OKAN UNIVERSITY

INSTITUTE OF SOCIAL SCIENCES

BUSINESS INTELLIGENCE APPLICATION ON HEALTH CARE INDUSTRY

Doğan ULUTÜRK

THESIS

FOR THE DEGREE OF MASTER OF

BUSINESS ADMINISTRATION

ADVISOR
Assist. Prof. Mustafa TURHAN

İSTANBUL, Eylül 2011

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Diğer Jüri Üyeleri: 1- Prof . Dr. Mithat KIYAK
2- Doç. Dr. Dilek TEKER
3- Yrd. Doç. Mustafa TURHAN

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ÖNSÖZ

Günden güne gelişmekte olan sağlık endüstrisinde, yönetimsel kavramların da aynı oranda gelişmesi gerekmektedir. Sağlık sistemi içerisinde yer alan organizasyonların daha etkin, daha verimli ve daha adil çalışması için iyi bir yönetime sahip olmalıdır. Bu çalışmada, günümüzde yönetimin önemli bir konusu olan İş Zekası'nın sağlık sektörü içerisinde nasıl uygulanacağını, uygulama esnasında hangi konulara dikkat edilmesi gerektiği belirtilmeye çalışılmıştır.

Çalışma boyunca benden hiçbir desteğini, bilgilerini ve yardımlarını esirgemeyen değerli hocam Yrd. Doç. Dr. Mustafa TURHAN'A, Okan Üniversitesi Sosyal Bilimler Enstitüsü Müdürü Prof. Dr. Targan ÜNAL'A, Okan Üniversitesi'ndeki tüm hocalarıma, Acıbadem Sağlık Grubu yöneticileri ve çalışma arkadaşlarıma ve son olarak hayatım boyunca benden desteklerini esirgemeyen aileme teşekkürlerimi sunuyorum.

Eylül 2011 Doğan ULUTURK

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SUMMARY

BUSINESS INTELLIGENCE APPLICATION ON HEALTH CARE INDUSTRY

Decision making is one of the important concepts of our life. During our life, we made a lot of decisions about our private life and about our business life. These decisions sometimes resulted with good effect, but sometimes resulted with bad effect. While we are making decision, the data that we have, help us. With the help of this data, we made some plans about future to get effective results.

By developing the technology, there becomes a new view for the decision making. Now, we have the ability of getting much more data, and we can make more detailed researches. At this point, the accuracy, functionality and ability of data are effecting our decisions. Business Intelligence applications are decision making system that helps managers to make their decisions. Business intelligence applications which were created for making right decision are affecting the people who work in companies and also work in other companies.

In this work, the importance of the business intelligence in health care sector is told. People are paying more attention to the idea of health. According to this, the environment that is affected by health care system is getting large. The idea of "which decision will be made and how" became more important in health care companies like others. When we analyze the organizations in health care industry, we see that they are more mixed and need to specialize. Having high numbered data parameters makes analyze hard. And this makes making decision difficult. The management of this mixed structure became easier with high functioned-applications.

In this work, first of all some information about health care industry is given. With this information, Deification, objective, services, finance and management of health care system were informed. Then business intelligence was defined. Also there have been given some information about history and methodology of business intelligence. Finally, an application about business intelligence was told.

Key Words: Business Intelligence, Health, Health Care Industry, Decision Making System

Date: 30.09.2011

ÖZET

SAĞLIK ENDÜSTRİSİNDE İŞ ZEKASI UYGULAMASI

Karar verme hayatımızın en önemli kavramlarından birisi haline gelmiştir. Hepimiz, hem özel yaşantımız hem de iş yaşantımız boyunca birçok karar vermişizdir. Bu kararların bazıları olumlu, bazıları ise olumsuz sonuçlar doğurmuştur. Kararların verilme aşamasında elimizde bulunan bilgiler bizlere ışık tutmuştur. Bu veriler sayesinde bazı planlar yaparız ve en verimli sonuca ulaşmak için hareket etmişizdir.

Gelişen teknoloji ile birlikte kararların alınması farklı bir boyut kazandı. Artık, karar öncesi daha fazla verilere ulaşabiliyor ve bu vesile ile daha detaylı bir araştırma yapabiliyoruz. Bu aşamada elimizde bulunan verilerin doğruluğu, kullanılabilirliği ve bizlere neleri ifade ettiği vereceğimiz kararları etkiliyor. İş zekası uygulamaları yöneticilerin verecekleri kararlara ışık tutmasına yardımcı olabilecek karar destek sistemleridir. Yönetimin gün geçtikçe önem kazandığı dünyamızda doğru kararı vermek için oluşan iş zekası uygulamaları, şirketlerde çalışanlar olmak üzere birçok insanın yaşantısını etkileyen bir yapı haline gelmiştir.

Bu çalışmada, dünyanın gelişen endüstrilerinin arasında yer alan sağlık sektörü için iş zekasının önemi anlatılmıştır. İnsanlar gün geçtikçe sağlık kavramına daha önem vermekte, bu doğrultuda sağlık kavramının kapsadığı çevre gittikçe önem kazanmaktadır. Her şirkette olduğu gibi, sağlık endüstrisi içerisinde yer alan şirketlerin yönetiminde hangi kararların nasıl alınacağı önem kazanmıştır. Sağlık endüstrisi içerisindeki organizasyonları incelediğimizde karmaşık ve uzmanlaşmaya yönelik bir yapı olduğunu görüyoruz. Bu karmaşık yapının yönetimi bazı özelliklere sahip olan uygulamalar ile daha verimli hale gelmiştir. Sağlık sektörü içerisinde veri

parametrelerinin fazla olması bu verilerin incelenmesini daha zor hale getirmiştir. Bu da kararların daha zor verilmesini sağlamıştır.

Çalışmada ilk önce sağlık endüstrisi hakkında bilgilendirmeler yapılmıştır. Sağlığın önemi, amacı, sağlık hizmetlerinin sağlanması, bu sektörün finansmanının nasıl yapıldığı ve sağlık yönetimi gibi konularda genel bilgiler verilmiştir. Daha sonra iş zekası hakkında genel tanımlamalar yapılarak iş zekasının tarihi ve metodolojisinden bahsedilmiştir. Çalışma sonunda ise sağlık sektöründe iş zekası uygulamasının nasıl uygulanacağı örneklendirilmeye çalışmıştır.

Anahtar Kelimeler: İş Zekası, Sağlık, Sağlık Endüstrisi, Karar Destek Sistemi

Tarih: 30.09.2011

CONTRACTIONS

SSI	: Social Security Institution
JCI	: Joint Commission International
BI	: Business Intelligence
KRI	: Key Result Indicator
KPI	: Key performance Indicators
CI	: Competetive Intelligence
MIS	: Management Information System
DSS	: Decision Support System
ES	: Expert System
EIS	: Executive Information System
CSF	: Critical Success Factors
OLAP	: Online Analytical Processing
ETL	: Extract,Transform,Load
OLTP	: Online Transaction Processing
HR	: Human Resources
CRM	: Customer Relationship Management
ERP	: Enterprise Resource Planning
IT	: Information Technology
IS	: Information Systems
ISE	: Istanbul Stock Exchange
SAN	: Storage Area Network
EBITDA	: Earnings Before Interest and Taxes
VAT	: Value Added Tax
AAA	: Abdominal Aortic Aneurysm
CEA	: Carotid Endarterectomy
CABG	: Coronary Artery Bypass Graft
PTCA	: Percutaneous Transluminal Coronary Angioplasty

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SECTION 1 INTRODUCTION AND PURPOSE

Decision making is important in every part of life. Every time we have to make a decision in not only our private life but also our business life. With the decision of a manager, a lot of people's life can be change.

Before making a decision, we need to do something. According to some information we make a plan and make our decision. At this time, data is playing a role. Analyzing data is important for making decision. We need to what we have, and what is it for. Unless you do not know what your information means, you cannot make any correct decision. So, very first rule is to understand what you have.

In companies, we call the people who make decisions, as managers. They are responsible for continue of existence of organization. That's why management is a very big responsibility. They have the responsibilities for making decision about company's life. Not only their company, but also other companies may be affected with their decision. While they are making decision, they need to some helps. As we told at the beginning data is very important at this point. But there is a question appears. Which data? Business intelligence can show us which data should be important and help us.

Business intelligence is very important, popular concept nowadays. It brings the data together which is disorganized. When we look at data, we have to understand what does it means. Business intelligence helps us to understand. With the help of this organizing, we can make some comments.

We can use it for branch that is far from central branch. On the other time it helps us to compare our branches with the same standards. Or we can compare people who work in different branches. A lot of different types of information like these.

In this work, a business intelligence application in health care industry was researched. Health is most important thing for people. The importance is further increased with each passing day. So it is a very huge industry.

Health care companies are very complex organizations. This brings hard management. Also there are a lot of data types in this system. It is the reason why making decision is difficult here. With all these things, I think that health care system is one of the best places to see the miracle of business intelligence.

First of all we analyze this industry. We need to see what the health care industry is. According to this, we can focus on how can we use business intelligence in this system. The objectives, functions, types of services, finance and management is researched. Then same researched is happen for business intelligence.

After having some information about health care industry and business intelligence it is time to make an application. In this work, I wanted to tell you business intelligence application in Acıbadem Health Group. It is one of the biggest companies of Turkish Health Care Industry.

SECTION 2 GENERAL INFORMATIONS

2. 1. HEALTHCARE INDUSTRY

2.1.1. Definition of Health

According to World Health Organization; ***health*** is defining as being "A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". (WEB_1, 2010)

According to definition, we can see that being healthy is not only being away from infections, but also being mentally in good condition. During our social situation, everyone should be a healthy person to fulfill their responsibilities. Today, everyone has some responsibilities according to their status. On the other hand, organizations have some responsibilities to individuals according to their purposes of existing. So, there is a connection between individuals and organizations about concept of health. Both of sides must realize and adopt this concept.

One of the objectives of the countries of the world community is keeping individuals to be healthy. To having healthy people is the main reason of social peace and economic development. Because unhealthy individuals cause, loss of labor and increase social spending. Within the law everyone has the right to live in a healthy manner. To ensure a healthy environment to live in public, to protect the environmental health and to ensure the continuation of this is the duty of the state against citizens. According to this, state, have to organize and control health organizations and make them to serve to the citizens.

With the aim of definitions, individuals need to get some services when they became unhealthy person. They need to get help with some way. At this time we face with the health care services. Health care service is; a service that is given by people who trained or educated about health and become health professionals. We define people who give these services as health professionals. Their duty is become individuals healthy.

There are three basic types of health care services. These are, Protection Health Care Services, Medical Treatment Health Care Services and Rehabilitation Health Care Services.

Protection Health Care Services are service that is given to environment for keeping individuals healthy. To provide people a healthy environment is responsibilities of the state. So that kinds of services mostly given by the state.

Medical Treatment Health Care Services are service that is given after the emergence of the disease. That is includes, medical examination for understanding the illness and medical treatment for curing the illness. Also maintenance services after treatment can be a part of this kind of services. That kind of services can be given by state and private industries.

Finally Rehabilitation Health Care Services are service that is given to individuals to maintain their mental health. People who get an illness or accident may have some psychological problems after treatment. These kinds of services are, care about people's mental or psychological situations after treatment. Some kinds of illnesses or accidents, may affect their social life in the future. The aim of these kinds of services, make people mentally healthy and help them to continue their daily life. These kinds of services may give by state and private industries.

2.1.2. Healthcare System

We can explain healthcare system as; all kinds of organizations, institutions, and resources to improve, maintain or trying to get back the health. There are a lot of factor that effect this system like life style, income, education, gender environment etc. because of this factors healthcare system has very close interaction with different industries. Their finance, technology, strategies, productions, human resources, trainings and a lot of things that we can say, have a very close action with this system. To summarize briefly, health care system is, all the people, organizations and sources that work for providing, improving or restoring the health.

2.1.2.1. Objectives of Health Care System

The most important objective of this system is; providing every individual a healthy condition and upgrade existing standards. According to this aim, people have to get healthcare services as much as they need. On the other hand those services must be accessible by the people who need them. These two subjects create a cycle. With this cycle there can be a self controlling and continuously developing system.

Societies need to be healthy, and this criteria is meaning the health conditions of individuals who create this society. So another objective of healthcare system is firstly make individuals then make society healthy.

Other objective that we can imply is effectiveness. “Effectiveness means the capability of producing an effect, and is most frequently used in connection with the degree to which something is capable of producing a specific, desired effect.” (WEB_2, 2010) According to that description using sources effectively is very important. We can see our sources like our weapons of an army. We may have very powerful weapons. But it does not mean anything unless you cannot use them. That shows us how effectiveness is a key point for managing. About health care you may have very good sources to make people health. You may have well educated health professionals, good medicines, and high-tech health care sites. But if you cannot use them effectively, you cannot provide people healthy environment.

Other objective that we can say is efficiency. “Efficiency is the extent to which time or effort is well used for the intended task or purpose.” (WEB_3, 2010) Sometimes completing o mission is not enough to be successful. At that time we need to focus in what conditions we did it. That means we should look up equviliant between our sources and our job. We may finish it. But if making doing it with less sources is possible that means we are not successful. That is one of the key functions of management. Using our facility efficiently help us to serve much more people. That means, making much more people healthy.

Finally we can say equity about objective. “Equity is quality of being fair.” (Quirk, 1987). That means everyone has the right of getting health care service and become healthy. Social groups, different places, gender and nationality can be a reason for discrimination. “Health equity is a new idea for most people. It's not hard to grasp, but it does require us to reframe the way in which health differences are usually presented and perceived.” (WEB_4, 2011) Health care system must provide society equal health services. Also financial aspects of the health system should be fair. Poor people can also have right of getting health services.

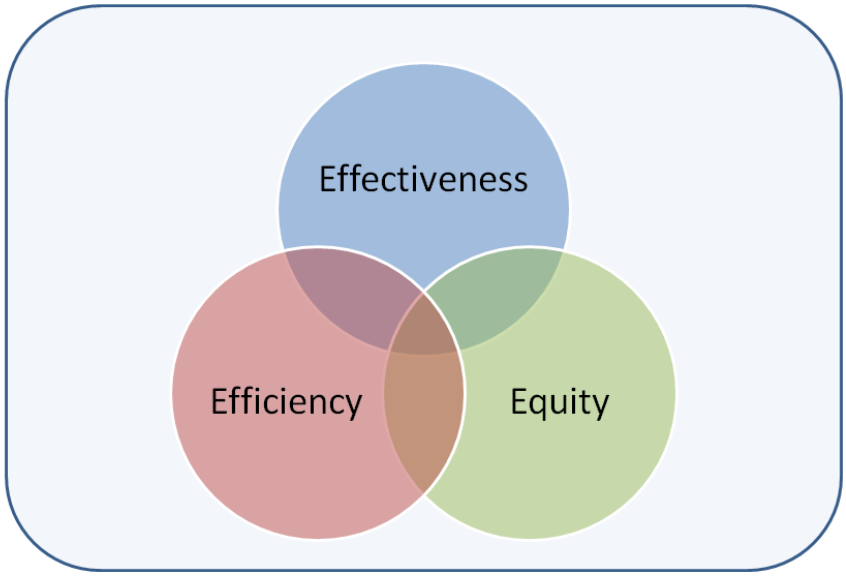

Figure 2.1 Objectives of Health Care System

2.1.2.2. Functions of Health Care System

This system is formed by several functions. We can say personal health services, community-based health services, finance or health care strategy. On the other hand we talk about the functions of the management. Generally, we can say health care system is a kind of organization. So, planning, organizing, leading and controlling are also functions of the health care system.

Personal health services are, services which’s given by health care system to individuals. Protection Health Care Services and Medical Treatment Health Care

Services can be some examples about these kinds of services. Community-based health services are the services, which's for groups of society. The aim is, making people healthy. Taxes and laws can also example for this. On the other hand we can say creating sources as a function of this system. There can be different sources for this. Human resources, medical sources like medicine or medical services, buildings, medical devices, vehicles, etc. all these sources are the functions of this system. At this time we realize that finance is another function. All this functions there must a financial source. So finance is another important function of this system. Taxes, which's example for community-based health services, can also example for this function. Incomes, social security community, government, private insurances, foreign investments can also example for this function.

On the other hand, the functions of the management can also be the functions of the health care system. As we said, we can see this system as an organization. Also there are a lot of organizations in this system. So, planning, organizing, leading and controlling are can be other functions of health care system.

"Planning is the act of determining the organization's goals and means for achieving them." (Draft, 2008) This system is not only an organization but also having a lot of organizations. So there must be good planning. Because, health is very important for people. We have to plan every situation. For general there must a goal for planning. In organizations the very beginning of the planning is setting a goal for the organization. This system, goal is already set. It is very clear, "make people healthy". According to this goal and for the other functions there must be a good planning. The second function of the management is organizing. "Organizing is the deployment of organizational resources to achieve strategic goals." (Draft, 2008) After planning we need to organize our resources. Making the parts of the system, giving responsibilities, creating a chain of command, work specialization, laws are simple headlines of this function. The third function of the management is controlling. "Controlling is the systematic process through which managers regulate organizational activities to make them consistent with expectations established in plans, targets, and standards of performance." (Draft, 2008) Controlling is one of them most important function for all organizations. Because of not having good control effort, a lot of organization had to finish their existence. "Control is

an important issue facing every manager in every organization." (Draft, 2008) As health care system, control is very important function. Most of the things are happening about states for this function. On the other hand there are several international controlling communities are playing role in this. In health care system we can say JCI as an example. Feed forward control, concurrent control, feedback control, financial control, quality control can be some headlines about this function. The final function of the management is leading. For leading there must be some people to manage organizations. Leadership is the most important qualify that those people must have. "Leadership is the ability to influence people toward the attainment of organizational goals." (Draft, 2008) There are a lot of organizations and a lot of processes in to this system. According to this, with the importance of health, there is very important function for this system. "Leadership is not simply ordering people: go here, does that. A leader must also guide the culture and spirit of a company or business. A manager must lead with ideas and be an embodiment of those ideas." (Draft, 2008)

Figure 2.2 Functions of Health Care System

2.1.3. Providing of Health Care Services

In Turkey, health care services provide in to three different steps. As general, ministry of health is responsible about planning and controlling these steps.

For the first step health care services, there are small health units, health clinics, dispensaries, occupational physician and small private clinics. These units are providing people general health services. On the other hand, Protection Health Care Services which are included general health services are given by the ministry of health, universities and private health organizations. Second step includes, state hospitals, private hospitals and military hospitals. The services which should give to inpatients, being a part of second step services. Third step health services are given by education and research hospitals. Especially university hospitals are place in this step.

In Turkey there are two main providers of health care services. One of them is state and another of them is private sector. In private sector, there are individuals and organizations. But nowadays, the number of individual is decreasing. The main reason is technologic development, increasing the number of proficiencies and needing of large capital.

2.1.3.1. Providing of Health Care Services Given By State

Ministry of health is the most important health care service provider of our country. The hospitals of the state give the biggest part of the health care service. Ministry of health is the general provider of first and second step health services and the only provider of the protection health care services. The general finance is providing by Turkish Government Social Security Institution.

2.1.3.2. Providing of Health Care Services Given By Private Industry

Private industries are other health care service provider of our country. With our laws, everyone has the right of choosing institution and doctor while getting health services. With giving health service by the private industry, it is possible to using our country's sources effective and efficiency. That is the most important point of the existing private industries in to health care system.

In private industry health care services are giving to people with certain amount. And people can get health services if they want. On the other hand, private providers may get an agreement with SSI then people may get health services without paying any money or with paying less money than it is.

2.1.4. Health Services Financing

Finance of this system is the key point of using sources effective and efficient. There is greater investment for health care industry in developed countries. We see that, the investment rate is same with the ratio of care for people's health. Health care spending is increasing day by day. The most important problem of this situation is how we can finance it. With this increasing, we need to find more financial sources. At this point organizations have to determine the sources that they allocate previously. It helps to organizations to make their plans.

Location	Time Period	Per capita total expenditure on health at average exchange rate (US$)	Per capita government expenditure on health at average exchange rate (US$)	Per capita total expenditure on health (PPP int. $)	Per capita government expenditure on health (PPP int. $)
Afghanistan	2009	51	11	69	15
Algeria	2009	268	231	544	469
Angola	2009	204	181	316	281
Argentina	2009	730	485	1.387	921
Australia	2009	3.867	2.711	3.382	2.371
Bangladesh	2009	18	6	48	15
Cameroon	2009	61	17	122	34
Canada	2009	4.380	3.009	4.196	2.883
Chile	2009	787	368	1.172	549
China	2009	169	85	309	155
Colombia	2009	323	272	569	479
Congo	2009	70	38	126	68
Cuba	2009	707	658	503	468
Ecuador	2009	255	124	503	244
Egypt	2009	112	46	282	116
Ghana	2009	53	28	122	65
India	2009	45	15	132	43
Indonesia	2009	55	29	99	51
Jamaica	2009	231	129	383	214
Japan	2009	3.321	2.657	2.713	2.170
Kazakhstan	2009	330	195	554	328
Kenya	2009	33	11	68	23
Kuwait	2009	1.416	1.189	1.498	1.257

Table 2.1. Expenditure of Countries for Health Care (WEB_5, 2011)

(Attch._1)

2.1.4.1. Objectives of Health Services Financing

The main objective of health services financing is, create adequate and sustainable sources for the individuals. People who need health care services should reach these sources when they need. On the other hand using these sources effective and efficient is another objective. It is important that people should not loss their economic situation while they are having these services. As we told at the beginning, everyone has the right of living healthy. At the beginning, the aim of the health care system is, to give everyone equal financial sources. But in the long run, some problems were happened about getting financial sources. So it effected people's economic situation. Because of not having enough sources, causes appearance of contributions.

2.1.4.2. Functions of Health Services Financing

There are three basic functions in health services financing. These are, revenue collection, pooling of funds and to paid service providers.

Revenue collection is getting sources for the health services. This function identify, how much money should be collected from whom. Private insurance premiums, compulsory health cuts, optional deductions about health, personal payments, credits, grants can be some examples about this. After collections, these sources collect in a pool. Private insurance companies, or ministry of health, SSI can be some example about this. And finally this founds pay to service providers.

2.1.4.3. Types of Health Services Financing

Despite the endless needs of individuals and communities to health care services, resources that allocated to these services are always limited. This situation forces the countries to give importance to financing of health services. Today, the subjects like; the way of financing health services, the way of organizing this and the types of financing in different countries, are very popular about health services financing.

There are two general types of health services financing called, direct method of financing and indirect method of financing.

2.1.4.3.1. Direct Method of Financing

In direct method of financing, there is a money transfer between service producer and service consumer. This method means that the individual who gets health services, pay for the service directly. It is possible to get health service directly for the people wherever they want.

It is very easy for wealthy individuals to get these services. The advantage of this method is people do not have pay any payments before. But it is very clear that, this is obviously a risky situation. Needing of health is sudden and coincidence case. Generally people cannot predict it. In this way, people may get difficult economic situation.

Nowadays, it is very hard to direct method of financing. Especially in treatments that requires technology, surgeries or transplantation services are very expensive. That kind of high cost services should be provide by large funding. This large funding can be SSI for our country or private insurance organizations. There are only high-income people can pay these kinds of services by themselves.

2.1.4.3.2. Indirect Method of Financing

In indirect method of financing, there is one more side into money transfer. As we told, in direct method of financing there are two sides. One side gets health service, other side provides health service. In indirect method of financing third side is responsible of paying money. So in this method, there is a risk sharing. Expenditures are sharing with the organization. This advantage is current for every individual who contributed to these organizations.

In generally, general taxes, special taxes, premiums, consumer contributions and grants are the financers of this method.

Basically we can talk about three types of indirect method of financing. These are participation of employees to health services financing, participation of employers to health services financing and participation of state to health services financing.

2.1.4.3.2.1. Participation of Employees to Health Services Financing

Individuals or groups are important consumer of the health care services. The main idea of this method is, premium that paid before will help them while getting health services when they need. People's payments will be the financer of their health service expenditures. People, who do not make any payment in this fund, will not get any financial help. So they need to pay their payment every time and should not make any delay.

Premium rates can be determined by the state, as determined by the institutions. Employees can pay it directly to state or private institutions. Or it is possible to cut from their salaries by the employers.

2.1.4.3.2.2. Participation of Employers to Health Services Financing

In this part, employer may extra premiums in addition to employee's payment. Also employers should pay extra premiums for their industry that they work. It is a kind of taking action against business related diseases.

2.1.4.3.2.3. Participation of State to Health Services Financing

At this section, state may extra premiums in addition to other payments. In This type of participation state is playing a role of third side in financing. It shows that, state must carry with the health of public. So, sometimes state becomes third part of financier in this system.

2.2. BUSINESS INTELLIGENCE

2.2.1. Introduction of Business Intelligence

2.2.1.1. Definition of Business Intelligence

Business Intelligence term (BI) is used for all the skills, applications and practices, in other words for an integrated mechanism that used to help a business have a better understanding of its commercial situation.

In general BI refers to collected information itself. BI often aims to support decision making. By the abilities of Business Intelligence, the historical, current and predictive views of business operations can be provided. Thus BI system can be called a Management Information System.

2.2.1.2. Definition of Corporate Intelligence

The term Business Intelligence can be used as a synonym for competitive intelligence (CI). CI is a similar term that can be described as actions of gathering, analyzing, and applying information about products, domain constituents, customers, and competitors for the short term and long term planning needs of an organization.

2.2.1.3. Definition of Business Intelligence 2.0

The term Business Intelligence 2.0, which is a term that refers to new tools and software for business intelligence that enable, among other things, dynamic querying of real-time corporate data by employees, and a more web- and browser-based approached to such data, as opposed to the static reports and proprietary querying tools that had characterized previous business intelligence software, raised in the mid-2000s. Business 2.0 takes its name from the Web 2.0 technology as it uses the abilities of Web 2.0.

2.2.2. History of Business Intelligence

Business Intelligence (BI) term firstly used in 1958 by the Hans Peter Luhn, who was an IBM researcher. He defined intelligence as "the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal." (Harris, 2007)

In 1989 Howard Dresner, who is a Gartner Group analyst, came up with BI term as an umbrella term to describe "concepts and methods to improve business decision making by using fact-based support systems." (Harris, 2007)

In these days, BI system is the most complex and efficient Management Information System among others. Figure 2.3 shows the development of a management information system through the time, and relevant complexity levels.

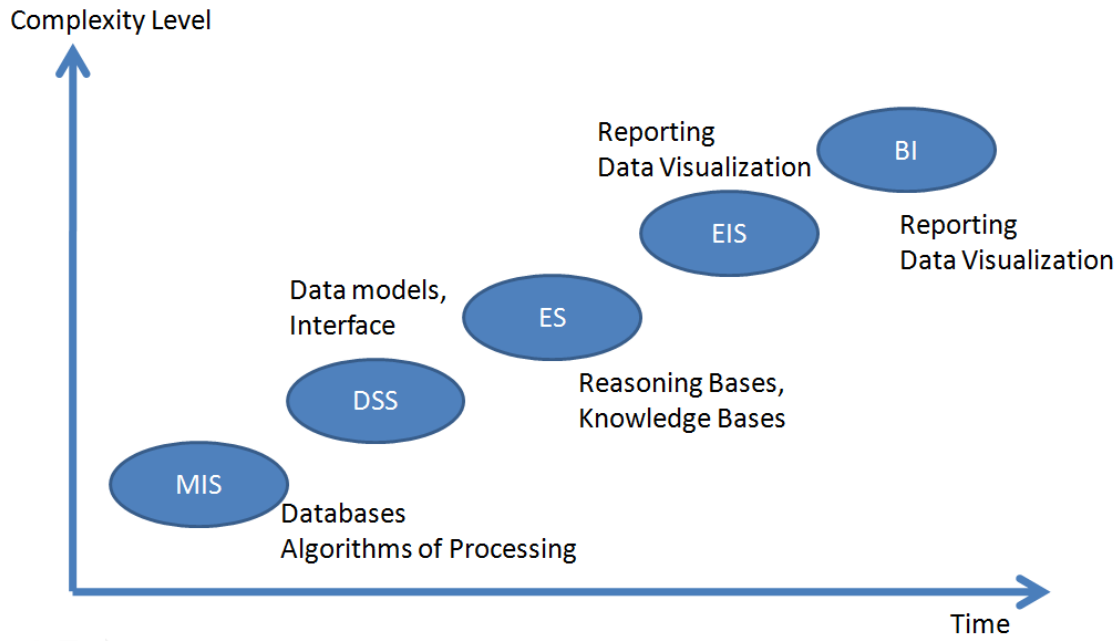

Figure 2.3 Developments of Management Information Systems.

In these days the socio economic reality has made organizations face some necessity to look for solutions that would be effective acquiring, processing and

analyzing the big amount of data that came from different independent sources and that would become a basis for discovering new knowledge.

Existing management information systems like MIS, DSS, ES and EIS have not always met decision maker's expectations such as making decisions under time pressure, monitoring competition, carrying out constant analyses of numerous data and considering different variants of organization performance.

They cannot handle the integration on different, distributed and heterogenic data well. The reasons for that are improper techniques of data acquisition, analysis, discovery and visualization.

On the other hand; Business Intelligence systems provide techniques for satisfying the needs of contemporary organizations. Main tasks that are to be faced by the BI systems include intelligent exploration, integration, aggregation and a multidimensional analysis of data originating from various information resources.

BI systems combine data from internal information systems of an organization and they integrate data from the different environment such as databases, portals and statistics.

Researches show, BI systems improves information flows and knowledge management. In addition BI systems make organizations be able to follow the profit, expenditures, corporate environments, and also find out failures or anomalies in the business processes.

2.2.3. Methodology of Business Intelligence Systems

BI implementation methodology includes 4 steps. These steps are “identifying the key business drivers”, “assessing the situation and course of action”, “developing the implementation plan” and “implementing the plan”.

Figure 2.4 shows the detailed roadmap to establish and implement a Business Intelligence project on institutional level.

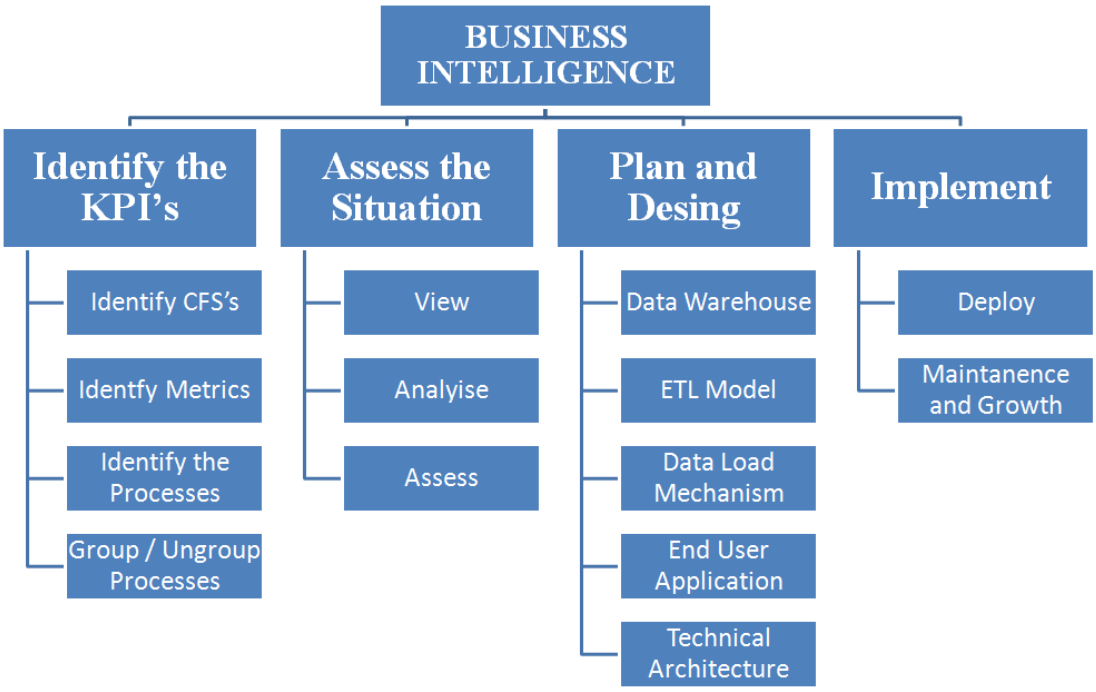

Figure 2.4 Business Intelligence Project Roadmap

2.2.3.1. Identifying the Key Business Drivers

Key Business drivers are the processes which have the maximum effects on the success of an organization. They bring up results that are directly towards to the business goals. An organization should always consider these processes to remain

competitive, and always excel these drivers in order to be successful on business both now and the in future.

Management teams in organizations have a deep knowledge about the key business processes. Thus they can improve the processes by planning and allocating resources as these improvements have the greatest effect on the business of the company.

In general a company can have a maximum of 12-15 key business processes. These processes can be general or specific. General processes may be generic across the industry that the company competes. Generally these appear along the value chain. A company may also have specific or distinct key processes. These processes are related with the company's specific issues and they are different when compared to its competitors. Distinct key business processes can address concerns of pursuing new opportunities, challenges that it needs to counter owing to its unique geographic location, market positioning, future aspiration, technology.

Following framework can be followed by the management team to identify and understand the key business processes of their organizations.

- Identify critical success factors (CSFs) to achieve company's objectives. These are performance drivers which have major contribution towards accomplishment of company's objectives.
- Identify metrics for measuring the critical success factors – these amounts to establishing organizational key performance indicators (KPIs).
- Identify the processes that deliver the above drivers for performance or KPIs.
- Group or un-group related or un-related processes and give them names which convey the activity or operation that gets done. These are the key business processes of a company.

2.2.3.2. Assessing the Situation and Actions

Assessing the situation is about linking the useful facts and inferences and filtering out irrelevant information. By gathering the business knowledge and gaining

the ability to see the big picture, decisions can be optimized and set in the context of the Business Intelligence. For a business to achieve optimal performance across all functions, executives and managers must be able to view, analyze, and assess how the business is operating. So the Business Intelligence System must be designed with knowledge of these terms in order to give the users the ability to optimize business processes and affect results in real time. To understand the business processes, interviews can be used. Interview can be conducted both the high level directors and professional team leaders of the organization. The synergy generated from these interviews can be very productive. For example, for manufacturing and procurement professionals to manage the supply chain more effectively, they need the tools to see and analyze customer orders, materials, and labor costs.

2.2.3.3. Developing the Plan

The development process of Business Intelligence Systems depends on the system complexity. On the other hand, in most cases creation of a BI system which is customized to the specific business requires a lot of time.

BI system design consists of several stages, so it doesn't mean to design the individual interfaces only.

Consistency and application logic are also very important stages of the designing phases as well as building a data warehouse which performs functions like a repository for further analysis and a base for the BI System.

To design the data warehouse, a scope should be set about the data to be stored, and also interconnections between data among different distributed systems should be defined. This step is very important for consistency.

Designing a data warehouse is also needed in order to provide an easy environment for database related reporting and querying mechanisms.

The design is suggested to aim at reaching a model of a star or snowflake that simplifies further implementation of data warehouse mechanisms.

Data warehouse should be systematically updated to include data that from different distributed systems. Thus, systematic data loads and update mechanism is also

another process to be designed before implementing the BI system. Such an extraction, transfer and load mechanism is called ETL. There are several ways for doing this, from developing custom processes to the more often used way of implementing ETL tools. Building a successful ETL requires security, lineage, compliance, legacy and other technical aspects to be considered. Also error control and inconsistency check mechanism should be considered while designing the data import model.

The individual roles of the project team members should be assigned. These team roles are usually application lead developer, data administrator, database administrator, project leader and business analyst. Except business analyst, all the roles assigned to the technical IT staff. On the other hand, business analyst role has a structure that is somewhere between the technical staff and management. Business Managers reports their needs and their expectations back to the Business Analysts. According Business analyst's feedbacks, the application, interfaces and data models are designed.

The BI tools that will be used on the project should be chosen, and the project group should be trained on the relevant processes before starting the development. Before implementing the project the test scenarios should be determined, and the test results should be reviewed.

Following is the set of things to consider before preparing for production:

- Production databases and production libraries should be defined.ETL processes should be defined and scheduled as daily, weekly and monthly. Operation staff ready should be ready to take cover.
- Backup, recovery and disaster recovery plan should be prepared and tested.
- Performance, security and data growth monitoring methods should be prepared and ready to be used.
- Business people should have been received training on using BI application, and BI Project team should have been received training on using the relevant BI Tools and System components.
- A security plan should be prepared and reviewed.

2.2.3.4. Implementing the Plan

Implementation phase of BI projects usually consists of two processes: Deployment and Maintenance, which are two steps which never end along the life time of the BI project. Requirements for new developments are always requested from the management team, and maintenance is also required because of the complexity of the system.

Deployment process is actually making it live what's designed and planned in the design phase. While deploying the BI system in to the live environment, a systematical path should be followed. In other words, Implementation phase should be remaining true to the implementation plan.

After the deployments have taken place, monitoring, administration, optimization, patching, diagnosing, debugging and scheduling the ETL process phases begin. All of these maintenance phases should already be planned, designed and tested while building the implementation plan.

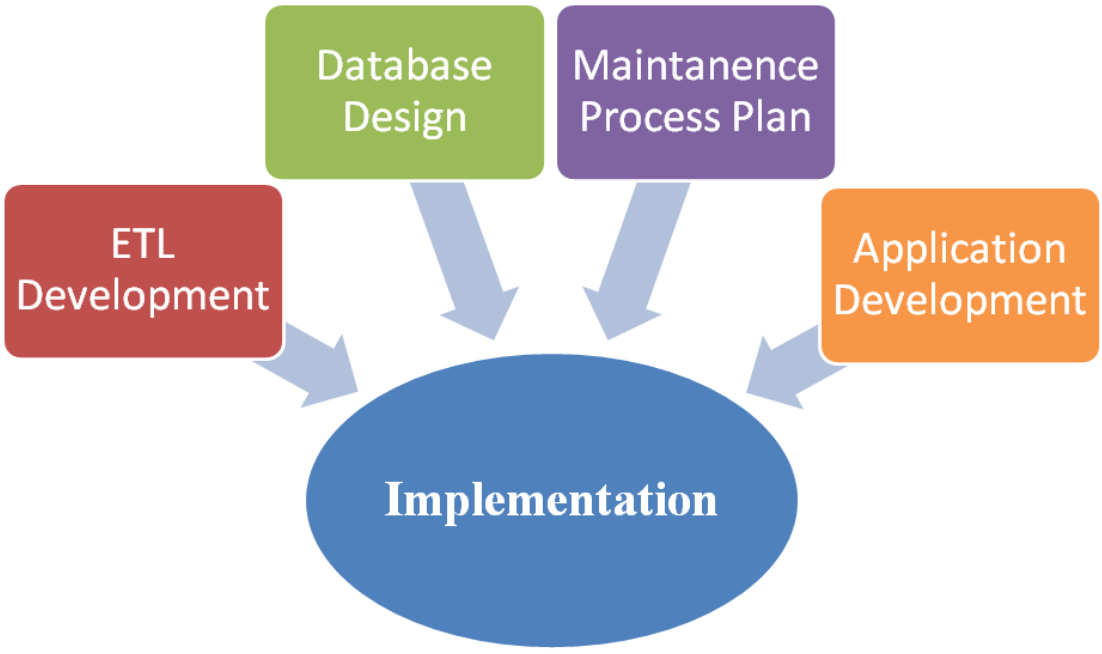

Figure 2.5 Design and Implementation Phases

2.2.4. Business Intelligence Implementation

Implementation of BI System‘s is a detailed process and a big scale of effort should be undertaken. In a detailed point of view following are the stages for the implementation phase:

- Data warehouse and BI Reporting
- BI Analytics
- Information structure

Business Intelligence Reporting, Analytics and interconnecting the distributed data across different data source which is an approach based on the information structure are the key points of implementing the Business Intelligence project. The effort that should be undertaken depends of the system complexity and the required needs of the management team of the company that BI project will be implement on.

2.2.4.1. Data Warehouse and Reporting

Building a data warehouse is a very important stage of implementing the BI project. The data warehouse is used as a database which feeds the BI applications, and has a big role on visualization of the data resources. The forecasting, automatic-rapid reporting and planning abilities of BI is based on the data resources in data warehouse which include the data from the data sources along the enterprise.

Data warehouse design is also important because properly designed data structure will provide easy configuration of reporting and querying mechanisms.

	Data Warehouse characteristics
1	Designed for analysis of business measures by categories and attributes
2	Optimized for bulk loads and large, complex, unpredictable queries that access many rows per table
3	Loaded with consistent, valid data; requires no real time validation
4	Supports few concurrent users relative to OLTP

Table 2.2 – Data Warehouse Characteristic

While loading the data to the data warehouse, it's also being reshaped, reorganized and consolidated, so analytical reports becomes simple and more efficient.

Technologies like online analytical processing (OLAP) and data mining should be used in the construction phase of the data warehouse. OLAP provides a multidimensional view of data. These dimensions are designed for the interests of queries posed by the BI system Reports and analysis, so there is a big performance gain even if querying 10 millions of rows of data.

On the other hand, data mining is a technology that has advanced internal algorithms to analyze the data directly (not dimensional) and expose interesting information for analysis. For example, in manufacturing industry data mining can be used to find customers who are more likely to buy a new designed product.

Data warehouse should be based on a dimensional model, so the dimensions should be gathered before implementing the warehouse. Detailed, summarized and consolidate data from multiple sources should be stored in the data warehouse while retaining consistency as well as focusing on a single subject like finance, sales or inventory.

The methodology of dimensional mode, which is based on two terms: Fact and dimension, is a set of detailed business facts surrounded by the multiple dimensions that describe those facts. In other words it s based on looking to the same data from a different point of view (dimension). That is, dimensions separate the attributes associated with facts into logically distinct data groups such as date, products, and customers.

For example, in marketing industry sales can be a fact. On the other hand sales respect to customers, sales respect to promotions, sales respect to date, sales respect to channels and sales respect to product can be the dimensions of sales fact.

Figure 2.6 shows the relationships between fact and dimensions.

Figure 2.6 Fact and Dimensions

Dimension data is relatively stable. That's, it s not changing rapidly. On the other hand, there are some kinds of business events that will cause the dimensions to change. Effects of these changes can cause some issues.

That's why the changes on the data warehouse must be managed. The term "slowly changing dimension" is used for discussions about these issues and solution methods.

Design approaches for dealing with slowly changing dimensions can be categorized into the three change types:

- **Type 1 :** Overwriting the dimension record with up to date value
- **Type 2 :** Adding a new dimension record for the update value
- **Type 3 :** Creating new dimension attribute to hold the old data in the dimension record

Type 1:

Changes that overwrite the dimension record can affect analysis results if the changed attribute is a grouping attribute used for analysis (Analysis key attribute). These kinds of changes can hide the valuable information like the old prior value of an attribute.

For example in banking, changes on credit limits of customers should not be lost, so differences of behavior before, during and after the change of credit limits should be available to be explored.

On the other hand changes to a dimension attribute that never used for analysis will not affect the results, so simply updating (overwriting) the data will work for maintenance.

Type 2:

Changes that add new dimensions record cause the data to be partitioned historically. That is, old value of the attribute must be available because it will be used for analysis, too. Consider this example: In a health organization, doctors get commissions by surgery they have done. These commissions are summarized by the hospital that the doctor works for.

When a doctor is transferred from one hospital to another hospital in the organization, the historical commission data must remain applicable to the prior hospital, and new commission must be applied to the doctor's new hospital. In addition the total commission must remain available regardless of the number of hospital that doctor worked in.

The solution for type 2 is to retain the existing data in dimension, and add a new data to the same dimension. These records can be separated from each other by including some control fields to the dimension.

Of course, some reports and query can be affected because of a type 2 change. In the doctor example, existing reports that summarize the commission by dimension records will show two entries for the same doctor. So, the reports and query affected must be modified in order to remain true.

Type 3:

Changes are tracked in additional columns, so old data will remain in the same dimension record. Often original and current values are stored

. In this type approach the necessity to hold multiple records for a single entity disappears.

However, because the intermediate values of changing data is not retained, there a historical shortage occurs and also because the additional columns, the reports and queries becomes more complex.

Dealing with slowly changing dimensions using Type 1 and 2 solutions can address all the situations and there is no need to apply Type 3 solution because Type 2 already covers the solution addressed by Type 3 and even more.

Once the data warehouse is constructed, reporting phase comes into play. In a BI project there may be simple and sophisticated reporting needs. Reporting activities should be taken care of by BI tools, so selection of necessary tool is needed and it is also a difficult task. While choosing the BI tools for reporting, functionality, solution complexity and compatibility of the relevant tool should be taken into consideration.

Organizational reporting needs are also one of the important things for the optimized selection. Selection of BI tools is process that requires good market knowledge of BI. In these stages asking the BI consultants for advice can be useful as well as observing some processes of consolidate providers.

Examples of some BI development tools are: Sygate Analyst (data visualization), Agatha Reports (reporting tool), Oracle BI, Oracle Apex (web application builder, and reporting) and so on.

The tools above are the complementary tools, which can be used as an infrastructure that can be used for developing the BI applications for reporting and visualization.

Purchasing a ready to use product is also another possibility, if it covers the project needs.

Reports can cover data from a wide range of data sources, such as Business Intelligence Data Warehouse, existing databases or custom data sources. By using BI reporting services, reports can produce additional output formats like html, excel, pdf

and contain interactive graphs. In addition outputs of these reports can be delivered to a variety of targets like E-mail or File.

An enterprise can have a variety of reporting needs.BI reporting tools supply scalable and extensible architectures in order to meet these needs. By using BI reporting architecture, IT staff can design and deploy a variety of reports as well as custom reports can be created by Business Users without the need of technical understanding of underlying data sources.

BI reports can be embedded to the Business Applications, so they can be easy to access by the Business end users.

Following Figure 2.7 shows a report which is produced by Oracle BI tool that shows the revenue attainment and projected sales compared with last year of an enterprise in one page.

Figure 2.7 BI Tools – Reporting Example

2.2.4.2. Business Intelligence Analytics

The term analytics is basically used for “the science of analysis”. In practice, analytics is the definition for arriving an optimistic and realistic decision which is based on existing data. In general as long as the business decision is based on data (no matter in which form), it will be considered as analytics.

Business analytics focus on the past business performance of an enterprise in terms of abilities, technologies, application and practices to make the management to gain insight and take necessary actions to build the business plan for the future.

On the other hand, business Intelligence refers to a consistent set of data in the form of metrics to measure the past performance and plan the business for the future.

Business metrics are defined in order measure the past performance of the business from the desired point of views.

Business Intelligence analytics can answer question like “what happened”, “how many time that it happened”, “how often does it occur”, “where is the problem”, “what actions are needed”.

BI Analytics helps managers improve business performance with complete, consistent and up to date information based on the accurate, timely, and transparent BI reports.

Business intelligence applications can vary. Business Intelligence can be applied to Financial Analytics, Human Resources Analytics, Sales Analytics, Loyalty Analytics, Price Analytics, Marketing Analytics, Service Analytics, Supply Chain Analytics, and Order Management Analytics and so on.

In the case of financial analytics for example, BI Analytics helps front-line managers improve financial performance based on the information on their department's expenses and revenue contributions. Key performance indicators and reports enable financial managers to improve cash flow, lower costs, and increase profitability while maintaining more accurate, timely.

As benefit, cash management can be assessed and operational effectiveness of the payables department can be monitored. In addition, working capital, collections and receivables risk can be managed by monitoring cache cycles as a benefit in terms of receivables.

Also financial performance can be managed along the enterprise according to customers, products, locations. Thus most profitable customers, products, regions, division and channels can be identified.

Figure 2.8 shows expenses of an enterprise classified by cities, and it presents this information with a user friendly graph.

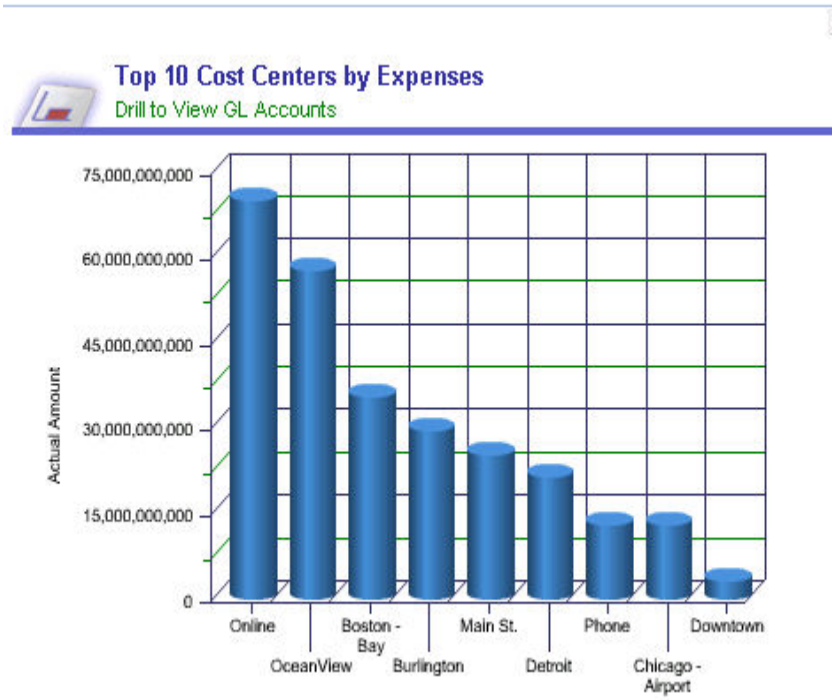

Figure 2.8 BI Analytics Examples

BI Analytics have different effectiveness for different business fields. Table 2.3 classifies benefits of using analytics among different business areas.

Benefits of BI Analytics				
Financial	**HR**	**Loyalty**	**Supply Chain**	**Service**
Payables	Workforce	Customer trends	Bottlenecks and order	Service effectiveness
Receivables	Workforce developlemnt	Promotion effectiveness	Management	Employee effectiveness
Genel Ledger	HR performance	Customer insight	Order fullfillment	Customer insight
Profitability	Employee absence trend	Customer satisfaction	Inventory management	

Table 2.3 – Benefits of BI Analytics

2.2.4.3. Information Infrastructure

The conceptual architecture of BI system consists of 5 key points: Source data, ETL, Data Warehouse, Cubes and BI applications.

Source data is the data which belongs to one or more operational databases or any other data source (even spreadsheets or texts).

In order to centralize the access to the source data, it should be copied from the source to a central data source. This process is called ETL (Extraction Transformation Loading). ETL is more complicated than simply copying the data. Most of the time source data is transformed and validated during the ETL process.

The source data is consolidated into a single relational database called “data warehouse” by the ETL process. The data in data Warehouses are often read only, because they are stored for querying and updated time to time by the ETL processes. End user interaction can worsen the quality of data and data quality is a very important factor for a BI project that must be watched out.

Another important factor is the speed. The relational databases generally can’t respond quickly to complex queries, which can handle big amount of data. On the other hand, BI reports and analytics must generally handle thousands of data and because their purpose is to find very specific and analytical information, they are very complex as well.

At this multidimensional cubes are the structures that are used to speed up the BI system querying performance. Cubes are basically data structures that contain data close to the desired format that BI queries are interested in.

In other words, data stored in cubes are complex, efficient and properly structured, so at query time no extra effort needs to be taken for those source consuming formatting because they are already stored in asked format.

The most visible layer of the business intelligence infrastructure is the applications layer which delivers the information to business users.BI applications like Olap, Static/live reports, data mining give business users the capability of discovering insights for decision making and make graphical trend analysis.

Another BI application named Scorecard displays key performance indicator current values and the targets as a summary of key business analytics.

Figure 2.9 shows the conceptual architecture of a common BI system solution.

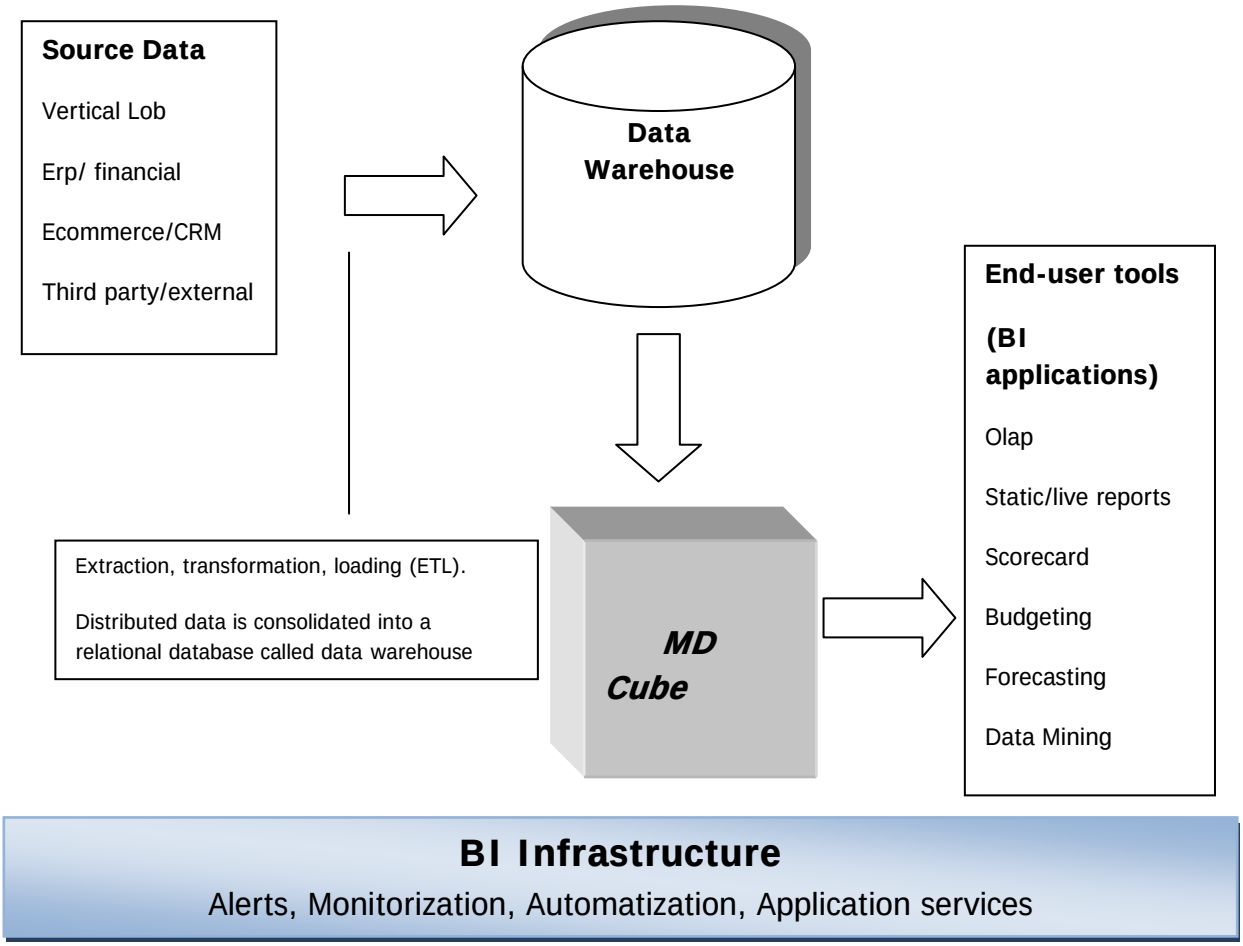

Figure 2.9 Conceptual Architecture of BI System

BI infrastructure can be thought as a set of layers that begin with the information and ends with the delivery of business intelligence to various business user communities.

Processes of Infrastructure layers shown in Conceptual architecture must be automated and monitored. Alert mechanisms should be constructed in order to deal with predictable exceptions that can be encountered.

Of course there are organizational requirements to keep the BI system alive. A business intelligence implementation and support team must be set off.

The implementation and support team should consists of BI architect, ETL developer, BI analyst, database administrator, and business content manager roles in order to develop new functions/reports, monitor the processes, deploy new features and support the services and data warehouse layers.

2.2.5. Performance Optimization

Generally, Business Intelligence applications operate with big bunch of data in order to meet business needs. In addition, Business analytical data grows continuously while time passes, and business operations occur.

In addition, BI applications usually work in online environments used by business users concurrently. So, as a matter of fact performance bottlenecks are likely to occur in BI projects, which can affect overall performance across all BI subcomponents.

As a result, performance optimization becomes an indispensable process for BI projects.

The nature of performance optimization steps can differ from organization to organization according to organizational expectations from the BI project.

After all, BI optimization should be performed based on the following 6 general steps.

- Planning
- Budgeting
- Record management
- Dashboards
- Scorecards
- Key Performance Indicators

2.2.5.1. Planning

BI system health should be diagnosed from the technical performance, security requirements, training needs, documentation and resource availability perspectives before developing a successful plan.BI project plan should include staffing, technical infrastructure, knowledge transfer, security, issue handling and growth management.

In the staffing phase, BI project team members should be determined and their roles should be assigned. Also, current architecture should be assessed, any gap in the architecture should be discovered and needed support should be identified.

Knowledge transfer activities are also required to be planned. A training plan should be developed for BI project staff as well as Business end users. In this step, trainers can be both from internal or external sources.

Another important aspect is the security. BI applications with sensitive data should be identified and secured. At this point a security plan should be developed by considering external security test results and technical infrastructure requirements.

Another concern is the issue support mechanism. An Issue handling plan should be constructed to handle pending support and development issues.

Finally BI system growth plan should be included to the BI project plan in order to manage possible system grow while optimizing the capacity and staff. To be able to develop such a growth plan, system growth should be predicted. Number of end users,

data sources, reports and possible new applications are the keys for stating the expected growth.

2.2.5.2. Budgeting

Building a BI project budget depends on the business case, BI infrastructure and the IT investment capability of the organization. BI infrastructure determines the need for IT investments. An advanced BI infrastructure requires separate development, test, validation and production environments.

Data integration is also another key to consider while building a BI project budget. Physical and Logical data integration architectures, which requires IT labor, system engineering, and licenses may be required according to the needs of the Infrastructure.

The data to be integrated, number of sources, characteristics of sources, refresh rate of data, batch processing requirements should also be considered while building a BI project budget.

All the factors above drive the BI project budget. On the other hand, budget assumptions should be enhanced by consulting a BI expert in order to ensure that the BI project needs are addressed.

2.2.5.3. Record Management

Activity or transaction records of the organization are the basis for BI applications. These records should be managed in a certain manner to optimize the BI system performance and enhance efficiency.

Record management is the process for an organization to manage its records by determining what to consider as a record, researching technological solutions for dealing with records, securing records from the external events and disposing expired records. In addition, record management process and terms should be documented to prove their necessity and effectiveness.

BI record management should be implemented by a record management application which can be developed in-house or gathered from outside such as Oracle Records Management 10g.

2.2.5.4. Dashboards

BI dashboards are user friendly interfaces that give the business users the ability to monitor the business from a complete view as well as to maintain complete control of data. BI dashboards of an organization take place on a single-screen, which displays the most important information about an organization to achieve its objectives. They are consolidated on a single screen so the information can be monitored easily.

Data which is aggregated from different sources in the analytics and ETL phases are displayed in dashboards in the form of desired metrics, high level summaries about the important activities and heuristic indicators.

So BI performance will be optimized because the necessary information is always in the dashboards ready to use and answers most of the user needs, so it s quickest way to reach the desired information in ordinary cases. Dashboards can have drill down capability, so high level details of the metrics can be monitored by using them. As a characteristic, the information taken place in a dashboard should be in form of high level summaries.

By looking a dashboard of a relevant perspective, it should be able to be understood quickly what is happening, as dashboard are the starting point for the KPI situation analysis.

By drilling down the information found in dashboards, further analysis can be performed and the question “why” can be answered. Figure 2.10 shows a typical BI dashboard.

Figure 2.10 A Typical BI Dashboard

Dashboard presented in the example figure above includes a values selector on the left that lets business users specify the product for which they want to get information.

2.2.5.5. Scorecards

Scorecards systematically transform aggregated business activity data into a clear format by grouping of key performance indicators ("KPI's") of the organization. This activity triggers actionable insights as the displayed values in scorecards are based on the strategic business goals.

Scorecards can be related to the different priorities that the organization is focusing on like financial, operational or customer, and include values related to short-term and long-term goals. They can also incorporate company and industry performance benchmarks and risk factors.

Characteristics of scorecards can be defined as strategic, goal oriented, collaborative, and consolidated and accountability driven, so they show long term values, goals and trends based on weekly or even monthly basis. By the design and implementation, scorecards enable organizations to improve processes and reduce costs by their forecasted, consolidated and strategic view of data as it can be used as

performance measurement, which affect directly to the management process and collaboration in general.

A special case of scorecard called a balanced scorecard, which was created by Robert Kaplan and David Norton in 1992. A balanced scorecard has no technical difference from a scorecard. The difference relies in its goal which is to focus on the factors that can affect the health of the company. In details, the goal of balanced scorecard is to be proactive and identify factors that can be critical to the success of business before they become problems, in other words, transforming the strategy and vision of an organization into actions.

As the methodology is based on the fact that financial indicators are not enough to be long term successful in business, balanced scorecards have four perspectives: Financial, customer, internal business processes and learning, which are interconnected and balanced.

Figure 2.11 shows the interconnection between the balanced scorecard perspectives, and their attentions.

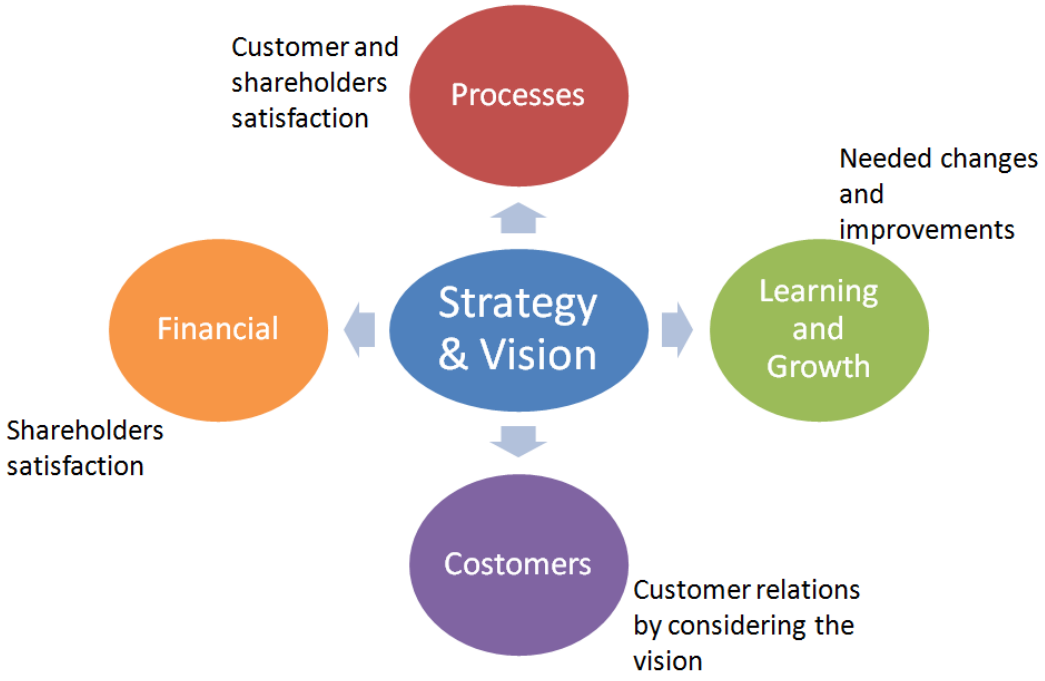

Figure 2.11 Balanced Scorecard Perspectives

By analyzing the scorecard displayed on following (Figure 2.12), it can be understood that a reduce in the manufacturing cycle time and increase on-time delivery , increase the customer satisfaction as considering company in question as a fast and reliable supplier. As a result, the market share is doubled and the shareholder values are increased.

Following figure shows an implemented scorecard which shows the connection between financials, internal processes and customer perspectives.

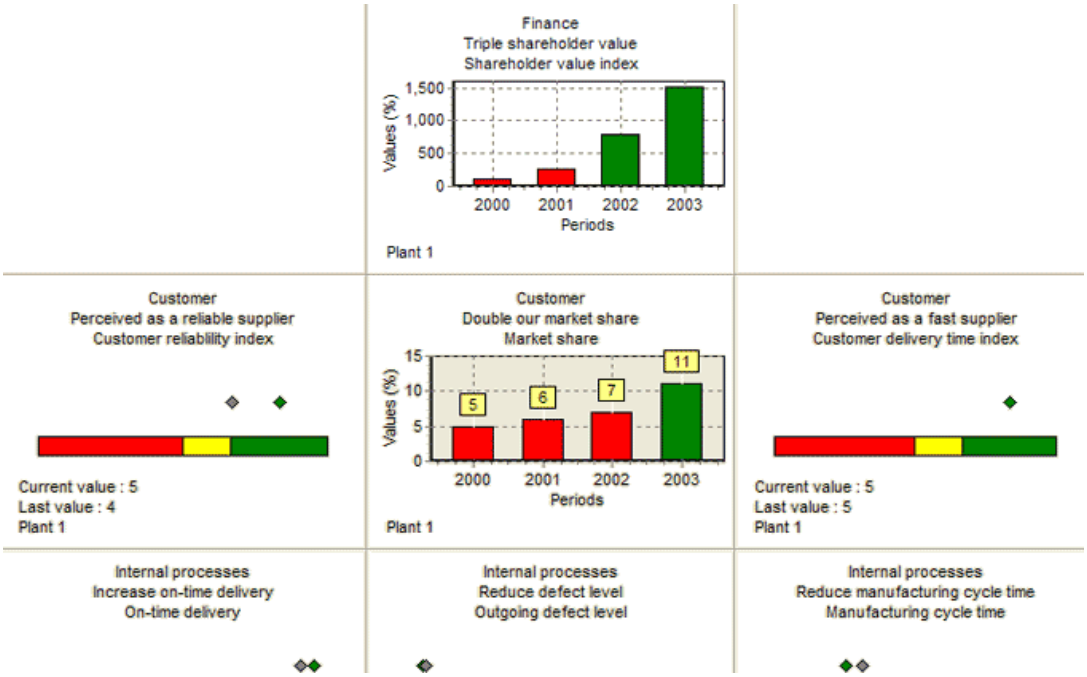

Figure 2.12 Balanced Scorecards

2.2.5.6. Key Performance Indicators

A key performance indicator (KPI) is a designated aspect that is critical and needed to paid attention in order to be successful on the business. KPI's are components of business scorecards for the key of BI corporate performance management concept. In addition, KPI's can be associated with different business activities such as customer satisfaction, productivity, supply channel and etc...

Determination of best KPI's for an organization depends on the business sector, company vision, organizational priorities and strategy of the organization. KPI's should measure the needed business aspects, and they can be even in form of ratios.

While determining the KPI's, the following characteristics must be paid attention to be sure that the selected KPI's are appropriate for the organization.

- Clear: precise and unambiguous
- Relevant: appropriate for the factor
- Economical: available at reasonable cost
- Adequate: provides a sufficient basis to assess performance
- Quantifiable: can be independently validated.

By determining the best KPI's for a business and applying an optimized organizational model, the organizational excellence can be reached. The organization model is illustrated in Figure 2.13.

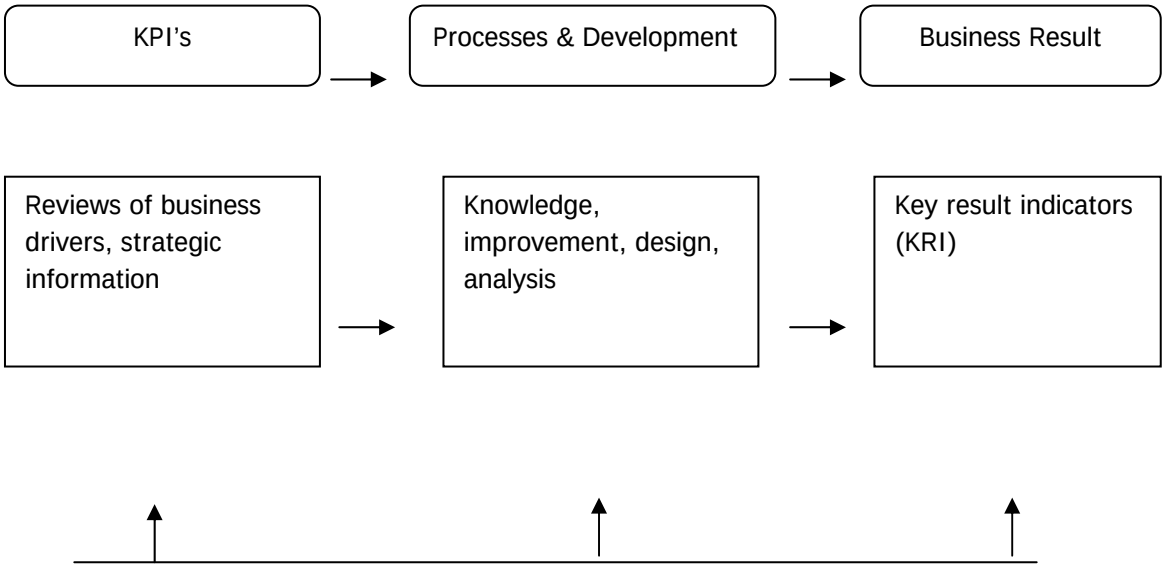

Figure 2.13 Organizational Models

In organizational model, the information gathered from the KPI measurements, valued on the knowledge base and transformed into improvements of business processes.

After the improvements the business results are expected and monitored from the Key result indicators (KRI's), which provide information ideal for the board. The organizational model is in a cycle and continuing for future business needs.

KRI's (Key result indicators) are often confused with KPI's. The main difference is that KRI's don't tell what needs to be done to improve the results; however, they give the results in a clear picture just as the board likes.

For Instance, for achieving the customer satisfaction measures, customer satisfaction and customer profitability can be KRI's for an organization, on the other hand, order cancelation, late shipment, incomplete order shipment, returns and customer attrition can be used as KPI's. For example, Human Resources Employee performance measurement can be applied by an employee scorecard which contains following KPI's:

- Customer satisfaction: Customer feedbacks give the company a clear picture of the processes that they can improve on.
- Quality: Quality measurements can be classified as an internal control mechanism for an organization and by having knowledge about the quality, top management can improve business by adhering to a set of standards
- Attendance and Tardiness: Attendance is a serious issue in many industries, especially in manufacturing since the human labor is needed to continue the business.

KPI's based on the organization's critical success factors let management to assess the problems and needed improvements on the aspects of the business. In addition they are required for making qualitative analysis of the organization's current state.

2.2.6. Data Management

Data management on Business Intelligence Systems focuses on the information itself to be sure that if it s right and appropriate. Large companies invest millions of dollars to manage the data from different sources along the organizations.

From a BI Intelligence system perspective, the data from different systems like Enterprise Resource planning (ERP), customer relationship management (CRM) and other transactional databases belong to other applications are aggregated and consolidated in the data warehouse, and also it should be ensure that no transaction or exchange occurs without logging. In this environment, data overload can be a real problem, as well as validation. Validation is the approach to not to have dirty data, which is inconsistent, fragmented or out of context data.

The data management approach should be aimed to identify the followings:

- The needed data for analytics system like BI.
- The data sources that the needed data can be obtained from

- The size of needed data
- The method for making the data more accurate and valuable for analysis.
- Necessary rules and processes to manage the data from its creation to its retirement.

To identify the needed data, executives must have a clear understanding of organization's activities, operational metrics, strategic metrics and business performance. The selected data should be analyzed in order to ensure the selected data is right. In that point, the IT and business personnel should work together. Without such cooperation, the correct data cannot be gathered because the process to identify the data has two sides, technical and functional. So in order to define the relationships in the data, IT personnel should have business expertise which can be supplied from business personnel. Without the relationships, the collected data won't have any value for BI systems.

Data for business intelligence is obtained from many data sources. Data sources can have different characteristics and can be in different locations, but they should be managed through a centralized enterprise-wide infrastructure in order to have a consistent, streamlined and scalable view across the organization, because it s required to achieve the goals of BI analytics.

Such an environment can be created by integrations and updates between processes and transactions systems. ETL tools should be used to make the integration, manipulation and aggregation for achieving BI analytics data.

Data collection and storage are very costly processes, as they require human labor, as well as system sources to be allocated. In addition, in some cases it's impossible to gather all the data from a data source, and if even it s possible, it s not worth to do that.

So in order to collect optimal sized data, which is necessary for BI applications and analytics, it s important to know what drives value in an organization.

Data quality of Business intelligence is also important as it is a big challenge for organizations face in developing business intelligence.

Assuming the data created from business transactional applications are not well formed in the data sources, there are several characteristics that need to be considered while having a valued data in the BI repository. To increase the value of data, following actions are nice to have:

- The correctness of data should be reviewed and tested.
- Completeness of data should be checked.
- Coverage of data should be checked as if it s instant, weekly or monthly.
- Redundant data must be eliminated in order to remain consistent.
- Safety, security and privacy should be checked in order to comply with business.

Data should be managed during its lifecycle in every phases starting from its creation to its retirement. Data creation should be done by IT managers and Business team leaders as we discussed above. In addition out of date or duplicated data should be identified and removed and incomplete data should be repaired. To be able to manage these processes IT should establish methods and rules to follow in order organize process and maintain the information. Moreover, systematical data extraction and storage method should be decided, modeled and implemented.

2.2.7. Business Intelligence Integration

Integration process begins with assuring the consistency across all of the Business Intelligence tools and data sources. All the data sources should have common integrity rules, data names and definitions. The common data should be in a repository for the use of business intelligence platform, available for viewing all the organizational data related to key business drivers from a single interface.

Business Intelligence integration is not only about to integrate data sources, it should be integrated as a whole in the enterprise. Business intelligence should be integrated all kinds of management software which are directly related with key business drivers.

For example, Business intelligence capabilities should be used in an enterprise which uses call center software to monitor call statistics to identify the organization's executive needs.

Organization's objectives should be at the center of a BI integration process. Considering the needs and priorities, needed BI applications that can help the organization's present applications achieve the common objectives.

Business Intelligence applications can be opened to web access by using web services of the corresponding application. Thus, organizations can easily integrate BI to the Business Intelligence portals, and by the help of the web services, BI applications can be accurately integrated to the other applications of the organizations as well.

Organization's portals can be integrated to the Business Intelligence applications in order to make final decisions and discuss the threaded situations by looking to the analytic information of BI through dashboards or scorecards and using the collaborative power of portals through net meetings, forums and etc...

SECTION 3 IMPLEMENTATION OF BUSINESS INTELLIGANCE APPLICATION IN HEALTHCARE INDUSTRY

3.1. INTRODUCTION ABOUT ACIBADEM

Acıbadem Healthcare Group is Turkey's leading health care institution, which provides extensive healthcare services with high medical technology since 1991. Acıbadem has over 9000 employees, of which 2000 are physicians, over 1300 are doctors in 11 hospitals, 6 outpatient clinics, medical center and laboratories.

Acıbadem Healthcare Group has facilities operating in network. 11 hospitals, 6 medical centers, one central clinical laboratory including pathology laboratory, an ambulance services company, a catering and an insurance company are the current facilities of Acıbadem.

In addition, as future plans, 2 hospitals in 2 different cities of Turkey will be established in 2012. Acıbadem has also established a university named "Acıbadem University" in 2007. Education activities will begin in fall 2009 with the health science faculty courses.

In the year 2000, Acıbadem went to public, and still today it s the only healthcare institution, which has shares on trade in ISE.

Acıbadem Healthcare Group is within the top 50 largest companies in last 3 years, and received "the most well – known brand" award in 2004, 2005 and 2006 in private healthcare according to AC Nielsen Research reports. %23 of all private medical services in Turkey is served by Acıbadem facilities.

3.2 BRIEF ACKNOWLEDGEMENT ABOUT ASGBOARD

Asgboard is a corporate performance management system based on Business Intelligence (BI) mentality. By using BI technologies and knowledge, performance management process in Acıbadem is advanced and a common language is created in the corporation. On the other hand, Asgboard is not an operational reporting system.

3.3 GOALS AND OBJECTIVES

Acıbadem Healthcare Group is in a rapid growth period, which should be well managed in order to achieve the planned growth without any compensation. In such a critical period, there is a need to support and assist the decisions of top management by a systematical data oriented method.

"The Asgboard", an implemented Business Intelligence System, provide the performance information of Acıbadem Group's departments and operations to be easily and comparatively monitored by essential indicators.

The goals and objectives of "Asgboard" project are planned to be achieved in two phases.

3.3.1. Phase 1's Objectives

- Development of a formative and modular decision support system infrastructure.
- Standardization of process terms along the organization. (Operation, Examination, etc...)
- Achieving the ability to monitor the organizational performance from different perspectives. (Financial, medical, etc...)
- Comprising a scorecard based managing concept on top management.
- Achieving the ability to develop scorecard for specific targets.

- Gaining the capability to maintain monthly, yearly and periodic information.
- Classifying the information into grub, sub grub, service and doctor levels.

3.3.2. Phase 2's Objectives

- Composing a tracking system to daily and/or instantly monitor important indicators.
- Gaining the ability to develop scorecards based on corporate customers and diagnosis.
- Meeting the expectation of middle level managers.
- Phase 1 is focused on the interest of top management, as it deals with the constructing an environment that contain filtered information for strategic decisions , and phase 2 is based on the needs of middle level management and operational users.

SECTION 4 ASGBOARD IMPLEMENTATION

4.1. GENERAL IMPLEMENTATION PLAN

The implementation time of Asgboard project was 24 weeks, grouped into 3 periods.

First period consist of 6 weeks and called as “the assessment”. In assessment period, meetings were done with all the top management and personnel that have critical roles. In the meetings the requests and desires of the top management were noted, and their present data sources were reviewed. While meetings were going on, BI projects that were already done in different companies were investigated.

For the technical assessments, current BI application platforms supplied by different vendors were examined and discussed with the current functional it personnel and consultants.

Second period was also consisted of 6 weeks, and called as “the design”. In design period, firstly, the dashboards to be implemented for different unit of the organization were identified.

Secondly the needed data sources were constructed and the required changes that should be done on the current applications were detected. After all the designs were finished and documented, approval of orientation committee was received.

As technical design, data warehouse was constructed, data classifications made and data architecture was designed.

In the last period, for 12 weeks, software development process were started and continued. After the development process was finished, application, data and visual tests were made.

At last, the approval of executive project board was received, and Asgboard system had been brought into the live service.

4.2. SYSTEM INFRASTRUCTURE

Asgboard system infrastructure consists of 4 layers, which are operational systems, integration, data management, and reporting.

In the operational systems layer, there are three systems that are relevant to the Asgboard through their services and data structures.

Cerebral is the hospital information system of the Acıbadem, and it have been installed nearly into all the client's computers in the group. Erp system was also constructed via a web interface and has been used by %50 of the operational and management personnel.

Asgnet is the intranet of Acıbadem, and has been used by all the personnel in the group, so in the operational layer, these 3 applications have been tuned to be relevant and connected to the Asgboard project. In details, new data structures, links, and functional procedures were added to these software applications in order to maintain a base for the Asgboard system.

In the integration layer of Asgboard, the data cleansing, data modeling and ETL operations have been done via the capabilities of Oracle Data Integrator.

In this layer, the data that are gathered from 10 different sources including Erp have been set into the data models in the data warehouse according to the rules and methodologies of Business Intelligence term.

Data warehouse layer have been used for the data store and data modeling. Data collected from different sources have been stored and manipulated in data warehouse in order to maximize the query performance and increase data quality. In addition, fact and dimension table structures were created in data warehouse layer.

The end user layer, referred as reporting, has been the visual side of the Asgboard system. Operational, middle level and top management business users have been the end users of the Asgboard. Through Asgboard BI applications implementation activities like querying, reporting, analysis and alerts can be easily achieved.

Analytic development was the base layer, which had been continued parallel to integration, data warehouse and reporting layers.

In the analytics, all the visual aspects, metrics, scorecards and dashboards have been developed and implemented.

Hardware:

- Two Hp servers, one for BI applications and one for the data warehouse.
- 10k discs connected through a SAN and applied raid architecture for performance and availability.

Software:

- Oracle Application Server 10g**:** Used for BI application services and maintenance.
- Oracle Business Intelligence Suite EE: Used for BI application development and implementation.
- Oracle database 10g: Used as a data warehouse.
- Oracle Data Integrator**:** used as an ETL tool for gathering and manipulating data from different data sources

4.3. INTEGRATED APPLICATIONS AND SOURCES

- **Cerebral:** A software application, developed in house and used as Hospital Information system.
- **Asgnet:** The intranet of Acıbadem, developed with Oracle Portal.
- **Erp:** Enterprise Resource planning system of Acıbadem, developed with Oracle Erp, which contains financial, inventory, human resources, purchasing and ordering modules.

Figure 4.1 presents the system infrastructure used for the Asgboard project.

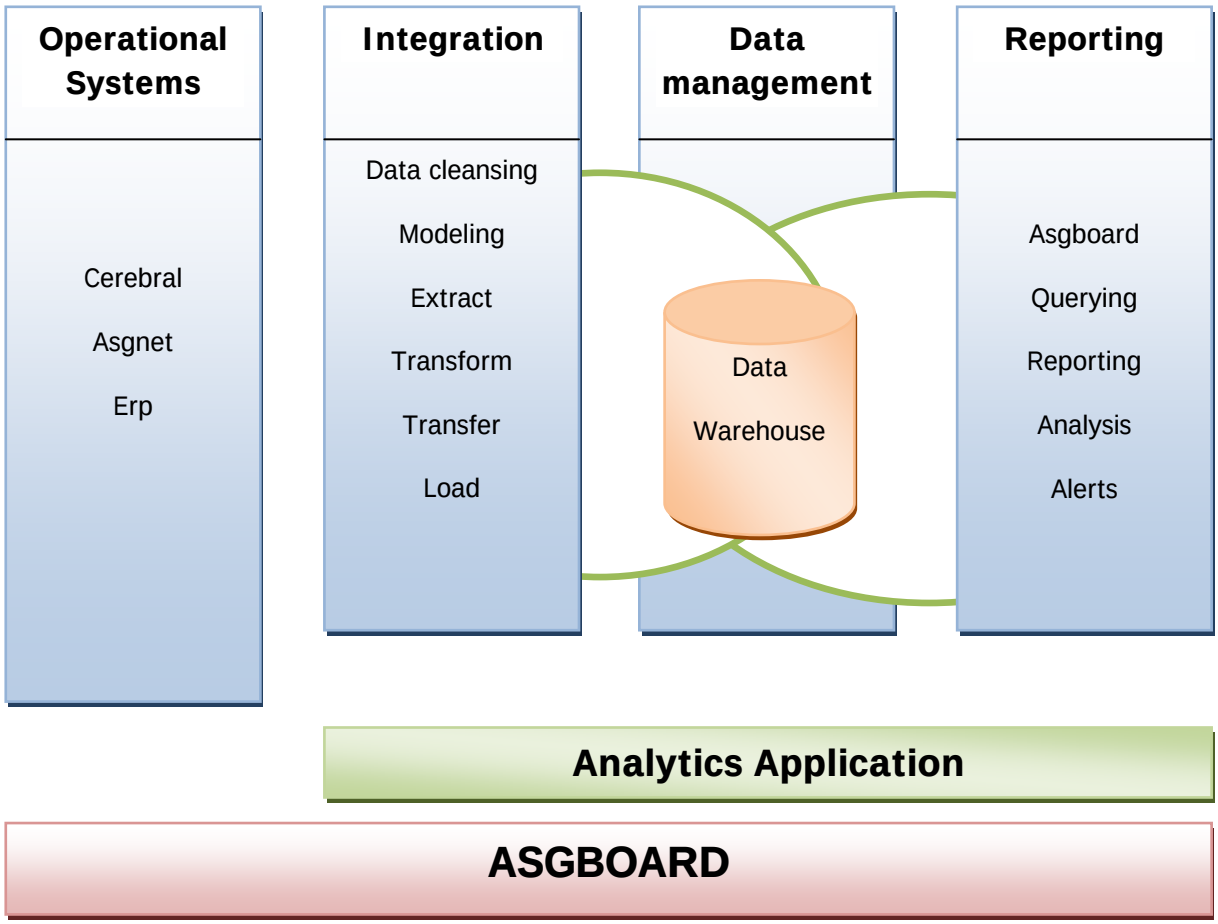

Figure 4.1 Asgboard System Infrastructures

4.4. ASGBOARD BUSINESS INTELLIGENCE KEY PERFORMANCE INDICATORS AND PERSPECTIVES

In the Asgboard system, there are 4 perspectives and each of them reflects different KPI's values. The perspectives used in Asgboard are named as their focuses: Financial, operational, qualitative and clinical. Perspectives are used to look to the Acıbadem Group information from related point of views.

Perspectives and related KPI's are listed below.

4.4.1. Financial Perspective

- Net Income: Gross Income – taxes – discounts – remands
- Ebitda: Earnings before interests and taxes
- Total Outcomes: outcomes of all branches. Depreciation is excluded.
- Maximum discount rate: VAT is not considered.
- Average invoice perception interval.
- Returned invoices rate: Returned invoices/Total invoices
- Income generated by doctor: Income from direct doctor operations like surgeries, examinations, etc...
- Income caused by doctor: Income by activities that referred by doctors like roentgen, blood test, etc...
- Total amount of invoices collected in the relevant period.
- Total amount of invoices could not be collected in the relevant period.
- Discount rate applied to invoices billed to contracted corporations
- Total costs of purchasing fixed assets

4.4.2. Operational Perspective

- Total number of outpatients
- Total number of hospital patients
- Total number of examinations
- Total number of angiographies
- Total number of births
- Total number of cardiologic approaches
- Total number of checkups
- Total number of surgeries
- Patients operated
- Bed fullness ratio: occupied beds /bed capacity
- Average banking duration
- Verification per examination
- Total number of requested verifications
- Average duration of dismissed patients

4.4.3. Qualitative Perspective

- New patient percentage
- Inpatient satisfaction rate
- Number of complaints
- Number of thanks
- Dial out of the proportion of patients satisfied
- Physician satisfaction rate
- Nurse satisfaction rate
- Satisfaction rate from room
- Meals satisfaction rate

4.4.4. Clinical Perspective

- Abdominal Aortic Aneurysm (AAA) Repair Volume
- Carotid Endarterectomy (CEA) Volume
- Coronary Artery Bypass Graft (CABG) Volume
- Esophageal Resection Volume
- Pancreatic Resection Volume
- Percutaneous Transluminal Coronary Angioplasty (PTCA) Volume
- Number of patients operated by gamma knife
- Unwritten surgical reports within 24 hours
- Number of patients that are discharged without a discharge summary
- Mortality rate
- Control examination rate
- Incorrect laboratory report rate
- Major anesthetic side effect number
- Number of transfusion reactions
- Cesarean section rates
- Gross Infection Rate
- Surgical Site Infection Rate
- Ventilator Associated Pneumonia Rate in General Intensive Care Unit
- Ventilator Associated Pneumonia Rate in Cardiovascular Intensive Care Unit
- Infection Rate in General Intensive Care Unit
- Unplanned Readmission Rate within 30 Days with the Same or Related Diagnosis
- Unplanned Surgical Readmission Rate within 30 Days for Same or Related Diagnosis
- Inpatient Mortality Rate
- Blood Typing Errors
- Rate of Whole Blood Use
- Number of Patient Falls
- Incorrect radiology report rate

- Rate of Complete Medical Records upon Discharge
- Number of Needle stick and Sharp Objects Injuries

4.5. ASGBOARD DIMENSION TABLES AND THEIR CONTENTS

- **Arrival Type:** the arrival type of patients.(hospital patient or outpatient)
- **Account:** accounting information related to incomes and outcomes.
- **Enterprise:** information about the branches of Acıbadem Group that will be displayed in Asgboard.
- **Services:** Information about Acıbadem medical services in details. (Cardiology, oncology, etc...)
- **Time:** Time related information

4.6. ASGBOARD FACT TABLES AND THEIR CONTENTS

- **Outpatient:** the number of outpatients classified by unit (emergency or others...)
- **Invoice:** invoices information grouped by branches and months.
- **Income:** Income information grouped by services, branches and months.
- **Outcome:** Outcome information grouped by services, branches and months.
- **Services:** Accumulated services grouped by months, services, hospitals and doctors.
- **Requisitions:** Information about total number of requested services grouped by months, branch and service type.
- **Quality:** Quality information **(**total number of dead patients, lab reports, late lab examinations, patients in intensive care, etc...)
- **Profitability:** Income, Outcome and Profitability information grouped by months, branches and services.
- **Inventory:** Stock information like inventory turnover, cost and stoppage time grouped by stock type, branches and repository type.

- **Examinations:** Information about examinations grouped by months, branches and exam types.
- **Hospital patient:** Information about hospital patient grouped by months, arrival type, branches and services.

Data in the fact and dimension tables are updated monthly. In every new month, data from the last 3 months are extracted, transformed and loaded in order to have up-to-date information and correct possible errors, because of possible changes in the obsolete records.

4.7. ASGBOARD FACT/DIMENSION ASSOCIATIONS

Following table 4.1 shows the fact tables and related dimensions about Asgboard.

	DIMENSIONS			
	Enterprise	Service	Arrival Type	Account
Requests	X	X		
Quality	X			
Profitability	X	X		
Stock (inventory)	X			
Service	X	X		
Examinations	X	X	X	
Patient	X	X	X	
Outpatient	X		X	
Invoice	X			
Income	X	X	X	
Outcome	X	X		X

Table 4.1 Asgboard Fact and Dimension Associations

4.8. ASGOBOARD'S SCORECARDS

Asgboard's scorecards are used to monitor performance based on KPI values. All the KPI's of Asgboard are included in the scorecards with their current and target values. Scorecards used for Asgboard project are Asg overall, branch, service, doctor and corporations with agreement.

On all of the scorecards, users can examine data from financial, operational, clinical and qualitative perspectives, and from these perspectives users can drilldown to different point of views. For example, in Asg overall scorecard, when drill downed, KPI values can be examined from the branch, service, or income type based aggregations.

Scorecards on Asgboard contain KPI data history, as well as graphical trend indicators in order to management to be able to keep track of the changes and trend of the KPI's.

Following figure 4.2 represents a scorecard used in Asgboard to display the situation of Acıbadem Healthcare Group based on the KPI's from operational perspective, and the legend to display the meanings of graphical indicators.

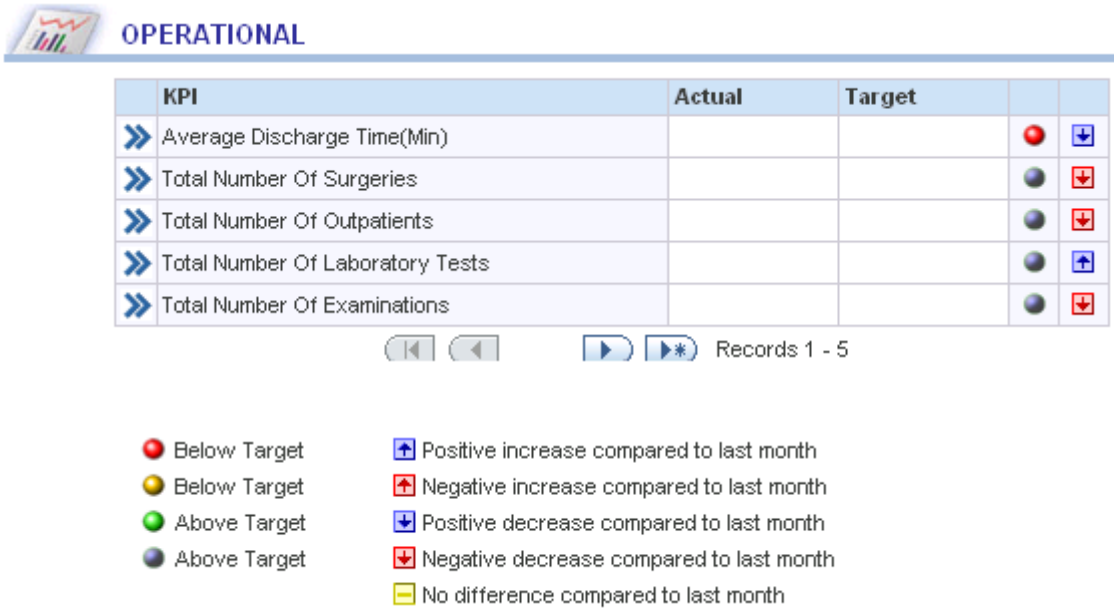

Figure 4.2 Asgboard Operational Scorecard

SECTION 5 CONCLUSION

Business Intelligence Systems are decision support applications that can help to top management. One of the effects of this kind of applications is, having ability of changing the strategy of management in the company. Enriched data plays one of the important roles in this scenario.

Now computer has already entered the business life. With this entrance, different kind of data is existed. People realize that not only having data but also using and resulting them are important. This process creates information systems and enterprise resource planning systems in companies. And then people realize that they should use the data that they have. They can understand their situation only creating indicators with this data. At the beginning BI systems are chosen for the big companies. But now, this excellent building influenced every middle and small sized company.

In this work, we tried to create a business intelligence system in health care industry. There are a lot of different data that can be an indicator in this sector. It is very difficult to determine for the top management, because of having extra parameters. It is the reason of needing a decision support system. We need to focus on every data. Because everything has a different meaning, and everything shows us different results for company. According to these different data models, we create some KPI's. These are critical outputs about our operational and managerial truths. Enriched data can show us the important points, bottlenecks or processes which are having problem. With the help of these, we can easily understand what is happening in the company.

One of the other subjects that we can see with the BI is, to compare the branches. In a multi branched company, we can find the problems with the help of comparing. Processes are going in different way for each branch. With the visualization feature of the BI, we can change our strategy or method. We can realize true or wrong methods, and then make an action according to a decision.

It is very hard to analyze the branches that place in different city with the head office. People need to visit them for fallowing their processes. Inspections are one the excuse to go the branches. But it is not possible to make this every time. Time and expenditures are playing big roles. If you create a BI that modeled correctively, you do

not need to visit these kinds of branches every time. You can see every process with the help of their KPI's while you are sitting at your table. After analyzing and comparing you can make a decision to visit those branches. BI can help us to show which point we have to focus.

On the other hand, we can make some reports with help of BI. Of course, in the situation that BI is not exists, there can be some reporting ways. But creating a report is very hard work. In BI, the enriched data has already modeled in data base. You do not need to convert the KPI's in every time. With the architecture of BI, it is enough to make this model one time. Then only thing that you should do is click a button. This is also a result of getting non error reports. Another objective is speed of preparing reports. With BI only thing that you should do is sign in with your username and choose the report that you want to see. With BI applications most of them let you reach real time data whenever you want. That is one of the most important features of this system.

Now general manager, assistant general managers, directors and board members can see a lot of key performance indicators in Asgboard. This KPI's can be analyzed for every branch and every sub levels. The reports that are present by Asgboard, can affect the result of board decisions. This system creates a common language for all part of the company. Ever manager can see the numbers correctly and gets warnings on time. People do not waste their time with the question of the correctness of the data.

Another point is, make people to enter data correctly. We realize that, people does not pay enough attention to enter the data in some processes. With the Asgboard we can easily realize and report this kind of situations. So it helps us to get right data during our operation. Managers warned their subordinates in these matters.

As an example, people started to pay attention to their expenditures. In this board, managers can see every branch, and have the ability to compare them. This time, it makes expenditures more important than before. People realize that, the point that looks profitable is not profitable actually. At that time, with the changing of some methods we create a better expenditure management.

After this example, we think about developing the Asgboard. We show the expenditures to managers. With this idea, if we can show the expenditures to sub-managers about their responsibilities, they will have the ability to control them. With

this aim, everyone can control their unit. If we can make this architecture until the bottom line, everyone can control themselves and their unit.

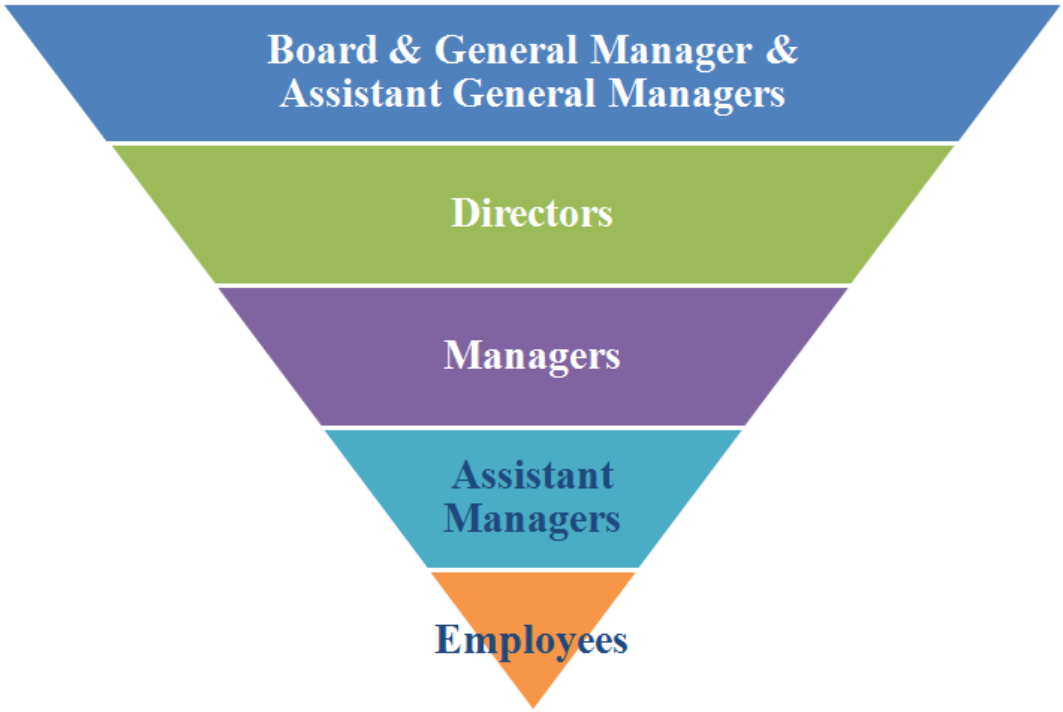

Figure 5.1 Ability of Reaching Data for Workers on BI

Other important point is, this system help us to compare the data between different time lines. For example, while we are controlling our expenditures, or incomes, we have the chance to see 3 month data about this subject. This helps us to compare the data into specific time line. Then we can see the trend of our KPI's.

As with all projects, this project should be good controlling. Small mistakes may cause big effects for the company. There must be a good planning and controlling sections. If you do not model the KPI's you will make wrong decisions. And also, we must choose true KPI's.

The share of business intelligence is growing in investments of information technology in the world, each passing day. This reason, many enterprises are also starting using business intelligence. Business intelligence has become a need for the companies that looks forward to grow and develop.

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ATTACHMENTS

The health care services financing table for the some countries in 2009. (WEB_5, 2011)

Location	Time Period	Per capita total expenditure on health at average exchange rate (US$)	Per capita government expenditure on health at average exchange rate (US$)	Per capita total expenditure on health (PPP int. $)	Per capita government expenditure on health (PPP int. $)
Afghanistan	2009	51	11	69	15
Algeria	2009	268	231	544	469
Angola	2009	204	181	316	281
Argentina	2009	730	485	1.387	921
Australia	2009	3.867	2.711	3.382	2.371
Bangladesh	2009	18	6	48	15
Cameroon	2009	61	17	122	34
Canada	2009	4.380	3.009	4.196	2.883
Chile	2009	787	368	1.172	549
China	2009	169	85	309	155
Colombia	2009	323	272	569	479
Congo	2009	70	38	126	68
Cuba	2009	707	658	503	468
Ecuador	2009	255	124	503	244
Egypt	2009	112	46	282	116
Ghana	2009	53	28	122	65
India	2009	45	15	132	43
Indonesia	2009	55	29	99	51
Jamaica	2009	231	129	383	214
Japan	2009	3.321	2.657	2.713	2.170
Kazakhstan	2009	330	195	554	328
Kenya	2009	33	11	68	23
Kuwait	2009	1.416	1.189	1.498	1.257
Lebanon	2009	663	326	1.054	519
Lithuania	2009	730	499	1.097	749
Malaysia	2009	337	151	677	303
Mexico	2009	515	248	846	408
Monaco	2009	7.137	6.279	7.521	6.617

Morocco	2009	156	54	251	86
Netherlands	2009	5.164	3.989	4.389	3.390
New Zealand	2009	2.634	2.113	2.667	2.139
Nigeria	2009	69	25	136	50
Norway	2009	7.662	6.018	5.395	4.237
Pakistan	2009	23	7	63	21
Paraguay	2009	159	68	305	131
Philippines	2009	67	23	136	47
Poland	2009	804	548	1.359	926
Portugal	2009	2.410	1.684	2.704	1.889
Qatar	2009	1.715	1.361	2.090	1.658
Romania	2009	408	322	773	610
Saudi Arabia	2009	714	478	1.150	770
Senegal	2009	59	33	102	57
Serbia	2009	419	265	836	529
Singapore	2009	1.503	618	2.086	858
South Africa	2009	485	195	862	346
Spain	2009	3.075	2.218	3.150	2.272
Sweden	2009	4.252	3.343	3.690	2.902
Switzerland	2009	7.141	4.254	5.072	3.021
Thailand	2009	168	127	345	261
Tunisia	2009	240	130	524	283
Turkey	2009	571	429	965	726
United Arab Emirates	2009	1.520	1.053	1.756	1.217
United Kingdom	2009	3.285	2.747	3.399	2.843
United States of America	2009	7.410	3.602	7.410	3.602
Uruguay	2009	698	440	979	617
Viet Nam	2009	80	31	213	82