OLAP at work

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Preface

When I was a bit younger, say 15 years old, I was in the third grade of VWO. There I learned during economics about managers and directors. At that time I really looked up to those people, but had no clue of what they really did. Interesting discussions during the break were about "which person is higher, a manager or a director?" or "which one is really the boss?" Since none of my friends really knew what they were talking about, nobody really won these discussions. Later on I learned about the strategic vision of a director who is the "leader" of a company and tries to steer the company into a certain direction. On the contrary a manager focuses on the inner workings of the company and motivates people to do their work in a certain way. He in fact, facilitates the vision of the director.

I still admire people who take action and are able to motivate groups of people to go into a certain direction. This requires strength, motivation, respect from workers but also a great belief in your decision making. After all, if motivating a group of people to do something ends up in a disaster, you will lose your credibility very soon. Not to think of what the results are for your company.

Primary question is "How can you make wise full decisions?". Well, the success of your decision making process depends on the information you have. But you'd rather be sure that this information is correct, accurate and up-to-date otherwise it's still useless.

From this point of view I started writing this paper. I wanted to know how we get valuable information from the bottom of an organization to the top-level managers who need this information for their decision making process. How can we make an organization as transparent as possible in order to detect problems in an early stage, or see the effect of certain decisions?

I focussed my research on a methodology called OLAP. This method of analyzing the inner processes of your company can deliver great value to your decision making process. Although many companies already have some sort of methodology of retrieving valuable information, I want to show with this paper that OLAP can even enhance your current methodologies.

This paper is meant as a reference work for managers and business people who have some understanding of information flows within organizations and have heard of OLAP before. This paper is especially interesting for people working in organizations which use methodologies like Activity-Based Costing, the Balanced Score Card and Corporate Performance Management. This paper focuses on these three methodologies and shows how OLAP can deliver additional value.

Fortunately I still have a quarter of A4 paper left to express my gratitude to Prof. Dr. A.E. Eiben, who has been my mentor for writing this paper. He has supported me in many ways, some of which he probably isn't even aware of. What I really appreciated was the freedom I had in writing this paper. In this way the "Big-Brother feel" which most students have, was totally absent. But even more memorably to me was the way in which he dealt with one of my questions "How do I quantify the added value of OLAP?". One day later he had assigned this question to another student who had to write a paper about this subject. What kind of reward is greater than this!

I would also like to thank Drs. Han Long Li for our discussions during the Thursday-night squash sessions. He gave me some really interesting ideas and posed different views on several subjects.

Raymond van Rootzelaar

Baarn, januari 2004

Executive Summary

This paper deals with the application of OLAP software. OLAP tools are powerful and fast tools for reporting on data. Bottom line in this perspective is how to turn raw data into information which is accessible throughout the organisation? Many difficulties have to be overcome like convincing managers that OLAP could be of additive value to the organisation. We often see that companies think they know how their processes work. They use methodologies like Activity-Based Costing or the Balanced Score Card to reduce costs and make information transparent. The task of this paper is to show those people that OLAP in fact is the facilitator of some of their methodologies and that OLAP functions as a monitoring tool to make the companyperformance clear.

Our focus within this paper lies on three commonly used methodologies. These are Activity-Based Costing, the Balanced Score Card and Corporate Performance Management. We then show how OLAP is combined with that methodology.

Activity-Based Costing (ABC) relies heavily on OLAP. First ABC defines productionsteps that generate costs. These productionsteps are often referred to as activities. Then a product that passes this productionstep and uses this activity is assigned the appropriate costs. To make this assignation of costs possible, products have to be traceable throughout the productionproces. This is all done by OLAP. OLAP shows where the product is, where it has been and what the production costs are. Without OLAP, none of these figures were available.

The Balanced Score Card (BSC) is a methodology which looks at an organization or project from four different perspectives; finance, customers, internal processes, and innovation & learning for employees. These four perspectives are recorded onto a card and on each of them progress is monitored. Main goal is to create a balance between them. In this situation OLAP functions as a monitoring tool. It extracts the values from a datawarehouse and puts them on the card. Then the card shows the overall performance of the project.

Corporate Performance Management (CPM) is a methodology which focuses solely on people. Their statement is that people are the main source of an organization that can build the company or break it down. CPM focuses on a structural change on human behaviour. So if people are motivated and coached to follow the managers' vision then the company will be successful. For each employee personal trainers are assigned and milestones are defined. These milestones have to be monitored. Again this is the job of OLAP. For instance, we take a salesman from a certain location. A milestone of this employee could be to sell 10 products this week. At the end of the week OLAP makes a report which tells that "Employee X has sold 11 items in week 32 at location Amsterdam". So this employee has reached its milestone. The personal trainer helps the salesman by giving him advice. For instance, telling him to smile at his customers.

During this literature research I came to two conclusions:

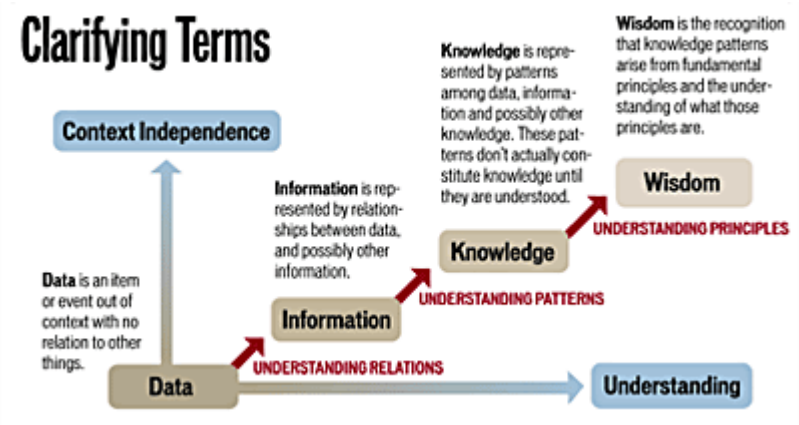
- OLAP is a facilitator. It makes certain processes possible. The first step in which business processes are translated into activities makes the company very transparent. It will make managers think about their business process and make them wonder if those processes are needed at all.
- OLAP is a monitoring-tool. OLAP in itself doesn't do anything spectacular. It is mainly a reporting tool. But because of OLAP, monitoring can be done in an extremely fast way. Without OLAP it would be quite a job to extract the right information using just regular SQL-queries.

In this paper I also focussed on the costs of OLAP. I did not make any calculations but let managers talk about their OLAP implementation. They all said that the benefits are definitely worth the investment!

Contents

Introduction

As stated in the preface, my starting point was the question "How can you make wise full decisions?". And I said that this depended on the information you had. But you had to keep in mind that you have different kinds of information. Information that is correct and accurate but out-of-date is useless. Later on, I came across the following figure which shows us the process of how raw data is transformed into wisdom. The reason why I like this picture, is because of its simplicity. Everybody understands the steps, everybody sees what has to be done, but strangely enough, many companies suffer from incorrect information or don't know how to get the right information into the right places. This is mainly because of the huge amounts of data that is present nowadays. Everything is stored into huge computer hard disks. As I learned from one of the lectures of Business Intelligence, "We're starving in data looking for information" (I wish I had the picture that accompanied this slogan).



In order to get from the data-fase to the information-fase we have to seek for relations in the data or analyse the data in such a way that it becomes valuable. OLAP has proven to be of great value in this process. Implementing OLAP into your organization is the same as placing windows in your house to let the sun come in. Really, OLAP will let you see things that were previously hidden in the dark.

So what can the reader expect to see in this paper? Well, in the preface I said this paper was meant as a reference work for managers and business people who already have some understanding of information flows within organizations and a little bit about OLAP. This notification allows me to skip some elementary things so I can get right to the point. The reason why I chose ABC, BSC and CPM as my focus points is because many companies work with these systems. When I want to convince a certain company of the benefits and potentials of OLAP they could say that they already implemented an expensive system like ABC. So why should they do another investment in OLAP? In this paper I want to show those people what OLAP can mean for such organizations that already have implemented such systems. I will show the different combinations with OLAP and it is up to the reader or manager to see if the added value is worth the investment.

Chapter layout

In chapter 1, I will briefly deal with the concepts of OLAP. The OLAP definition is discussed and we deal with the placement of OLAP within an organization. Chapter 2 will handle Activity-Based Costing (ABC). We give a short example of ABC followed by quite an extensive and detailed example of the combination of OLAP with ABC. Subsequently this chapter will be relatively large compared to the other chapters. This is done to show you how OLAP is implemented exactly. Giving such an extensive example once is sufficient to understand the OLAP trajectory. Therefore the other chapters are somewhat smaller. Chapters 3 and 4 have the same structure as chapter 2. We will discuss the Balanced Score Card and Corporate Performance Management successively. In chapter 5 I try to quantify the benefits of an OLAP implementation. I will show that benefits are not

always shown through financial figures, but can also be expressed in other measures. Finally, in chapter 6 I give an overall conclusion.

Furthermore, I wish to point out that the references used in this paper are intended to be illustrative of the concepts discussed, rather than comprehensive. I apologize if I left out other relevant references.

Author's note:

From my academic background this paper is supposed to contain an economical, informatics as well as a mathematical aspect. The economical aspect is primarily represented by the fact that this paper is written from a manager's point of view. We're using OLAP to inform managers about economic changes internal and external to the organisation. I try to make clear that the economic benefits of OLAP are substantial enough to justify the investment. The informatics aspect is represented by the implementation of OLAP and also because OLAP in itself is software. The mathematical aspect is somewhat lacking, and that is quite an understatement. But this is inherent to the subject. My personnel opinion on my study also contributes to the selection of this subject. BWI focuses on being a link within an organisation. Understanding what managers want, programmers can do and mathematics can prove results in being a cohesive layer between several domains. That's exactly what OLAP does.

Chapter

1 Theory of OLAP

In the introduction I already told that this paper is for people who are a bit familiar with the term OLAP. With this I mean that the reader knows something about the systems that acquire the data (Point-of-sales systems (**POS**), Customer Relationship Management (**CRM**) etc.) and that OLAP performs analysis based on this data. They also have some understanding of how an organization works. I said that this notification allows me to skip some elementary things so I can get right to the point.

Before I start off telling what OLAP is all about, I first want to focus on the area to which OLAP belongs. In this way we get an idea where to place OLAP precisely. After that, the OLAP concepts and it's origin will be explained. We continue with an example of how OLAP-cubes will be constructed. And finally the advantages and disadvantages of OLAP will be discussed. We start with a rather wide scope called **Business Intelligence**.

1.1 General information on OLAP

1.1.1 Business Intelligence

Nowadays, companies that sell products keep a very detailed administration. The reason they do this is because they want to make wise full decisions based on analyses of their detailed data. They literally store everything, from number of items in stock to time of purchase to customer behaviour. Therefore, these companies have huge databases in which they store their data. This data is gathered by several systems. Table 1.1 lists a few systems which are commonly used [BI 2003].

ERP	CRM	POS	WEB

Table 1.1: Transaction Processing Systems (TPS).

These systems are so-called Transaction Processing Systems, which means they store data which is generated by a transaction itself. Some systems monitor their own domain (**WEB**), others try to integrate several systems (**ERP**). These systems are the first systems that a customer encounters when he buys for example a DVD-player. These systems store data like:

- At which location does the customer buy his DVD-player (POS)?
- Did he visit the website (WEB)?
- Did he order through the website (WEB)?
- How much time did he spend on our website (WEB)?
- What is the history of this customer (CRM)?
- Do we know the interests of the customer (CRM)?
- etc.

Explanation of these **TPS**-terms is beyond the scope of this paper. The only thing we should know is that these systems provide the data which form a basis for our primary goal: Turning DATA into INFORMATION! See figure 1.1 [BI 2003].

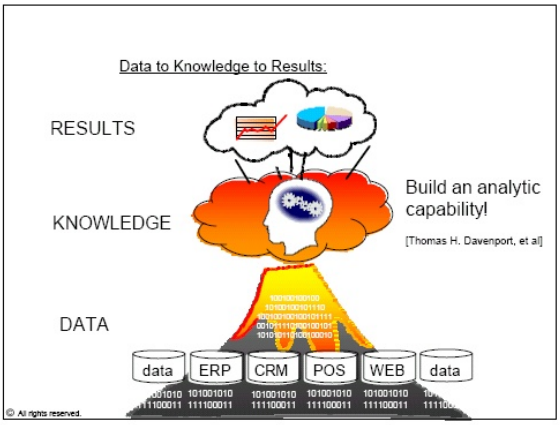


Figure 1.1: Turning data into information.

So we have systems that gather data, but data alone is not sufficient to make a wise full decision. We need some conversion tool to interpret the data and make some sense out of it. So a conversion from data to knowledge is necessary which deliver results on which a manager can make a decision.

Business Intelligence provides this conversion step. It combines the upper two layers (Knowledge, Results) and deals with questions that managers, and also other users, ask themselves. Business Intelligence is an umbrella term [Quarles van Ufford, 2002]. It was introduced in 1989 by Howard Dresner. The term covers several components, i.e. **Datamining**, OLAP, Queries & Reports. Each of the components, and Business Intelligence in general, deal with the analysis and representation of data using various analytical applications. A commonly used graph is the pyramid shown in figure 1.2 [Quarles van Ufford, 2002]. Note that the **Datawarehouse** layer is an aggregation of data delivered by TSP-systems.

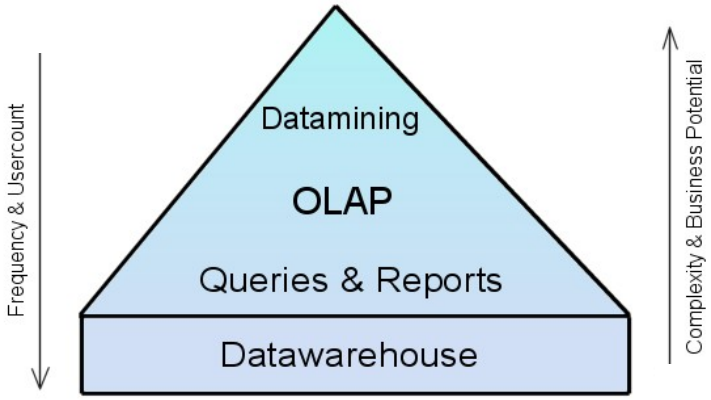


Figure 1.2: The BI pyramid.

The pyramid shows us two things. If you go upwards, the more complex the analyses taking place and the more business potential lies in the resulting information and knowledge. If you go downwards, the more frequently the tool is used and the more users it will have. Within Business Intelligence, OLAP takes a prominent role and has proven to be the most extensive field.

Conclusive, TPS-systems gather data from customer-transactions. This data is aggregated into a datawarehouse. And this datawarehouse is a Decision Support System (**DSS**) on which OLAP analysis takes place. Finally a manager makes a decision based on the results that OLAP gives.

1.1.2 OLAP Definition

In the 1990's the area of On-Line-Analytic Processing (OLAP) was introduced for the analysis of transaction based business data, such as retail stores transactions. The definition, used by the Olap Council is as follows:

> *On-Line Analytical Processing (OLAP) is a category of software technology that enables analysts, managers and executives to gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information that has been transformed from raw data to reflect the real dimensionality of the enterprise as understood by the users.*
>
> [Olap Council, 1997]

To comprehend this definition, it is easier to explain it bit by bit. The first thing to know about OLAP software is that it supports managers and users in making decisions. It analyses huge amounts of data and presents its findings or solutions to the end-user. In this way, OLAP can be seen as a Decision Support System (DSS). But that's not all. OLAP is also capable to look through data in a very fast way. This is because OLAP focuses on access performance [Shoshani, 1997] which is needed because of its "online" capabilities. The term "online" within this concept means "interactive". In the next subchapter where we discuss terms like "drill-down" or "roll-up", the interactiveness will become clearer. And finally, the element which almost every definition mentions, is OLAP's multidimensionality. Multidimensionality means viewing the data in three or more **dimensions**. For a database of a retail store, these dimensions could be Product, Time, Store Location and Profit. Viewing the data in multiple dimensions has the advantage of discovering relationships that can not be directly deducted from the data itself.

Managers use OLAP software to analyse the data across any dimension, at any level of aggregation and with equal functionality and ease. It enables managers, analysts and executives to gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information. OLAP transforms raw data so that it reflects the real dimensionality of the enterprise as understood by the user. This user can equally be a manager or just a simple worker. [OLAP Council, 1997].

1.2 Construction of the OLAP-cube

1.2.1 Some explanatory information

When I started reading about OLAP, I got confused by the terms dimension, **measure** and **point of a dimension**. In one perspective a noun represented a measure, in another perspective the same noun represented a point of a dimension. For example, if we want to know the number of people who visit the Anna Frank house each month per nationality, we have a simple structure like in table 1.2.

Number of visitors AF house	Jan	Feb	Mrt	etc.
Finland	45	56	19	15
Greece	89	48	17	13
Belgium	15	74	87	56
Austria	15	53	16	88

Table 1.2: Simple 2-D representation of data.

Here we have the two dimensions "Nationality" and "Month" i.e. the yellow parts of the table. Besides the dimensions we also have one measure, "Number of visitors" i.e. blue parts of the table. When we talk about a "point of a dimension", we mean for instance "Mrt" or "Belgium". The first one is a point of the dimension "Month", the latter one is a point of the dimension "Nationality". This is all quite obvious.

It gets more complicated if we take more houses into account. We don't only look at the Anna Frank house, but also at the van Gogh house and other prominent figures. Then, what first was called a measure (measure: Number of visitors AF house), now becomes a point of a dimension (dimension: house, point of dimension: Anna Frank house, measure: Number of visitors)!

Very frequently used terms used within an OLAP environment are **slice**, **dice**, **roll-up** and **drill-down**. Slicing and dicing is used to reduce the number of dimensions, so in the previous example we could take the slice "Belgium" and only look at this slice and leave the other countries out of our analysis. Drilling-down and Rolling-up are used to walk through hierarchies of dimensions. We could zoom in on the month "February" to look how many visitors there were at day-level. Rolling-up would be looking at year-level.

Within OLAP terms we often speak about **OLAP-cubes**. I will briefly show you what a cube looks like and how a slice is represented by a cube. Consider a shoe retailer who has many shops in different cities, selling different styles of shoes. Monthly values could look like the ones in table 1.3.

Month	Style	Quantity	Value
Febr 2003	Ski boots	10	1500
Febr 2003	Sneakers	100	10000
March 2003	Ski boots	5	750
March 2003	Sneakers	200	20000
April 2003	Ski boots	1	150
April 2003	Sneakers	250	25000

Table 1.3: Monthly values of a shoe retailer.

In this table we can see the quantity sold and the corresponding value of sold goods on a monthly basis. Drilling-down on a certain month would show us the weekly or daily values. We can represent this same data through a cube. First we define a global cube with three dimensions month, style and outlet as can be seen in figure 1.3.

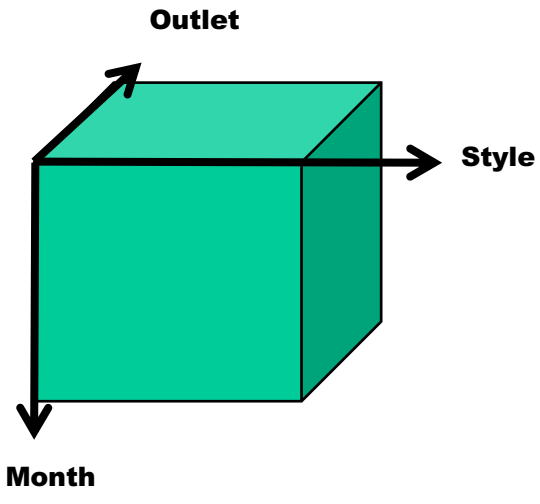


Figure 1.3: Basic cube with 3 dimensions.

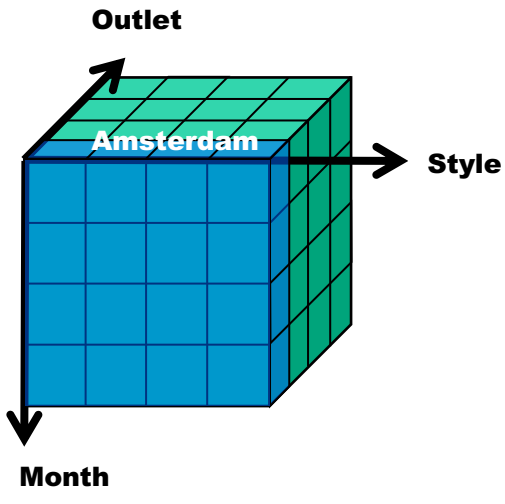


Figure 1.4: Slice of cube 3D->2D

Then, if we look at figure 4, we can take a slice of this cube to look into a certain dimension. In this case we look from the outlet dimension and we see the outlet in Amsterdam in particular. By taking a slice, we in fact reduce the number of dimensions. First we had three dimensions month, style and outlet. But since we took a slice of a single outlet, the outlet dimension is no longer taken into account. What remains are the dimensions month and style in which each single blue square represents "quantity" or "value". Whichever the end-user finds necessary.

The same technique of slicing and dicing can be performed on the other dimensions.

1.3 Multidimensionality

1.3.1 OLAP multidimensionality and 2-D

As stated before, OLAP deals with the representation and support of data in a multi-dimensional space. But what is multi-dimensional space exactly? So far we've learned about measures, dimensions and displaying information through multiple dimensions, but how do we visualise that? And how exactly do we store multidimensional data? In the next section we will describe two examples. In the first example we show how multidimensionality is displayed through the traditional 2-D representation of databases. In the second example we show how multidimensionality is displayed through a data cube representation of OLAP databases. Finally we show the correspondence in concepts.

1.3.2 The representation of multidimensionality in traditional 2-D databases

Take a look at the dataset represented in table 1.4 as a 2-D table. It shows the 4 dimensions "Number of Students in Amsterdam", by "sex" by "year" and by "education" (the numbers are fictitious). This representation was very popular in the early days. For one thing because it's simple, for the other thing because it was the only possible way to represent data. They only had paper to put their information on, thus the 2-D restriction.

Number of students in Amsterdam		School type					
		MBO		HBO		University	
		School		School		School	
		MBO1	MBO2	HES	HVA	UVA	VU
SEX Male	2000	5,568	20,450	3,512	17,250	2,152	14,562
	2001	5,763	22,543	3,343	16,857	1,852	15,167
	2002	----	----	----	----	----	----
	2003	----	----	----	----	----	----
SEX Female	2000	5,773	19,257	2,212	12,650	1,252	12,199
	2001	5,958	20,678	2,896	14,278	1,942	13,111
	2002	----	----	----	----	----	----
	2003	----	----	----	----	----	----

Table 1.4: A 2-D representation of a data (the numbers are fictive).

This 2-D representation poses several problems [Shoshani, 1997].

(i) By necessity, more than one dimension must be represented by the rows and the columns if more than 2 dimensions exist in the dataset. This is accomplished by selecting an arbitrary order of the dimensions for the rows and the columns. In Figure 2, the rows represent the two dimensions "sex" and "year", which were arbitrarily ordered "sex" first, then "year".

(ii) The columns in this example do not represent 2 dimensions, although their layout looks exactly the same as for the rows. Rather "School type" and "School" represent a hierarchical relationship between the instances of "School type" (e.g. "University") and the instances of the "School" (e.g. "VU").This structure is often referred to as a "classification hierarchy". This can be easily verified by realizing that the measure in a cell of this table refers to 3 dimensions only (sex, year, school), not 4. For example, 15,167 refers to the number of male VU-students in the year 2001.

(iii) The label "Number of students in Amsterdam" represents the summary measure for this dataset being "Number of students", but it also says that this dataset has an additional dimension "location" where the instance value selected is a singleton "Amsterdam". Indeed, this dataset may be only one "page" of a collection of pages each representing another location.

(iv) There is a summary function implied with this dataset before further summarization is done (such as over "sex" or "school"). In this case the summary function is "sum". We note that while "sex" and "year" is a one level summarization, the summarization over "school" can be done to the "school type" level or over all schools and all school types. This is because of the classification hierarchy structure.

The dataset above has the following conceptual structure:

Summary measure	: Number of students
Summary function	: Sum
Dimensions	: Sex, Year, School, Location = Amsterdam
Classification hierarchy	: School type --> School

N.b. The notation "-->" means, one-to-many, as in: each "school type" has many "schools".

1.3.3 The representation of multidimensionality in the OLAP-cube

In Figure 1.5 we show a typical example of an OLAP database, represented as a multidimensional "cube". Obviously, this graphical representation can only be used for up to 3 dimensions. But, it is useful for illustrative purposes. This data cube example contains the "quantity sold" (in euros) for a particular store chain, for each "product" by "store" by "day".

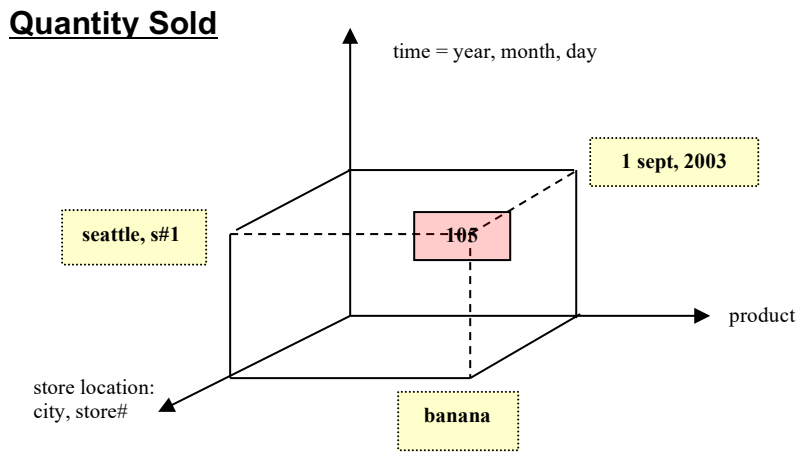


Figure 1.5: A "data cube" representation of OLAP data.

We note the following [Shoshani, 1997]:

(i) The dimension "Store location" has a natural hierarchy to it. "Store location" has two components: "city" and "store number". Since stores are organized according to the city they are located in, the hierarchy city --> store exists. The actual measures are for particular stores, and could be summarized to a city level if we desire so. However, if store numbers (or some other identifier) are not globally unique, then one needs to concentrate "city, store number" to make it unique. Following the terminology of ER models, one can say that there exists an "ID dependency" of store on city.

(ii) The dimension "day" is another example of an "ID dependant" classification hierarchy. Given that day is identified with its month and year (e.g. 3 Aug. 2003) then it is ID dependant on the month (Aug., 2003) which in turn is dependant on the year (2003). Thus, it can be treated as a 3 level classification hierarchy for the purpose of summarization to the month or the year level.

(iii) The summary measure "quantity sold" has a unit associated with it: euros. In the previous example "Number of students in Amsterdam" there was no unit defined. This is because of the type of summarization operation. The summarization operation originally applied to that dataset was: count.

The dataset above has the following conceptual structure:

Summary measure	: Quantity sold
Summary function	: Sum
Dimensions	: Product, Store location, Day
Classification hierarchy	: City --> Store
Classification hierarchy	: Year --> Month --> Day

From these two examples, we can see two things. First, the traditional representation and the OLAP representation have exactly the same components: a summary measure, a summary function, one or more dimensions, zero or more classification hierarchies. Secondly, the OLAP example can easily be represented by the 2-D representation and visa versa.

1.4 Chapter 1 Summary

In this first chapter we briefly tell how raw data is collected into a datawarehouse and that OLAP makes analysis based on this data. The OLAP technology is a field which lies within the environment of business intelligence (BI). It is used as a tool to support management decisions by monitoring changes and progress of measures. Figure 1.6 covers the main part of the first chapter.

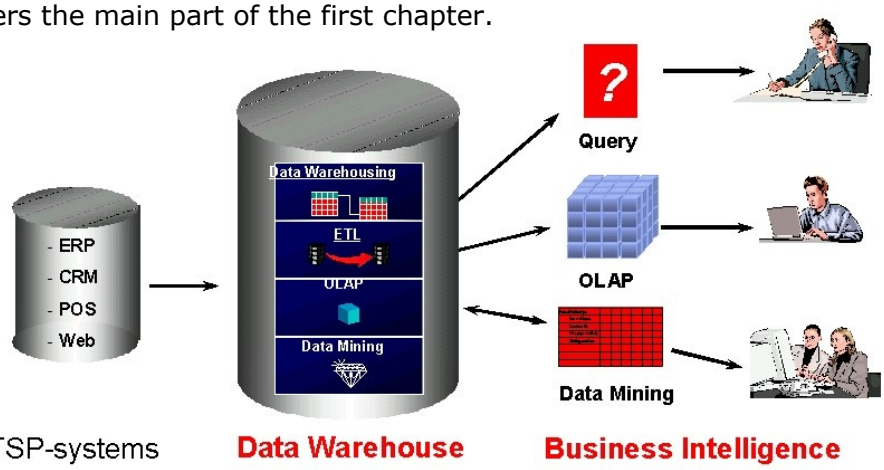


Figure 1.6: From raw data into a datawarehouse resulting in end-user decisionmaking.

We see that data is collected trough TSP-systems like ERP, CRM, POS and web. This data is stored into a datawarehouse to obtain a central location where data is stored. Finally analysis on the data can take place using simple queries, more advanced OLAP, and highly sophisticated datamining tools.

Finally we discussed the advantages and disadvantages using a 2D tabular representation of data versus a 3D representation through a cube. Both representations are equal and can be changed into eachother.

Chapter

2 Activity-Based Management

The lifecycle and economic situations often determine the way how a company should be organised. When a company first starts out, the managers have an overview and know the inner workings of the company. If everybody does his or her part the company will thrive. Each business function manager reports once in a while to the higher management and in this way, the higher management only receives high-level activity summaries.

This strategy works just fine in times of economic growth, but as the company gets larger and the economy decreases they are exposed to more dynamic market forces and it becomes harder for managers to make the right decisions. Because management level only receives summaries it is not only difficult to make decisions but even to detect problems. Managers could immerse themselves in knowing every detail of the company, but there are so many detailed activities that this approach is likely to fail. So, what's a corporate manager to do?

According to *E.Thomson* the resolution lay in building an OLAP solution on top of a datawarehouse. The purpose of this system was to solve top management information problems. These could be problems of the following kind.

- The inability to compare and analyse cost, throughput, and quality information at differing levels of granularity across time, space, employees, capital, business functions and other appropriate business dimensions.

- The inability to equate activity-based costs and quality with revenues.

To facilitate this process of activity-based management (**ABM**), we have to look at the principles of activity-based costing (**ABC**). This is what we will discuss in the next paragraph. When these principles are clear we give an example of how OLAP is used in combination with ABC. We conclude this chapter with a short summary.

2.1 Traditional Costing & Activity-Based Costing

Within company terms, making money means receiving more money from the customer for a certain product than it costs us to produce that same product. Therefore companies need to know exactly how much it costs to produce a certain product. But how do we define costs, **indirect costs** in specific?

Traditional Method

In the early days managers had rather global reports. And even if they had detailed reports about costs, the calculations were done based on standard values for production costs and standard values for operating expenses like shipping and inventory costs. Calculating the standard earnings for a certain product for a certain year, would be done as follows:

Average product sales price
Average cost of products --
Average gross margin
Overhead (other expenses) --
Result

If we take this result and divide it by the total volume of production, we get the "standard earnings per product".

E.Thomsen wonders how managers are supposed to make informed decisions to reduce earnings volatility if they assume away the volatility in their cost structure by using year-level aggregate costs and assuming that all other costs are the same for all the products sold. If we use *standard* values for costs why don't we use *standard* values for revenues either? This makes clear that it is as ludicrous to use standard values for costs as it is for revenues.

So, if we are to answer the question "How do we define costs?", using the traditional method this would mean taking the combined indirect costs of many activities into a single **cost pool** and then allocate these indirect costs using a single **allocation base**, often direct labour or machine hours. Besides the ridiculousness of having standard values for revenues, it is even ridiculous to think that there is only one single allocation base (direct labour) which is responsible for all costs! There are far more **cost drivers** within a company.

The method discussed next uses fine-tuned techniques to allocate these indirect costs much better.

Activity-Based method

When company profits decline, managers often focus on their most profitable products. But which are the most profitable? Using a fine-tuned cost accounting system like ABC could answer this question.

ABC is a method which defines several indirect **activities** from the value chain. Then, for each activity a separate indirect cost allocation rate is defined. The goal is to assign the costs of each activity to the products that caused that activity's cost. A definition used by [HHB, 1999] is:

> *"A system that focuses on activities as the fundamental cost objects and uses the costs of those objects as building blocks for compiling costs."*

In table 2.1 we see some activities and their cost drivers, to get an idea of what we mean.

Activity	Cost Driver
Materials purchasing	Number of purchase orders
Materials handling	Number of parts
Production scheduling	Number of batches
Quality inspections	Number of inspections
Photocopying	Number of pages copied
Warranty services	Number of service calls
Shipping	Number of pounds

Table 2.1: Activities and their Cost Drivers [HHB, 1999].

In many ways, ABC systems are similar to traditional systems. The main difference is that ABC systems have separate indirect **cost allocation rates** for each activity. this means that ABC systems have (1) more indirect cost pools, and (2) more indirect cost allocation bases.

Figure 2.1 illustrates the differences between a traditional system and an ABC system. In this picture we see that the traditional system has only one single cost allocation base from which it derives its cost per product. However, ABC has defined several activity's and allocation bases. From each allocation base the cost per product are derived. Because of this more refined cost structure, ABC is able to make far more detailed cost calculations.

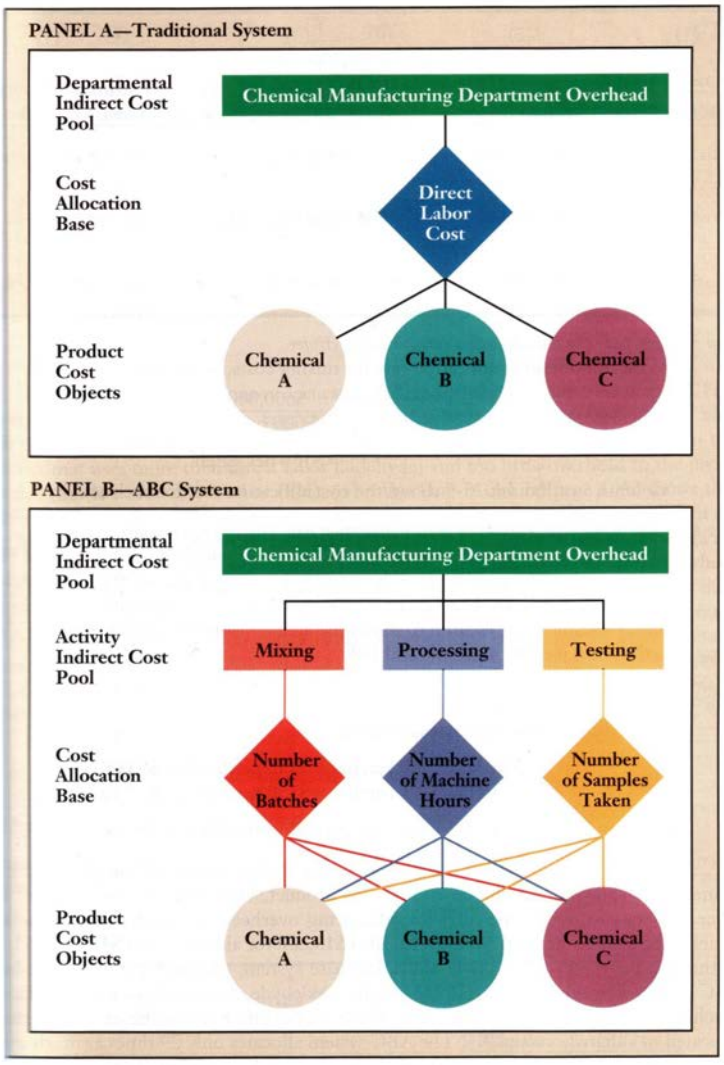


Figure 2.1: Traditional versus an ABC system.

Back to our question with which we started this paragraph, "How do we define costs?". Using the Activity-Based method this would mean taking the indirect costs of each activity to several cost pools and then allocate them to their own allocation base. After this, the calculated costs per product are more accurate.

2.1.1 Development steps in ABC.

When developing such an ABC-system, we use the following steps [HHB, 1999]:

Step 1. *Identify the activities*
Step 2. *Estimate the total indirect costs of each activity*
Step 3. *Identify the allocation base for each activity's indirect costs (this is the primary cost driver).*
Step 4. *Estimate the total quantity of each allocation base.*
Step 5. *Estimate the total cost allocation rate for each activity:*

Cost allocation rate for activity =
Estimated total indirect costs of activity/Estimated total quantity of cost allocation base

Step 6. *Obtain the actual quantity of each allocation base used by the cost object (i.e. the quantity of each allocation base used by a particular product).*
Step 7. *Allocate the costs to the cost object.*

Allocated activity cost =
Cost allocation rate for activity x Actual quantity of cost allocation base used by the cost object.

Table 2.2 illustrates the seven steps of development. It is only meant to get a view of how the various steps are done in real life. It is not my intention to explain the values.

(1)	(2)	(3)	(4)	(5)	(6)		(7)	
Activity	**Estimated Costs**	**Cost Allocation Base (CAB)**	**Estimated Quantity of CAB**	**Cost Allocation Rate**	**Actual Quantity of CAB Used by:**		**Allocated Activity Cost**	
					Aldehyde	**PH**	**Aldehyde**	**PH**
Mixing	€ 600,000	# Batches	4,000 batches	$\frac{€600,000}{4,000}$ = € 150/batch	60 batches	1 batch	€150x60= €9,000	€150x1=€150
Processing	€3,000,000	# Machine hours (MH)	50,000 MH	$\frac{€3,000,000}{50,000}$ = € 60/MH	30½ MH	2 MH	€60x30½= €1,830	€60x2=€120
Testing	€600,000	# Samples	3,000 samples	$\frac{€600,000}{3,000}$ = € 200/sample	14 samples	1 sample	€200x14= €2,800	€200x1=€200

Table 2.2: The Activity-Based Costing System

As we can see the first step is identifying the activities which are needed to produce a single product. In this case mixing, processing and testing. During this identification process, managers are forced to think about how each activity might be improved or even think whether the activity is needed at all. So this first step contributes to help managers and executives manage operations more efficiently. The steps 2 to 7 are quite self-explaining.

This example is taken from HBB where the production of two different chemicals, Aldehyde and Phenylephrine Hydrochloride(PH), are discussed. This example travels through each of the seven steps, from determining the activities (step 1) to a final allocation of the costs (step 7).

When using the traditional method, it seemed that PH was by far the most profitable product (10 times as profitable!). But, as ABC enters the stage, it becomes clear that PH is not as profitable as it seems to be. On the contrary, PH generates big losses and Aldehyde is the chemical that generates profits!

2.1.2 When to implement ABC.

After reading the above the reader may believe that ABC is a revolutionary development. On the contrary, accountants have long known that product costs would be more accurate if companies allocated indirect costs using several cost drivers rather than a single allocation base. Until recently, however, it was too expensive to develop multiple-cost-driver costing systems. Because of the greater detail of ABC-systems, ABC-systems are much more expensive than traditional costing systems. This is why most companies started out using direct labour as their only allocation base. However, computers have made ABC feasible. Companies now can buy commercial software packages or develop their own software. Dell computer developed its own ABC system using Excel spreadsheets [HHB, 1999].

The benefits of an ABC system are most likely to happen when:

- The company produces many different products that use different amounts of resources. (If all products use similar amounts of resources, then a simple single-allocation-base system works fine.)
- The company has high indirect costs. (If indirect costs are immaterial, it does not matter how they are allocated.)
- The company produces high volumes of some products, and low volumes of other products. (Traditional single-allocation-base systems tend to overcost high-volume products and undercost low-volume products.)

Still, ABC is not a "quick fix". There exist several failed ABC implementations. Mainly because organizations tend to define too many activity's. Focussing on the 10 most important activities is a good strategy used by Dell. Also, information technology is very important to record the cost driver data. Not only accounting expertise is required in such a project, but also information systems experts.

2.2 OLAP at work on ABC

We have seen the seven steps in developing an ABC system. Assume we are developing such a system. First we think about the activities a product needs (step 1). Then we need to know some estimation figures. But how do we know these figures like "estimated costs" or "estimated quantity's" (step 2,4)? And how do we know the "actual costs" (step 6,7)? If we have a large company with say, 40 activities and 20 different products, we have to look for 800 values! Here is where OLAP takes a prominent role. With an OLAP tool you are able to track a product through the complete value chain. Displaying information of products on your screen the way you like it. Meanwhile you accumulate the costs which you encounter and finally you put your results into a report which is delivered to the management.

We illustrate the interaction between OLAP and an ABC system by taking a foodcompany as an example [taken from E.Thomson, 2003].

2.2.1 The cost structure

This company has the following cost-structure.

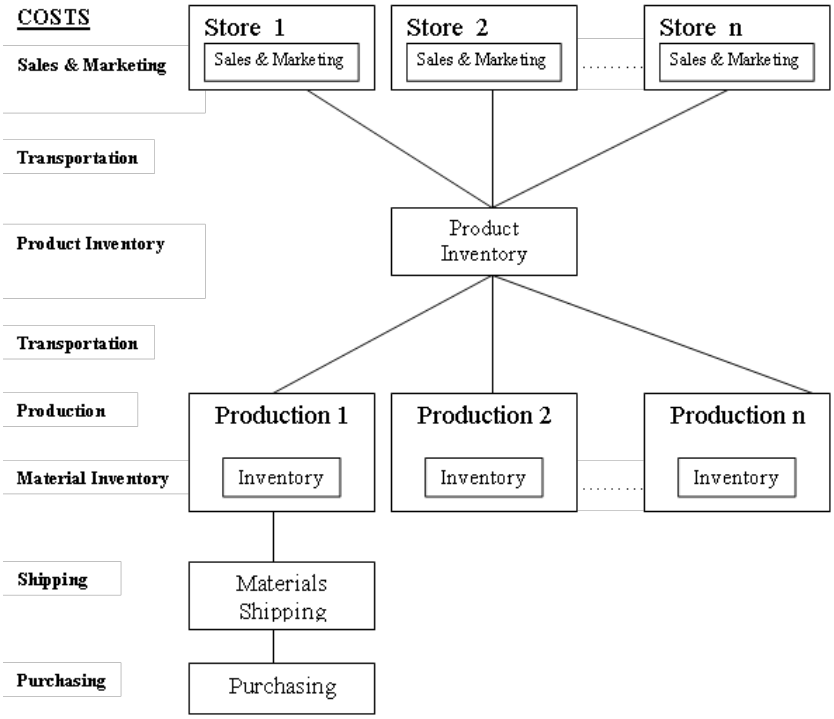


Figure 2.2: Cost structure of Foodcompany.

We track the cost trail backwards since we start with the manager's view. Managers only see reports about the sales and marketing strategies. So, at the top level we see the costs made for "Marketing and Sales" per store. The step before that are the costs made

for transportation to the stores. One level lower we have the inventory costs. Then, again we have costs for transportation. This time from the production sites to the inventory site. Then we calculate the costs made at the production site itself and the costs of "Material Inventory". Before material arrives at the production site, they are shipped in. These costs of shipping are an outsourced activity, done by another company. Finally our cost trail ends with the purchase of foodsources.

In this example two identical batches are tracked. These are two batches of the same product, produced in the same facility on two successive days and send to the same inventory facility and sold in the same area on the same day for the same price. They only differ in the store where they were sold. These two batches follow the cost structure as explained above.

There remains one little problem. How do we calculate the earnings? You would think this is a simple question. Just subtract the costs from the revenues. Well, that's right. But a problem arises. This is because revenues and costs are dimensioned differently.

```
(Time * Store * Foodcake) ~ Revenue

(Time * Business Process * Asset) ~ Costs
```

Because of these different dimensions we can't just subtract the one from the other. If we want to make calculations within an OLAP environment we have to connect these two cubes. The only dimension that they have in common is the dimension of time. Unfortunately that's not enough to calculate the costs per foodcake. We have to take a dimension that is traceable through all the **Business Processes** of the company. In case of the foodcompany this is the BatchID.

A BatchID is uniquely assigned to each foodcake being produced. It contains information like machinetype and time of production. So by tracking a BatchID we can see through which business processes a certain product travels. Along its journey we track its costs.

The BatchID's being tracked in this example, are "B123" and "B101" sold in the stores "Cambridge" and "Allston".

2.2.2 Start tracking

According to ABC we start with determining the activities, or in this case the Business Processes. See table 2.3.

Business Processes
Foodsource purchasing and currency exchange
Foodsource shipments
Foodsource inventory
Production
Product transport to DC
Product inventory
Product distribution
Product sales and marketing

Table 2.3: The business process dimension.

Each of these processes generates costs. To calculate these costs we have to define allocation bases that get used by each of these business process. These allocation bases are called assets. See the assets listed in table 2.4.

Assets
Throughput
Facilities
Equipment
Labour
Utilities
Financial
Other

Table 2.4: Top-level members of asset dimension.

As far as ABC is concerned, the major steps are done. Which are identifying business processes (activities) and defining assets (allocation bases). We now know were the costs are generated. The next part consists of the actual calculations. This is where OLAP becomes useful. In order to make OLAP work we have to make several cubes. There is a cube for each Business Process. Using queries for each cube, we can allocate costs to the right allocation bases. This is done for each cube. At the end we add the cubes together to get the total costs of a batch.

Sales and Marketing cube

In this cube we can derive several interesting things. If for instance, we want to know for which foodcake we sold the greatest number of packages from two different stores located in the Boston zone on January 18, we can enter the following query:

```
"Foodcake", "Geog.Store", Time.Jan.(18), Geog.Zone.Boston_Area,
Qty_Sold.max
```

The result is that `Neptune.4pack` is the product of which the greatest number of packages are sold in location `Cambridge`.

This and other questions like, which is the hottest selling foodcake?; which product was best sold in Boston?; what are the sales for a certain product?, can be answered within this cube by entering rather simple queries in **SQL** (Fortunately most OLAP packages are mouse-oriented and slicing and dicing is mainly used instead of entering queries).

In the two batches we're tracking we are only interested in the following table.

Business Process	Hfoodcake.	Costs {$/Kg}, Asset.All	Wholesale Revenue{$/Kg}, Asset.all
Sales & Marketing	Neptune.4pack.B123. (OrderID.0169)	1.00	11.00
	Neptune.4pack.B101. (OrderID.0170)	0.75	11.00

Table 2.5: Activity-based costs of sales and marketing.

If we look at the last two columns, we see that all assets are taken into account. So we now know the total costs and total revenues for our two batches. Remember, this is the result of only one cube, only one business process. We still have seven other cubes to go.

Transportation from Product Inventory (DC) to Stores cube

Working backwards, the next business process is transportation from the product inventory to the stores.

In this cube we can ask questions like, what is the travelcost for the vehicle that our batch `Neptune.4pack` travelled in? So in this cube, we find vehicles, distances, fixed travel costs, cost per km, etc.

Of our two batches we derive the following information.

Business Process	Hfoodcake.	Costs {$/Kg}, Asset.All
Product Distribution to Stores	Neptune.4pack.B123.(OrderID.0169)	0.29
	Neptune.4pack.B101.(OrderID.0170)	0.15

Table 2.6: Activity-based costs of product distribution.

Things that become clear from this cube is that high vehicle operating costs have a substantial impact on the transportation costs. The reason why batch 123 is more expensive to transport, could be the longer distance to the store. But it could also be due to operating costs on the vehicle. If we want such detailed information, we could drill down in this cube. For now, we move on to the next cube.

Product Inventory cost cube

How many days did the product spend in inventory? And what was the cost per day for that specific period of time? This last question can be very important. Storing products during the winter could be more expensive than storing products during the summer. For example, winter requires heating.

The information to calculate the cost of product inventory on a per kilogram basis is shown in table 2.7.

		Costs {$/Kg}, Asset.All			
Business Process	Hfoodcake.	All	Labor	Facility	Utilities
Product Inventory	Neptune.4pack.B123.(OrderID.0169)	0.15	0.06	0.06	0.03
	Neptune.4pack.B101.(OrderID.0170)	0.25	0.10	0.09	0.06

Table 2.7: Asset costs of product inventory on a per kilogram basis.

Transportation from Production to Product Inventory (DC) cube

This cube is almost the same as the cube where we transport products from the distribution centre to the stores. But when we look closely at the cost structure in figure 2.2, we see that the DC receives its products from several production sites and not only one. But this is of no interest to the calculations we need.

Business Process	Hfoodcake.	Costs {$/Kg}, Asset.All
Transport Production to DC	Neptune.4pack.B123.(OrderID.0169)	0.839
	Neptune.4pack.B101.(OrderID.0170)	0.832

Table 2.8: Transport costs per kilogram.

The reason why the costs in table 2.8 are substantially higher than in table 2.6 is because the shipment from the production site to the DC is done by plane.

Production

This is a very important cube because it shows the inner workings of the organization. It literally shows how well the engine is running. Although we don't have to know every last detail of every process, it is sufficient to see the major variables or facts for each

business process. These variables and facts are needed in order to have the information required to make appropriate decisions.

This cube answers questions like, what is the average production time of machine 1? What is the number of stoppages of machine 1? What is the average cost of production? How much time does it take to produce our two batches?
This last question generates the following query:

```
Time.day, Geog.ProductionSite, Machineid, (Start time, Process.Cleaning),
(End time, Process.Packing), Foodcake.Neptune.(B123, B101)
```

This results in table 2.9.

		Time. day	Site	Ma chine	Start time,cleanin g	Stop time,packin g
Batch	101	Jan15	Vanc	4	3:00 P.M.	7:00 P.M.
	123	Jan16	Vanc	1	9:00 P.M.	12:00 P.M.

Table 2.9: Processing time by day and machine.

For some reason the Neptune foodcakes produced on Machine 4 on January 15 consumed 33 percent more time than the foodcakes on January 16. Since a batch produces about 1,000 Kg and each machine costs $1,000 per hour, we can see that the cost of production for batch 101 was around $1 per kilogram higher than the cost of production for batch 123! For managers, it would be very interesting to see if this is a one-time event or if there is some pattern.

For now we skip the summary table for Production since there isn't much more to tell about it. The Materials Inventory cube is also not very interesting and quite self-explanatory. So we arrive at the Material Shipping cube.

Material Shipping cube

The foodcompany currently **outsources** its materials shipping to a firm called FTI. But the management wonders if it is better to do the shipping internally. Now that we have an ABC-system we can calculate the true costs of doing business with FTI.
As you can see (look at table 2.10) there was almost a 15 percent difference in the cost per kilogram of materials shipping between our two batches of Neptune foodcakes. This does ***not*** mean that FTI is cheating on us! But it tells us that one batch was probably shipped from another market place than the other. Maybe if we did our own internal shipping we could make certain to buy our products on the same market place.

Business Proces	Hfoodcake.	Costs{$/Kg},Asset.All
Materials Shipping	Neptune.4pack.B123	0.84
	Neptune.4pack.B123	0.95

Table 2.10: Activity cost for material shipping

Finally we arrive at our last cube, Purchasing Costs.

Purchasing Costs cube

In this cube we can see the three main components of the total purchasing costs:

- The cost in local currency of the foodsource purchased
- The cost of local currency as determined by exchange rates and the local money that the foodcompany's supplier has in stock
- The asset utilization costs associated with purchasing operations.

The final costs made for purchasing can be found in our final summary-table 2.11. This is a copy of table 2.3. Only this time the indirect costs are filled in.

	Costs{$/Kg}	
Business Processes	**B101**	**B123**
Purchasing & Currency Exch.	**0.50**	0.25
Materials Shipping	0.95	0.84
Materials Inventory	0.50	0.48
Production	**4.40**	3.52
Transport from Production to Product Inventory	0.832	0.839
Product Inventory	**0.25**	0.15
Product to Stores	0.15	**0.29**
Sales & Marketing	0.75	1.00
Management	0.25	0.23
Revenue	11.00	11.00
EBIT	(0.48)	0.75

Table 2.11: A summary of costs by business process combined with revenues.

2.2.3 Final Results

Because of OLAP, the managers have an incredibly informative view on their foodcompany. When we look at the final table, wee see that the Neptune batch 123 makes a profit of $0.75 per kilogram. On the other hand, the foodcompany loses almost $0.50 per kilogram of batch 101! That is an amazing difference for two batches of the same product produced in the same facility on two successive days and sent to the same inventory facility and sold in the same area on the same day for the same price!

We also see that over 50 percent of the costs are allocated to purchasing material and production. While this is not uncommon, we also see an amazingly nearly 40 percent going to distribution and inventory. This shows that the company definitely needs to improve its turn efficiency of their materials inventory. Another point is outsourcing. Looking at their costs for internal distribution, they might realize lower costs if they would also take shipping for their own account. Maybe partially shipping could be an option.

But OLAP did not only show us the costs. The highlighted values in the table are the costs that are more than a standard deviation from the mean. These deviations take place in prominent business functions. This shows a huge amount of volatility in costs. Thanks to OLAP, the management is able to identify from where the volatility is arising.

2.3 Chapter 2 Summary

We began this chapter by introducing the term Activity-Based management. This is the process of making decisions based on the information obtained through an activity-based costing system (ABC). In contrast to a traditional costing system, ABC does not have only one cost pool with one allocation base, but focuses on activity's that form the building blocks for calculating the indirect costs. Each activity generates its own costs and has its own allocation base. This enables ABC to be far more accurate than traditional costing systems.

In general ABC proves that traditional costing systems:

* Undercosted low-volume products
* Overcosted high-volume products

Implementing an ABC-system requires seven steps according to HHB. We've put these seven steps into practice with an example of a foodcompany. In this example we track two identical batches throughout the value chain and calculate their costs. This is done by adding up the costs made in each activity.

Within the foodcompany they speak of business processes instead of activity's, of which they had eight. The eight business processes were mapped into eight cubes to facilitate the OLAP analysis. During the OLAP analysis it becomes clear that every cube contains a lot of interesting information. But since were only interested in costs, we only look at relevant information.

The table presented at the end of the analysis contained detailed information about the cost structure of the two batches. Over 50 percent of the costs were generated by purchasing and production. This is not unusual. Though almost 40 percent was generated by distribution and inventory!

The management now tries to ship their products internally instead of outsourcing their shipping materials. They are also looking for ways to improve their turn efficiency for their materials inventory.

This chapter has shown that OLAP is of great value to a company which also incorporates activity-based costing. Not only does OLAP make the cost structure transparent, it also makes a total blueprint of a company.

"Activity Based Costing focuses on the costs of an organization. It's goal is to classify each cost to its righteous cost owner. A detailed cost structure will be created in this way and thereby improving company profits."

Chapter

3 Balanced Score Card

A company consists of various businessprocesses. Keeping these processes in balance with eachother has always been one of the most difficult things. Because of the increasing pressure from the economy, managing businessprocesses becomes more and more difficult. As a reaction to the dynamic economy, the management continuously looks at the business performance. They compare the business performance to the **mission** and **strategy** of the organization. If the performance falls behind they increase the demands to the performance and make adjustments in order to maintain the balance. But all these adjustments are after-effects. It would be much easier for managers if they knew the impact of a certain decision at forehand. Companies want to know how a certain decision affects the company.

The Balanced Score Card (**BSC**) is a methodology managers can use to monitor and steer business performance and achieve business processes that are in balance with eachother. Hence the name "*Balanced* Score Card.

Just like Activity Based Costing, the BSC isn't really a new phenomenon. Bringing balance into the output of processes based on performance has always been an issue. It has always been troublesome to get a balance between demand, inventory, production capacity and suppliers in the flow of goods. But what we've been doing in the past has nowadays got a name in the form of the Balanced Score Card.

3.1 The Balanced Score Card

The concept of the BSC is developed by Robert S. Kaplan and David Norton. They coined the term "Balanced Scorecard" in a 1992 article for the Harvard Business Review which is available at the Harvard Business School Publishing. As stated in the introduction, the BSC is a model which helps companies determine what impact a potential change will have on the rest of the organization. This is done by looking at it from four perspectives: finance, customers, internal processes, and innovation & learning for employees.

For each of these perspectives critical success factors (**CSF**) are defined. The businessprocesses are developed and steered by these CSF's. CSF's are measured by their performance indicators (**PI**) which indicate if a certain CSF is going into the right direction or not. So by monitoring the PI's we can see the impact of a certain decision on these four perspectives.

Definition:

The Balanced Scorecard model offers a way for a corporation to gain a wider perspective on its strategic decisions by considering the impact on finances, customers, internal processes and employee learning. The analysis takes into account financial and nonfinancial measures, internal improvements, past outcomes and ongoing requirements as indications of future performance. IT departments are applying the model to help keep e-commerce, supply-chain management and other business-focused projects on track.

[Robinson, 2000]

Instead of focusing solely on a company's financial goal, the model requires decision-makers to consider the impact of strategic decisions on staff, customers and the organization's function. When companies look at setting strategies and goals, they classically fall into setting financial objectives: increasing revenue or return on assets.

The BSC approach is to take each objective and ask, "What are the specific initiatives to accomplish?". "What about the people, the processes, the customers and the financials?" Then you figure out how to measure each of these areas. With BSC we don't just look from the one vantage point, the almighty euro or dollar [Robinson, 2000].

3.1.1 Development steps in BSC

Through the years, the balancing problem has gotten more complicated. The company has to be in balance with all its stakeholders of which buyers, suppliers, financiers and personnel are the most important. To maintain this balance or to get such a balance one has to look at the mission and strategy of a company [Heijkoop, 1999]. Many people would say that it is obvious to get a performance model like BSC in line with the businesses mission and strategy, but only 30 percent of the companies around have an organization plan with a clear mission statement and strategy! And many people say it's obvious, but why? Because the scorecard makes the vision and strategy operational. Words do not sufficiently communicate change initiatives, since the same words mean different things to different people. It's when word statements are translated into measures that everyone in the leadership team understands clearly what the vision and strategy are about [Kaplan & Norton, 2001]. So the first step is:

1 ▪ Line up the performance model with the company's mission statement and strategy. If a company does not have a clear mission statement or strategy, develop one. After this, the mission statement has to be translated into critical performances which are delivered by the various businessprocesses.

The lack of critical performances is often very easy to detect in organizations. Conventional administrations can not answer questions like "How much cashflow is generated by received orders, orders in progress, delivered orders or factured orders?" Or if we take a look at the sales department, they often don't know "How many of the outstanding offers are not honorated and why, What is the relation between customer complaints and productdelivery and productquality?". And what about financial administrations which show periodically skyrocketing results, while further analysis shows that the future marketposition is quite questionable. All these types of problems are due to the lack of monitoring performance of businessprocesses.

The mission and strategy of the organization are clear now. In subsequence of the strategy we get the following step:

2 ▪ Analysis of the strong and weak points of the organization and preferably an analysis of the opportunities and threats. This is a so called **SWOT**-analysis (strengths, weaknesses, opportunities and threats).

From this analysis **steeringdata** is derived. This steeringdata will form the basis for the BSC. The SWOT analysis determines what the critical success factors (CSF) are and which are dominant. For these CSF's performance indicators (PI) are developed. So for the basis of the card we have the mission statement and strategy combined with CSF and their PI's. The most important thing to do now, is to determine the effect on all the PI's if we see a change in one of the PI's. In this way the BSC does not only make the performance of the company visible through PI's, but it also measures what the effects are.

There are other measuring methodologies like for example enterprise resource planning (ERP). But this methodology is only used to steer the flow of goods as in production, transport and stock activities. It has a narrow focus. Therefore it can look as if the internal flow of goods is in balance, but in reality this is not true. An ERP-system does not bring a balance between critical success factors. The BSC does.

It is obvious that the BSC is a complicated system that has to be carefully build and developed. The effects on the organization are tremendous. We often see that partial steeringmechanisms like finances, marketing and planning do not integrate. We then have to adjust these steeringmechanisms to let them work together [Heijkoop, 1999]. This must be done to see what happens to one side of the organization if we change something on the other side.

3 ▪ Implementation step which is done in a stepwise manner. It is impossible to implement a BSC instantly. According to Heijkoop it is in the last place an IT-problem. He focuses on engagement of other parties first, primarily the management. Then at the end IT activity is required.

According to Heijkoop, the steering of the financial administration is affected the most. Financial administrations in which they only use one cost pool and allocation base is not longer done. Activity Based Costing (ABC) is introduced and implemented (see Chapter 2). But the implementation of ABC is not the hardest part. With ABC they now have a methodology at hand which shows directly the financial consequences if the performance changes. This time the department has to deal with this instantly and in a practical way.
This is quite different from a periodical delivery of **balance sheets** and **income statements**.

But the effect on the management is also of a great magnitude. This is primarily because the BSC could be seen as a Management Information System (**MIS**). The critical success factors (CSF) within the balanced scorecard (BSC) tell the management when to take action and to what problem. Hence, these CSF's in fact represent their own mission and strategy.

4 ▪ Final step is the building of a model which gathers the real performances of the company. In many cases this model is build on top of a datawarehouse.

Every part of a company is represented by a performance-indicator via just a simple number. This number and the development of the performance will be compared to the targets. Subsequently one knows if the performance is good or bad and if it develops in the right direction. The overall companyperformance is build from various businessprocesses.
So the PI's are formulated, the meaning of the PI's are clear, the information is available, and the information is available at the right time. Now we have to build a model on which we can extract the right information to determine the real performance of the company. This is often done using a datawarehouse. It contains lots of detailed information of an organisation. Therefore the datawarehouse is the central point for recording performance information. Not only internal information is stored in the datawarehouse, but also external information like marketdevelopments.

Measurable Goals

IT managers developing a Balanced Scorecard for their projects should take the following steps to develop measurable goals in each of the model's four areas of concern:

- *Internal processes:* Define the crucial capabilities and purposes of the IT department.
- *Finances:* Weigh the cost of an IT project against the benefits it will deliver and the operational impact it will have on the rest of the company.

- *Customers:* Consider the impact of IT projects on the user community and how any IT projects will influence users' opinions of IT's performance.
- *Employee innovation and learning:* Determine whether any planned projects will fill the need of IT employees for continual development.

"Any company implementing the Balanced Scorecard that has not made the IS department central to this task has missed the boat," [Robinson, 2000]. "The IS department controls the company's data. They are the crucial group responsible for transforming data into information." [Robinson, 2000]

Instead of being a planning tool used only by executive management, the Balanced Scorecard model can clarify roles and expectations at all corporate levels. From each executive director to each area manager, they can see how their specific goals tie to the entire organization's software management objectives.

3.1.2 When to implement BSC

Since the development of a Balanced Score Card (BSC) is a continual process it could take up to several years. As stated before, the BSC needs a stepwise implementation in order to get all parties aligned in the same direction. A very important part is to construct a cohesive layer between the critical success factors (CSF) with their performance indicators (PI) on one side of the balance and their effects on the other side of the balance. The BSC has got its strength to show how the balance is distorted and what the effects of this distortion are on several areas.

In order to make the BSC project a success we must take into account that 20% of the PI's has to be readjusted each year [Heijkoop, 1999]. This is due to market changes or new productlines or because of realisations of previous performance indicators new ones have to be set-up. The success of a BSC project also depends on the rightly chosen CSF's. Because of the BSC, information becomes available much sooner, if the CSF's are chosen right the information adds value to the decision process of managers. But there is no guarantee that these decisions are the right ones. It depends on the CSF's and the cohesive layer between CFS interdependencies.

But most of all, one must remember that the BSC program is a change project, not a metrics project [Kaplan & Norton, 2001]. The BSC is the guiding coalition for driving a major *change* in the organization. It is than that it is most effective. Executives use the

BSC to communicate a vision for performance that is better than the present. Gradually a new system evolves, a strategic management system, which institutionalizes the new cultural values and structures. The BSC is a powerful tool for driving change initiatives [Kaplan & Norton, 2001]. So if you ask your self "When to implement the Balanced Score Card?" you in fact need to ask yourself whether it is going to be a change project or not.

For instance, the strategy of a company could be growth. Those who adopt the BSC include a strong growth component. They don't want to increase profits simply by cutting costs, downsizing and eliminating unprofitable business units. They want a change that lasts for a longer period of time. Cost and productivity improvements typically deliver only the short-term component of the strategy [Kaplan & Norton, 2001].

3.2 OLAP at work on BSC

In chapter 2 we dealt with Activity Based Costing (ABC) and we discussed a rather wide example. This was done because OLAP played a prominent role. It was OLAP which had to determine the cost pools and allocation bases. And later on OLAP was used to monitor the costs through each stage. We saw that OLAP was, in fact, the facilitator of the whole process of implementing ABC. Therefore the quite extensive example.

This time OLAP is active on a somewhat lower level. We can still say that OLAP is a facilitator but on a lower level. The Balanced Score Card (BSC) is the "big picture" which contains the OLAP element. Within the Balanced Score Card it has mainly the function of monitoring the performance indicators (PI).

If we recall step 4 of the development process, we are building a model which gathers the real performances of the company by using a datawarehouse. And this is the stage where OLAP comes in to play. We already know from chapter 1 that OLAP gets its information from datawarehouses. Now it is up to OLAP to gather the performance indicators and put them into management-reports. Based on these reports the management makes a decision to steer some PI's. After that, OLAP is needed to see what the effects of the decision are.

If we recall step 3 of the development process, we talk about the stepwise implementation of ABC. One of the steps could be the implementation of Activity Based Costing. If this is the case then OLAP plays a far more prominent role, as discussed in chapter 2.

So, if we have a BSC project, OLAP plays the facilitator-role of a monitoring-tool of performance indicators. But this role can become larger if one of the BSC-steps contains the implementation of ABC. Then the role of facilitator comes into a wider perspective.

But don't underestimate the role of a monitoring-tool within the BSC. A monitoring-tool for measures is not a control tool, but a communication tool. We are not controlling the measures by using OLAP, we are communicating through these measures to the management in order to get alignment throughout the organization. [Kaplan & Norton, 2001].

3.3 Chapter 3 Summary

The Balanced Score Card is a card which tries to keep the business processes within a company into balance. This is done by looking at four perspectives: finance, customers, internal processes, and innovation & learning for employees.

The implementation of the BSC can be roughly described by four steps:

- Line up the performance model with the company's mission statement and strategy. Business processes -> deliver performance -> is in conjunction with the mission statement.

- Perform a SWOT-analysis from which the steeringdata is derived in the form of Critical Success Factors and Performance Indicators.
- Implementation of the BSC in a stepwise manner. Stepwise because of the impact the BSC has on a company. One of the steps could be the implementation of an Activity Based Costing system. In this case we would look from a financial perspective.
- Final step is the building of a model which gathers the real performances of the company. OLAP-tools are used to walk through the datawarehouse.

For each perspective, goals have to be set in order to measure the development process of the Balanced Score card itself. If the BSC is to be successful one has to take into account that it could take up to seven years to implement. Management support and IT capability is of vital importance. Even when the project is finished one has to keep in mind that the process is continues in nature. Every year around 20% of the PI's have to be revised due to market changes or other influences. And new ones have to be made.

This time the facilitator role of OLAP has diminished. The focus lays on monitoring the PI's. This in contrast to chapter 2 where OLAP plays both functions extensively.

But the first word that has to pop in mind when talking about the Balanced Score Card, is "communication". Communication through a performance measuring system while focussing on four perspectives. It could be seen as a communication vehicle for reporting (OLAP), planning and budgeting processes.

"The Balanced Score Card focuses on balancing business processes by looking at them from four perspectives. It then measures the progress and performance of these processes through performance indicators. By adjusting these indicators a balance can be obtained"

Chapter

4 Corporate Performance Management

Corporate Performance Management (**CPM**) is a integral managementconcept that manages the stategysetting(planning) and strategyguidance(control). Its reach is far beyond of that of the direction alone. This is because strategic success eventually depends on the behaviour of people, especially those who work daily on the production floor. A very popular and usable aid for the introduction of CPM in an organization is the Balanced Score Card (BSC) as discussed in the previous chapter [Ordina, 2003]. The reader may find that there is a correspondence between BSC and CPM in terms of defining implementation steps.

Strategy

CPM tries to get your companyresults in line with your companystrategy. Besides this it also tries to improve the alertness of your organization and makes your people more result-minded in order to improve those companyresults. Final goal is a structural change of behaviour among managers and employees who are going to achieve the strategic success of the company. To make this work, CPM works in several implementation fases.

4.1 Development steps in CPM

The CPM implementation knows three different stages:

1) Design
2) Development
3) Implementation

4.1.1 Design

During the designstage the strategic content of the steeringmodel is recorded. On an organizational level a strategic ambition is spoken and recorded into the strategic content. To support this general succesdefinition, critical success factors (CSF) are determined. The CSF's are also called **performance drivers**. Based on these performance drivers, the company strategy is compared to the companyperformance. The performance drivers are measured by performance indicators (PI) which are measured periodically and used to build a hypothesis about the company performance.

As a starting point, we define **milestones** and performance-measurements at a organizational level. From there we derive milestones and performance-measurements for lower levels of organization. First on departmentlevel through resultoriënted departmentprofiles and finally on a individual level through a confrontation with resultoriënted functionprofiles.

We now have constructed the first stage of CPM. On paper we have defined the companies' strategy, CSF's, PI's and some milestones and performance-measurements from the top of an organization right to a single individual.

4.1.2 Development

When we enter the developmentstage, we rely on the IT department of the company. They are the ones who implement the ICT infrastructure with which we periodically monitor the progress on the critical success factors. If we talk about the ICT

infrastructure we mean tools like Management Information System (MIS) used for problemsignaling on an organizational level (alarming), or flexible management reporting tools for problemanalysis on detaillevel (diagnostics). Common tools used for diagnostics and flexible reports are OLAP-tools. With the aid of OLAP-technology, these reports are build on a ad-hoc basis.

4.1.3 Implementation

During the implementation stage, managers and employees are instructed how to use the steeringinstruments in order to accomplish the structural change of behaviour. This is what it is all about. CPM believes that a structural change in behaviour will lead to company success. As a part of the development program of CPM, several competencies of managers are specifically developed on a individual basis. But also the more common employees are motivated. Their milestones and performance-measurements are recorded into a personnel coaching cyclus.

4.2 OLAP at work on CPM

I will keep this paragraph rather short since the function of OLAP is quite clear now. Just as with the BSC, OLAP fulfils the role of monitoring the performance indicators. But this time it does not monitor from four perspectives, but rather one i.e. the personal milestones. In this way each employee is monitored and the structural change of behaviour can be monitored through time.

But within CPM there's also a big emphasis on making reports. These reports form an important element, because with these reports the management controls the progress. With the BSC reports were not that important since the progress was represented by the card. Via the card managers are able to see in which direction the project is heading.

4.3 Chapter 4 Summary

Corporate Performance Management focuses on people! The final goal is a structural change of behaviour among managers and employees who are going to achieve the strategic success of the company. And this is a major difference with the BSC. CPM focuses on people. It is a method to achieve business performance by changing human behaviour. The BSC also takes human behaviour into account, but has a far wider area of application. It also looks at other perspectives. CPM is strategy oriented whereas BSC is more project oriented, although it can be used for strategic purposes also. That's why we often see some sort of combination with the BSC.

CPM is implemented through three stages. During the designstage, we're dealing with a creative process in which we try to capture the right content of an organization. With content we mean the mission statement, the business strategy and the goal that the organization wants to accomplish. We use the term creative, since we try to figure out what managers want by doing interactive workshops and informationanalysis. So this stage handles the definition of relevant information.

Then, during the developmentstage, we try to realize them. After the creative start, we start developing a datamodel, which is then build and tested. A part of the developmentstage is used to look at how data is stored and extracted. The operational sourcesystems need to store their information into a datawarehouse which transforms the tapped data into information. Then this information is extracted via OLAP tools for flexible reporting purposes.

Finally in the implementation stage, managers and employees are stimulated to create the appropriate behaviour. This stimulation is done by setting personal milestones and performance-measurements. Using techniques like **workshops** and **role-playing** games, employees learn how to act and react in real-time situations. They are also trained how to behave in management-team (**MT**) meetings and in individual talks about your achievements.

"Corporate Performance Management concentrates on the behaviour of people. If the employees change their behaviour in a contributive way to the company's strategy then the company will be successful. After all, people are the engine behind a company, everything depends on them"

Chapter

5 OLAP Benefits

Implementing ICT solutions are not very popular these days. After the ICT hype from a few years ago, there has been a tremendous drop in demand for ICT personnel and software, due to project failures related to ICT. Therefore many organisations are not very willing to implement such a solution or start an ICT project. Not because it costs a lot of money, but mainly because the profits are not quite clear and the **failure-rate** is quite high. As many as 75 percent of all large systems may be considered to be operating failures [Laudon & Laudon, 2000]. Although these systems are in production, they take so much extra time and money to implement or are so functionally deficient that businesses can't reap the expected benefits. According to Laudon & Laudon, 28 percent of all corporate software development projects were cancelled before completion and 46 percent were behind schedule or over budget.

In this chapter we will discuss the implementation costs and benefits from a business intelligence (BI) software solution. We don't look solely at an OLAP implementation because it is not very likely that a company decides to implement OLAP as a stand-alone application. If a company decides to make use of OLAP software, it often buys a complete BI software package. That's why we look at the costs of a total package. BI software generally contains, packaged data marts, datamining software, OLAP tools and user query and reporting tools. Also costs like creating a datawarehouse and training personnel should not be forgotten. There are many BI software packages available like Business Objects, Cognos Powerplay, Hyperion,…. etc. A comparison between these BI software packages could be something for further research.

5.1 Costs

If we are to implement BI software which costs do we encounter? (list not exhaustive) If possible we try to isolate the costs directly related only to OLAP. Otherwise we assign them to the whole business intelligence software package.

- Creating database and database structure for central information storing. If you are going to improve information access you have to store data in one place. In this way the company can extract valuable information easily.
- Business intelligence software, like OLAP, requires clean **legacy data**. The legacy data often isn't formatted to be recognizable by the software, so users must build a data **integration layer** that can find and correct errors. This costs extra money [Songini, 2003].
- Making the organization ready
- Buying software package
- Training personnel for using & maintaining

Financial figures

To get an impression of how much a business intelligence implementation costs, we give some real world examples. Keep in mind that the height of the costs also depends on the type of organization and the scale to which it is implemented. For example, implementing software for a regional company or for an international operating company makes a lot of difference. The latter one requires a far more complete package and **modules** and probably more hardware support which in turn costs more.

The J.R. Simplot Co. is a privately held agribusiness corporation with around 13.000 employees. Its revenue, derived from food processing, fertilizer manufacturing, and agriculture is approximately $3 billion annually. Their company's mission statement is "customer satisfaction". But something held the company back from total fulfilment of its mission. It could not obtain a strong and reliable grasp on how it performed, which affected its **customer service**. The company needed comprehensive reports on how it delivered orders to its customers to achieve annual sales goals. The company implemented Brio Intelligence from Brio Software. Total costs, several hundred thousand dollars. According to the private owner "The money spent has been well worth it" [Jaroneczyk, 2002].

A Fortune 1000 hardware retailing company called TruServ, and employs about 5.000 employees. TruServ records all its sales and marketing information into one database but users were never able to recognize if the information originated from the sales or marketing teams. TruServ implemented Business Objects at a total cost of $250.000 .The return on investment (ROI) was achieved within five or six months [Jaroneczyk, 2002].

Brayton International, a furniture manufacturer, suffered from a lack of reporting and accessibility to information. They needed to collect and report on integrated corporate data in a secure manner and harness technology to improve its relationships with its dealers. They implemented SyteLine from Frontstep as an enterprise resource management application. Besides that they also implemented Cognos Business Intelligence solutions to analyse and report on SyteLine transactional data stored in data marts or cubes. The company with 450 employees says "Have we saved money, yes. Can we put our finger on it? Not really. We don't have any hard numbers on any of that." He refers to the employees who are now trying to track down every possible expense [Jaroneczyk, 2002].

In California, as many as 500.000 residents fail to file their income states. Therefore the California Franchise Tax Board decided to use IBM Business Intelligence software in order to collect the money. The system was implemented in December 2001 and consists of an IBM RS/6000 SP Server, DB2 Universal Database and IBM's DB2 OLAP server. This system cost about $29 million, but has already repaid itself since it is able to collect an estimated $36 million annually from residents who haven't filed their returns [Baron, 2000].

Visa International Inc. uses a fraud detection system based on an array of MicroStrategy Inc.'s BI-software. Due to this system, Visa was able to contain its losses due to fraud to approximately $1.4 billion. Total cost about $20 million [Baron, 2000].

5.2 Benefits

In paragraph 5.1 we discussed the costs of implementation and we showed that these costs were worthwhile since each of these managers or directors were content with the results they got from business intelligence. So while discussing the costs we directly told the benefits of the costs made. Of course, there are also managers who can tell a total different story. Remember that almost 75 percent are failures. But the paragraph was meant to give you some feeling about the costs and to show you that the big investment IS very worthwhile IF implemented correctly. So if all goes well, the benefits in terms of revenue are much higher than the costs made. If all goes bad (75 percent), well than we have a problem. Some of the reasons why implementations go bad can be found in

paragraph 5.3. Or read Chapter 13 "System Success and Failure: Implementation", since this is beyond the scope of this paper [Laudon & Laudon].

Now lets take a look at the possible benefits of BI software. We use the word "possible" since not every benefit is applicable to every organization. Once again we try to isolate the OLAP benefits if possible.

- The most obvious OLAP benefits that are also mentioned in the first chapter are the multidimensionality, the fast data access, wide accessibility and the user friendliness. Almost every end user can use it and make its own decisions in a very fast way. No communication is needed with other departments or IT-personnel.
- BI software in general can factor variables such as demand, the cost of a good or service, and the amount of revenue the company needs to be profitable. It then calculates the best sales price for a good or service. This is all done automatically and almost no expensive personnel are needed [Songini, 2003].
- OLAP is very beneficial for organisations because it can be applied to various levels of an organisation. ABC only refers to operational cost reduction. It can't be used for setting company goals for example. BSC is only related to projects and how to steer them in the right direction. But OLAP is a very general software solution. It is almost applicable to any process or methodology within the organization.

Since the financial benefits of OLAP are quite hard to determine we might have a more useful approach if we just let managers speak for themselves. Managers who have implemented OLAP software can be more convincing than just summing up a few benefits. So we take the same companies from paragraph 5.2 and let them give their opinions.

Comments of managers and directors. Their goal: Customer Service.

J.R. Simplot Co. (agriculture business) benefits:

- Accessibility: Brio Intelligence collects and tabulates information like "Are the placed orders also shipped? And if not, why? Where the goods damaged? Did a shortage occur?" These metrics help the company reach its goals of excellent and efficient customer service because everybody could access this information.
- Speed: Before the implementation there was a specific IS group who had to extract the information by hand using SQL-queries. Now around 410 users can do it themselves which saves a lot of time.
- Multidimensionality: The software enables to define key performance measurements, which allows measuring its customer service in key market segments.
- Transparency: Basically all employees now know the total impact of a price increase.
- Customer Service: "I can come up with an overall picture and the customer is impressed!" this was said by the director of order fulfilment & e-commerce of J.R. Simplot Co.

TruServ (hardware retailing company) benefits:

- Accessibility: Lowered IT support costs by two full-time employees. Every single one of the 300 users can operate OLAP tools and have access to the data in a fast way. Previously they had to wait up to two weeks to get the right information. Now, they only have themselves to blame if they don't get the answers they need!
- Accuracy: Accurately tracks retail promotions, which allows for increased customer service. During a promotion of paint in 600 stores, the software was

able to obtain the information on what was sold as a result of that promotion. "Managers can literally run an ad promotion in Sunday's newspaper, and know its success by Monday".
- Multidimensionality: Business Intelligence software helps TruServ determine what's likely to appear in particular stores in certain regions.
- According to the CIO of TruServ "I like it to a gold mine. you see a vein of gold and as you dig, you realize there is a boat load of gold back there".

Brayton (furniture manufacturer) benefits:
- Fast, accurate sales and marketing reports. "Sales have reaped time-savings and revenue generating benefits. Year-to-date bookings, for example, took two to four hours to generate. Now three years worth of sales information can be extracted in 10-15 seconds." "And time-savings are dollar-savings", says the manager of information technology.
- Unanticipated and valuable product development information
- Accessibility: Solid foundation for Web-based (Cognos Powerplay web-based) data access for dealers and customers.
- Traditionally, the furniture industry has not been at the forefront of information management. But they wanted to prove that data warehousing technologies would serve them into the 21st century. And it did.
- According to the manager of information technology the big benefit of OLAP (Cognos Powerplay 7) is "it gives us a consistent source of information, a place where we can derive reports from and its changed how we do reporting inside the company"
- Finally he says "Companies that can't support their business strategy with well-managed information are dead in the water".

We've summed up some benefits from the first chapter, took some opinions of managers who successfully implemented OLAP and BI software and made clear that OLAP can be of added value. Still, the summed up results are somewhat biased. So I started thinking "how we could put a value on information?". Finally I came up with an answer that satisfied me. One week later I came across an article by Jennifer Jaroneczyk who exactly thought the same way.

How do you put a value on information?

Very easily, when a lack of access to it can cost your company millions of dollars.

[Jarobeczyk, 2002].

Today, leading companies need to access vital customer data, including order histories, delivery information, and pricing histories, in order to have a competitive value. Those companies that invested in business intelligence software get a competitive edge.

5.3 OLAP future

Many information system "failures" as stated in the beginning of this paragraph are not necessarily falling apart, but either they clearly are not used in the way they were intended (**office politics**), or they are not used at all (**shelfware**). Users often have to develop parallel manual procedures to make these systems work properly. In some systems, nearly all reports put out for management are even never read. They are considered worthless and full of figures of no consequence for decision making analysis. [Laudon & Laudon, 2000]. Besides the issues of politics and shelfware, we also have the problem of finding the best product for the least amount of money.

This all looks as if the future of Management Information Systems and OLAP in particular, is very unpromising. To each of these three issues Nigel Pense, an OLAP expert, has an answer [Perez, 2001].

Nigel first attributes the problem of OLAP office politics. This is about the notorious inability of the IT department and end users to get along. Nigel says "Companies need to spend more time at the beginning of the project outlining what each department needs". In this way, the MIS software is developed according to the wishes of the end-users and thereby the software is used the way it is intended to be.

Then the problem about shelfware, which is software purchased but not being used. The average shelfware rate for the 10 leading OLAP products is 39 percent. Despite of these high rates, many companies even plan to buy more licences [Perez, 2001]. According to Nigel "more than 80 percent of organizations would like to deploy their OLAP solutions more widely". Why is this? Because Microsoft sells it's product at an attractive price, unlike other vendors, and the customers were pleasantly surprised with its quality [Perez, 2001].

Then Nigel answers to the costs of OLAP software. According to Nigel there are too many vendors on the OLAP market and eventually the market will consolidate. Only medium companies may survive like Business Object and Hyperion Solutions Corp. He says that a successful OLAP implementation doesn't necessarily mean an expensive one. For example a survey on 650 OLAP users revealed, that 40 percent of those companies used big-five consultants for implementation with a total cost of more than $500.000 on consultancy. And even then they didn't get the highest **goal-achievement rate**. Instead, the implementers that did get the highest goal-achievement rate were specialist business consulting firms and vendor consultants.

So the future of OLAP is quite promising. Issues like office politics and shelfware can be dealt with. And even the costs don't have to be a problem. But, the current costs of many solutions, the economic downturn, and the normal shakeout of companies in a relatively new market will all be factors in the future of OLAP [Perez, 2001]. A clear statement about this can't be made, but the potential is there.

Chapter 6 Conclusion

This paper has shown the different areas to which OLAP can be applied. I tried to make clear that whatever methodology or system a company uses, OLAP can always be of additional value. That is, if some conditions are fulfilled, like the existence of a datawarehouse or datamart. But also a good working IT department which in fact is the backbone of any OLAP tool.

When we look at chapter 2 we see an internal process in which costs are reduced. This reduction of costs is not only done to make more profits. We are mainly interested in refining our cost structure to see where improvements could be made using Activity Based Costing. Each activity generates its own costs. Simply adding the costs of the activities through which a product travels, will result in the total costs for that product. We are trying to improve the information feed from an operational level, so to speak. To facilitate this refinement we could use OLAP software to determine the cost-pools and it's accompanying values.

Chapter 3 works from a total other point of view. This time we don't look at an internal process but at a strategic process. With the Balanced Score Card managers looks at four aspects of an organisation and want to know the impact of a certain decision on these four aspects. In this way a card is constructed in which the four aspects finance, customers, internal processes, and innovation & learning for employees, are represented. For each of the aspects, performance indicators have to be defined. Once these indicators are clear they have to be monitored. To facilitate the monitoring of all the performance indicators, OLAP software could be used.

Chapter 4 looks at the organizational process. This time we want to improve the organizational information feed. We look in which direction the company wants to go as a whole. Each department within the company has to face the same direction as the management does. Corporate Performance Management is a way of making employees focus on the direction to where the organization has to go. This often takes a long period of time. Therefore, monitoring your progress, setting milestones and evaluating feedback is of vital importance. You need to do this to make sure you are still on the right track and if you're not, make subtle adjustments. Again, this can be done by defining performance indicators. Hence OLAP software can be used to monitor these indicators.

We see that OLAP can be instantiated in every level of an organization. Whether it concerns operational, organizational or strategic decisions, OLAP is there to give you the information you need. It is not only used by managers, but by every single end-user. Whoever needs information can benefit from OLAP. This could be in the form of detailed cost information about a production process or monitoring several performance indicators.

This leads us to a somewhat restrictive thesis about OLAP. In my opinion OLAP is in the first place a facilitator for the decisions a manager makes and the accompanying processes derived from these decisions. Decisions are always based on the information at hand. Later on, the impact of decisions has to be monitored. OLAP is the fastest way for information retrieval and gives methodologies like ABC, BSC and CPM the right information. It makes these methodologies work!

Secondly, OLAP is a monitoring tool for performance indicators. With this statement I don't want to degrade OLAP software. OLAP software is capable of much more things, but in fact many organizations use it to monitor the progress of their performance indicators.

I want to conclude my paper with my opinion on the definition of OLAP. If you read about OLAP they always talk about the ability of OLAP software to deal with multidimensional data, looking at it from different perspectives. Well in fact, in some way

OLAP software itself is multidimensional. Multidimensional in the sense that whether you look from an operational perspective with internal processes or from a strategic perspective with external processes, OLAP can deal with it.

Difficult words

These lists contain difficult words categorized per chapter by first time of appearance. The syntax is as follows:

<term><(page number)>:<explanation>

Related terms to chapter 1

POS (1): Point of Sale is the physical location at which goods are sold to customers. A point-of-sale software terminal is a computer replacement for a cash register i.e. barcode-scanners. More sophisticated than traditional cash registers, a point of sale software system includes the ability to track customer orders, process credit cards, and manage inventory.

CRM (1): Customer Relationship Management contains those aspects of a business strategy which relate to techniques and methods for attracting and retaining customers

ERP (1): Enterprise Resource Planning is an amalgamation of a company's information systems designed to bind more closely a variety of company functions including human resources, inventories and financials while simultaneously linking the company to customers and vendors.

WEB (1): Web-based applications in which visitors or possible customers fill in records with name, address and other sorts of information.

TPS (1): A Transaction Processing System focuses on data, storage, processing and flows at the operational level. Efficient transaction processing is it's goal as well as making summary reports for management.

BI (1): Business Intelligence is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions.

Datawarehouse (2): A collection of integrated, subject-oriented databases designed to support the DSS function, where each unit of data is specific to some moment of time. The data warehouse contains atomic data and lightly summarized data.

DSS (2): A Decision Support System is a computer program application that analyzes business data and presents it so that users can make business decisions more easily.

Datamining (2): Data mining is analysis of large pools of data to find patterns and rules that can be used to guide decision making and predict future behaviour.

Dimension (3): Each dimension has structure, described by a directed graph of categories, a set of members for each category, and a child/parent relation between members. An important application of this structure is to use it to infer summarizability, that is, whether an aggregate view defined for some category can be correctly derived from a set of precomputed views defined

Measure (3): The value represented by a cross-section of 2 or more dimensions. This value could be "number of items sold" or "sales" or "profit" etc.

Point of a dimension (3): A subset of a dimension.

Slice & Dice (4): Used to reduce the numer of dimensions.

Roll-up & Drill-down (4): Used to walk through hierarchies of dimensions.

OLAP cubes (5): You can think of a cube as the equivalent of a relational table, that is to say a collection of data with common attributes. However a cube does not have fields, instead you define dimensions. The cubes gives a graphical representation of the cross-sections of the dimensions.

Related terms to chapter 2

ABM (9): Activity-based Management is the use of activity-based costing to help managers focus on the continuous improvement of operations and processes.

ABC (9): A system that focuses on activities as the fundamental cost objects and uses the costs of those objects as building blocks for compiling costs.

Indirect cost (9): Costs which can not be assigned to a single product, i.e. labour, overhead costs.

Cost pool (10): A process to which costs can be assigned. Having more cost pools will give a better insight in your cost-generating processes.

Allocation base (10): A base on which costs can be accumulated. The allocation base in fact calculates the costs that belong to the cost pool.

Activity (10): Any event or transaction that causes a cost to be incurred in an organization.

Cost Driver (10): A unit of output that's used to calculate the cost of each activity.

Cost Allocation Rate (10): The costs of making one single product based on a certain allocation base in a certain cost pool.

Business Process (14): Steps within a system in which raw products are transformed in goods which are sold to the customers.

SQL (15): The Structured Query Language is an industry-standard language for creating, updating and, querying relational database management systems.

Outsourcing (17): Outsourcing is an agreement concluded between a business and a third party for the ongoing management and the improvement of activities related to a part or to the whole of:

- business functions (e.g. human resources, marketing, payroll, billing)
- an infrastructure (e.g. information systems, security systems, telecommunications networks)
- operating processes (e.g. procurement of raw materials, industrial production, operation of a telecommunications network).

Outsourcing includes a fixed-limit contractual arrangement covering transfer of the business processes. It may also include a transfer of assets and human resources. Customers focus on defining the results to obtain, leaving the outsourcer the responsibility to deliver them.

Related terms to chapter 3

Mission statement (20): A mission statement is a written statement of purpose that can be used to initiate, evaluate, and refine all company activities. It serves as a basis, guiding you to a successful company and interaction with others.

Strategy (20): A written road map for accomplishing your mission statement.

CSF (20): Critical Succes Factors are factors that determine the success of a project or goal. The CSF's make clear if progress is still made and if it is in the right direction.

PI (20): Performance Indicators are the actual values that deliver the input for critical success fators.

BSC (20): The balanced scorecard is a management system (not only a measurement system) that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results.

When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into the nerve center of an enterprise.

SWOT-analysis (21): SWOT Analysis is a very effective way of identifying your Strengths and Weaknesses, and of examining the Opportunities and Threats you face. Carrying out an analysis using the SWOT framework helps you to focus your activities into areas where you are strong and where the greatest opportunities lie.

Steeringdata (21): Data which managers use to base their conclusions on and make adjustments in certain processes if necessary.

Balance sheet (22): The Balance Sheet presents a picture of your business' net worth at a particular point in time. It summarizes all the financial data about your business, breaking that data into 3 categories; assets, liabilities, and equity.

Income Statement (22): The income statement is a financial document showing a company's income and expenses over a given period (like one fiscal year). Also known as the Earnings Statement or Statement of Operations.

MIS (22): A Management Information System is a computer system, usually based on a mainframe or minicomputer, designed to provide management personnel with up-to-date information on an organisation's performance, e.g. inventory and sales. These systems output information in a form that is useable by managers at all levels of the organisation: strategic, tactical, and operational. A good example of an MIS report is an annual report for a stockholder (a scheduled report).

Related terms to chapter 4

CPM (26): The essence of Corporate Performance Management is a consolidation of concepts companies have been practicing for quite some time (data warehousing, business intelligence, quality management, financial planning and forecasting) into a single, integrated concept focused on enhancing corporate performance through organizational concentration on specific, measurable and documented performance objectives, the employees.

Performance driver (26): Is the same as a Critical Succes Factor (CSF), see CSF.

Milestones (26): Significant accomplishment; intermediate goal

Workshops (28): A facilitated workshop is a team-based information gathering and decision making technique designed to accelerate business planning and development. It is an interactive communication technique involving experienced and empowered personnel working in one or more sessions run by an independent facilitator. A workshop is a process to be implemented when there is a requirement to make decisions, explore ideas and exchange knowledge to solve a business problem.

Role-playing (28): Role-playing is pretending , acting a particular role. A Role-playing game is just a place to give unbridled creativity a few rules and an appropriate environment.

MT (28): A Management Team is a group of persons who have different key-functions within an organization. They make the most important decisions within the company.

Related terms to chapter 5

Failure-rate (29): This is the frequency at which failures occur within a certain system or environment.

Legacy data (29): Legacy Data is used to describe any sequential (or "Flat") file that is not under the control of separate data management software.

Integration layer (29): A layer in which two layers come together. It smoothens the edges of the adjacent layers. It is also used as an interaction layer in which information from one layer is made understandable for the other layer.

Modules (29): Components that make up the whole system.

Customer Service (30): Customer Service is a function of how well an organization is able to constantly and consistently exceed the needs of the customer.

Office Politics (32): Due to the culture of an organization some opinions are not welcome and some opinions a taboos. These are called office politics. If you want some organizational change, but the management is rather rigid and conservative you deal with office politics.

Shelfware (32): Shelfware are products which are bought by a company but not used at all. These products cost a lot of money and are in this way not worth the investment. Shelfware is often due to the lack of knowledge of the software.

Goal-achievement rate (33): The highest satisfaction level.

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