2 Types of service providers

Figure 4 gives an overview of the percentage of services provided by each of the three types of service providers introduced above. It is important to note that the data gathered is mostly based on estimates provided by the survey's participants who were in charge of the respective application systems. It was not possible to evaluate in retrospect the exact ratio between the three service providers. In most cases, the planning stage of a new application system is carried out by the business units or by an internal service provider. On average, only 17% of all planning services are provided by external service providers. 25% of the initial development services are, on average, carried out by the business units themselves. The remaining 75% are equally distributed between internal and external service

providers. This is also true for the further development stage, although the percentage of business unit services and services by an internal service provider is slightly higher compared to the initial development stage. 50% of the services at the production stage are carried out by internal service providers and 37% by the business units themselves.

	Planning			Initial Development			Further Development			Production		
	BU	ISP	ESP	BU	ISP	ESP	BU	ISP	ESP	BU	ISP	ESP
Application 1	0%	75%	25%	25%	25%	50%	20%	30%	50%	0%	100%	0%
Application 2	100%	0%	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Application 3	25%	25%	50%	25%	50%	25%	30%	60%	10%	80%	15%	5%
Application 4	-	-	-	-	-	-	20%	80%	0%	0%	100%	0%
Application 5	-	-	-	-	-	-	-	-	-	-	-	-
Application 6	40%	40%	20%	20%	40%	40%	30%	40%	30%	50%	50%	0%
Application 7	30%	0%	70%	0%	15%	85%	-	-	-	100%	0%	0%
Application 8	60%	30%	10%	20%	80%	0%	20%	80%	0%	5%	95%	0%
Application 9	30%	40%	30%	30%	40%	30%	30%	40%	30%	25%	50%	25%
Application 10	-	-	-	-	-	-	-	-	-	-	-	-
Application 11	60%	30%	10%	50%	10%	40%	60%	30%	10%	60%	40%	0%
Application 12	20%	20%	60%	0%	75%	25%	-	-	-	10%	90%	0%
Application 13	-	-	-	-	-	-	-	-	-	0%	100%	0%
Application 14	10%	50%	40%	10%	40%	50%	30%	20%	50%	10%	40%	50%
Application 15	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%
Application 16	40%	30%	30%	20%	60%	20%	10%	70%	20%	10%	90%	0%
Application 17	90%	10%	0%	-	-	-	-	-	-	-	-	-
Application 18	0%	50%	50%	0%	10%	90%	-	-	-	0%	100%	0%
Application 19	0%	100%	0%	0%	10%	90%	0%	70%	30%	0%	100%	0%
Application 20	10%	90%	0%	0%	60%	40%	0%	50%	50%	0%	100%	0%
Application 21	100%	0%	0%	0%	0%	100%	-	-	-	100%	0%	0%
Application 22	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%
Application 23	50%	30%	20%	50%	30%	20%	50%	30%	20%	70%	10%	20%
Application 24	80%	0%	20%	60%	0%	40%	-	-	-	100%	0%	0%
Application 25	20%	80%	0%	20%	80%	0%	-	-	-	-	-	-
Application 26	20%	80%	0%	20%	80%	0%	20%	40%	40%	40%	30%	30%
Application 27	50%	50%	0%	30%	70%	0%	50%	50%	0%	30%	70%	0%
Application 28	75%	25%	0%	50%	50%	0%	90%	10%	0%	80%	20%	0%
Application 29	100%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%	100%
Application 30	100%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%	100%
Average	**50%**	**33%**	**17%**	**25%**	**37%**	**38%**	**33%**	**40%**	**27%**	**37%**	**50%**	**13%**

BU: Services provided by the business unit
ISP: Services provided by an internal IT service provider
ESP: Services provided by an external IT service provider

Figure 4. Distribution of service types

6 RESEARCH RESULTS

6.1 Central importance of recurring costs

The survey provided a number of significant insights. First of all, it confirmed that the majority of life cycle costs for application systems occur in the further development and production stages. After a presumed production time of only 5 years the ratio between -recurring and non-recurring costs is almost 4:1. In practice, the average production life span for application systems is often more than 5 years, which further increases this ratio. The cost data allows us to draw the conclusion that companies tend to underestimate the significance of recurring costs for the total life cycle costs. Hence these costs are badly documented and hardly transparent. Furthermore, when participants, who were in charge of the respective application systems, were confronted with the survey's results, it became obvious that their notion of the actual cost distribution diverged very much from reality - the actual results came as a surprise to them.

Equally surprising were the significant variations regarding cost distribution among the individual application systems. For example, the percentage of non-recurring planning and initial development costs ranges from 4% to 40%. Although this high variation is most likely caused by several factors, one particular factor could be observed. Application systems that show a low percentage of non-recurring costs incur significantly higher further development costs in comparison to their initial development costs (this is true for example for application systems no. 6, 9, 12, 18 and 27). One explanation, provided by the survey's participants, was that these application systems were put into operation before the initial development stage was fully completed or without sufficient testing due to strong time pressures or project delays. Thus, issues that should have been addressed within the initial development stage were solved after the application systems were put into operation and therefore contributed to the recurring costs. However, despite these variations it must be noted that none of the application systems reached a ratio of non-recurring costs that exceeded 40%. Hence, recurring costs represented the majority of the total life cycle costs for all application systems evaluated.

6.2 Poor quality of cost data

The quality of the data provided in the questionnaires allowed further insights. Basic data relating to functionality and purpose of the application systems as well as time-related data for the planning, development, and production stages was well documented and relatively easy to obtain. The same was true for data on the number of users and types of business processes supported by the application systems.

In comparison, however, the quality of the cost data proved to be much lower. An analysis of the cost data showed that it is often incomplete and based on assumptions. There were no systems in place for recording life cycle application costs. Also cost accounting was limited to each life cycle stage. Cross-stage accounting processes were the exception. Data on initial development costs was among the most readily available, because it was documented both in the initial development project and by project accounting systems. Further development and production costs, on the other hand, were seldom planned. They were therefore hardly ever documented and difficult to evaluate in retrospect. Because no exhaustive and well-documented cost reviews were available, the data quality depended on input provided by the persons responsible for the application systems. Problems arose especially for older applications, which had been managed by different persons over the course of time, and for very complex applications that had been managed by several persons at a time.

6.3 Important role of business units as service providers

The survey results show a high percentage of services provided by the business units. 25% of initial development services and 33% of further development services represent a significant percentage of services provided by the business units themselves. These figures indicate that business units maintain considerable IT resources, or that they have their own IT departments. The survey results do not support the traditional view of a strict separation of business-related tasks of the business units on the one hand and IT-related tasks by internal or external IT service providers on the other hand. This is also true for the production stage, during which more than one third of the services are provided by the business units themselves. These figures indicate that the business units operate their own IT infrastructure, or manage their own data centres.

To properly evaluate the survey findings, we must acknowledge that the type of service provisioning is not only influenced by the application system, but also depends strongly on the organizational structure of a company and its respective regulations and guidelines for providing IT services. As mentioned above, all three companies involved in this survey have an internal IT service provider, which might be one of the reasons for the low percentage of services provided by external IT service providers.

7 CONCLUSIONS FROM A RESEARCH AND PRACTICAL PERSPECTIVE

A number of conclusions can be drawn from the survey findings. The key role of further development and production costs in total life cycle costs of application systems and thus IT costs in general, is not reflected properly within the existing IT management concepts. Instead, focus is mainly cast on managing new IT projects and the planning and initial development stages. To avoid management mistakes, life cycle-oriented cost accounting procedures for application systems must be developed and implemented. A life cycle perspective is useful both for the analysis of new application systems and for the management of existing application systems. For new application systems, it allows a qualified projection of the total costs. Turning IT project portfolios, which include mainly data of the development project, into IT product portfolios, which are based on a product life cycle perspective, is a first step in this direction (Zarnekow & Brenner 2003). In the case of existing application systems, a life cycle perspective enables IT managers to make better management decisions, e.g. to determine the optimal point in time for the shutdown of an application system. Currently, this decision is, at best, based on technical considerations or on ad-hoc decisions rather than on an institutionalized management process.

Recording the actual costs incurred by an application system is a prerequisite for life cycle costing. In the future, it will therefore be necessary to develop and implement methods and tools that allow for application management accounting. Such an approach would significantly increase the cost transparency for all parties involved. It would provide both customers and IT service providers with a complete and up-to-date view of all costs incurred by an application system. A stronger business-orientation in IT cost accounting also plays an important role. In particular, concepts and instruments must be developed for allocating technically-oriented types of costs - such as the use of hardware resources or the costs of application systems - to economically-oriented types of costs such as business processes or business products (Britzelmaier 1999).

Last but not least, a life cycle perspective encourages the development of integrated IT management concepts. The survey has shown that today's IT management concepts focus on managing the individual stages of the life cycle, especially in the area of cost management. They aim at optimizing each individual stage such as the planning stage, the initial development stage, or the production stage. Life cycle management requires integrated, cross-stage management approaches as can be found e.g. within industrial manufacturing.

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