Daffodil International University

Department of Software Engineering

Assignment

Course Name: Advance Database with Lab
Course Code: SWE-423

THE DATA WAREHOUSE ENVIRONMENT: QUANTIFYING COST JUSTIFICATION AND RETURN ON INVESTMENT

Submitted To:
Prof. Dr. Touhid Bhuiyan
Head, Department of SWE

Submitted By:
Md. Nahid Hasan
ID: 142-35-675
Section – A
Department Of SWE

Submission Date: 17-08-2017

THE DATA WAREHOUSE ENVIRONMENT: QUANTIFYING COST JUSTIFICATION AND RETURN ON INVESTMENT

INTRODUCTION

In this modern era we are going to smart and modern day by day. Technology developing is one of them. To scope up with these technology many companies store a large volume of data every day. Such as Facebook, Google, Microsoft, Twitter and many others companies. Only Facebook produced 500+ TB data each day. So can we imagine how much data produced by Facebook every month or every year? They stored data not only for future purposes but also process decision making from these data. So they used data warehouse where the processed data are attached and making various decision process. Now we can understand why a company used data warehouse instead of traditional database. But there is a common question arises that cost effectiveness of a data warehouse. It is obvious that a data warehouse is not built for free. In this paper, we discuss about the cost justification and return on investment of data warehouse.

VARIABLE COSTS

To begin with, the costs of a data warehouse are very variable. One organization builds a large data warehouse for a large amount of money. Another organization builds a large data warehouse for a significantly smaller amount of money. And ironically the organization that spends significantly less money for their data warehouse is usually much happier with their data warehouse than the organization that spent much more money.

Some of the factors that determine the cost and the satisfaction of a data warehouse are:

- does the organization understand that with the large volumes of data found in a data warehouse that the mass of the volumes of data should not be placed on high performance disk storage,
- does the organization understand that building a central architected data warehouse surrounded by data marts is the best long term approach,
- does the organization understand that the data warehouse must be built in small fast iterations of development rather than in a single large "big bang" approach,
- does the organization understand that for serious amounts of exploration that a separate structure called an "exploration warehouse" is required,
- does the organization understand that for true oltp response time that a separate structure called an ODS is required, and so forth.

If an organization does not understand these basic architectural issues then the costs of the warehouse will rise at an alarming rate along with the dissatisfaction with the warehouse. The first and most important key to managing the costs of the data warehouse

is to understand the architecture of the warehouse and the environment that surrounds it. However, even if these architectural issues are understood, there is still a cost to the data warehouse.

COST JUSTIFICATION

There are many approaches to cost justification of the data warehouse. Several of those approaches will be addressed in this white paper.

The easiest and most straight forward way to address the cost justification of the data warehouse is to simply say that the data warehouse greatly reduces the cost of getting information into the hands of the user - across the board - for all of the organization. With a data warehouse, the cost of getting information shrinks dramatically. For everyone. Every time there is a need to access information. Of any kind.

In other words, data warehousing reduces the cost of accessing information dramatically.

INFORMATION WHERE THERE IS NO DATA WAREHOUSE

In order to illustrate this dramatic and profound effect, consider the classical environment shown in Figure 1.

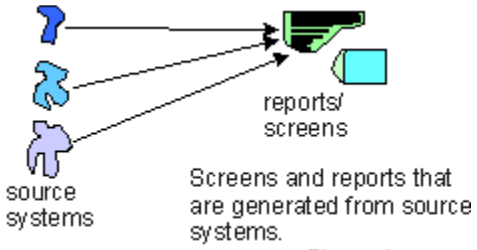


Figure 1

In Figure 1 there are some source systems, usually called the legacy environment. These source systems provide the data needed by the end user. Usually these legacy systems are transaction processing systems and reflect business requirements. There is a need for information from these legacy systems. That need is represented as the desire for a report or a screen. In order to fulfill that need, the legacy systems are accessed, information is

gathered and that information is fed into the report or screen. This simple scenario is where most organizations are prior to the building of a data warehouse.

INFORMATION WHERE THERE IS A DATA WAREHOUSE

Now consider Figure 2.

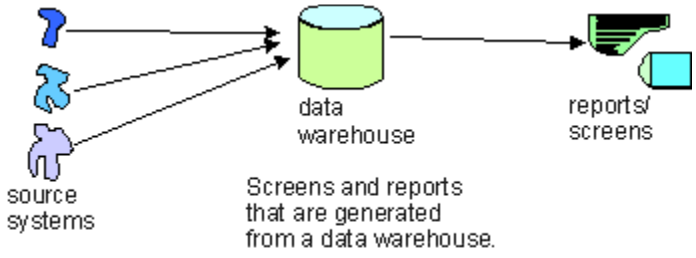


Figure 2

Figure 2 is the same as Figure 1 except that there is a data warehouse. The data warehouse sits between the legacy applications and the report. The legacy applications feed the data warehouse and the data warehouse in turn feeds the report or screen. The only difference between Figure 1 and Figure 2 is the existence of the data warehouse. There is no data warehouse in Figure 1 and there is a data warehouse in Figure 2.

THE COST DIFFERENTIAL

In order to understand the cost differential between Figure 1 and Figure 2, consider the work that has to be done in order to produce a report. Figure 3 outlines the work that must be done to produce a report in the case of no data warehouse.

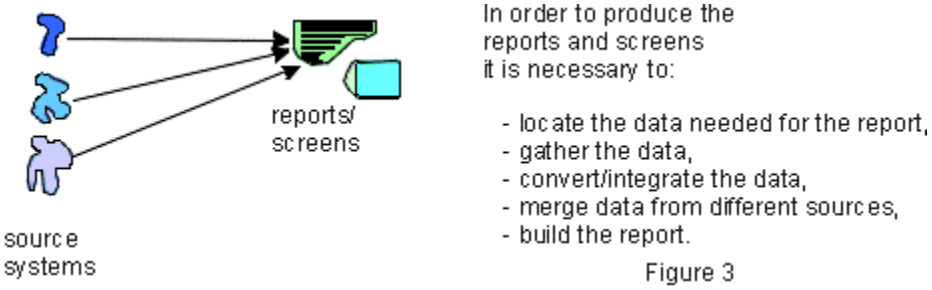


Figure 3

Figure 3 shows that in order to feed the report from the legacy systems environment, the following activities must take place:

- the data needed for the report or screen is located in the legacy environment,
- once located, the data is gathered. This means accessing the data across a wide variety of technologies, such as IMS, IDMS, VSAM, ADABAS, Oracle, DB2, et. al.,

- once the data is gathered it must be converted or integrated. This means reconciling keys, internal encoding values, reference tables, data structures, operating systems, and so forth,
- once converted, if there are multiple sources of data, then data must be merged, and
- the report or screen is produced.

Depending on the state of the legacy environment, how many legacy applications must be produced, and the size and complexity of the report, the cost of producing the report from the legacy environment may be from:

- 2 or 3 months to 2 or 3 years, and
- $100,000 to $2 or $3 million.

In fact the cost of getting information from the legacy environment is so high that many organizations simply give up in frustration.

GETTING DATA WHERE THERE IS A DATA WAREHOUSE

Now consider the costs and activities required to get the same report from the data warehouse environment. This scenario is shown in Figure 4.

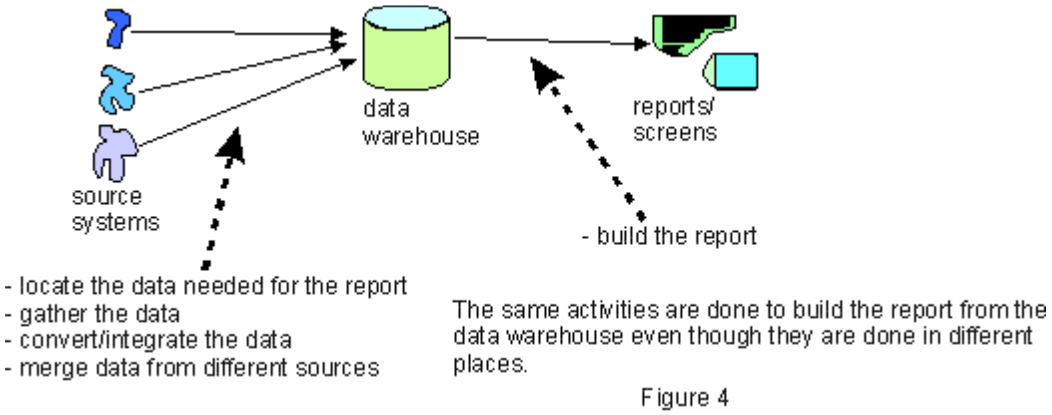


Figure 4

In Figure 4, there is a data warehouse. The report or screen is created from the data warehouse. But in order to create the data warehouse, it is necessary to:

- locate the data in the legacy environment that is needed for needed for reporting,
- once located, gather the data in preparation for movement into the data warehouse. This
- means accessing the data across a wide variety of technologies, such as IMS, IDMS, VSAM, ADABAS, Oracle, DB2, et. al.,
- once the data is gathered it must be converted or integrated as it is moved into the data warehouse. This means reconciling keys, internal encoding values, reference tables, data structures, operating systems, and so forth,
- merging the data, once integrated, that comes from multiple sources.

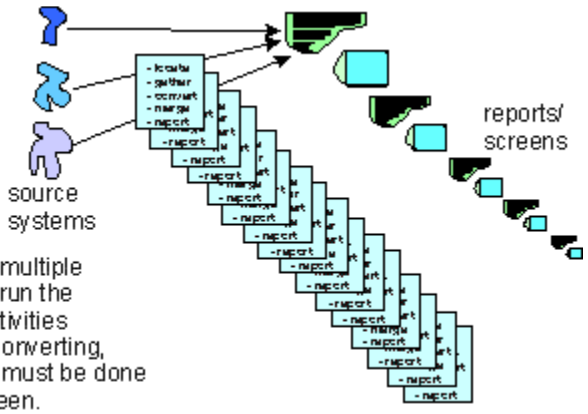
In other words, the first four steps that are done in Figure 3 are also done in Figure 4. In Figure 3 the preparation steps are done to produce the report. In Figure 4 those same steps are done to produce the data warehouse. In fact the only real difference between

Figure 3 and Figure 4 is that the report is issued from the data warehouse in Figure 4 instead of being directly issued from legacy systems as in Figure 3.

MULTIPLE REPORTS

The answer is that if there were only one report to be created, then there is no savings to be made by creating a data warehouse. But the reality is that no corporation operates on a single report. Instead corporations operate on many reports and many screens.

Given the reality of the corporate need for many reports and screens, Figure 5 shows what corporations need.



Any corporation needs multiple reports and screens to run the business. The same activities of locating, gathering, converting, merging, and reporting must be done for each report and screen.

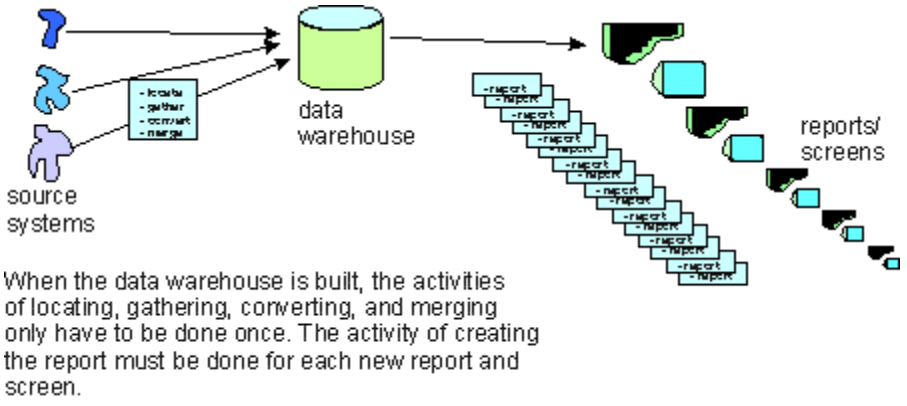
Figure 5

Figure 5 shows that corporations operate on many forms of information. The problem is that EACH report and EACH screen requires its own unique set of transformations. In other words, each report requires its own set of activities that include:

- locating the data
- gathering the data
- converting/integrating the data
- merging the data.

The cost of EACH report and EACH screen then is very high when the source of the data is the legacy environment.

Now consider the costs of reporting when there is a data warehouse. Figure 6 illustrates this set of circumstances.



When the data warehouse is built, the activities of locating, gathering, converting, and merging only have to be done once. The activity of creating the report must be done for each new report and screen.

Figure 6

In Figure 6 data is gathered into a data warehouse. Once gathered into a data warehouse, the data is then available for reports. Many reports are written from the data warehouse.

FARMERS AND EXPLORERS

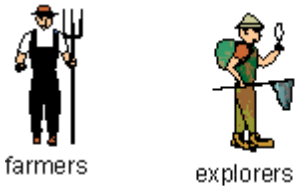
There is another aspect of the cost justification of a data warehouse that needs to be explored. That aspect is: for whom in the corporation is the data warehouse justified in the first place?
In order to answer that question, consider that the corporation has two very different kinds of users – farmers and explorers.

A farmer is someone who knows what they want before they set out to find it. A farmer is predictable. A farmer usually finds what he/she wants. A farmer submits small queries. A farmer seldom finds huge nuggets of information, but a farmer often finds small flakes of gold. If a farmer were a baseball player the farmer would hit a lot of singles, seldom strike out, but only infrequently hit home runs.

An explorer is very different from a farmer. An explorer is the original "out of the box" corporate thinker. An explorer is very unpredictable. An explorer may go six months submitting no queries at all, then one week submit ten queries. An explorer submits very large queries. Often times the explorer finds nothing for his/her efforts. But occasionally an explorer finds a priceless nugget of corporate wisdom that has been overlooked. If an explorer were a baseball player, the explorer would hit a lot of home runs. And correspondingly, the explorer would strike out often.

There are then very real differences between farmers and explorers even though farmers and explorers both use the data warehouse.

Figure 7 illustrates farmers and explorers.



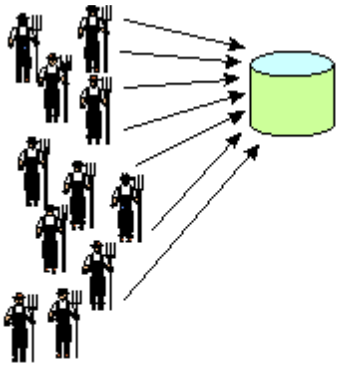
Two members of the DSS data warehouse community are farmers and explorers.

Figure 7

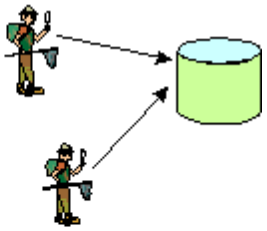
The issue of data warehouse cost justification is very germane to farmers and explorers. Doing cost justification for a data warehouse is almost always done on the basis of the results obtained by farmers, not explorers. Stated differently, doing a cost justification for a data warehouse based on the work of explorers is a very risky and unadvised thing to do.

FARMERS, EXPLORERS AND COST JUSTIFICATION

Figure 8 shows that cost justification for a data warehouse is best done for farmers not



Lots of farmers, each with a high probability of success in finding what they want.



A few explorers, each with a rather low probability of finding something useful on the first and second pass through the system.

Figure 8

explorers.

Why is it that cost justification for a data warehouse is not done for explorers? The answer is that with explorers you never know what you are going to come up with. If by some chance you set out doing exploration and you achieve a spectacular result, then management feels very good about the sponsorship of the data warehouse. But if you set out to do an exploration activity and come up with nothing, then management will feel very bad about paying for the data warehouse. And truthfully, at the outset of an

exploration activity, you never know what you are going to come up with. The chances are excellent that as an explorer, you will not hit a home run your first time at bat.

DATA MARTS AND THE DATA WAREHOUSE

Another issue relevant to the cost justification of the data warehouse is that of whether the organization should build a data warehouse or a data mart. In order to understand the issues it is first necessary to understand what a data warehouse is, what a data mart is, and how they differ.

A data mart is a departmental structure. Typical departments having a data mart are the finance department, the sales department, the marketing department, the accounting department, and so forth. The data in the data mart is designed to be optimal for access for the different users of the data mart. The data warehouse is structurally different from a data mart in that the data warehouse must serve the needs of the entire corporation. The data warehouse is truly a corporate structure, serving many different needs.

Figure 9 shows the architectural positioning of the data marts and the data warehouse.

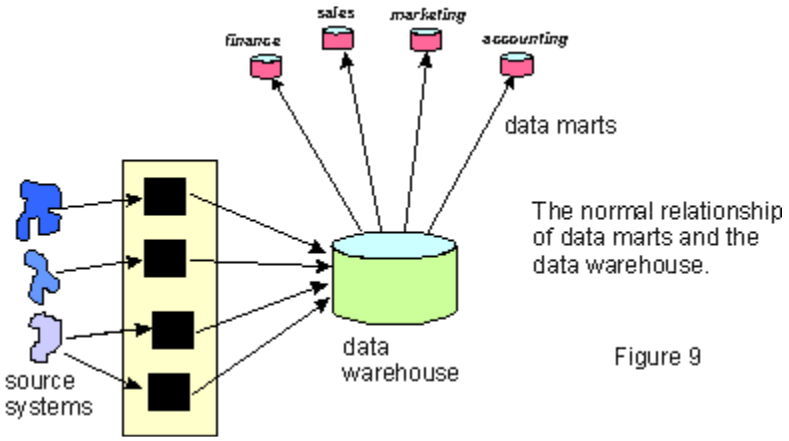
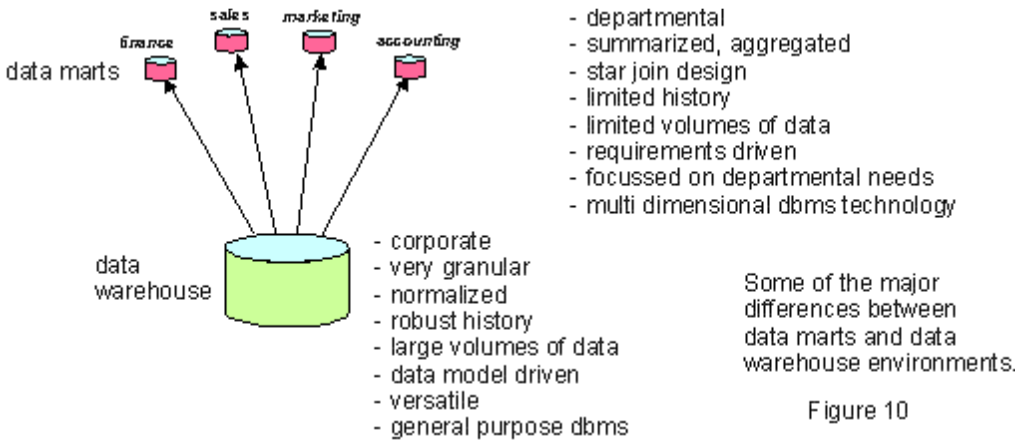


Figure 9

Figure 9 shows that the data marts are fed data from the data warehouse. In turn the data warehouse is fed data from the legacy applications.

There are many fundamental differences between a data mart and a data warehouse. Figure 10 depicts some of the major differences.



Some of the major differences between data marts and data warehouse environments.

Figure 10

In Figure 10, it is seen that a data warehouse contains corporate data, granular data, and normalized data. The normalization of the data in the data warehouse allows the data in the warehouse to serve all purposes.

DATA MARTS AND DATA WAREHOUSES

Data in the data warehouse contains a deep, robust amount of history, typically from five to ten years' worth of history. The data mart contains only limited amounts of history, from one month to a years' worth of history. If there is any great length of history preserved in the data mart it is preserved at the summary level.

The data warehouse contains large volumes of data - up to several terabytes typically. The data mart contains substantially smaller amounts of data, say from five gbs to fifty gbs.

The data warehouse is designed primarily from the data model. The corporate data model reflects the abstraction of the needs of the corporation for information. The data mart reflects specific requirement needs by a department. The different applications of the data mart user and the ways the data mart user needs to access data shape the design of the data mart. The data mart is requirement driven while the data warehouse is data driven.

The data warehouse is very versatile in its usage. The data warehouse serves first one user then another. The data warehouse allows data to be looked at one way, then in the next minute allows the data to be looked at another way. The data mart allows data to be viewed optimally in only one manner. While a data mart is optimal for access by one group of people - say finance, the data is non-optimal for access by anyone else - say accounting, sales, marketing, and so forth.

WHICH TO BUILD FIRST?

The question in many shops becomes one of which do I build first - a data warehouse or a data mart? In fact if I build a data mart first, do I even need to build a data warehouse?

In truth it is possible to build a data mart without building a data warehouse. And the data mart vendors greatly encourage that stance. Figure 11 shows that building a data mart without building a data warehouse is a real possibility.

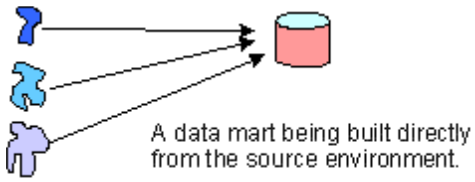


Figure 11

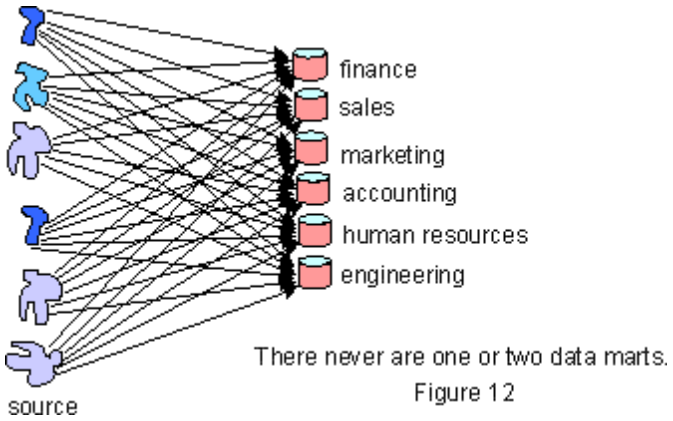
In Figure 11 there are some legacy systems feeding a data mart. Such a configuration is relatively easy to accomplish. And as long as there are only one or two data marts, such a proposition is acceptable. But the problem is that an organization NEVER builds one or two data marts. There are many parts of the organization that will need their own data mart:

- Marketing
- Sales
- Finance
- Accounting
- Actuary
- Engineering
- Production Control
- Human Resources, and so forth.

It is never reasonable to assume that there will be a single data mart in an organization. Therefore, the simple diagram seen in Figure 11 is valid only for a short amount of time, while the corporation is building and operating the first data mart. Very quickly the diagram shown in Figure 11 changes.

MULTIPLE DATA MARTS

As the corporation grows, the diagram shown in Figure 11 turns into the diagram shown in Figure 12.



There never are one or two data marts.

Figure 12

In Figure 12 it is seen that there are many sources of data and many data marts. Suddenly, the interface between the data marts and the source systems turns complex and ugly. If there are *m* sources of data and if there are *n* data marts, then the number of interface programs needed vare *m* x *n*.

But there are other problems with the architecture shown in Figure 12 as well. The amount of detailed redundant data among different data marts is truly significant. Each data mart collects and stores much of the same detailed data as each other data mart. The result is massive duplication of detailed data across all of the data marts.

But the largest inadequacy of the architecture in Figure 12 is the inability to reconcile data. When management asks what revenues were made last quarter, finance says $10 million, sales says $12 million, and marketing says $15 million. It simply is a management nightmare to try to make decisions where there is conflicting information that cannot be resolved.

BUILDING THE DATA WAREHOUSE

One of the incorrect claims made by the data mart vendors is that the data warehouse must be built in an "all at once" proposition. In doing so the data warehouse development becomes an unworkable proposition. But a large development effort is not the way that data warehouses are built, when they are built properly. From the beginning the knowledgeable data warehouse practitioners have warned against the "big bang" approach to the building of the data warehouse.
Instead the practitioners have always advocated the iterative approach to the construction of the data warehouse.

In the iterative approach, first one part of the data warehouse is quickly built and populated. Then another part of the warehouse is built and populated, and so forth. Throughout the development process the end user can use the warehouse and provide feedback to the developer.

In Figure 15 it is seen that first one portion of the data warehouse

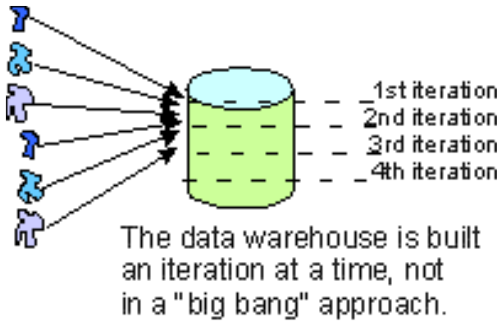


Figure 15

Then another portion of the data warehouse is designed and populated. Then another portion is built, and so forth. It is absolutely against the principles of proper data warehouse development to try to build the data warehouse in an "all at once" approach.

BUSINESS BASED COST JUSTIFICATION

The approaches taken to quantify the development and usage of the data warehouse have previously focused on the "back office" costs, those seen by the IT developer. But there is an entirely different approach to the cost measurement and justification of the data warehouse. That approach is the business based approach.

If a data warehouse is effective, it allows an organization to:

- hold on to and increase market share
- maximize profitability
- minimize expenses.

Since a data warehouse has the potential to accomplish these very worthwhile objectives, then the worth of the data warehouse should be able to be measured in terms of the incremental fall and rise of these measurements.

Consider a variable measured by every corporation – revenue over time. Figure 16 shows a sample measurement of revenue over time.

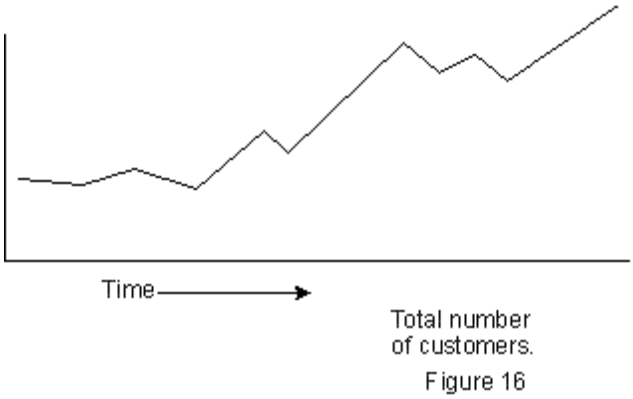


Figure 16

Now suppose that a data warehouse is introduced to the corporation at point in time *n*. Figure 17 shows that the point *n* is marked.

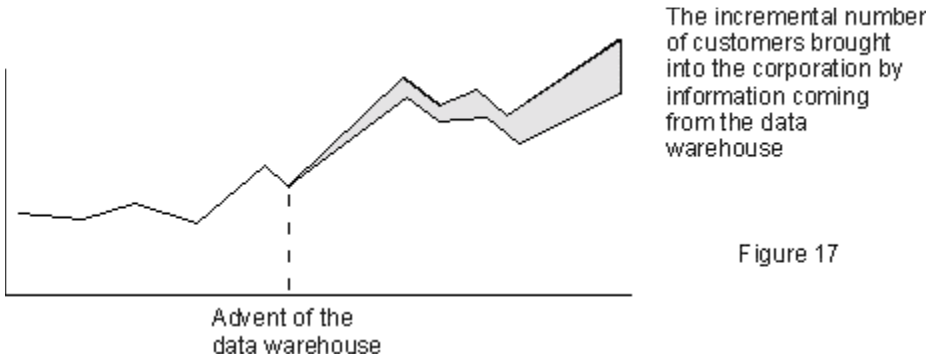


Figure 17

The data warehouse administrator does an extrapolation to management that shows two things – the actual revenue made and the incremental revenue attributable to the information coming from the data warehouse. In such a manner the quantifiable argument for the cost justification of the data warehouse can be made.

CONCLUSION

In this paper, we discuss about the quantifications of the benefits of the data warehouse and data marts for company.

The first approach of cost justification is that compare the general cost of accessing information. We are not say that making decision is not possible who have no data warehouse. But this process is so complex. Because several operations are need for each request, such as gather data, integrate data, merge and summarize data. But with a data warehouse, data must gathered and already integrated and merge. So we can produce report quickly and efficiently from data warehouse.

The second discussion as to the efficiencies and economies of data warehousing relates to the differences between data warehouses and data marts. Where there is a data warehouse there is the opportunity to quickly and efficiently build the data mart. But where there is no data warehouse, each new data mart requires the same construction from the legacy application environment as the previous data mart.

The third approach to the measurement of cost benefits for a data warehouse, are from a business perspective. A data warehouse contains integrated and historical data.

So finally we can easily understand and compare the cost of the data warehouse build and manage with return on investment.

References

1. http://www.carleton.com.au/cost%20justification.pdf [17 August 2017]