

A Study on Successful Business Intelligence Systems in Practice

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Abstract

Although the concept of Business Intelligence (BI) Systems is still emerging, nowadays many global companies like Agfa, POSCO, TDS Telecom and etc are implementing BI systems as their major strategic tool. Most of those BI projects are reaching success, and it is worthwhile to study the success story of those projects and deduct a lesson from them. Thus, this paper analyzes the successful cases for BI solutions provided by various global IT vendors such as Microsoft, Oracle, SAP and SAS. It will describe the BI strategy and the main priorities of BI projects implemented in case companies. We will try to study the success factors of BI through considering different BI cases in different industries and on different platforms. As a result of BI success, we account the tangible and intangible benefits of investing in BI project and observe the real return from implementing it. Through studying the various cases of enterprise BI development, we gain lessons leading to success. So the paper lists several important lessons deducted from the experience of case companies.

1. Introduction

What made people build BI Systems? IBM gives the clear definition of BI: “*Business intelligence means using your data assets to make better business decisions. It is about access, analysis, and uncovering new opportunities.*” [5] So the BI is the system that uses the data banks within some company and derives novel and useful information from those data resources. The need for BI arose from several issues caused by the accumulation of huge amount of dead data within corporations. The historical data stored in massive data storages turned into data tombs and it was no benefit of keeping them. However the introduction of data warehousing and artificial intelligence to those data tombs resulted in the derivation of useful patterns and the discovery of new business opportunities. With the help of data mining techniques, it has become possible to find interesting associations which support decision makers in taking crucial measures toward enhancing their business processes.

Of course, people did not come to BI suddenly. There were two eras passed before the BI spread into our life. The first generation of business information systems was engaged only in operating the daily transactions and had concrete function to be utilized. These systems were usually directed to specific areas of business like sales, marketing, accounting or stock keeping. So the managers had to make their decisions according to standard reports and figures derived from operational databases. It was very time-consuming process and the decisions made were not always accurate and reliable. Basically the main part of business data analysis was the responsibility of human decision maker who, in turn, made decision based on his/her own experience and intuition. Therefore this generation of business information systems is called Host-Based Query and Reporting [5].

The second level of BI evolution was the introduction of data warehouses as a central data storage keeping the historical data in summarized way and involving the time attribute along with each record. This business information system had several advantages over the previous one. Firstly, it was a system separated from operational data and was specially designed for analytical purposes. Secondly, it stored historical data in different levels of summarization while the previous systems handled detailed current data. Keeping historical data in summarized way made data warehouse systems fast and efficient in terms of access and storing the analytical data [5, 6].

Finally, the BI itself came out into the business stage of the world. It had many advantageous features versus data warehouses. While the data warehouses were oriented to technology and the easy access of information without specifying to whom it has been developed so far, BI systems were not only a tool which has been tailored specifically to some business, but also an engine that provided business knowledge through OLAP and data mining techniques. It extremely facilitated the job of decision maker by supporting him/her with new knowledge which has just been mined

out [2].

Therefore many multinational enterprises such as Agfa, TDS Telecom, POSCO, Etos and etc have initiated their BI projects and succeeded in gaining outstanding return. The purpose of this paper is to review the development of BI projects by various corporations and to study the success factors of them. We will also discuss the solutions provided by global IT vendors like Microsoft, Oracle, SAP and SAS. Furthermore we will review the return of BI solutions implemented in case companies. Through the experience of those companies we will draw a conclusion on the extent of successfulness of implemented BI projects and review the lessons learned.

2. BI in Practice

In this section, we will consider several BI cases which have been implemented successfully and will analyze their success. Naturally, nowadays there are many prepackaged software applications that include the necessary functionalities of BI, but it is still not a solution. BI solutions are generally offered by well-known software vendors like Microsoft, Oracle, SAP and so forth. So it is the choice of a company to choose on what platform their BI system is going to run. We will discuss a couple of different BI cases implemented on various platforms.

2.1 Agfa's BI Success Story on SAP Platform

Agfa is one of the world's leading imaging companies. The company develops, manufactures, and markets analog and digital systems – intended mainly for the graphic and healthcare markets. Agfa's headquarters are in Mortsel, Belgium, and the company is active in 40 countries and has agents in another 100 countries throughout the world. In 2003 the company achieved a turnover of €4.2 billion. Success in Agfa's new markets demands constant product innovation and careful control of sales and operations expenses. Furthermore, Agfa is also quoted on the stock exchange and the company therefore requires accurate and timely consolidated financial information [17].

In 2000 Agfa began an ambitious technology and business process reengineering strategy that started to systematically replace its dozens of worldwide transactional systems with a central SAP® R/3® software installation (this functionality is available today in the mySAP™ ERP solution). Further consolidating its IT efforts, Agfa also installed SAP NetWeaver® Business Intelligence (SAP NetWeaver BI) – a component of the SAP NetWeaver platform – for centralized data warehousing and business reporting.

At the initiation of BI project, Agfa determined the main priorities of implementing BI system. So it has to provide the following benefits:

- A single version of the truth
- Confidence that accurate and timely data underpins decisions
- A global view of company performance
- A broader view of key performance measurements

The legacy system of Agfa was designed to process the business transactions related to photography supply business and was running on heterogeneous platforms which have been independently raised on each Agfa's office locally. Definitely that delayed the data gathering and analyzing process and the senior business executives had not received the requested information for strategic decision-making even for months. So putting forward 2 major factors for success: centralized data collection and analysis accompanied by detailed report production, the BI has been initiated.

For that reason, among ample of BI solutions in the market, Agfa chose SAP NetWeaver as it provides all necessary functions and utilities to maintain the operational and strategic business activities throughout the enterprise. As most of Agfa's IT infrastructure was cultivated on non-SAP platform, the initial track of BI implementation concerned with the deployment of SAP R/3 (operating system from SAP). Meanwhile, the European reporting standards has been introduced to branches located in European and Asia-Pacific countries. The countries beyond are still using the legacy system, but in near future Agfa is looking forward to extend its SAP platform to other countries. By the end of European project in 2004, the management information system (MIS) implementation was on its peak while the most of its functions regard consolidated turnover, profit and loss information, balance sheet and headcount reporting issues.

Currently Agfa has a notion of "Corporate memory" which hosts all data regarding the company and its business activities. Data coming from various sources throughout the world is aligned in persistent staging area and then it is passed to two major components. First component is corporate data warehouse which keeps historical records and processes them for strategic decision making. The second component is operational data storage where the current business transactions and operative data are stored, and kept for 3-6 months period. Both data storage components are aggregated in a number of data marts based on their business semantic. The pictorial representation of Agfa's "Corporate Memory" can be seen in Figure 1.

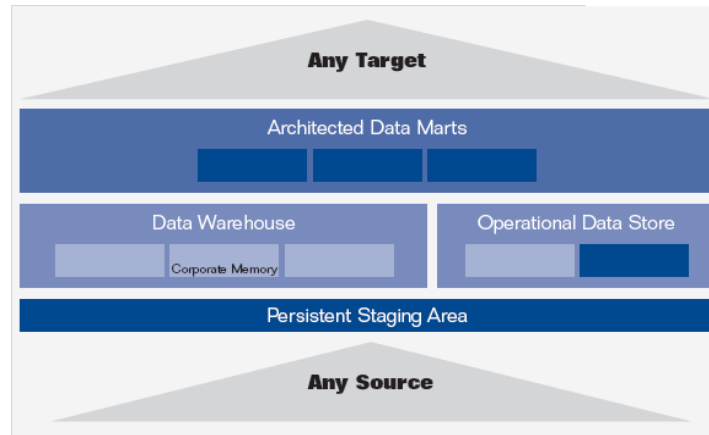


Figure 1. Agfa's "Corporate Memory"

The data analysis process has been facilitated by predefined models in the SAP data warehouse which enables business people to modify their own ad hoc reports based on wide range of data from sources like accounts payable, accounts receivable, general ledger, cost cent accounting, profit center accounting and profitability analysis. In future the MIS for Agfa is planning to integrate more financial information including competitive key performance indicators (KPI). Although Agfa is using legacy CRM, SAP NetWeaver BI component is linked with this system and together it provides customer-centric overview. Agfa is on the way to develop supplier relationship management (SRM) and product life-cycle management (PLM).

In order to centralize all business processes, Agfa adopted a central master data maintenance approach in the SAP NetWeaver BI environment. Agfa also defined standard reports which have to be used by everyone. This eases the comparative analysis process between regions, countries and individual divisions for senior managers. However the local offices still can use ad hoc reports for undertaking local operative decision making. Similarly the clear and single definition of standard terms to express business data eliminates ambiguities and misunderstandings between departments and provides single version of truth.

Agfa refers to three major points in its successful business process reengineering. Firstly it involved key business personnel in determining which reports would be run and which formats they would use. The second key success factor was the tight support of Agfa's board for the project's successful accomplishment. Thirdly during the implementation stage Agfa identified key users who can identify technical and people-related problems and take appropriate actions quickly.

In future Agfa is looking forward to extend its BI system by equipping it with more functionality. For example, it will develop its CRM, SRM and PLM systems on SAP platform. Deploy new data marts responsible for storing KPIs on implementation time of new products, on technical support, and on customer benefit and competitive analysis. Agfa's overall platform for Business Intelligence can be seen in Figure 2.

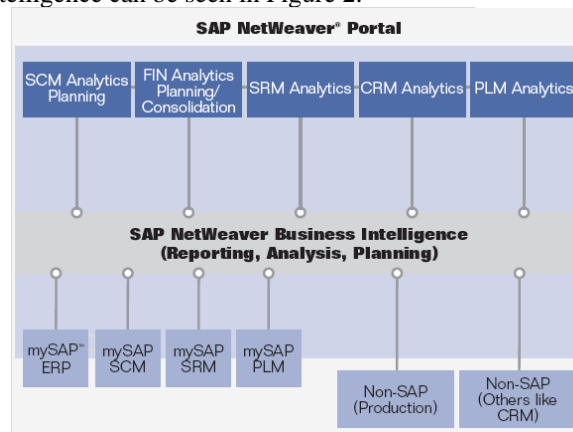


Figure 2. Agfa's Strategic Platform for Business Intelligence on SAP NetWeaver

2.2 POSCO's BI Success Story on SAS Platform

POSCO was founded in 1968 and has been one of the most competitive companies in the world. According to *BusinessWeek* it is titled as "the Master of the Web", similarly in April 2005 *Fortune* honored this organization to call "globally most admired company". Basically POSCO specialized in heavy industry which has two large production plants with around 19 000 employees working to produce 28.5 million tons of steel annually. In 2005 yielded a net profit of more than \$3.6 billion whereas the overall revenue of the company is accounted for \$19 billion. POSCO has 24 subsidiaries and 17 offices around the world [18].

Initiation of BI project has been directed to the implementation of Six Sigma performance strategy. Six Sigma has been developed by Bill Smith, the Motorola's CEO, in late 1980's and it constitutes set of methodologies toward enhancing the quality of production and performance control. Generally speaking, Six Sigma revolves around six basic concepts such as:

- Critical to Quality: Activities aimed at identifying the attributes which are most important to the customer.
- Defect: Identifying defects which refers to failing the customer's expectations.
- Process Capability: Identifying the capacity of each process delivery.
- Variation: Knowing the customers' views and feelings.
- Stable Operations: Ensuring consistent, predictable processes to improve what the customer sees and feels
- Design for Six Sigma: Designing the process toward meeting the customer needs and increase process capability.

Six Sigma has two key methodologies such as DMAIC and DMADV. The former method is aimed at enhancing the existing business processes and stands for Define, Measure, Analyze, Improve and Control. The latter method is concerned with creating new product designs and process designs and acronym of Define, Measure, Analyze, Design and Verify. Six Sigma's practically recognized belief is that 80% of all problems are generally caused by 20% of influencing factors [19].

The essential part of improving the efficiency and competitiveness at POSCO has been directed to process innovation (PI) software which has been raised on SAS platform. Fortunately, the legacy system for PI software has been developed by SAS, but its functions have been restricted to performing only data extraction, transfer and transformation of ERP and legacy data to SAS data warehouse. On the other hand, current PI software developed by SAS implements a Six Sigma Project Tracking system enabling the senior managers to gather and analyze data on the run. SAS automatically gathers and enables the daily monitoring of projects' progress.

PI software deployed by SAS paid off the endeavors through decreasing the standard coil production time by 50% (from 30 to 14 days) and reducing the inventory by 60% (from 1 million to 400,000 tons). The introduction of web-based techniques such as e-procurement reduced the planning and sales cycles.

In 2002 POSCO launched the further enhancement project and used Six Sigma for aligning its business processes with the corporate strategy to satisfy customers and stakeholders. By the end of the project implementation period, the company saved about \$450 million, after spending \$35 million for realization of the project.

SAS provides BI solution with the features of Six Sigma whereas other well-known platforms do not support it. Moreover, SAS has been opted as a platform for BI implementation, because of its capability to deal with large data and brilliant analytical tools which are capable of uncovering nonlinear relationships. Similarly, SAS presents excellent reporting tools assisting decision-makers to grab more information in much comprehensive way. It eases the data manipulation and analysis processes through a single flow diagram that is implemented on user interface. It also enables to choose the best fitting model for some special case.

Traditional statistical analysis could not help to eliminate the scrap losses on the production of hot coil, but SAS along with its analytical power discovered fundamental insights into POSCO's physical processes. As result, it decreased the scrap ration from 15 percent to 1.5 percent, giving \$150,000 return on the investment on this part of the process alone. Likewise, the project launched for identification of reasons for large variations in profitability by plant, item and specification in producing cold roll steel returned \$1.2 million on its investment. By using SAS solution POSCO pinned out those factors critically influencing the profitability and undertook reasonable measures. It also reduced the analysis process and enabled POSCO to make rapid progress on deployment of Six Sigma methodology. Having a real-time insight into the quality of POSCO's performance and harnessing the "intelligent concepts" of SAS in production system, enables the managers to predict problems and correct them before they happen. The contribution of SAS solution to POSCO has been accounted for \$14 million on Six Sigma projects and additional \$1.5 million on other project. For two years this is considered to be impressive result, but company looks forward to gaining much profit from the implementation of BI throughout its business.

2.3 TDC Telecom's BI Success Story on Microsoft Platform

TDC is the Denmark's telecommunication leader with annual revenue of \$8 billion is spread over 12 countries. Recently it implemented SQL Server 2005 to integrate 6 terabytes of data from over 60 disparate sources into one data warehouse and to harvest much knowledge from that data. The growth rate of data is about by 30% annually which is sustained by 3 millions of land-line customers, 2.5 millions of mobile customers, 1 million of Internet subscribers and almost a million of cable television customers [16].

The heterogeneity of over 60 sources scattered throughout 12 countries posed a number of problems in operating several business activities commonly requested by top decision makers. As the company grew, its IT infrastructure became more complex and diverse which made the access to those systems very complicated. Also it was hard to merge data from different sources. Another problem was the absence of single standard for reporting and interpreting the data. It made analysts rather difficult to combine ad hoc reports into one point and analyze the progress. So the analysts had to be experts in many different systems just in order to get the data they needed to study. The company was in need of Business Intelligence system which would integrate the data from various sources and would possess following features:

- Perform extract, transform, and load (ETL) processes on data from all sources and consolidate it into a data warehouse to provide a single "version of the truth."
- Create multidimensional cubes to support data analysis.
- Reduce the cost of analyzing disparate data.

The BI solution provided by Microsoft Corp. with the use of technologies such as Microsoft SQL Server 2005 (65-bit) Enterprise Edition, Microsoft SQL Server Analysis, OLAP and Reporting Services on the Microsoft Windows Server 2003 (64-bit) Enterprise Edition had a new name called CUBUS. New CUBUS data warehouse system found solution for not only above stated requirements but also increased the efficiency of data management and yielded ROI of more than 7000 percents.

Firstly, CUBUS adopted single standard for interpreting the data and met the requirement of single "version of the truth" which was stated above. It integrated the available data into one source which, in turn, maintained the consistency of data. Also even the data is stored in one source the views for that data could differ upon the analyst's preference. This frees analysts from combining different versions of reports by themselves, so they can view all data in the way they prefer. The single standard also included the definition of each data construct stored in separate meta-data repository. That enabled business analysts to understand the context of each data and consequently make appropriate decisions.

Similarly, with help of multidimensional cubes consisting of up to 32 dimensions and 450 billion aggregations, the terabytes of data has been efficiently stored and summarized which led to fast and accurate retrieval of data. The processing time has been reduced by 80% the implementation of a new system.

Moreover the success of this BI project could be proven through high motivation of key business representatives in building such system. The project was highly appreciated, as the most of financial departments were able to figure out how profitable the project is.

2.4 Etos Group's BI Success Story on Oracle Platform

Etos is the major supermarkets chain scattered over Neitherland with its 450 outlets. Before it started to promote brands of other foreign stores, it had operated single database. But with integration of different foreign stores, its overall IT infrastructure has become heterogeneous which consequently posed new challenges. Etos needed a centralized collection point from which to gather information on point-of-sale purchases, product range, pricing, and special offers [15].

The Oracle platform appeared to be the best choice as a ground for comprehensive business intelligence environment which would provide enough capacity to handle increasing amounts of data, enough flexibility to manage data in variety of combinations, and the potential to scale in tandem with Etos' growth. Setting up a data warehouse with Oracle Warehouse Builder, Oracle Database, Oracle Portal, Oracle Reports and Oracle Discoverer, made it possible to access business data in any required combination. Now it has integrated data into one point and it could be viewed by means of graphs and tables. The previous system was weak to support historical data and it made business analysts rather sad, as there was no detailed trace of figures in order to draw the trend. But the present system makes possible to store historical data and facilitates the job of analysts while examining the precise trend.

The integration of information from procurement, logistics, and sales systems made it possible to monitor the actual picture of how every part of the retail business is performing. For example, BI discovered much knowledge about how particular products are selling well in a particular region and how their shelf-position affects sales. The logistics department gained a clear insight into stock history and weekly turnover rates, which enabled the purchasing department

to refine its buying policies. Moreover information in data warehouse allowed monitoring the employees on many factors like absenteeism.

3. Lessons Learned

Through studying the experience of four companies who implemented their BI solution from global IT vendors like SAP, Microsoft and Oracle, we can deduct several useful lessons such as:

- Centralization of data in a corporate data warehouse and its aggregation on several specialized data marts enable quick and reliable access to any requested information. It also makes the process of analysis and monitoring rather efficient and trustworthy.
- The definition of reporting standards for corporate-wide use makes the exchange of information between departments much clear and consistent. Similarly senior managers can benefit of using those standardized reports to compare the performance of branches by region, country or individual division.
- Some predefined report models has to be implemented in order to provide decision makers the functionality to add or subtract necessary elements and build ad hoc reports.
- There should be network of responsible people to align specifications of standard reports with local needs and to facilitate the implementation of BI project. Moreover the close involvement of end-users in the project can result in early identification of technical and business issues that have to be redeemed.
- Also there should be strong commitment from company's board of directors toward standing ready to resolve any conflicts and changes occurred during the project development.
- "Six Sigma" concept is considered to be the recognized methodology aimed at systematically enhancing the performance and decreasing the defect rate in production almost to zero (3.4 defect per million units). Integration of "Six Sigma" techniques into the IT infrastructure of the company will result in robust BI system and ease the monitoring and management processes within the company. We have seen the return yielded from implementing Six Sigma with the use SAS software in POSCO.
- In order to reduce the cost of analyzing data from heterogeneous sources, the IT infrastructure has to be raised on a single platform which is provided by well known companies like Microsoft, Oracle, SAP, SAS and etc.

From lessons listed above we can draw several useful points for BI systems development process. However studying the experience of the companies that launched their BI projects, we can learn more lessons and success factors regarding the BI project progress. Therefore it is worthwhile to consider the case studies regarding the BI success, while studying the success factors of BI.

The experience of studying BI development strategies of most companies exposing some pitfalls in managing BI development. For example, most of BI systems tend to be tailored upon the organizations internal requirements. Although it combines the company's data into one point, it does not deal with external issues like customer behavior, and market situation. But basically BI systems should be directed to analyze the market and customer needs rather than the company's internal technical requirements. All functionalities of BI system have to be customer-centric which means that it has to be directed toward enhancing customers' experience while increasing the efficiency of workflow. BI systems should be purely market oriented and able to grasp knowledge about the customer needs. Also it should involve well-organized CRM system which brings the customer close to top decision maker and makes the strategic vision of business much clear [1].

BI team often gets misled if it considers BI development as a technology project. Generally BI projects are done by IT people who have no thorough knowledge of business and as a result it becomes completely technology oriented project. However the BI should be directed to solving business issues which are traditionally done by business executives. So the business executives define the overall purpose of BI and influence the project's progress. Moreover apart from business executives, many other parties should be involved in order to avoid the failure of BI. For instance, the customers should be the major subject of any BI and departments like Marketing and Sales which are directly concerned with them should be highly involved in BI projects [2].

BI projects should conform to unique BI development methodology which pinpoints project deliverables, goals, milestones and deadlines. Unlike operational business applications, the deliverables of BI project aimed at reaching strategic goals. The technical requirements should be posed in terms of how quickly the data can be analyzed rather than how fast the transaction can be accomplished. The BI applications are data-intensive, so it should do most with analyzing the existing data rather than maintaining data input and output [2, 3].

BI development is an incremental process which never stops getting improved. Usually OLTP systems reach their destination when all functions are completely developed, but for BI there is no set of functions that could be strictly listed. Therefore it should be iteratively improved and enriched with new knowledge base. In OLTP systems, there are

set of business processes and they should be automated through computers while BI systems provide decision support which enables decision makers think of new business processes. So BI creates new business processes rather than implements existing ones.

Even though the process of BI development is iteratively evolving, it has to pass through several steps while being planned. At the beginning of any project, it is natural to gather project requirements which are necessary to clarify the feasibility of the project. As the foundation of any BI system is data, the availability of databases and source files should be examined. The next step should be the cost estimation of overall BI project including the further maintenance of the system which will evolve continuously. At the same time, the risk of the project should be analyzed in terms of its payback period, ROI, NPV and so on [3].

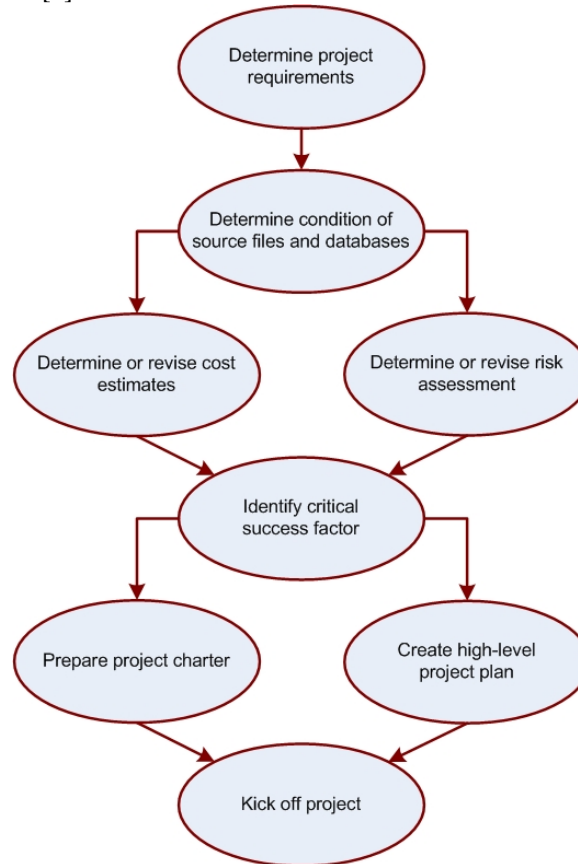


Figure 3. BI Project Planning

If the money invested is to be justified by its risk and reward balance, it is time to identify the major conditions that would support BI success. It may include the willingness of business sponsors, the availability of resources and, of course, required skills in BI development team. Afterwards, the final project charter citing the responsibilities of each team member should be submitted and signed by the key business representatives. In the same pace, the high-level project plan indicating the major time frames and milestones of BI development process should be verified. It might be in the form of Gantt chart. Finally at the last step, project can be kicked off or, in other words, exposed to actual BI development process. The whole picture of the activities included in project planning can be seen in Figure 3 [3].

It is obvious that the knowledge derived from BI system totally depends on inputted data. So the genuineness of extracted knowledge is directly connected to the accuracy of processed data. Many enterprises incur in millions of losses as a result of false knowledge discovered from dirty sources. Therefore proper policy of cleansing the existing data should be issued and implemented. Data cleansing procedures are often practiced while transforming the data from one source to another taking into account the domain or business rules of destination. Some data may not conform to the rules of the destination system and considered as dirty data. So it should be either removed or adjusted to the rules of a current system [1, 4].

Despite how clean is the data, it is worthless if it has no meta-data which describes its context. Meta-data is strictly

required component of any BI system. It is classified into 2 categories. The first category is technical meta-data which describes the technical issues within database or business application. The second category is business meta-data which gives the definition of data and puts it into some context. For example, people understand one thing in different ways, so it is necessary to provide clear reference to any article which is included in data. BI systems usually include meta-data repositories which store the data about data.

BI developers usually strive to implement everything, but in many cases it is hardly achieved and sometimes it causes many problems associated with the continuation of the project or maintaining the bundle of tools which are not rather used. The surplus of different unneeded components overwhelms the BI system itself and makes the utilization of it very complex. There are three major applications should be included in any BI system. Firstly, BI should include tool for extracting, transforming or loading the data from one source to another, or in other words, it should possess ETL services. Secondly, it should store the usable data in data warehouse and analyze it through OLAP services. Thirdly, it should have front-end applications which comprehensively present information and accept queries [1].

It is worthwhile to say that if to take into account all issues that have been mentioned above, the BI project is likely to payoff and to reach its ultimate goals like increase in sales, efficient product development cycle, minimized expenses, better loyalty of customers and, of course, discovery of new business opportunities.

4. Conclusion

To sum up, BI refers to a strategic business information system which searches for novel and effective solutions for given problems by analyzing vast amount of data. From history we saw that there has been 3 eras passed until people arrived at a notion about Business Intelligence. The concept of BI is still evolving and becoming more robust. In this paper, we have studied the experience of 4 companies that developed their BI system and considerably benefited from that. Observing this scene, most of worldwide corporations are to harness their data through developing their own BI system. But in order to do so they have to implement efficient framework for storing and analyzing it. Therefore companies like Agfa, POSCO, TDS Telecom and Etos considered the development of their BI system as a major strategic milestone on their pathway to achieve corporate goals. We discussed their success stories and found out a strong commitment to accomplish key objectives determined at beginning of the project and close collaboration with IT company which provides BI solution behind the success of those companies. Moreover we have deduced some lessons drawn from the experience of those companies. Therefore continuing to research the success of BI projects could be helpful for those companies who are at the edge of launching their BI project.

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