Business Intelligence Tools & Techniques for SMEs and how they affect their strategic decisions

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SCHOOL OF SCIENCE & TECHNOLOGY

A thesis submitted for the degree of

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Abstract

This dissertation was written as a part of the MSc in E-Business, Innovation and Entre-preneurship at the International Hellenic University.

Constantinos Athanasiou

30/04/2019

Contents

1 Introduction

This first chapter aims to present to the reader an overall understanding of the dissertation, the background, problem area, research methodology and outline.

1.1 Background

Business Intelligence refers to techniques and practices that help enterprises gather and analyze valuable data from multiple sources in order to make faster and better decisions. The first to refer to BI was Hans Peter Luhn back in 1958 in one of his articles in the IBM journal. Since then there have been numerous definitions by many researchers, often one overlapping the other and the concept of BI is still evolving. D.J.Power (2007) states that the origins of BI development can be found in Procter & Gamble's efforts in 1985 to build a DSS (Decision Support System) that linked sales information and retail scanner data. However, the term was presented first by Howard Dresner in 1989 as concepts and methods to improve business decision making with the use of fact-based supporting systems (Power, 2007). Gartner, one of the world's leading research and advisory companies defined BI in the 1990s as an analytical process that transforms internal and external data into information about market positions, goals, activities and possibilities that a company should pursue in order to stay competitive (Seufert, Schiefer, 2005). Wixom and Watson (2010) define BI as an "umbrella term that is commonly used to describe the technologies, applications and processes for gathering, storing, accessing and analyzing data to help users make better decisions". On another view, BI envelopes concepts like Data Warehouses, Online Analytical Processing (OLAP), Reporting, Querying, Data Mining and Visualization all of which are considered components of a complete BI system. Initially a BI system must gather and consolidate data from many enterprise operational systems into a data warehouse and from there move on to the next levels. The ideal system would give the employees and users in general the ability to access the desired information in order to complete a task and of course easily share this information with others.

The above definitions underline the structure of BI. It is a complex system that involves the human factor and gathers multiple sets of technologies and processes with the one goal to provide

insights and help decision making in an organization. Figure 1 provides a visualization of the basic concepts already mentioned.
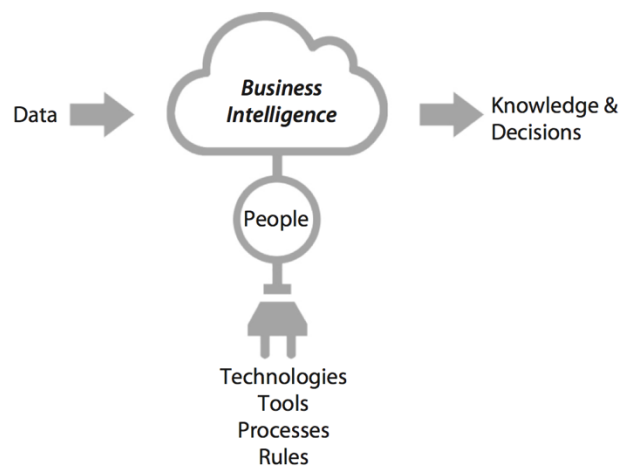

Fig. 1. Concept of Business Intelligence

1.2 Problem area

The business environment is now more competitive than ever and rapidly changing. The available data are increasing by the second as does their speed, volume and diversity. This creates a crucial need for managing information in a timely, precise and up-to-date manner (IBM Institute for Business Value; LaValle, 2009). The time has come that data are considered as a corporate asset and a main source of revenue (Brown, 2011). Of course, one could argue that BI gains are very difficult to measure. That's why in an IBM study conducted in 2009, 40% of executives state that they rely mostly on experience and personal judgment when it comes to make an important business decision rather than business analytics (Williams, 2011).

For large companies BI is a prerequisite and is usually highly valued by CEOs and top executives. It helps them make informed decisions relying on internal and/or external data reducing this way the risks and facilitating the decision support process.

As history shows us, BI systems have been adopted mainly by large companies that can afford to make such an investment with unclear results that are difficulty quantifiable, at least from the start (Olszak and Ziemba 2012)

In Small Medium Enterprises (SMEs) and especially Greek ones the integration of BI has been slower than larger companies. Søilen (2012) and Hwang (2004) note that most SMEs can't invest

the necessary resources for a traditional BI system. Additionally, the large failure rate of BI projects implementation which is over 50% (Laskowski, 2001, Legodi and Barry, 2010, Meehan, 2011) discourages SMEs to invest in these types of projects. In order to survive though in the unstable and competitive environment SMEs are obliged to monitor and analyze their business and be well aware of their resources. Enterprises are faced with many risks, especially when operating in a continuous financial crisis and an unstable environment while at the same time they require to streamline their operations and cut costs (Sheikh, 2011). Therefore, they are called to adapt quickly and make faster decisions in order to keep their customers' satisfaction and their business performance high. In recent years and with the explosion of the available data, the need for their analysis has been widened. SMEs should embrace more the use of BI in their everyday struggle to surpass the competition and gain a larger market segment.

The new digital age has led companies to utilize ICT tools in internal and external processes and integrate them with their core activities. ERPs, CRMs, Cloud services and other software solutions are a prerequisite for most companies. However, these tools are mostly used by large companies and to a lesser extent by SMEs and if they are used they are underutilized. These smaller companies have to find a way to exploit the vast amounts of available data from their ICT tools and other sources, bring them together, analyze and make sense of them since this has become a key business success factor. This will surely boost their competitiveness and help them with the management of information and subsequently with the process of decision making.

This thesis investigates the use of BI tools that help SMEs innovate the decision support system and examines a case study of the implementation and deployment of BI tools in a Greek flour milling industry.

1.3 Research questions and methodology

The questions that will be addressed in this thesis are the following:

1) What is BI and how it can help SMEs in making strategic decisions?
2) What are the benefits of BI?
3) Which are the factors that influence BI and its evolution?
4) What is the process of decision making in SMEs?
5) Which are the available BI tools and techniques for SMEs?
6) How are BI applications implemented and deployed? (case study)

The methodology that is used during this thesis is mostly exploratory research in order to explore key concepts of BI and SMEs and the offered tools and techniques that help them reach their strategic decisions. Extensive research had been conducted as to understand in a measurable way which are the factors that affect SMEs in using BI tools and their connection with their decision support system. Online databases and scientific journals such as Google Scholar, Journal of Computing, TDWI's Business Intelligence journal (Transforming Data with Intelligence), Inder-Science publishers (International Journal of BI and Systems Engineering), have been leveraged as well as well-known websites and blogs on BI. Also, there's been a careful selection of keywords during the research process that has made possible to discover valuable articles and papers and from there get to their fewer known sources. Moreover, due to the extremely volatile IT market the focus has been on more recent papers and older ones have been avoided as they were almost certainly outdated. Consequently, the theoretical framework of this paper is mostly based on secondary data.

This research has also relied on professional IT consulting companies as well as renowned vendors which have proven to be useful on gaining information about market research and trends. Apart from the extensive research described above interviews have been conducted in order to get quantitative data during the case study. Specifically, the CEO, the VP of Sales, the Production Manager, and the Quality Manager of the selected enterprise have all been interviewed. All interviews have been conducted on site in order to gather actual data and use them to extract knowledge for the company through specific BI tools. It is imperative to mention that all the interviewees are professionals that hold a basic knowledge of BI.

Due to the continuously evolving research field of BI and the fact that many of the articles that have been consulted are produced by software vendors, the author of this thesis has tried to find

several sources to support the same information. Since this is a relatively new field lots of the literature comes from consultants and IT companies.

1.4 Structure of the thesis

The thesis is organized into eight chapters in order to present the research in a logical manner that makes easy for the reader to grasp and understand all the concepts. As already stated, the fields of BI, DSS, and SMEs are vast therefore there has been a careful selection by the author of the points that are examined according to his personal interests and opinion as to what is of importance for the given subject. More on this can be found on the acknowledgment section. The composition of the thesis is:

1. **Introduction**

   This first chapter briefly presents the background of the research, defines the problem area as well as the research questions, methodology and objective of the thesis.

2. **Definition of key concepts**

   Here is a definition of the key concepts studied and mainly BI, its characteristics and benefits, SMEs and the decision support process.

3. **Business Intelligence Tools and Techniques**

   In this chapter there is an examination and presentation of BI tools and techniques.

4. **Reporting and Visualization**

   Chapter 4 focuses on report generation and visualization. This is because it is a pain point for many executives that don't possess the technical background and/or require information to be presented in a fast and easily understandable manner. The author considers reporting and visualization tools of utmost importance for the successful implementation of a BI system and its acceptance and adoption by the executives.

5. **Decision Making in BI**

   Chapter 5 examines the decision-making process with the use of BI and the benefits that derive for SMEs. There is a focus on strategic business decisions and operational decision making.

6. **Bibliography**

   This chapter highlights conclusions and makes recommendations that will help future researchers and scholars interested in BI and analytics. It also provides recommendations for further future research.

7. **References and Supporting Material**

   Finally, chapter 7 presents the references and supporting material that have been used for this thesis.

2 Definition of key concepts

This chapter presents in brief the definition of the key concepts of this thesis. It is divided in two parts, the first on BI and the second on SMEs.

2.1 Business Intelligence

2.1.1 What is Business Intelligence

BI can be descriptively put as "the processes, technologies that are needed to turn data into information, information into knowledge, and knowledge into plans that drive cost-effective business actions" (Turban, Sharda, Dursun, 2009). The first to refer to BI was Hans Peter Luhn back in 1958 in one of his articles in the IBM journal. He described BI as an automatic system that distributed information to the various sections of any industrial, scientific or government organization. However, literature review shows us that Howard Dresner in 1989 was one of the first to provide a definition of BI during the time he worked as an analyst in Gartner Inc. (Karim, 2011). His definition of BI is "a broad category of software and solutions for gathering, consolidating, analyzing and providing access to data in a way that lets enterprise users make better business decisions" (Karim, 2011). On the other hand, Payrot, Childs and others have stated on their research on competitive intelligence that, Michael Porter, the American academic of the well-known theories of five forces framework and competitive analysis, was one of the first to create the concept of Business Intelligence. His work on competitive analysis in the 1980s led to many publications on competitive intelligence. During the same time Wally Rhines (1985), an American engineer and businessman, published a paper on transferring artificial intelligence from laboratories into business suggesting that computers are capable of simulating part of human intelligence into businesses by capturing and using knowledge to provide solutions in pre-defined situations, just like a human would do. This publication also led to the establishment of BI as a research topic. It is now well known that the roots of BI can be found in AI.

BI is a study field for many scholars in different areas such as finance, marketing, management and others. All of them agree though that the true aim of BI is to assist in the decision-making

process in an enterprise by providing knowledge through information. Marren (2004), describes BI as "the rational application of the principles of intelligence services to business. It is simply the collection, analysis, and application of strategic information to business decisions". Karim (2011), defines it as "the mixture of the gathering, cleaning and integrating data from various sources, and introducing results in a move that can enhance business decision making". All the available definitions though recognize knowledge as the main point for BI. Dobbs et al. (2002) state that knowledge is the key building block of Business Intelligence and BI aims at enabling decision-making according to business knowledge rather than assumptions. This knowledge is based on information which is indispensable in order to answer to questions for the business having to do with sales figures, right product for the right market, etc. These questions lead to answers that help the business make the right decisions. Therefore, information utilization is extremely important for any business since it leads to knowledge which is the input to intelligence.

In recent years another term, BPM (Business Performance Management) has arisen and is used as an umbrella term to describe the methodologies, metrics, processes and systems that monitor and manage the performance of an enterprise (Gartner). Many also use the term CPM substituting Business with Corporate. In many cases the terms BPM/CPM and BI are used synonymously but are distinctly different since BPM encompasses and enhances BI. BPM is mostly the strategic deployment of BI and the latter is its backbone. BI is more targeted at transforming data into information whereas BPM is more about combining BI and business strategy to accomplish the organizational objectives. BPM and BI together are the bridge that connect data to decisions.
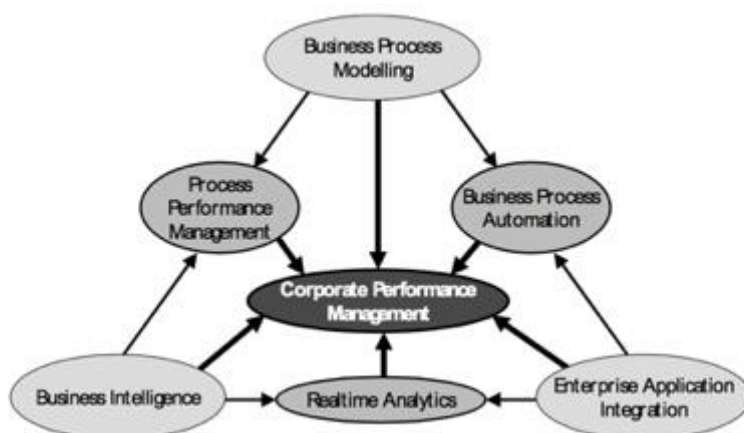
Fig.: Converging technologies for Corporate Performance Management (source: Melchert, F., Winter, R. & Klesse, M. 2014)

BI aims at supporting users in making better decisions in their business and is a very wide research topic. Most popular BI applications are query and reporting, online analytical processing (OLAP), statistical analysis, data mining and forecasting (Jing, 2006).

BI tools

As already stated previously BI has to do with the use of IT/IS to enhance the process of decision making in business. In order to generate knowledge for a business, information should be applied in the right time at the right place and in the right manner (Folkes, 2004). Here enters the use of databases as these are very important information resources that help to create business knowledge. Databases are used to record data from various business operations but in order to access and manage data from different applications a system needs data warehouses. A data warehouse differs from a database in the way it accesses and processes information. Griffin (1998) defines DWHs as enterprise-wide database management systems that can manage large amounts of data in a design that enhances the use and analysis of data in businesses. This is maybe the most important of the BI tools and was originally presented by Barry Devlin and Paul Murphy, two IBM researchers, in a paper called "An architecture for a business and information system" in 1988. This coincides with the introduction of the term of BI by Dresner and since data warehouses are required in order to successfully implement a BI system it is fairly considered as the first and foremost important BI tool. Next in line of the most significant BI tools is online analytical processing (OLAP) which basically handles the analysis of multidimensional data stored in data warehouses.

Implementation of a BI system

For a company to implement its own BI system or even make a selection among different vendors there has to be serious and careful planning, just like any type of investment. As Williams and Williams state, (2007), the ROI of such an investment can be ensured if it is aligned with a core business process i.e. aligned with the business strategy. Specific KPIs must be set that support important processes of the company. A BI application should improve the company's processes that drive profit. As Cooper et al, 2000 states if the BI investment is not aligned with the company's strategic goals, then it will not add value to the company and the BI analysis will be useless despite the correct and timely delivered information. Consequently, the top management

should firmly support the development and continuous use of a BI system and managers should make clear to their teams what type of analyses and data they need and are useful to them in order to make better decisions. Moreover, there must be a careful planning of the BI and IT architecture which will be deployed. At the same time, the level of acceptance of BI has to be determined since this is a great factor for the successful implementation of the BI system. The right data sources have to be used in order to minimize the amount of errors and omissions in the reports and ensure the trustworthiness of the analysis (Williams and Williams, 2007). Proper and structured training of the employees should also take place in the organization to increase the level of acceptance of the BI processes since if users do not accept them the business value of the BI initiatives is lost (Williams and Williams, 2007). In addition, information must be used in a timely manner otherwise the business value of the BI application will not be reached (Williams and Williams, 2007). As Popovic states, 2010, the ROI of a BI investment doesn't come from the BI application itself but rather from the improvement it generates in business processes. It is rather difficult to measure the value of BI for a business since this is mainly intangible gains such as information and knowledge. How can one measure accurately the value of timely information that helps in the decision process? One way would be to measure the unnecessary costs and extra revenue because of better decisions. Even if one could measure the value of BI this would seriously lag in time (Loonqvist et. al., 2006).

An important factor to take into consideration when implementing a BI system in an SME is the speed of adoption. Business operations have to keep on going at the same time the adoption of the BI system is taking place. According to Costello and Chibelushi (2009) there are four factors that affect the speed of adoption of new technologies in SMEs. These are:

1) The level of education of the SME owner-manager

2) Not understanding the benefits from new ICT technology adoption

3) Low investment in ICT

4) Lack of innovation which comes from lack of R&D

According to Nguyen's (2009) model that describes technology adoption is SMEs there are both internal and external challenges for the organization. Externals are the ones that have to do with the market's status (market-pull/innovation and technology push/competition) and the internal ones with the business's status (lifecycle of the system and maturity of the business). In particular Nguyen's framework distinguishes four types of factors, organizational, networking, external expertise, and IT. Figure 2.2 presents this model.
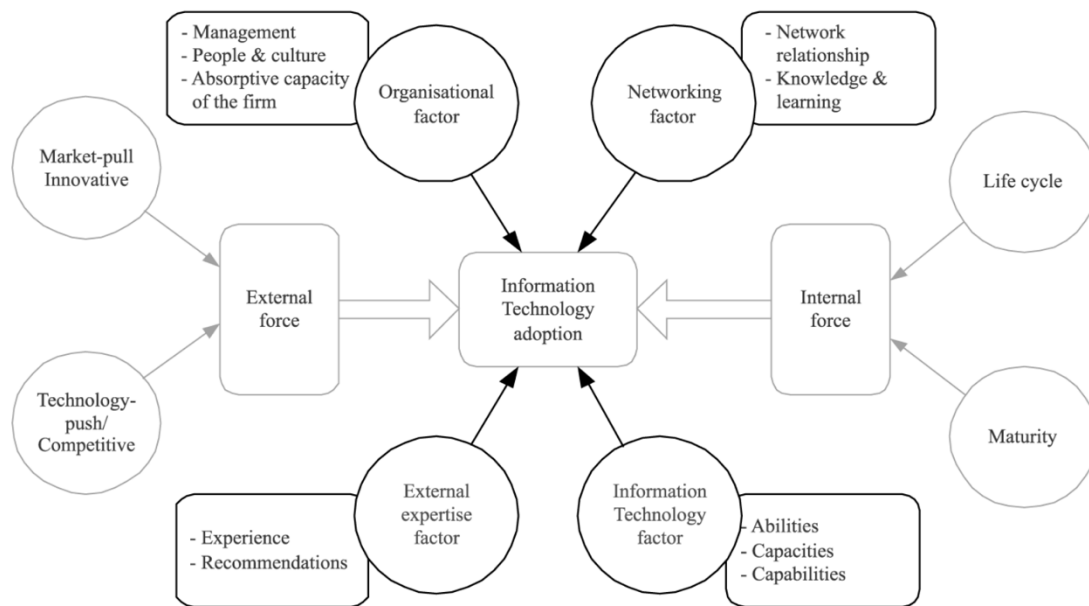
Fig. 2.2 Information Technology Adoption: an integrated framework (Nguyen, 2009:164)

Business Intelligence Process

It is imperative to present and understand the main points of the BI process so that this process can be adapted to an SME. Normally this process includes; identification of information needs and sources, extraction of data from various sources, processing of the data, storing and analysis of it, and finally distribution of the extracted information (Muller 2010, Lonnqvist 2006). Ernest Young has developed a BI process of its own called Information Value Chain as seen in figure 2.3. It is comprised of five steps which are the following (EY, 2013a):

1. *Collect*

   The process during which raw and organized data (unstructured and structured) is collected by identifying internal and external sources.

2. *Process*

   In this part takes place the cleansing and transformation of data in order to be in place with the business's standards.

3. *Organize*

   This is where data is being organized and stored in the data warehouses after it's been transformed.

4. *Analyze*

   In this step data is being analyzed and visualized in order to get information out of it.

5. *Decide*

> In this final step the extracted information is shared in a timely manner with the users that will eventually help them in the decision-making process.

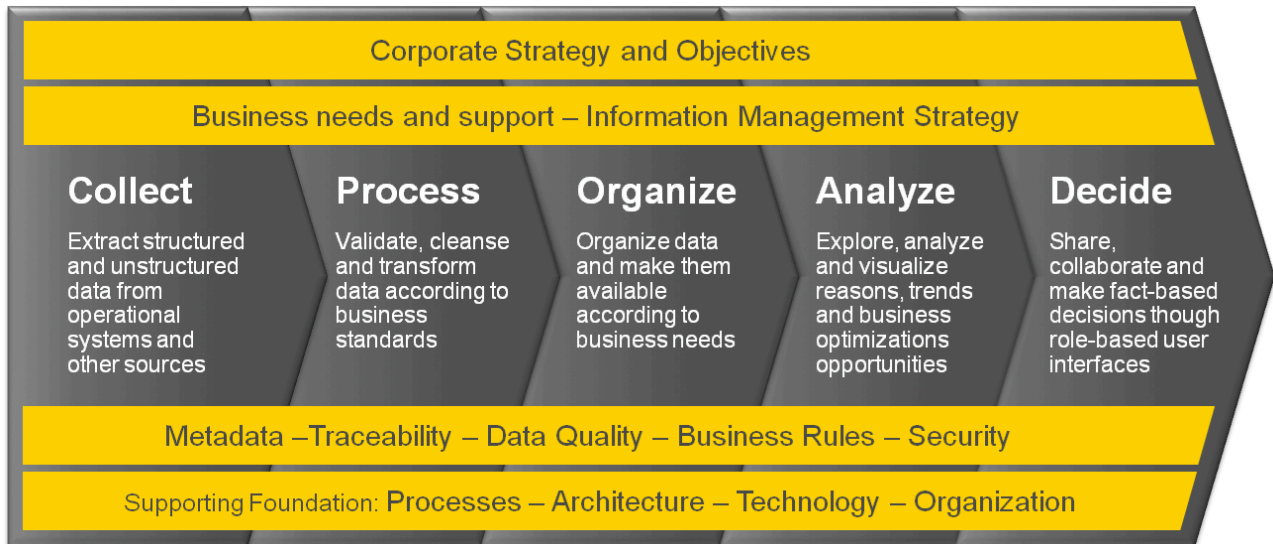The above BI process can be viewed in the following figure:

Figure 2.3: The Information Value Chain by EY

2.1.1.1 Business Intelligence Characteristics

Business Intelligence architecture

The architecture of a BI system is the way different components are combined for it to work without problems. The same BI system can't be implemented and used by all companies since each enterprise has its own needs and structure, therefore the BI architecture should be different (Lonnquist, 2006). Although there are plenty of BI architectures in the literature some basic key elements can be found in most of them.

Initially, there are the data sources from which data is being collected. An enterprise can have multiple and different data sources which can be quite challenging since the data will almost definitely differ in format and quality. Additionally, different sources might provide the same data in different formats which will result in duplicate archives. (Watson, 2009). For these reasons enterprises must implement as possible a standardized BI system that can integrate data from various sources and make it consistent (Williams and Williams, 2007). This will help the business achieve better business analysis (SAP Thought Leadership, 2009). Moreover, data

quality is also of great importance because the amount of available data is increasing fast and there's a difficulty in controlling it. A good solution to making sure that the quality of the data is acceptable is metadata. This ensures data consistency and traceability of information because ultimately if the users don't trust the data, they will not use it and the cost per report will be high (Williams and Williams, 2007).

Next the data is being extracted, integrated and prepared through different technologies. This is a process that is necessary so to extract, transform data and load it to the data storage. The most common data integration process is ETL (extract, transform, load) although it can be found as ELT also (extract, load, transform). The difference between the two is the sequence in which data is being handled. In the next phase data must be stored. Data warehouse is maybe the most important BI tool and technology and is the place where data is stored and data mining, analytical processing such as OLAP, querying and reporting activities take place. There are also data marts that can be such as small data warehouses that are used by single departments and/or processes of a business (finance, marketing, production, etc.). Finally, data is being analyzed with the use of different technologies and processes in order to extract knowledge so that the users can finally use the data and make informed decisions (Watson, 2009). All the above are presented in figure 2.3:
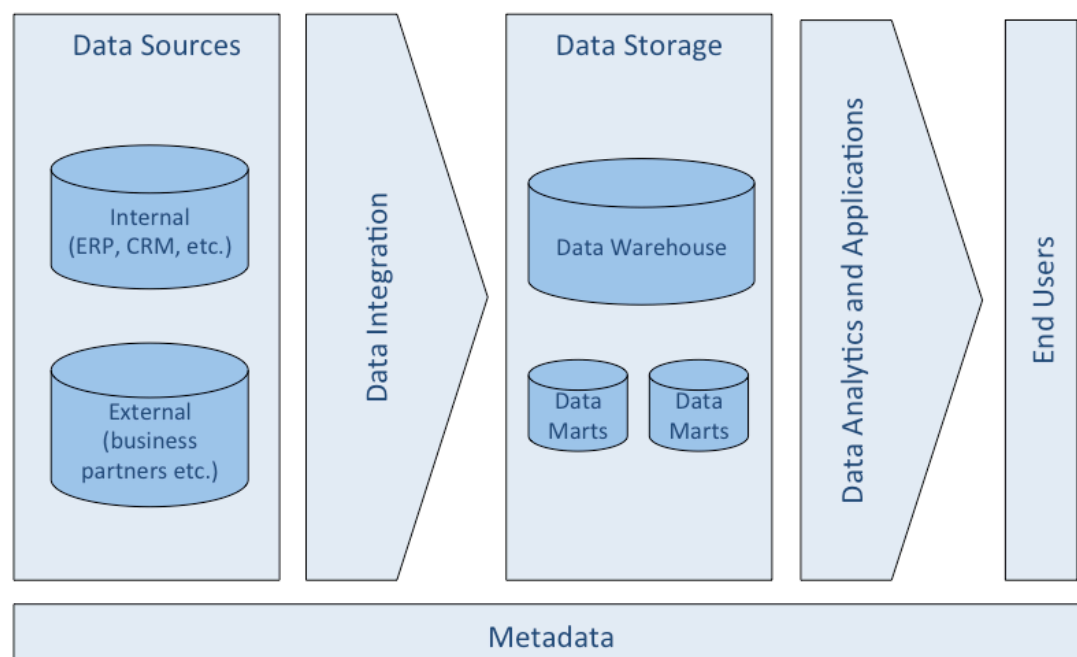

Figure 2.3 BI architecture

Use of BI

The most popular and widely used BI application is the known to all and beloved Excel, although it has many limitations (Davenport and Harris, 2007). The use of BI applications depends among other things on a business's needs and structure, for example how many users will there be. For SMEs and bigger companies as well, the traditional user is the top management of the company, although BI can provide information at all levels of a company (Negash, 2004). Besides the top management, power users can also be key players in a certain department, e.g. financial executives and people that interact with the system on a regular if not daily basis.

The use of a BI system in an SME helps the business unleash the complete value of the data stored therefore obtaining intelligence which is critical to the success of the enterprise. SMEs, like any type of company, must meet their customers' requirements and they need the flexibility to analyze their business's results almost daily and efficiently. Such systems that present data in a user-friendly manner can be used in lots of areas of a business such as order processing, inventory analysis, purchasing, sales and services. This way users can now have access to information that before wasn't available such as profit and cost drivers, sales integration and financial systems, sales and production forecasting and estimation, trend analysis, tracking of orders, profitability analysis, monitoring and standards compliance, ad hoc reporting, and many others. In addition, users of the system can use BI as a source of competitive advantage and transform the company's operational data into business assets that help them reach strategic decisions and improve their performance. As Stiroh (2001) and Williams and Williams (2007) state, BI use and improvement in a company affects it on several levels, as well as its whole supply chain. In order to ensure success for the use of BI top management has to convince employees who are resistant to change to accept the need for new tools, understand the benefits, and learn how to use it.

2.2 Small Medium Enterprises

2.2.1 SWOT Analysis of SMEs

Below there are some Strengths, Weaknesses, Opportunities and Threats that are faced by SMEs based on Kalpande, Gupta et. Al. (2010) papers and Commission Against Corruption (2013) article.

Strenghts	Weaknesses
Operational flexibility	Limited resources
Sharing common goals, developing mutual trust	Different working styles that change over time – lack of clear guidance
Simple organizational structure	Lack of systems and controls – trust abuse between employers and employees
Employee cooperation	Lack of planning
Closeness to market	Under-utilization of capacity
Inexpensive Labor	Lack of skilled employees
	Lack of technology innovation

(Source: Kalpande, Gupta, et. Al. 2010; Commission Against Corruption, 2013)

Opportunities	Threats
Government support	Uncertain economic environment Operational pressures
Excise relief	Increases in expenses from salary costs, raw materials etc.
Increase of ceiling	Legal, regulatory and cultural differences
Ancillarisation to big business	Financial inflexibility
Government can reserve products	Technological obsolescence
Low-cost, high efficiency of online platforms	High input prices
	Disregard for industrial training

(Source: Kalpande, Gupta, et. Al. 2010; Commission Against Corruption, 2013)

2.2.2 Innovation in SMEs

According to OECD (2018), innovation is a key driver of efficiency and long-term development and can assist to the solution of social challenges at the most reduced conceivable fetched (OECD, 2015a). Innovation in small and medium-sized enterprises (SMEs) is at the center of comprehensive development techniques: more innovative SMEs are more profitable SMEs that can pay superior compensation and offer superior working conditions to their specialists, hence making a difference diminish disparities. Besides, later advancements in markets and innovations offer unused openings for SMEs to improve and develop. Digitalization quickens the dissemination of information and is empowering the rise of unused business models, which may empower firms to scale exceptionally rapidly, frequently with few employees, substantial resources or a geographic impression (OECD, 2018).

Current Trends and Challenges

According to OECD (2018), SMEs are, normally, less innovative than huge companies. For case, across OECD (Organization for European Economic Cooperation) countries, the median value in the national SME share of business R&D is 35%. Moreover, SMEs (10-49 employees) are roughly as it were half as likely as expansive firms to have a business site permitting for online requesting and as it were one-third as likely as large firms to be utilizing Enterprise Resource Planning (ERP), a software platform that integrates core business processes in real-time (Figure1) (OECD, 2018).

Figure 1. Use of enterprise resource planning, 2015

By firm size, percentage values

Source: OECD ICT Database.
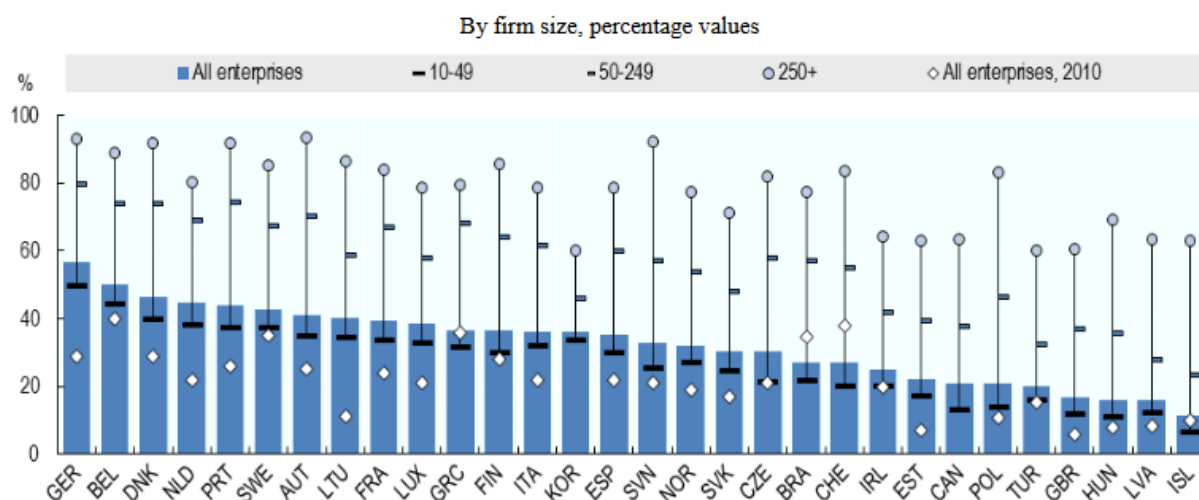
However, based on OECD article (2018), total figures conceal an extremely heterogeneous reality (OECD, 2017a). Survey information appear that a noteworthy extent of SMEs lock in all shapes of development, particularly in higher-income nations (Figure 2) which indeed the smallest employer enterprises (i.e. less than 10 workers) can reach efficiency levels over the large-company normal (OECD, 2018).

Figure 2. Innovation types by firm size, 2010-12

Percentage values (of firms within the scope of national innovation surveys)
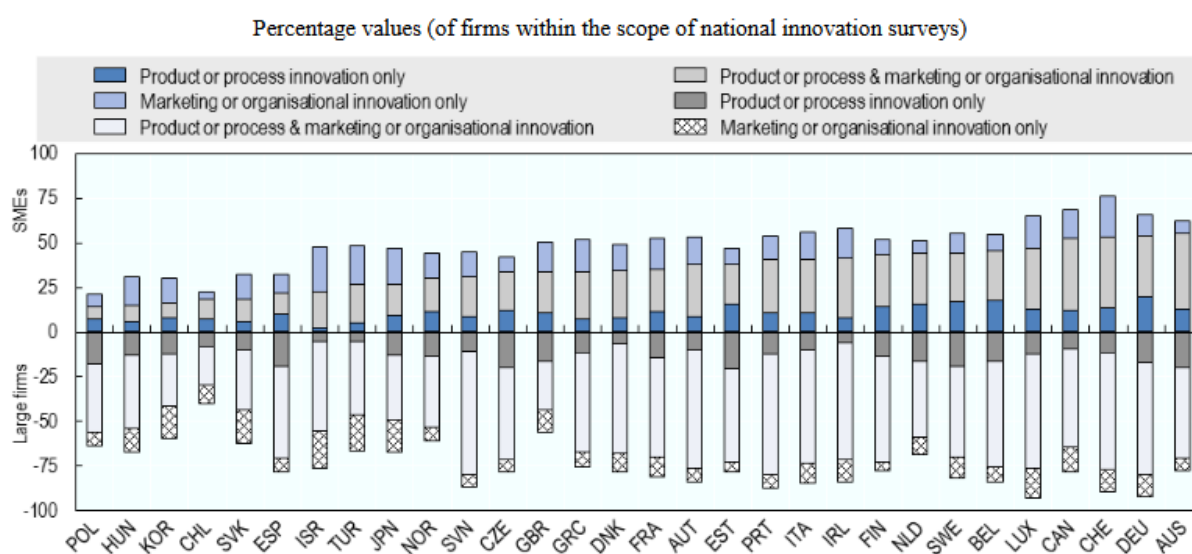
Source: OECD (2015), OECD Science, Technology and Industry Scoreboard 2015, OECD Publishing.

Based on OECD (2018), the commitment of SMEs to development has expanded in later decades much appreciated to changes within the way innovation takes place in the economy (OECD, 2017d). Enterprise innovation is not restricted to corporate R&D labs and is frequently the result of collaborative endeavors in which businesses associated and trade information and data with other accomplices as portion of broader innovation systems. This move towards an 'open innovation' worldview has decreased the require for innovation-related capital speculations, making business development more available to SMEs (OECD, 2010a). Moreover, particularly in science-driven divisions (e.g. biotech and nanotech), little businesses are frequently the source of radical advancements, much appreciated to their adaptability and to their capacity of working exterior of prevailing information ideal models; for case, SMEs account for almost 20% of licenses in bio-technology-related areas in Europe (OECD, 2017d). SMEs too constitute the bulk of high-growth firms, which are quintessentially "innovative" ventures able to develop quick over a brief period much obliged to troublesome changes in their 'business as usual' processes (OECD, 2018).

As OECD (2018) article claims, contrasts in SME execution and development introduction result from how inside key assets are utilized to contribute in in-house development and to collaborate with outside accomplices. Prove focuses to a solid connect between way better managerial aptitudes and formal administration processes (e.g. HRM, benchmarks and certifications, accounting, etc.) on the one hand and efficiency development on the other (OECD, 2017b). As an example, process innovation frequently includes cost-reduction methodologies, whose victory depends on the capabilities of the company administration. So also, the selection of Industry 4.0, which includes the utilize of mechanization and digitalization in fabricating, requires solid administrative aptitudes in SMEs (OECD, 2018).

According to OECD (2018), numerous governments have backed the updating of administrative abilities in SMEs, both in low-tech and high-tech businesses. Canada's Operational Proficiency Program, for case, reinforces operational effectiveness in fabricating SMEs by empowering taking part companies to benchmark and screen their operational execution against the industry normal. The objective is to eradicate the causes of squander within the production prepare and to create the trade handle more beneficial. Mexico has conveyed a large-scale six-hour administration preparing course for small scale trade proprietors in conventional divisions (e.g. retail exchange). As portion of this program, low-skilled business visionaries get an electronic tablet

which inserts the administration preparing computer program (management training software) and empowers client electronic installments (OECD, 2018).

Workforce abilities are moreover imperative based on OECD (2018), particularly in little businesses where a bigger extent of specialists than in expansive companies are included within the execution of commerce development on the 'shop floor'. In this regard, there's prove that SMEs that give workers with opportunities to create problem-solving abilities and to form utilize of their information are more likely than others to succeed in creating modern items or forms (OECD, 2015b). Governments in OECD nations back workforce preparing in SMEs through approaches which empower the arrangement of trade preparing bunches. Illustrations incorporate Germany's Inter-company Vocational Training Centers, Australia's Group Training Organizations, and Korea's Training Consortia. This method has critical benefits both for the government and for little businesses: governments can reach a bigger number of companies through a single approach intercession, whereas little businesses pick up way better coaches at lower costs and learn from their peers within the same preparing bunch (OECD, 2018).

Concurring to OECD (2018), the selection and successful utilize of ICT equipment and computer program could be a shape of trade development (business innovation), but moreover a prerequisite and assist driver of other shapes of commerce development. Certain administration program (e.g. client relationship management or enterprise resource planning) can help the professionalization of little commerce administration but may require upstream advancements in administrative abilities through preparing and counseling (see Box 1). A few advanced innovations are more significant than others for SMEs. For illustration, cloud computing can empower businesses to lease computing framework and computer program administrations from a third-party supplier without forthright speculation in ICT capital (OECD, 2017c; OECD 2014).

It can moreover ease the require for on-site IT staff and can empower SMEs to create utilize of other important advanced technologies such as information analytics, i.e. the utilize of crude "big data" for commerce purposes after satisfactory cleaning and preparing. Approaches which bolster speculation in ICT ought to take into thought the level of improvement, innovation needs and administrative aptitudes of the focused-on companies (OECD, 2018). Based on OECD (2018), most SMEs don't have an IPR (Intellectual Property Rights) procedure, nor do they coordinate IPRs into their trade techniques or model, which is for the most part the result of need of information and ability in SMEs.

Impediments to the utilize of IPR ended up especially intense when SMEs work universally and may include lawful overheads, numerous filings, administrative and specialized contrasts over

nations, and the vigor of neighborhood IP authorization (OECD, 2011). Supporting the development of administrative aptitudes is additionally imperative to spread the utilize of IPRs in SMEs (OECD, 2018).

As OECD (2018) article proposes, SMEs are too frequently ignorant of the near interface between commerce advancement and trade survival and development or may not be cognizant of how to engage in development; for case, little venture proprietors are frequently unconscious of the degree to which digitalization can move forward their trade (OECD, 2018).

Concurring to OECD (2018), little businesses may moreover be disheartened to improve on the off chance that huge (worldwide) players have overwhelming advertise positions, which may possibly be the case in an economy where innovation pioneers progressively capture most showcase offers due to "winner-takes-all" elements (OECD, 2018). Globalization has expanded the importance of cross-border collaboration in advancement, but SMEs discover it troublesome to identify and interface to fitting information accomplices and systems at the neighborhood, national and worldwide levels (OECD, 2018).

At last, based on OECD (2018) article, government development arrangement may not be suited to the way SMEs enhance. For case, R&D assess credits, one of the foremost common shapes of advancement approach, regularly unintendedly favor huge firms since R&D action is highly concentrated in some, for the most part expansive, firms, and since of their authoritative complexity. A few OECD nations have put in put extraordinary arrangements to goad SMEs to utilize R&D assess credits, such as upgraded venture assess credit rates (e.g. Australia, Canada, Japan, Korea, Norway, Poland and United Kingdom). Other development arrangements, such as pre-commercialization pubic obtainment, may not take account of the collaborative approach to advancement that's commonplace of SMEs (OECD, 2018).

2.2.3 Decision making in SMEs

According to Toqeer et. Al. (2015), strategic decision making is important for every kind of firm (Gibcus, Vermeulen, & de Jong, 2006). Different scholars describe strategic management from different point of view. Many of the modern scholars view strategic management in small firms as different from strategic management in large firms; and many of these scholars have proposed separate approach to describe it (Charles, Ojera, & David, 2015).Process of decision-making and strategic management in small firms does not follow any set rules or procedures; rather every small business follows a plan which entrepreneur finds suitable for his business (Hill and Gareth,

2012). Schoemaker (1993) defined strategic decision-making to be "intentional choices of programmed responses about issues that materially affect the survival prospects, well-being and nature of organizations". Strategic decisions are those decisions that decide the future line of action of the firms (Toqeer et. Al. 2015).

Based on Toqeer (2015), key decision-making forms in little firms vary from expansive firms based on three reasons (Gibcus, Vermeulen, & de Jong, 2006). To begin with reason talked about by Hambrick and Crozier (1985), Covin and Slevin (1989) is that the business-people in little businesses confront environment which is more dubious as compared to huge businesses. Supervisors and business-people in little firms don't have get to data which is open to expansive firms. Huge firms are backed by colossal staff and supervisors which make environment less dubious for expansive firms (Busenitz & Barney, 1997). Complexity and dynamism in environment are more prominent for little firms as compared to huge firms. (Busenitz & Barney, 1997). In huge firms, supervisors have plans for making choices but in small firms, business-people don't have such plans and decision-making in little firms is generally based on openings (Gartner, Fowl, & Starr, 1992).

Third reason talked about by Mador (2000) is that, usually, individuals included in decision-making in little firms are business visionaries, instead of supervisors, so they have diverse approach to decision-making, which make the method of decision-making in little firms distinctive from huge firms (Toqeer et. Al., 2015).

As Toqeer et. Al. (2015) claim, in arrange to form profound understanding of handle of decision-making in firms, it is vital to consider all autonomous factors examined over i.e. nature of choice to be taken, business person and environment that can have an effect on choice (Papadakis, Lioukas, & Chambers, 1998).

Concurring to Toqeer (2015), comparative components have been considered by other inquiries about to affect the method of choice making (Elissaveta & Gibcus, 2003). So, we will partition the decision-making handle at three levels: key choice level, a characteristic of choice taker and environment in which decision-making handle is carried out (Elissaveta & Gibcus, 2003). Human being performing the work of choice making is considered, in this setting, beneath the impact of behavioral, natural and individual influences. According to Pajares (2002), these impacts have been translated in an unexpected way by distinctive people. Major elements influencing the method of decision-making in little, as well as huge firms have, are appeared within the figure below:

a. Relationship between strategic decision-making process and entrepreneur

"Entrepreneur... they not only see the system as it is, but as it might be." (Mitton, 1989).
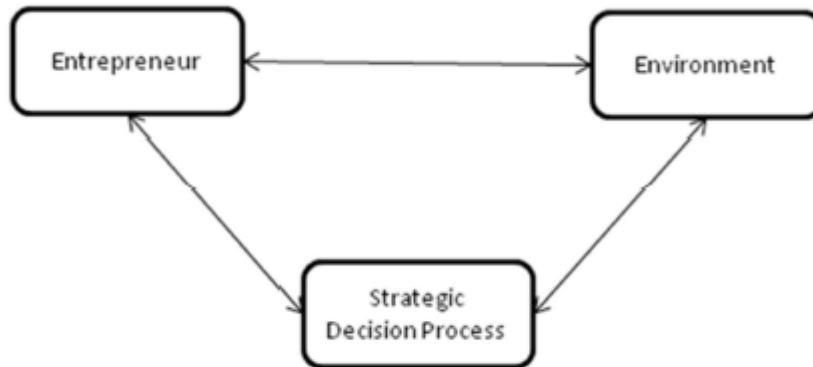

Fig 1. Conceptual Model: Levels of Analysis in Decision Making Process

Concurring to Toqeer et. Al. (2015), diverse sorts of business-people utilize diverse sorts of decision-making approaches in several circumstances (Charles, Ojera, & David, 2015). Passionate, judicious or intuitional decision-making approach utilized by business-person chooses the parameters of key choices taken by business person (Gibcus, Vermeulen, & de Jong, 2006). Based on Toqeer et. Al. (2015), choice, in turn, has an effect on encounter and information of an business-person by turning out to be a great or awful choice (Gibcus, Vermeulen, & de Jong, 2006). Cognitive decision-making handle of business visionaries is formed by the vital choices of past and their results (Gibcus, Vermeulen, & de Jong, 2006).

b. Relationship between Environment and Entrepreneur

As Toqeer et. Al. (2015) claim environment is one of those components that have most prominent effect on decision-making of a business-person since it is the environment that gives business person with openings of wander creation (Gibcus, Vermeulen, & de Jong, 2006). According to Toqeer et. Al. (2015), environment is additionally noteworthy since, in expansion to openings, environment is biggest source of danger as well. Business-person too has an impact on environment within the frame of his act of creation of wander. Issues like chance recognitions and hazard penchant are of major concern for business visionary (Toqeer et. Al., 2015).

c. Relationship between Strategic Decision-Making Process and Environment

Agreeing to Toqeer et. Al. (2015), the effect of vital decision-making handle on environment can be watched within the frame of advancement and generation of goods/services. Enhancement in showcase and development in economy are the major impacts that a key decision-making handle can have on its environment (Toqeer, et. Al. 2015). Based on Toqeer et. Al. (2015), environment influences strategic decision-making handle within the frame of instabilities and dangers. Due to these instabilities, most of the decisions taken by business-people are generally palatable, instead of being ideal (Gibcus, Vermeulen, & de Jong, 2006). An inquiry which will emerge at this arrange can be approximately recognizable proof of most imperative figure. Concurring to an observational ponder carried out by Papadakis et al. (1998), organizational setting, or environment in which choice is being carried out is the foremost vital calculate of all that has the effect on last result (Toqeer et. Al., 2015).

As Toqeer et. Al. (2015) recommend major distinction between decision-making handle in huge and little trade is that expansive businesses have directors for this reason whereas in little commerce, these and each kind of other choices are taken by business visionary of the commerce (Gibcus, Vermeulen, & de Jong, 2006). Choices taken by business visionaries are for the most part anxious and activity arranged and McGrath et al. (1992) called them "rugged individuals". Opposite to supervisors of expansive firms, business visionaries don't make profound examination and their choices are not exceptionally comprehensive (Smith, Gannon, Grimm, & Mitchel, 1988). Social examined carried out by McGrath et al. (1992) appeared social contrasts between the business visionaries of distinctive locale. Same considers appeared a few similitudes as well, such as business-people are as a rule chance takers, they support independence, and they are not equitable. They are dictator in their choice taking approach (McGrath, MacMillan, & Scheineberg, 1992).

Busenitz and Barney (Busenitz & Barney, 1997) found that each business person is interesting in his characteristics e.g. discernment of hazard of each business visionary is special from any other. They utilized deductive approach for making choices, too they are not prepared as supervisors, so the choice they make is often reflecting over-confidence in self (Gibcus, Vermeulen, & de Jong, 2006). Distinctive thinks about have uncovered, with observational prove, that business people are diverse from supervisors, at huge firms but all business visionaries share a few unsurprising values in their characteristics (McGrath, MacMillan, & Scheineberg, 1992). The highlights they share are those which really recognize them from common individuals (Gibcus, Vermeulen, & de Jong, 2006).

Definition of SMEs

The European Commission (EC) characterizes SMEs as having less than 250 people utilized. They ought to too have a yearly turnover of up to EUR 50 million, or a adjust sheet (Balance Sheet) add up to of no more than EUR 43 million (Commission Recommendation of 6 May 2003). These definitions are critical when evaluating which endeavors may advantage from EU financing programs pointed at advancing SMEs, as well as in connection to certain arrangements such as SME-specific competition rules. Little and medium-sized ventures (SMEs) represent 99% of all businesses within the EU. Assist SME examination breaks it down by size-class and the most ones utilized are:

- Micro enterprises: with less than 10 persons employed;
- Small enterprises: with 10-49 persons employed;
- Medium-sized enterprises: with 50-249 persons employed;

In figure 2.4 below the main factors that determine whether an enterprise can be classified as an SME are presented.

Company category	Staff headcount	Turnover	or	Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Figure 2.4 SMEs in EU

According to Statista.com the overwhelming majority of SMEs in EU in 2017 were micro enterprises. In figure 2.5 the exact numbers are presented.
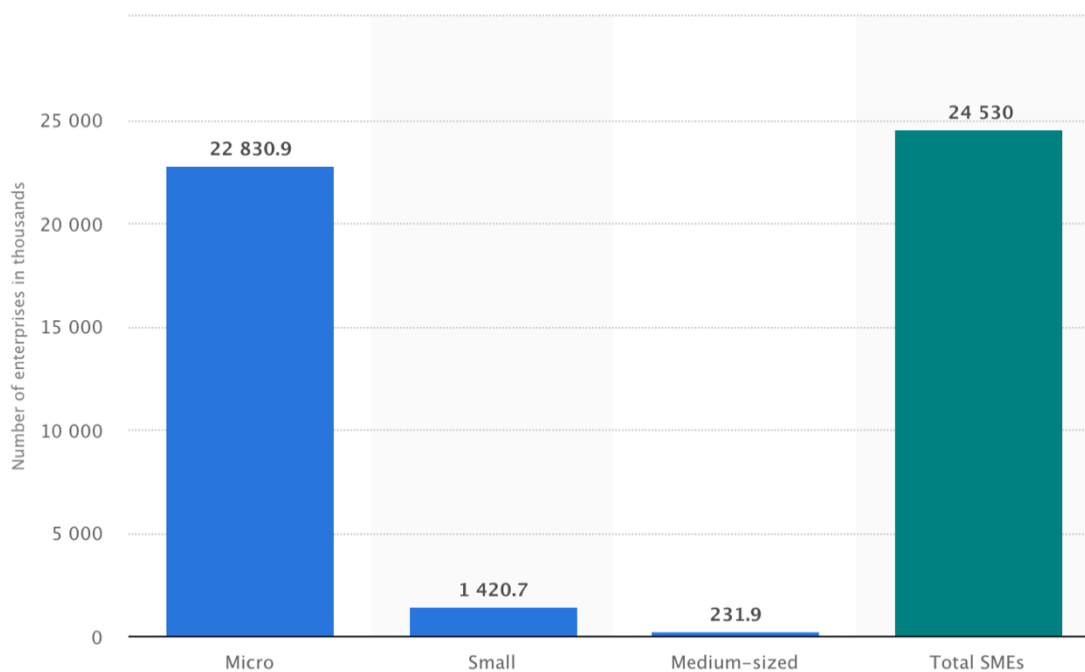
Figure 2.5 SMEs in EU by size in 2017

SMEs and BI

Numerous SMEs can be presently considered to be acting in a knowledge-based economy instead of a labor based one. As Godin (2016) focuses out the modern financial structure has included the information base as a vital calculate that influences the financial yield. In such an economy the production, conveyance and utilize of information and knowledge play an extremely imperative part in helping businesses to pick up competitive advantage over others (Sureephong, 2008). High competition in an information base economy makes the utilize of IS and BI pivotal in arrange to back choice making (Karim, 2011). In expansion, SMEs receive IT advances in arrange to fortify their position and competitiveness (Nguyen, 2009). In combination with the knowledge-based economy the appropriation of IT is a vital viewpoint for an SME in arrange to outlive the modern commercial center (Hoganson, 2001).

A European Commission report of 2006 expressed that as it were 10% of SMEs utilized ICT arrangements and devices for promoting, deals and acquirement in comparison to a 20% of medium-sized and a 30% of expansive companies. That report expressed that "SMEs endured from restricted understanding of ICTs and their potential, restricted budget for ICT speculations and trouble in selecting ICT professionals". The issue concurring to Gibson and Arnott (2003) was that most frequently SMEs were confronted with constrained financial support to buy and usage of commerce insights instruments (Business Intelligence Tools).

Benefits of BI

There's an assortment of areas in which BI can help SMEs, most companies utilize it for show-casing, deals and client benefit, ICT administration, human assets, SEO and web analytics as well as financial analytics. Within the same sense as greater enterprises, the benefits that BI can bring to SMEs are many. Many of the foremost vital ones are:

1. Provides quick answers on basic questions given that BI permits business visionaries and little trade proprietors to drag out data from unstructured information pools.

2. Empowering representatives since BI essentially turns each representative into a com-merce investigator and choice producer. This is greatly critical for SMEs that have re-stricted human resources.

3. Time saving since BI saves time that employees used to spend on data entry and editing. These days that BI software is computerized to an awesome degree, workers are cleared out with more time to be more creative.

4. BI can give more precise client profiles and increment their sales funnel conversion. Usually it is exceptionally valuable for cleverly gathering of people targeting, especially for SMEs that don't have as a rule a huge number of clients and ought to be exceptionally productive in advancing their administrations and items to a wide audience.

5. Identification of cost-cutting areas. SMEs usually operate with small margins and limited funds, therefore require smart budgeting. BI help them plan costs and improve their fi-nances.

6. Small businesses don't usually have the luxury to employ a seasoned data analyst that will transform data into easily comprehensible knowledge for top executives. BI plat-forms offer advances visual features that present results and data with colorful graphics and pie charts that are more easily understood than plain text.

7. BI software makes team work and cooperation easier since it allows data export and sharing for all team members to easily access important company data in real time.

Evolution of BI

Concurring to Miller (2007), the "Intelligent Enterprise" is characterized by seeing, understanding and acting in genuine time. Enterprise agility is the capacity to alter trade and adjust rapidly to proceeding changing conditions; it is maybe the significant point that characterizes organizational victory and disappointment (Mill operator, 2007) [1].

As Rogers focuses (2006), within the past, enterprise agility has been greatly troublesome to realize since it may not be tired a cost-effective way to see all the basic information spilling through the frameworks, applications, and forms that make up an enterprise's exchange and information data flow (Rogers, 2006). [2].

But things are advancing altogether. Orain (2009) underlines that presently business information that can be caught on in its commerce setting is streaming between applications – and indeed between our organizations and those of our trade accomplices, clients, and providers.

In these circumstances, Business Intelligence (BI) plays a critical role and must also be available in real time (Orain, 2009). [3].

Concurring to Panian (2012), Business Intelligence rapidly progressed through a few stages depending upon the innovation utilized. Changes in consequent stages don't criticize those of past ones but or maybe complement them, so that BI becomes increasingly complex (Panian, 2012).

As demonstrated by Panian (2012), at the supreme beginning point, authentic information mining techniques and devices were utilized for key regulatory uncovering purposes.

The second transformative stage is depicted by On-Line Analytic Processing (OLAP) progressions and dimensional examination of data put absent in data conveyance centers and data shops (Panian, 2012).

In the third stage Balanced Scorecard methodology is utilized as a strategy for Business Intelligence creation (Panian, 2012).

With the rise and creating predominance of E-Business and other Web applications and organizations the modern stage of BI appeared up since Web Analytics and Web mining as a sort of BI begun to draw within the wide expert consideration (Panian, 2012).

The fifth change orchestrate started when utilization of Business Dashboard advancement turned into a center portion of cautioning and aggravating systems in trade fundamental administration reinforced by BI.

As Panian (2012) focuses, these days we are seeing the period of mobile and location-based Business Intelligence built up on fitting mobile and location-aware innovations (Panian, 2012). To the degree it exceptionally well may be seen from the show point of see, the assist headway some time recently long can be typical within the field on unstructured substance in this way called big data analysis as a sort of complex Business Intelligence (Panian, 2012).

Factors Influencing Business Intelligence

According to Hung, Huang et. Al., (2016), Tornatzky and Flescher presented the TOE (Technology-Organization-Environment) system in 1990 when they examined the method of strategy advancement. This system basically states that when an endeavor chooses to embrace or execute a modern data innovation, the way toward settling on choices would be affected by innovation, organization, and environment (Hung, Huang et. Al, 2016).

Based on Hung, Huang et. Al., (2016), innovation setting incorporates the related innovation inside and exterior of the undertaking, such as hardware and forms. Organization setting incorporates commerce characteristics and assets, such as firm measure and degree of centralization, degree of formalization, administrative structure, human assets, sum of slack assets, and linkages among workers (Hung, Huang et. Al, 2016).

As Tornatzky & Fleischer (1990) point, environment setting is the entire industry structure, industry estimate, firm's competitions, macroeconomic setting, and administrative environment (Tornatzky & Fleischer, 1990).

Tornatzky and Fleischer (1990) clarified that despite the reality these three settings make a few openings for the undertakings to embrace development innovation, it too brings some impediments. In this manner, it is essential to form a self-assessment some time recently an undertaking choose to receive the advancement innovation and have a clear picture approximately its request and deformity in arrange to alter its operational structure and maximize it competitive advantage (Angeles 2013).

According to TOE Framework that was created by Tornatzky and Fleischer (1990), and the related writing, this consider examined a few key variables influencing the victory of BIS usage (Tornatzky and Fleischer, 1990).

Based on Hung, Huang et. Al., (2016), concurring to earlier studies, the estimations for BIS victory incorporate framework utilize (Yeoh et al. 2008), data utilize (Popovic et al. 2014), data quality (Yeoh et al. 2008), framework quality (Yeoh et al. 2008), user satisfaction (Da-vison,

2001). BI satisfaction (Isik et al. 2011) and Organizational benefits (Isik et al. 2013). In this study, organization utilize fulfillment and in general framework viability as a surrogate for BIS success (Hung, Huang et. Al., 2016).

BIS Characteristic
-Relative advantage
-Complexity
-Compatibility

Organizational Characteristic
-Top management support
-Organization Size
-Knowledge Integrate

Environment Characteristic
-Competitive pressure
-Consultant ability
-Training

BIS Success
-User satisfaction
-Overall System Effectiveness
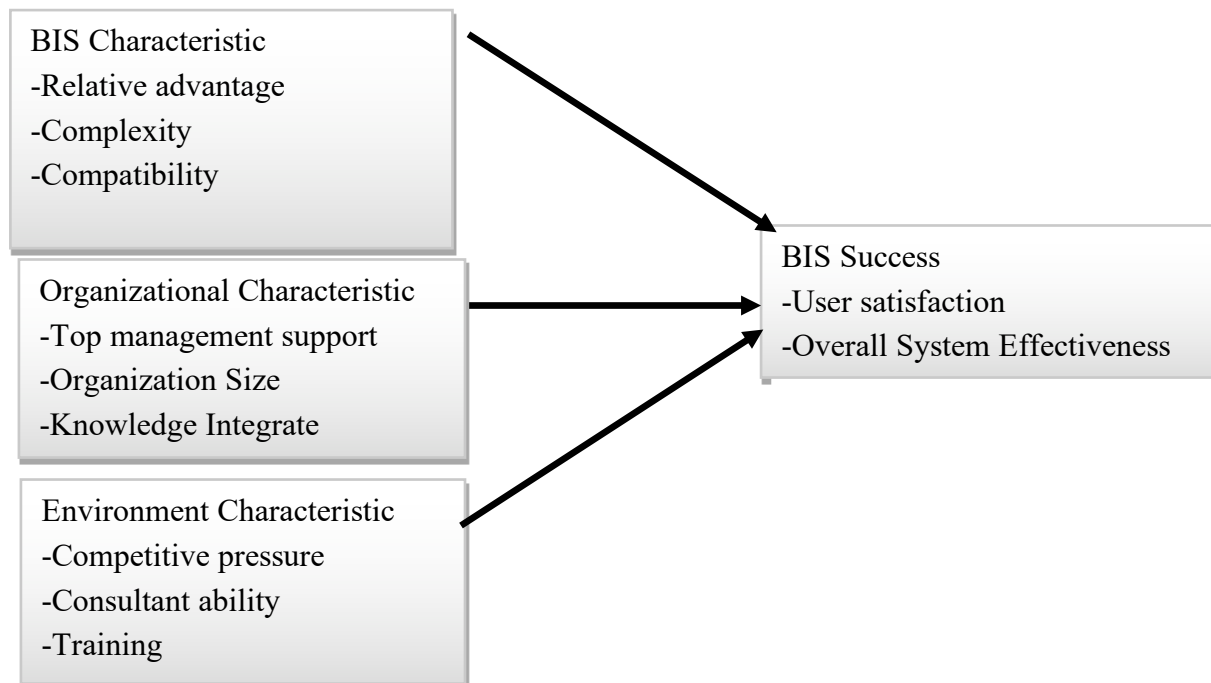
Business Intelligence Systems Models.

(Hung, Huang et al. 2016)

Hypothesis Generation of Technical Characteristics

As indicated by Hung, Huang et al., (2016), technical characteristics are the center key to impact the IS use in a corporate as its choice can physically improve the operational execution. Inside the examination of Tornatzky and Klein (1982) about advancement qualities and improvement reception usage, they called attention to that-relative preferred position, similarity, and unpredictability are the three attributes that can basically affect the choice of IS in an undertaking (Hung, Huang et al. 2016).

As Hung, Huang et. Al. (2016) guarantee various analysts appeared if a development headway is observed to be identified with the level of structure, regard, degree, strategy, and normal consistency, by then this specific advancement is bound to be gotten for supporting the activities of

a trade (Gopalakrishnan, Bierly 2001; Jeyaraj et al. 2006; Rogers, 1995)(Hung, Huang et. Al., 2016).

As Hung, Huang et. Al. (2016) state various analysts appeared if a development headway is observed to be identified with the level of framework, esteem, measure, technique, and typical consistency, by then this specific advancement is bound to be gotten for supporting the activities of a business (Gopalakrishnan, Bierly 2001; Jeyaraj et al. 2006; Rogers, 1995) (Hung, Huang et. Al., 2016).

The center capacity of BIS is to supply continuous and important information to support customers or chiefs to make exact decisions to make a progressively upper hand for related organizations in a business (Afolabi, Goria, 2006).

- Relative favorable position envelops a positive effect on BIS utilization achievement.

- Compatibility includes a positive effect on BIS execution achievement.

- Complexity incorporates a negative effect on BIS utilization triumph (Hung, Huang et. Al, 2016).

Hypothesis Generation of Organizational Characteristics

According to Hung, Huang et. Al, (2016), a great organizational climate is the foundation for the victory of organizational change within the ventures (Bocket al.2005). A number of analysts declared that the support and commitment of beat administrators is one of the basic variables for IS effective usage within the organization, as their underpins empower the related exercises of computer program designing to accomplish physic asset, counting: the input of gifted labor and capital reserves, asset allotment, or minimizing the potential resistance caused by the inside structure alteration (Chau & Tam1997; Greenery & Atre 2003; Sabherwalet al.2006). Thong & Yap (1995) contended that since of the deficiency of budgetary asset, labor, and strategy, a little estimate trade will be much slower than the expansive measure endeavor within the execution of innovational technology (Thong, Yap, 1995) (Hung, Huang et. Al, 2016).

Agreeing to Diffusion of the Innovations Theory of Rogers (1995), the estimate of a trade can altogether influence the victory of innovational technology execution. Since the foundation of BIS costs more, and have a longer payback period than the other data frameworks; particularly, it requires to overcome a few variables such as: integration of information from diverse offices, information correction, and operational objective alteration subsequently, it is considered that the execution of BIS is exceedingly related to the estimate of the organization and the degree of information integration (Rogers, 1995).

- Top Administration back has positive impact on BIS usage success.

- Organization estimate incorporates a positive impact on BIS usage success.

- Knowledge integration incorporates a positive impact on BIS execution victory (Rogers, 1995).

Hypothesis Generation of Environment Characteristics

According to Hung, Huang et. Al, (2016), the commerce exercises are closely related to its outside circumstance. The more instability there's within the business circumstance, the more we must create IT in order to create benefits and resolve potential issues for the organization (Kuan & Chau2001; Xueet al.2011) (Hung, Huang et. Al, 2016).

Based on Hung, Huang et. Al, (2016), researchers concluded that social environment, assignment environment, and data are the variables influencing the exercises of an organization. Based on this conception and having investigated earlier literary works, this inquire found a few vital components that can essentially impact the victory of BIS usage, they are competitive weight, specialist capacity, and training. These variables are utilized as the base of the investigate mode (Sangar & Iahad 2013; Xueet al.2011) (Hung, Huang et. Al, 2016).

As Hung, Huang et. Al, (2016) conclude, regularly, the reason of actualizing a BIS is to manage with the strongly contention between businesses, and to get the competitive advantage. In any case, amid the period of executing a modern framework, exceptionally frequently it can make a few affects in the organization. Subsequently, in arrange to oversee the planned issues, the help from a proficient and experienced specialist is vital. In expansion, a few proper preparing can help the clients cope with the framework, and to be more recognizable with the operational method (Sangar et al.2015).

- Competitive weight encompasses a positive impact on BIS implementation success.

- Consultant capacity contains a positive impact on BIS usage success.

- Training includes a positive impact on BIS usage victory (Hung, Huang, et. Al 2016).

3 BUSINESS INTELLIGENCE TOOLS AND TECHNIQUES

Stage I: Data Mining

The Three Parents of Data Mining

As per Han (2001), information mining as a system has three guardians: insights, software engineering, and database/data warehouse management. In the mid-1980s, insights contributed strategies, for example, recursive parceling and non-parametric relapse, and apparatuses, for example, the bootstrap and cross-approval (Han, 2001).

At roughly a similar time, software engineering created neural system models and new calculations for quick execution of conventional factual investigations on enormous informational collections (data sets), for example, clustering and smoothing; they additionally begat the adage "data mining" (Han, 2001).

As Han focuses, database management researchers created consecutive inquiry techniques and social information bases, just as the idea of information distribution center (data warehouse). The juncture of these thoughts prompted the extension of inferential science to bigger and increasingly complex data sets (Han, 2001).

Business Data Mining

Based on Han dynasty (2001), data processing has been terribly effective in centered areas, like diagnosing, research project, and activity identification, research project, and activity identification since the mid-1980s. however data processing technology has additionally journeyed into the business world wherever it's value-added new dimension of predictive analysis (Han, 2001).

Data mining could be a powerful technology that converts detail knowledge into intelligence that companies will use to predict future trends and behaviors. Some vendors outline data processing as a tool or an application of an algorithmic program to knowledge (Han, 2001).

Han (2001) describes that the reality is data mining isn't simply a tool or algorithmic program. It is a process of discovering and decoding antecedently unknown patterns in knowledge to unravel business issues. It is a reiterative process, that means that every cycle refines the result set. This

could be a posh method, however there are tools and approaches offered these days to assist business user navigate with success through the steps of data mining projects (Han, 2001).

From an IT perspective, the data mining process needs support for the subsequent activities:

- Exploring the info

- making the analytic set knowledge

- Building and testing the model

- group action the results obtained into business applications (Han, 2001).

Therefore, as Han (2001) concludes, the IT organization should give a setting capable of addressing the subsequent challenges:

- Exploring and pre-processing massive data volumes

- Providing enough process power to expeditiously analyze several variables (columns) and records (rows) in an exceedingly timely manner.

- Integrating data mining results into the business process.

- making a protractile and manageable data processing setting (Han, 2001).

For years, as Han (2001) elaborates, business have relied on reports and ad hoc query tools to garner helpful information from data. However, as data volumes still increase, finding valuable information becomes a frightening task. Data mining technology was designed to sift through careful historical knowledge to spot hidden patterns that aren't obvious to humans or question tools. Several of those antecedently hidden patterns reveal intelligence which will be integrated into business processes to supply prognosticative capabilities for up strategic business deciding.

To be effective within the business world, the data mining method had to be tailored to deliver models in an exceedingly time-sensitive manner. Today, with the arrival of in-database data processing techniques, businesses have finally found it doable and cheap to profit from the advanced capabilities of this powerful technology (Han, 2001).

Data mining makes analytical business applications smarter by providing insights into several new areas of the business that may otherwise go unperceived. By creating business applications smarter, data processing interprets into a better come on business investment (Han, 2001).

The Way Data Mining Is Deployed

In view of Graham, Lin et. Al. (2002), a business can't just purchase a data mining product, apply it to data and hope to produce a significant model. Data mining models are worked as a component of an information mining process – a progressing procedure requiring support for the duration of the life of the model (Graham, Lin et. Al., 2002).

As per Bellazzi, Ferrazzi et. Al. (2011), the data mining procedure isn't direct, yet an iterative procedure where you circle back to the past stage. For instance, the underlying model you make may prompt understanding expecting you to come back to the information pre-preparing stage to make new systematic factors. The data mining procedure contains four high-level steps:

- Define the business issue

- Explore and pre-process the data

- Develop the data model, and

- Deploy information.

As Bellazzi, Ferrazzi et. Al (2011) point out, albeit every one of these means is significant, a large portion of time will be spent in the information investigation and pre-preparing stage. A well-organized information distribution center can fundamentally decrease the agony felt in this stage (Bellazzi, Ferrazzi et. Al. 2011).

Stage II: On-Line Analytical Processing (OLAP)

OLAP Basics

As per Schrader, Endress et. Al., (2008), OLAP implies a wide range of things to various individuals, yet the definitions as a rule include the terms 'cubes', 'multidimensional', 'slicing and dicing' and 'speedy-response' (Schrader, Endress et. Al. 2008).

As Miller (2010) claims, OLAP is every one of these things and that's only the tip of the iceberg, however it is additionally an abused and misjudged term, to some extent since it covers such a wide scope of subjects. OLAP is an abbreviation, meaning 'On-Line Analytical Processing'. This does not give a precise depiction of OLAP, however it distinguishes it from OLTP or 'On-Line Transactional Processing'. It is anything but difficult to scrutinize the requirement for OLAP. On the off chance that an end client requires abnormal state data about their organization, at that point that data can generally be gotten from the basic value-based information, consequently we can accomplish each prerequisite with an OLTP application. Were this valid, OLAP would not have turned into the significant point that it is today. OLAP exists and keeps on extending in use since there are impediments with the OLTP approach. The cutoff points of OLTP applications are found in three regions. OLAP applications vary from OLTP applications in the manner that they store information, the way that they investigate information and the way that they present information to the end-client. It is these crucial contrasts that permit OLAP applications to respond to increasingly complex business questions. OLAP applications present the end client with data as opposed to simply information. They make it simple for clients to distinguish examples or patterns in the information all around rapidly, without the requirement for them to look through piles of 'crude' information. Regularly, this examination is driven by the need to address business issues, for example, 'How are our deals getting along this month in South-Eastern Europe?' or 'From which provider, X, Y or Z, we have requested the biggest amounts of merchandise required?' (Miller, 2010).

From these establishments, as indicated by Miller (2010), OLAP applications move into territories, for example, forecasting and data mining, enabling clients to address questions, for example, 'What are our anticipated work costs for one year from now?' and 'Demonstrate to me our best sales rep' (Miller, 2010).

Multidimensionality

Regarding to Miller (2010), although different OLAP tools use different underlying technologies, they all attempt to present data using the same high-level concept of the multidimensional cube. Cubes are easy to understand, but there are fundamental differences between cubes and databases that can make them appear more complicated than they really are. The cube is the conceptual design for the data store at the center of all OLAP applications. Although the underlying data might be stored using several different methods, the cube is the logical design by

which the data is referenced. The axes of the cube contain the identifiers from the field columns in the database table. Each axis in a cube is referred to as a 'dimension'. The basic logical construct is a simple two-dimensional cube. Although useful, this cube is only slightly more sophisticated than a standard database table. The capabilities of a cube become more apparent when we extend the design into more dimensions. Multidimensionality is perhaps the most 'feared' element of cube design as it is sometimes difficult to envisage. Although the word 'cube' refers to a three-dimensional object, there is no reason why an OLAP cube should be restricted to three dimensions. Many OLAP applications use cube designs containing up to ten dimensions but attempting to visualize a multidimensional cube can be very difficult. The first step is to understand why creating a cube with more than three dimensions is possible and what advantage it brings (Miller, 2010).

The Key Differences between OLAP and Data Mining

According to Miller (2010), OLAP is a Business Intelligence instrument that enables a businessman to dissect and comprehend business drivers in 'true terms". Ordinarily, a particular 'spellbinding' or genuine inquiry is figured and either approved or disproved through specially appointed questions. OLAP results are additionally true outcomes. Data mining, then again, is a type of disclosure driven examination where factual and AI strategies are utilized to make forecasts or gauges results or attributes before knowing their actual qualities. With data mining, expectations are joined by explicit assessments of the sources and number of mistakes that are probably going to be made. Appraisals of mistakes make an interpretation of straightforwardly to evaluations of hazard. Thus, with data mining, settling on business choices within the sight of vulnerability should be possible with nitty gritty and solid data about related dangers. Data mining strategies are utilized to discover significant, frequently mind boggling, and already obscure or shrouded designs in data (Miller, 2010).

Stage III: Balanced Scorecards

Robert S. Kaplan and David Norton, co-makers of the Balanced Scorecard Method, composed their first book in 1996.

Kaplan and Norton (1996) took a gander at the Balanced Scorecard as a Performance Management framework that could be utilized in any size association to adjust vision and mission to

client necessities and everyday work, oversee and assess business strategy, screen operation efficiency upgrades, fabricate organizational capacity, and communicate advancement to all representatives. The scorecard enables an association to gauge monetary and client results, activities, and organizational capacity. The Balanced Scorecard (BSC) has relocated after some time to turn into a full Performance Management system appropriate to both private segment and open (and not-revenue driven) associations. Furthermore, the accentuation has moved from simply the estimation of money related and non-budgetary performance, to the administration (and execution) of business methodology. In this sense, BSC turned into another style of Business Intelligence. BSC frameworks can be the core of a corporate presentation framework. They give the capacity to see three distinct elements of an association's presentation: Results (monetary and client), Operations, and Capacity. The parts of a completely created scorecard framework are: Business Foundations, including vision, mission, and values; Plans, including interchanges, usage, robotization, and assessment plans, to assemble worker purchase in and convey results; Business Strategies and Strategic Maps, to diagram the course and characterize the intelligent de-sythesis of techniques into exercises that individuals chip away at every day; Performance Measures, to follow genuine execution against expectations; New Initiatives, to test strategic suppositions; Budgets, including the assets required for new activities and mongrel lease tasks; Business and Support Unit Scorecards, to make an interpretation of the corporate vision into significant exercises for divisions and workplaces; and Leadership and Individual Development, to guarantee that representative learning, aptitudes and capacities are upgraded to meet future employment prerequisites and rivalry. In BSC language, vision, mission, and technique at the corporate dimension are disintegrated into various perspectives, or points of view, as observed through the eyes of entrepreneurs, clients and different partners, administrators and procedure proprietors, and workers. The proprietors of the business are spoken to by the Financial viewpoint; clients and partners (clients are a subset of the bigger universe of partners) are spoken to by the Customer point of view; chiefs and procedure proprietors by the Internal Business Processes point of view; and workers and infra-structure (Capacity) by the Learning and Growth point of view. In any case, building and implementing a scorecard framework is a certain something; transforming the scorecard into an utilized and valuable BI framework is something totally different.

As indicated by Cokins (2009), the way to changing a scorecard into a BI framework is to begin at the correct dimension of granularity and 'come to an obvious conclusion among the segments

of methodology (mission, vision, values, torments, empowering influences, vital outcomes and topics, and strategic goals) and the parts of tasks (ventures, procedures, exercises, and assignments), and the spending plan and cost revealing procedures (Cokins, 2009).

At long last, Cokins (2009) reasons that presentation estimates integrate the parts and give a business an approach to gauge how fruitful they are at accomplishing their objectives (Cokins, 2009).

Stage IV: Web Mining and Web Analytics

As per Heinrichs, and Lim (2003), with the dangerous development of data sources accessible on the World Wide Web, just as different E-Business exercises, it has progressed toward becoming increasingly important for clients to use robotized apparatuses in finding the ideal data assets, and to follow and break down their utilization designs. These variables offer ascent to the necessity of making server-side and customer side insightful frameworks that can viably dig for learning. That is the motivation behind why a lot of Web Mining and Web Analytics devices are produced (Heirichs, Lim, 2003).

Web Mining

In view of Heinrichs and Lim (2003), Web mining can be extensively characterized as the disclosure and examination of helpful data from the World Wide Web. This depicts the programmed hunt of data assets accessible on-line, for example Web substance mining, and the disclosure of client access designs from Web servers, i.e., Web use mining (Heinrichs, Lim, 2003).

Web Content Mining

As indicated by Michiels and Jefferies (2003), the absence of structure that penetrates the information sources on the World Wide Web makes computerized disclosure of Web-based data troublesome. Customary web indexes, for example, Lycos, Alta Vista, WebCrawler, and others give some solace to clients, yet don't for the most part give basic data nor sort, channel, or translate archives (Michiels, Jefferies, 2003).

As of late these variables have incited scientists to grow progressively clever devices for data recovery, for example, shrewd Web specialists, and to stretch out information mining systems to

give a larger amount of association for semi-organized information accessible on the Web. We outline a portion of these endeavors beneath:

1. Operator based Approach–Generally, specialist-based Web mining frameworks can be set into the accompanying three classes:

a. keen pursuit specialists

b. data separating/classification

c. customized Web specialists

2. Database Approach–Focused on strategies for sorting out the semi-organized information on the Web into progressively organized accumulations of assets, and utilizing standard database questioning components and information mining systems to investigate it:

a. staggered databases

b. Web inquiry frameworks (Michiels, Jefferies, 2003).

Web Usage Mining

As per Michiels and Jefferies (2003), Web use mining is the programmed revelation of client access designs from Web servers. Associations gather huge volumes of information in their everyday activities, created consequently by Web servers and gathered in server access logs. Different sources of client data incorporate referrer logs which contain data about the alluding pages for each page reference, and client enlistment or overview information accumulated by means of CGI contents. Most existing Web investigation instruments give systems to revealing client movement in the servers and different types of information sifting. Be that as it may, lately increasingly complex frameworks and strategies for disclosure and investigation of examples are additionally rising. These devices can be set into two fundamental classifications, as recorded underneath (Michiels, Jefferies, 2003).:

1. Pattern Discovery Tools–The rising devices for client design revelation utilize refined procedures from AI, data mining, psychology, and information theory, to dig for learning from gathered information.

2. Pattern Analysis Tools–Once access patterns have been found, investigators need the fitting apparatuses and systems to comprehend, envision, and translate these examples.

As Michiels and Jefferies (2003) point out, one of the unclosed issues in data mining, all in all, and Web mining is the formation of wise devices (intelligent tools) that can aid the understanding of mined learning. Plainly, these apparatuses need explicit information about the issue space to do any more than sifting dependent on measurable characteristics of the found standards or examples. In Web mining, for instance, keen specialists could be built up that dependent on found access designs, the topology of the Web region, and certain heuristics got from client conduct models, could give proposals about changing the physical connection structure of a website (Michiels, Jefferies, 2003).

Web Analytics

As expressed by Michiels and Jefferies (2003), quite recently, who was visiting Web destinations and for what reason was basically a riddle. Website admins put counters on Web pages to follow how often individuals 'hit' the page – that is, visited, downloaded a record, or some other action – however that was the degree of the understanding. Genuine Web investigation capacities were restricted to enormous corporations that could bear to burn through a huge number of dollars every month on programming to track and write about web movement (Michiels, Jefferies, 2003).

Today, as indicated by Poepsel (2003), there is a wide scope of Web measurements estimating and following applications accessible, making examination a standout amongst the most discussed points both on the web and off. Albeit a portion of these devices are yet costly, a couple of examination programs accessible currently are totally free – and similarly as successful (Poepsel, 2003).

Basically, Web examination includes estimating, gathering, investigating, and announcing Web website traffic and conduct with the true objective of advancing the accomplishment of the Web webpage.

As expressed by Poepsel (2003), all Web examination apparatuses work by gathering crude information about Web website guests and sorting out it in a manner that is simpler to see and get

it. A few projects, called log analyzers, use server logs (information records gathered by web servers) to give information about guests. At that point there are different projects – investigation applications – which use bits of code introduced on a Web webpage to accumulate data about web movement and produce reports (Poepsel, 2003).

By and large, log analyzers are viewed as increasingly specialized and the crude data they give might be difficult to see, particularly for individuals who are new to Web measurements. For this situation, it is most likely a superior plan to stay with an investigation program (Poepsel, 2003).

As indicated by Poepsel (2003), regardless of which Web examination apparatus is utilized, their clients are going to be given a powerful exhibit of measurements. From online visits and one of a kind guests, to referrers and normal time nearby, there are unlimited measures of information to filter through. In any case, focusing on the accompanying key measurements will advise clients nearly all that they have to know:

- Visitors–The quantity of guests to a webpage will give a general thought of how well the website proprietor is getting the word out about his business.

- Page Views–Looking at online visits can determine what substance on the website is the most popular.

- Referring Sites–Looking at alluding destinations will give a brilliant depiction of the sort of individuals who are visiting the site.

- Bounce rate and Exit pages–A skip rate estimates something other than what's expected than a leave page, yet both can give significant bits of knowledge into why individuals are leaving the site. In many examination programs, a "ricochet" is recorded when an individual visits and leaves with-in a second or two, for the most part before the page is even done stacking. Top leave pages show which pages individuals visit preceding they leave (Poepsel, 2003).

- Keywords and Phrases–Keywords and expressions let the website proprietor recognize what terms individuals are utilizing to discover his webpage in web crawlers. This can give him/her some thought of how to add diverse substance to engage considerably more clients. Even though still a moderately new creation, Web investigation is turning into an inexorably well known – and effective –webpage improvement strategy utilized by online entrepreneurs. By giving profound knowledge into the who, what, when, why and how of site traffic and guest behavior, Web examination devices can enable you to improve the ease of use of the webpage and lift its adequacy (Poepsel, 2003).

Stage V: Business Dashboards

As per Sanna (2008), Business Dashboards are turning into the new essence of business intelligence (BI) at the earliest reference point of the 21st century. While superficially, Executive Information Systems (EIS) from the 1980s had a comparative look and filled a comparative need, current Dashboards are intuitive, simpler to set up and update to changing business needs, and significantly more adaptable to utilize. This, in addition to their capacity to display information and data at both a synopsis and definite dimension, makes them a standout amongst the most incredible assets in the business client's pack (Sanna, 2008).

To be helpful, as Sanna shows (2008), notwithstanding, a Business Dashboard must be actualized around the requirements of the business [14]. Its capacities ought not be directed by innovation or by the impulses of the end clients. Likewise, a Business Dashboard ought to be actualized so it gets utilized – thus that the leaders utilizing it can follow up on the data the Dashboard presents (Sanna, 2008).

Business Dashboards vs. Spreadsheets

As indicated by Vasiliu (2005), alongside current Dashboards advancing from the old EIS apparatuses, another BI device has been with us for some time: the spreadsheet. Frequently as Microsoft Excel, the spreadsheet has a natural interface and is anything but difficult to learn, at any rate like its most fundamental capacities. It gives nitty gritty numbers, which clients can dissect including their very own estimations (Vasiliu, 2005).

In any case, Vasiliu (2005), alludes that while the spreadsheet is anything but difficult to utilize and comprehend, it is frequently too nitty gritty to even consider giving a fast and far reaching

outline of business information. Moreover, clients are probably going to reformat this business information in different spreadsheets, including estimations and conglomerations. This will make yet more cells of significant business information. Although it is conceivable to make corresponding graphs in many spreadsheets, this is a tedious, manual movement that fits effectively committed errors (Vasiliu, 2005).

In any case, Vasiliu (2005) claims that numerous business clients stay with spreadsheets since they feel good with them and are hesitant to change to another model. Actually, not all things can be done proficiently in the spreadsheet; and one ought not stall out with them essentially in light of the fact that is the thing that they have or have been utilizing. This can prompt a circumstance where it's the confinements of the program – as opposed to business needs – that decide the extent of announcing and examination (Vasiliu, 2005).

Considering Vasiliu (2005), with the privilege basic innovation, the present Business Dashboards emerge from the spreadsheet, which in any case remains the most utilized BI interface today. Dashboards consider a speedy and simple to-customize diagram of basic business information in an opportune manner. This additional esteem transforms the present Business Dashboards into the new essence of BI (Vasiliu, 2005).

Business Dashboards vs. Scorecards

As per Carotenuto (2007), much of the time, the terms Dashboard and Scorecard are utilized reciprocally. Be that as it may, although Dashboards and Scorecards share much for all intents and purpose, there are the contrasts between the two [15]. From one viewpoint, administrators, directors, and staff use Scorecards, and especially Balanced Scorecards, to screen vital arrangement and accomplishment with key goals and targets. Then again, Business Dashboards are utilized at operational and strategic dimensions. Administrators, directors, and administrators utilize operational Dashboards to screen point by point operational execution on a week after week, every day, or even hourly premise. In a similar vein, supervisors and staff utilize strategic Dashboards to screen strategic activities (Carotenuto, 2007).

Benefits of Business Dashboards Deployment

As Carotenuto (2007) states, Business Dashboards help associations achieve expressed objectives by utilizing data and investigation. They give arrangement, perceivability, and joint effort over the association by enabling business clients to characterize, screen, and break down business execution by means of key execution markers (KPIs). Regardless of whether associations decide to implement key or strategic execution the board activities, dashboards can give the establishment to empowering associations to even more successfully adjust their business methodology to execution.

In characterizing, following, and breaking down execution pointers, Business Dashboards can furnish clients with the accompanying abilities:

- Root-cause Analysis - They give the capacity to bore down on a Key Performance Indicators (KPIs) to an increasingly definite report uncovering the fundamental business action driving the larger amount pointer yield. This licenses investigation of causative factors and empower remedial activity (Carotenuto, 2007).

- Time-Series Analysis - Dashboards give the capacity to track and break down key measurements after some time and to recognize patterns and special cases (Carotenuto, 2007).

- Rules, alerts and alarms - They give the capacity to track and screen a lot of business forms and get ongoing warnings when they are lopsided. When a warning has been gotten, business clients can look at the anomaly, perform proactive underlying driver examination, and make remedial move (Carotenuto, 2007).

- Predictive Analysis - Dashboards give the capacity to figure, model, and break down complex connections. Predictive analysis is important to more likely comprehend the future effect of choices and the key influencers of future business practices (e.g., beat and rehash buy) (Carotenuto, 2007).

- Segment Analysis - Business Dashboards give the capacity to characterize, oversee, and comprehend the conduct of business groupings, for example, vital client portions, divisions, and

areas. Division can be utilized in characterizing measurements and in providing underlying driver examination.

- Statistical procedure control – They give the capacity to screen and track factors through control diagrams and measurable examination, usually utilized in quality control projects, for example, Six Sigma and Total Quality Management (Carotenuto, 2007).

Numerous associations likewise need to send the Business Dashboard in progressively advanced and mind-boggling application settings, for example, with a diagnostic application organization or as an extranet that spans past the corporate limits. As per Carotenuto (2007), cooperative energies between Business Dashboards and other BI applications lead to enhancements in both (Carotenuto, 2007).

Stage VI: Mobile and Location-based Intelligence

Mobile Intelligence

As indicated by Yang (2010), Computing is entering its new time with work area Internet applications offering route to another age of Mobile Internet applications. The utilization of the Internet on smartphones and other mobile devices has changed the way individuals convey and expend data, making an exponential ascent in the acknowledgment, selection, and use of information Yang, 2010).

As indicated by The Convergence of Mobile Technology and Mobile Intelligence (2010), with the capacity to get to data whenever, in any area, on a hand-held gadget, shoppers would now be able to settle on an ever-increasing number of choices rapidly and effectively. As customers gain by the intensity of cell phones, a similar change is happening in business. Business applications that were somewhat prolific when utilized on a work area, have turned out to be very successful and profitable when expended in a hurry, at whatever point and any place business is directed. The progressive effect of Mobile Intelligence is confirmed by three noteworthy drivers (The Convergence of Mobile Technology and Mobile Intelligence, 2010):

- Mobile Intelligence expands the user population by a factor of 10– Mobile devices will significantly surpass the impact and number of desktop Internet devices. The range and

number of mobile devices is showing explosive growth and the boundaries between these devices is blurring. Mobile computing devices now range from smartphones and tablets to handheld game consoles and fully functional in-car computers. For all their differences, these mobile device types harmonize across themes of connectivity, mobility, and information delivery (The Convergence of Mobile Technology and Mobile Intelligence, 2010).

- Mobile intelligence expands information opportunities by at least a factor of 10– As mobile computing becomes pervasive in both personal and professional lives, people are discovering more and more opportunities to make complete use of these powerful devices. From the moment they wake, they can use applications that not only enhance their personal lives but also make them more productive and effective at work. The ability to access information at any time in any location, easily in the palm of a hand, allows immediate decision-making The Convergence of Mobile Technology and Mobile Intelligence, 2010).

- Mobile intelligence expands personal query relevance by a factor of 4–Today's mobile computing devices are revolutionizing how information is deposited into applications. Using a keyboard and a mouse is now outdated. A natural user interface allows users to point at what they want, touch where they want to go, and move the device to indicate how they want to explore the information. Mobile computing devices respond to how users move their fingers and arms, and understand their location, the direction they are moving, and how fast. Mobile devices use these natural actions as inputs. Touch screens dynamically change into convenient input controls to meet the user's needs, such as a keyboard, a calculator, a map, and a data visualization control. As a result, the user's inputs are faster and cover a greater range of options, all while being more intuitive (The Convergence of Mobile Technology and Mobile Intelligence, 2010).

Based on The Convergence of Mobile Technology and Mobile Intelligence (2010), the ongoing impact of the evolution in device inputs and natural interfaces is to make BI applications faster, easier, and more natural to use, leading to greater usage and a higher user adoption rate.

Location-based Intelligence

As indicated by Panian (2012), practically all associations give in any event passing consideration regarding the attributes of area, regardless of whether in assessing traffic designs in picking a manufacturing plant area, deciding ideal travel courses, or figuring business sector compensation in choosing where to site a mechanical plant. There is absolutely advantage even in these disengaged, regularly unstructured perceptions. Be that as it may, surveying the effect of area along these lines – call it 'area derivation'– is like stargazing without a telescope (Panian, 2012).

As Panian (2012) states, albeit less natural than telescopes, the software and analytical tools fundamental for methodically examining area based information closer to home are similarly also created and offer willing organizations a far more extravagant and increasingly educated point of view on their physical working condition than is conceivable with progressively easygoing examinations (Panian, 2012).

Panian (2012) points that these devices permit organizations not exclusively to watch and gather information portraying even the concealed, business-significant highlights of their area, yet in addition to test and convey this information in a manner that extraordinarily upgrades comprehension of the effect of area and, at last, empowers associations to drastically decrease costs, increment incomes, and lift benefits. Such instruments in this manner help to interpret the notational "area deduction" into a substantially more dominant type of area-based learning called Location-based Intelligence (LBI) (Panian, 2012).

Reasonably, Panian (2012) underlines that LBI bears numerous similitudes to the client insight idea that developed to noticeable quality during the 1990s and that underlies such surely understood innovation arrangements as client relationship the executives programming, more normally known as CRM. The center reason of client insight and CRM programming specifically was that, if an organization find out about a specific client's socioeconomics, inclinations, and purchasing propensities after some time, it could tailor promoting offers and client communications in a manner that would build the client's penchant to purchase and, when all is said in done, support the client's general lifetime esteem (Panian, 2012).

As confirmed by Panian (2012), LBI has likewise been a piece of business tasks for quite a long time, in any event in a simple structure. For example, well before the appearance of PCs, conveyance firms arranged pick-ups and drop-offs to limit travel time and fuel use. Retailers and administration establishment proprietors like stores and vehicle fix shops regularly have considered a few factors before choosing where to find their organizations. What's more, obviously, land operators have long realized that home estimations are resolved principally by three elements: 'area, area, and area'. As clear as these models may be, they speak to just a small amount of the significant knowledge intrinsic in an organization's area, and a little bit of the esteem that can be gotten today from complex LBI instruments. Area and its business-important ramifications imbue about all business activities: each association with a physical nearness exists some place, and the equivalent is valid for almost such association's clients and providers (Panian, 2012).

Panian (2012) explains that these and numerous similar models affirm that LBI is exactly what it has all the earmarks of being priceless authoritative knowledge, drawn from both the organization's and clients' areas that can upgrade the comprehension of the association's working condition, as be utilized to build incomes, lessen expenses, and improve benefits. It is a similar sort of significant worth that CRM-style expository arrangements started bringing to client confronting associations 10 years prior. What's more, similar to those client insight arrangements, which depended vigorously on cutting edge data innovations for their expository and information the board control, so too are LBI arrangements currently being controlled, not by gut impulse and agreement "speculating," yet by cutting edge analytical and data-processing that can identify patterns, dangers, and openings that generally would be undetectable to human 'eyeball' examination (Panian, 2012).

4 REPORTING AND VISUALIZA-
TION

According to Zheng (2017), Data visualization has been rising rapidly for the past a few years in the BI and analytics industry, as part of the modern BI movement which emphasizes on self-service (Parenteau et al., 2016). It is also a big part of data science which has gained wide popularity recently. There have a been a plethora of tools and systems that feature their data visualization solutions (Zheng, 2017).

Based on Zheng (2017), as an interdisciplinary field, data visualization brings together psychology, technology, art, and decision science to deliver the last mile of the complete BI and analytics capability to users. Compared to other types and applications of visualization, business data visualization, particularly concerns about the visualization of business data, is mainly for the purpose of communication, information seeking, analysis, and decision support (Zheng, 2017).

As Zheng (2017) claims, one of the key questions in business data visualization is how, and in what form, data visualization contributes to the overall business intelligence process and system. This chapter provides a comprehensive high-level view of different types of data visualizations that can be used in the business environment, and to provide a guidance of technology and system selection (Zheng, 2017).

The chapter starts with defining business data visualization and comparing it to other common types of visualizations and their applications, then provides a comprehensive review and analysis of common tools and applications of business data visualizations used in business intelligence and concludes with a brief overview of recent trends and prospects (Zheng, 2017).

What Is Business Data Visualization?

According to Zheng (2017), the term "business" in "business data visualization," as well as in "business intelligence," has a broader meaning than just commercial activities. It generally refers to many human and organizational activities and operations that keep a system running. This can include commerce, education, sports, entertainment, government, and many others. In these business activities and processes, data are produced and recorded to reflect all aspects of the business (human or organizational activities), and then it is analyzed and reported at various levels. Business intelligence is about transforming raw data into meaningful and useful information that is consumed by humans (Zheng, 2017).

Business data or information is different from other types of data (Tegarden, 1999). In the context of business intelligence, business data has the following features:

- Abstract: most business data describe abstract activities and processes (e.g. product sales, member registration, product or user movement, etc.). The data does not describe or is not directly used to create real-life entities (objects, models) or phenomenon. The visual representation of this kind of data is also abstract by using metaphors (Zheng, 2017).

- Quantitative: although qualitative data also offers great insights and has a lot of values today especially in the artificial intelligence discipline, quantitative data is the focus of business data. In many cases, qualitative data is quantified in business intelligence analysis and business data visualization (Zheng, 2017).

- Structured or semi-structured: most data are structured and shares common attributes with clearly defined metadata (Zheng, 2017).

- Multidimensional: facts or measures can be viewed and analyzed through different perspectives and levels. This is particularly common in business analysis (Zheng, 2017).

- Atomic: most business activities are based on business transactions; each raw data record represents a transaction and can be viewed and understood independently (Zheng, 2017).

- Comprehendible: data and results can be directly understood by human users (assuming with domain knowledge) in a short time (Zheng, 2017).

According to Zheng (2017), the BI process typically consists of data management (also including data gathering, cleanse, storage), data analysis, and data presentation. The term data presentation describes the interfacing layer between data and human. In this layer, data (can be raw, aggregated, or any types of analysis results) are presented to users in their desired forms and formats.

In the statistics discipline, the three basic categories of data presentation are commonly summarized as textual, tabular, and graphical. These categories can also apply to BI data presentation methods. Data visualization is the graphical or visual method of presenting data. In the context of business intelligence, it can also be called business data visualization or business information visualization to distinguish other types of visualization (Zheng, 2017).

In general, based on Zheng (2017) visualization is the process of forming a concrete and direct vision-perceivable image in a human mind by utilizing a combination of visual elements (shapes) and variables like color, positions, etc. Things that can be visualized include visible reality that people can see (person, world, nature), hidden reality that normally be hidden (earth core, blood, universe), invisible reality (wind, air, heat, electron, sound, smell), and abstract things (data, idea, hierarchy, process, relationship) (Zheng, 2017).

According to Zheng (2017), data visualization is the visual and interactive exploration and graphic representation of data of any size, type (structured and unstructured) or origin. The purposes of visualizing data are multifold, ranging from general comprehension and understanding of ideas, supporting information behaviors (analysis and decision support, information seeking, browsing, navigation), to artistic (beauty) expression and appreciation (Viégas and Wattenberg, 2007), and even just for fun or storytelling. In contrast, the goals of visualizing business data are focused on human information seeking and decision-making behaviors, particularly in two broad goals: (a) visualizing key metrics for easy and fast comprehension which directly facilitates decision-making; (b) providing a visual and interactive way to explore data. Such visualizations often use simple, standard, and abstract charts or diagrams, and utilize data binding techniques at the back end (Zheng, 2017).

Based on Zheng (2017), both research and practices have shown data visualization's value and contribution to the decision process (Vessey, 1991) and information-seeking process (Shneiderman, 1996). Visualization generally helps data comprehension and enhances problem-solving capabilities. More specifically:

- Visualization eases the cognitive load of information processing, and it helps one recall or memorize data easily because of the perceivable image (Borkin et al., 2013).

- Data visualization techniques provide a visual overview of complex data sets to identify patterns, structures, relationships, and trends at a high level.

- Visualizations provide visual cues that draw people's attention to quickly focus on areas of interest or areas of difference (can be an anomaly). This allows decision makers to use their natural spatial/visual abilities to determine where further exploration should be done (Tegarden, 1999).

- Visualization exploits the human visual system to extract additional (implicit) information and meaning, sometimes referred to as intuition (Zheng, 2017).

Business Data Visualization vs. Other Types of Visualization

Business data visualization has some unique features compared to some related fields or methods that also utilize general visualization techniques. These related fields or methods mainly include information visualization, illustration, scientific visualization (discussed together with computer graphics and VR), and simulation. Their differences can be best illustrated in their content (what is to be visualized), visual forms/tools (how they are visualized), and purposes. The comparison is summarized in the following Table:

6 Data Visualization in Business Intelligence

	Content	Visual Forms/Tools	Purpose
Business data visualization	Quantitative data, metrics, key performance indicators (KPIs)	Charts, diagrams, dashboards	Data exploration, analysis, decision-making
Information visualization	All kinds of information, quantitative and qualitative	Infographics, illustrational diagrams	Information seeking, artistic illustration, casual communication, storytelling
Illustration	Processes, structures concepts, ideas	Diagram, image, graphics	Making the content more vivid and engaging, easier to understand the complexity
Scientific visualization	Real-world object or phenomenon, mathematical functions and formulas	Computer-generated graphics, 3D virtual reality	Recreate or simulate the real-world object or phenomenon, or visualize an algorithm effect
Simulation	Calculated data based on formulas or rules	Animated diagram or virtual reality	Demonstrate the effect of scenarios under certain rules

Information visualization is a very close field to data visualization. In fact, the term is often used as the synonym to data visualization if data is used in a more general sense (in contrast to business data). They share many common features, principles, and methods. However, information can be generally more qualitative and less structured, for example, information about workflows, structures, concepts, and ideas. The visualization of information utilizes more free forms of visual diagrams or illustrations (illustrational diagrams) that are not specifically for quantitative data, for example, network graphs and workflow charts.

Information graphics or infographics are a common tool for information visualization especially in a more casual context. An infographic is commonly a mixture of different forms of information (text and numbers) and multiple visual forms (charts, diagrams, images, tables, maps, lists, etc.) to quickly and vividly communicate a good amount of information in an engaging manner (Harrison, Reinecke, and Chang, 2015). Many infographics have a typical format characterized by large typography and long vertical orientation (Lankow, Ritchie, and Crooks, 2012). They are gaining popularity in online marketing over the years and their use has expanded in many occasions where communication to the public is important.

Information visualization is more casual (Pousman, Stasko, and Mateas, 2007), general, and subjective than business data visualization whose purpose is more for decision support or data exploration. It is intended for a wider and casual audience with a focus on storytelling or narrative visualization (Segel and Heer, 2010). Because of this, information is presented with stronger artistic expression than that found in typical business data visualizations (Hagley, n.d.), sometimes with overuse of artistic design, often referred to as visual embellishment (Bateman et al., 2010).

Illustration, as a term, is a little different than visualization. Illustration often is used to explain ideas or concepts with the help of diagrams or even general pictures and graphs. It materializes abstract ideas using more concrete and directly perceivable images for explanation or uses simplified diagrams for explaining more complex situations (processes or structures). Most importantly in the context of business, illustrations are not necessarily data driven.

Scientific visualization, commonly used in science, is "primarily concern[ed] with the visualization of three-dimensional phenomena (architectural, meteorological, medical, biological, etc.), where the emphasis is on realistic renderings of volumes, surfaces, illumination sources, and so forth" (Friendly and Denis, 2006). Examples include physical science visualization, visualization (simulation) of reality (universe, sun, explosion, atom, climate, etc.), and mathematical model/algorithm visualization. The visual output can be a virtual replica creation based on real data, or computer-generated data based on algorithms and imaginary creation.

Scientific visualizations often make use of computer graphics and virtual reality technologies to recreate the visual scene.

Simulation is somewhat related to scientific visualization and is specifically used to demonstrate motion-based visuals. It can utilize complex computer graphics to generate realistic scenarios. On the other hand, it also can create simple scenarios using animated diagrams or simple graphics.

Business Data Visualization Forms

With the increasing recognition of data visualization's roles and values in a business intelligence system, tools and applications that specifically target business data visualization solutions have become widely available. This section will review some most common types of data visualization forms and tools used in BI.

Categorizing Business Data Visualization Forms

Typically, BI results are presented in the form of reports, dashboards, and analytical tools. Among these, dashboards are mostly data visualization driven. Reports are traditionally static and non-interactive, and they present more detailed data. Modern reports add a lot of elements of visualization (either embedded visuals or charts/diagrams) and interaction, which enhance reports' readability. Analytical tools are also becoming more visually oriented. Some analytical tools, labeled as visual analytical tools (or analytical dashboards), are also driven by visualizations.

There are several commonly used visualization forms and tools in BI reporting and analytics. There are three basic categories of visual forms based on how visualizations are presented on screen: embedded visuals, block visuals, and standalone visuals. Table 6.2 summarizes features and examples of each one.

Form/Style	Description	Typical Types and Examples
Embedded visual	It is embedded in, or directly on top of, texts and other forms of data presentation (tables, graphics, etc.).	• Conditional formatting • Inline chart (Sparkline)
Block visual	It is displayed as an independent visual unit and occupies a larger space. It is often a part of a report or dashboard, appearing together with other content. But sometimes it can become a standalone visual with many data points or enough complexity.	• Chart • Illustrational diagram • Map (smaller) • Data table (usually with embedded visuals)
Standalone visual	It is a standalone application and is not mixed with other types of content or tools. Most interactions are within the visual. It may consist of a combination of different types of visuals.	• Dashboard • Visual analysis tool (or an analytical dashboard) • Map (bigger or full screen)

Embedded Visuals

As indicated by Zheng (2017), embedded visuals are special visualizations installed in another type of introduction. They are not freely displayed but rather constantly utilized over other introduction frames. Embedded visuals incorporate two noteworthy structures: restrictive arranging and inline smaller than usual diagrams (or Sparkline) (Zheng, 2017).

As Zheng breaks down (2017), restrictive designing alludes to the immediate arranging or styling of content, numbers, shapes, and different substance using visual factors like shading, estimate, and so forth. (Bertin, 2010). Restrictive organizing does not fundamentally change the format and stream of substance hence it is less meddling to the substance. Rather, it gives an enhancing impact that uncovers even more significance or features chosen content from the information or content (Zheng, 2017).

As per Zheng (2017), a Sparkline is a little limited diagram installed with regards to content passages, tables, pictures, or other kind of data. It shows the general information design (variety, patterns, separations, and so forth.) in a straightforward and exceedingly consolidated way (Tufte, 2006). Interpretive and supporting data like title, mark, information point, legend, are precluded from the outline. A small-scale line diagram (subsequently called Sparkline) is most ordinarily utilized, yet it very well may be of other outline types, including bar diagrams, slug charts, and so on (Zheng, 2017).

Charts and Diagrams

Considering Zheng (2017), a square visual consumes a bigger space yet at the same time some portion of a report or dashboard, seeming together with other substance. It is an increasingly free and independent visual unit. In some cases, it can turn into an independent visual if there are numerous data focuses or enough visual and association unpredictability. Outlines and graphs are the two most normal types of square visuals (Zheng, 2017).

Zheng (2017) characterizes charts as a visual blend of images (visual components of point, line, and territory) and visual factors (shading, shape, measure, and so forth.) which are straightfor-wardly connected with information. The terms of chart and diagram can in some cases be utilized reciprocally with no express contrasts. More frequently, diagrams are considered to incorporate graphs. With regards to business information perception, a chart is progressively unique and spotlights on visualizing quantitative qualities (for example business execution measures and markers), while a diagram can picture subjective data also to show structures, relationships, suc-cessions, and so on. Charts and diagrams are the real types of business information visualizations utilized in BI. They are the crucial piece to exhibit information in numerous reports and intro-ductions (Zheng, 2017).

Essential kinds of charts incorporate line charts, bar charts, pie charts, and so forth., and instances of diagrams incorporate association structure diagrams, tree diagrams, organize diagrams, work processes diagrams, and so on. Abela (2008) gives an essential arrangement of charts; the visual guide has been generally utilized for managing outline decisions (Table 6.3). Another reason,

profiling, is additionally added to the table for a progressively complete examination. Profiling can be viewed as a unique instance of examination among numerous information things.

Purpose	Meaning	Example Charts
Comparison	Comparing and sorting data points	Bar/column chart, line chart, radar chart
Composition	Showing part-to-whole comparisons	Stacked column/area chart, pie chart
Distribution	Aggregated value (usually count) of data points placed in categories; the category can be value ranges or time (trend).	Histogram, scatter plot, bubble chart
Relationship	How things (data items) are related or positioned in a bigger context.	Scatter plot, bubble chart
Profiling	Comprehending things through visual shapes and patterns.	Radar chart, parallel coordinates

Other more specific types of charts are used in different business contexts for more specific purposes. These charts are based on the more generic chart types like bar charts and line charts, and add more specific visual elements, or arrange the elements in a specific way to represent domain-specific meanings. For example, bullet charts (based on bar charts) are used in performance measuring; perceptual maps (based on scatter plots) are used in marketing; waterfall or bridge charts (based on column charts) are used in driving factor analysis; Gantt charts (based on data tables and bar charts) are used in project management; funnel charts are used in sales; candlestick charts are used in stock technical analysis.

Location-Based Visuals

Zheng (2017) points that location as a dimension plays an important role in many areas of business data analysis and decision-making. Many business activities are associated with locations. It has been gaining increased attention especially with the wide adoption of location sensors (like GPS and other location capture technologies) which generate location data. Location-based visuals, commonly based on a map, provide a background or a context that is familiar to the users and make the location-related data more comprehendible and perceivable. A 2015 yearly survey (Dresner, 2015) finds map-based visualization of information as the top priority, and more than 95 percent of respondents rank it as at least somewhat important (Zheng, 2017).

As Zheng (2017) claims more than 60 percent report that the functionality for layered visualizations is "very important" or "critical" for their organization. The location-based visuals involve three basic factors: type of location data, visual forms, data points representation on the map (Zheng, 2017).

Zheng (2017) states that the types of location data are directly associated with a business and its analysis. One major type of location data is geo locations that come with real-world maps. Many places and regions are based on geospatial mapping, such as political regions (country, state, city, etc.), various types of real estate properties or areas (park, campus, road), or any other arbitrary locations determined by businesses (postal ZIP area, sales region, service district). A second type of location data is local contextual locations which do not directly rely on geo coordinates. These locations are relative locations within in a confined area, such as inside a park, campus, building, room, court, bus/subway line, or even as small region such as a shelf, body, etc. For example, many sports-related analytics analyze the data related to locations on playing fields; stadium and airlines analyze seating data which relates to locations; mall, hospitals, universities, and apartments analyze room/facility usages which are also related to locations. The last type of locations is associated with more abstract ideas like processes, computer networks, organization structures, etc. These abstract locations can also be visualized on an abstract map (or more like an illustration diagram) (Zheng, 2017).

According to Zheng (2017) the visualization forms for location data is how the background layer of the map is presented. There are two broad categories: (a) real-world maps are used as the background layer, then points, paths, and areas are displayed accurately or closely proximate to the background (Figure 1); (b) a more abstract map (either geo location or non-geo location), sometimes just an illustrational diagram, is used as the background layer, and positioning of objects are based on relative position (e.g. X/Y coordinates) in the map context. The positions or areas on the map are for illustration purpose only, and not corresponding to their real-world positions or sizes (Figure 2) (Zheng, 2017).
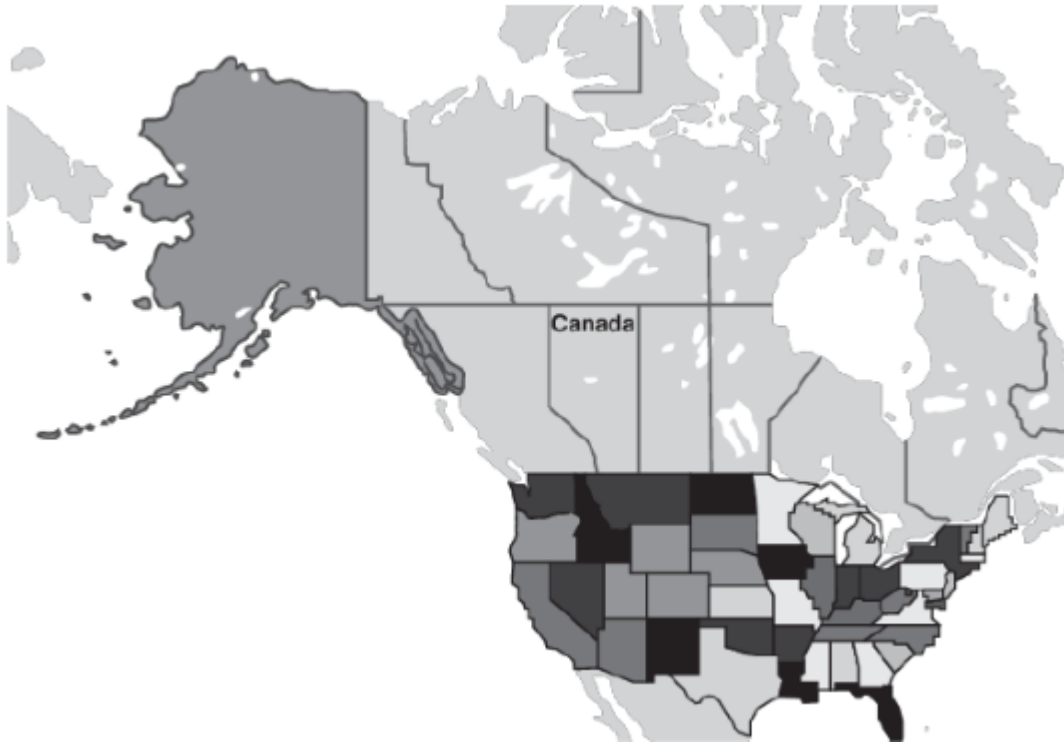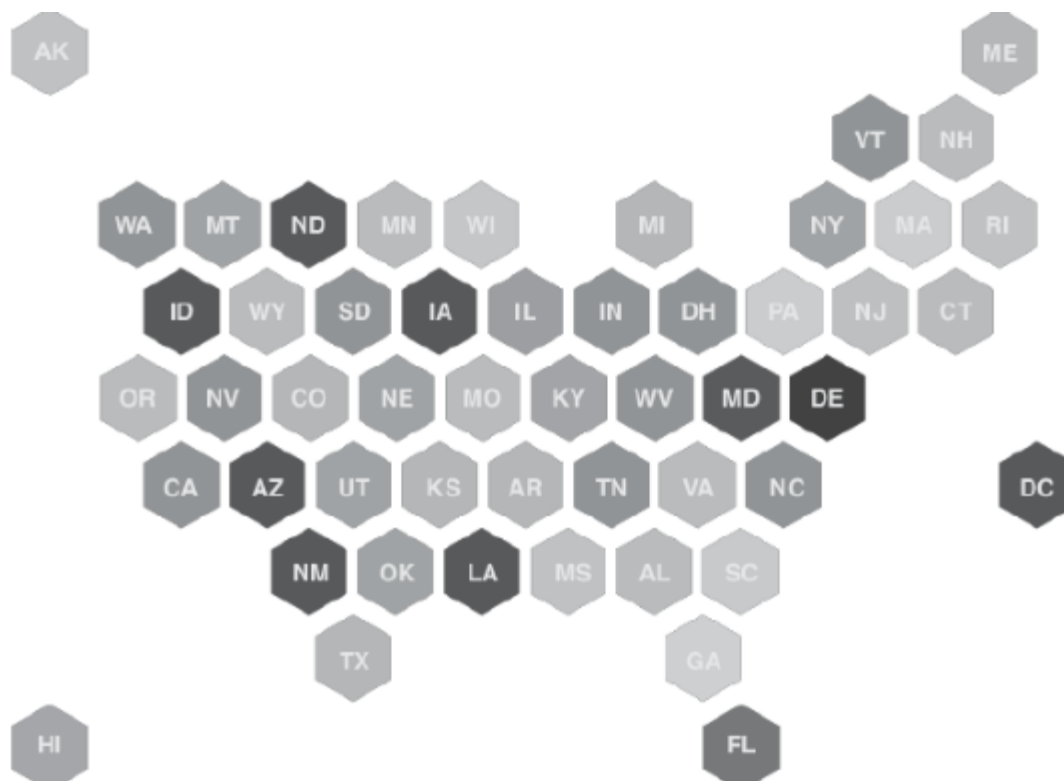
Figure 1.

Figure 2.

Figure 2 shows a type of abstract map called tile grid map (Shaw, 2016). Tile grid maps abstractly use similar-sized tiles to represent geo regions with irregular sizes. It has several visual advantages in some cases when location precision is not important:

- Eliminate map distortions on some real-world map projections. For example, avoid the Alaska effect on US maps (Taylor, 2017).

- Provide a more consistent view of places of irregular shape and different sizes. In some cases, it makes smaller areas more visible.

- Provide a more modern and consistent look and feel.

Dashboards

According to Zheng (2017) standalone visuals are more like applications than visualizations. They occupy even larger space or even full screens. They also contain multiple types of content as well as interaction controls. A digital dashboard is a major type of standalone visual. A dashboard is "a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance" (Few, 2004). The term dashboard originally came from operational status monitoring on machines which provides visual display for quick reading. Its use has been expanded to visualization of digital data associated with business performance on screens. A dashboard (at the front end) is basically an integrated application of data (content), visual views, and user interface/interaction (UI) (Zheng, 2017).

Dashboard = Data + Visualization + UI

Based on Zheng (2017) the data on the dashboards primarily consists of metrics, Key Performance Indicators (KPIs), and textual information. Metrics (or measures, indicators) are numerical values that measure various aspects of the business activities. A KPI is a metric that compares to its target (goal) and other comparable benchmarks (performance intervals, historical periods, or industry averages) (Barr, 2009). KPIs are used intensively in performance-focused dashboards. Other common data on a dashboard include a set of values to reflect history, trends, distributions, breakdowns, forecasts, or other kinds of comparisons and relationships. Textual information is not typically on many dashboards, but it can be included depending on the purpose of the dashboard (Zheng, 2017).

The data on the dashboard are presented via a variety of views or visualization forms discussed earlier, including charts, diagrams, tables (with conditional formatting or other embedded visuals), and styled standalone numbers (usually KPIs).

Last, a dashboard is a business application with a rich user interface for users to interact with data. The key UI elements considered in dashboard include layout (arrangements of data and visualizations, following human information behavior best practices), overall formatting/styling components (which can be visuals themselves) such as title and background, and user interaction controls such as command buttons and navigational controls (menus, tabs).

Traditional BI reports contain detailed data in a tabular format (or pivot tables) and typically display numbers and text only. The two main purposes of reports are printing (with styling) and exporting (raw data). It is geared towards people who need detailed data rather than direct analysis and understanding of data. Modern BI reports can be interactive and visual, but the focus is still on presenting detailed data. The distinction is a bit blurred between reports and dashboards in some practical cases. For example, the IT spending dashboard (www.itdashboard.gov/drupal/summary/006i) is more like a report (a visual-intensive interactive report).

Compared to reports, dashboards are more focused on data visualizations arranged in a single screen, or with limited scrolling and panning. Textual information and detailed data tables can be part of a dashboard only if they are necessary and important to user needs. Even so, it is better to present detailed data through interactive means like pop-ups, tooltips, or in separate screens via details-on-demand designs (Shneiderman, 1996).

A well-designed dashboard allows decision makers to see the most relevant data that reflects business status and supports decisions. It is a highly summarized and centralized snapshot that saves a user's time by eliminating the need to run multiple reports or get data through different sources. It should allow the user to quickly understand data and respond promptly at one place (bidashboard.org, n.d.). As the use of dashboards grew, they have expanded into three basic types of dashboard: overview, operational, and analytical. Each of them shares common attributes of dashboards (data + visualization + UI), but each of them has some different purpose, data, and design best practices.

Operational dashboards display data that facilitate the operational side of a business, monitoring operational activities and statuses as they are happening. They provide views of important operational indicators, often based on real-time or near real-time data; they focus on current performance and are action-oriented. Summary/overview dashboards provide high-level

summary of business performance represented by KPIs. A strategic dashboard is a typical example of a summary/overview dashboard at the strategic or executive level, which specifically concerns the state of the overall business against strategy goals. Analytical dashboards, or visual analysis tools, focus on interactive exploration or analysis (visual analysis) of a large amount of data. They allow users to investigate trends, predict outcomes, and discover insights.

This kind of use is a bit different from traditional dashboards, which are primarily used for quick scanning and understating of key metrics. Some people specifically categorize them as "visual analysis tools" (Chiang, 2011) rather than a type of dashboard. Nonetheless, the design of analytical dashboards is similar to general dashboards with a focus on data, visualization, and UI design. Analytical dashboards usually visualize patterns, trends, and other complex relationships among a large amount of data, without a significant focus on a few metrics. The purpose is to explore data and analyze patterns through an interactive process. They contain abundant parameter settings, selections, filters, and other controls to manipulate the main visualization. The main visualization is usually a single (or very few) visual component that occupies a big portion of the screen as the main UI component, with many data points displayed on it. Users' major activity will be repeatedly setting parameters and examining the generated visuals. This type of dashboard often supports ad hoc querying, dynamic visualization generation, common OLAP operations like drill down. It is primarily used for intensive data exploration or analysis, used by data analysts and researchers.

Trends and Prospects

Data visualization has been one of the growing forces driving the BI industry. As an important part of modern BI systems and platforms, business data visualization closely follows or even impacts the general BI and analytics trends. Some of the notable trends are presented below. Personal or self-service BI: Self-service BI features control in the hands of users, especially power users. This group of people is highly skilled in using technology applications in business tasks, and they often need instant results. They can use computer tools and languages to get what they want with little assistance from their IT departments. Some of the tools like Tableau and Power BI have quickly risen to satisfy this need using a visualization-driven approach and gained wide recognition (Sallam, 2017).

Embedded BI: Personal BI tools are usually standalone tools which need a separate data connection or import process. Embedded BI emphasizes the analytics and data presentation as an

integral part of an application, instead of using an independent tool or system. Embedded BI or visualization has an advantage in local data modeling and integration, thus delivers standard reports and dashboards in a more efficient way to satisfy the most common needs. The analytics component has become a competitive component of many business systems. However, in many systems, the module is often seen as a separate module which requires businesses to pay separately (for example, Brightspace Insights).

Mobile BI: Mobile computing also drives the evolvement of BI and data visualization to be more accessible and usable on multiple devices with different screen sizes and interaction techniques. Although not typically for mobile phones, access to dashboards though tablets or tablet-like devices is increasing in many business environments where people move around regularly, such as sales, field support, sports, and hospitals. The major influence from mobile computing is the interaction method of touch-oriented interfaces, which requires some new design principles and best practices on dashboard interactions.

The job market and career development related to data analysis and visualization have seen an increasing demand over recent years. Preferably, data visualization development requires skills from several fields, including information design, UI design, human information behavior and cognition, interaction design, artistic design, programming, data processing, and business domain knowledge. The demand for multi-skill and interdisciplinary experience will continue to grow.

Conclusion

The shifting focus on end users with better and more effective data presentation and visualization is a global phenomenon. Business data visualization has an increasing importance in the complete BI process and is becoming an integral part of any BI system. Various forms of data visualization, each with their unique features, help BI users and decision makers at different levels from different perspectives. BI managers and developers should understand their features, strengths and weakness, and use them together to create a good mix that satisfies different types of users with different needs. This chapter provides a comprehensive review of these visualization forms and tools, which will help BI managers, decision makers, analysts, and developers better select and utilize them. The perception of visualization is common across all cultures and business environment, but the meaning delivered through visualizations may be

affected by a number of factors like color and orientation. Adapting data visualization solutions in local culture is also important in the global business environment.

5 DECISION MAKING IN BUSI-NESS INTELLIGENCE

According to Kearney (2018), as organizations center around development and business improvement, the accessibility of value information is pivotal to making fast, discerning business choices. New advances, be that as it may, can cause data over-burden, leaving chiefs covered under a mass of superfluous, insufficient, and conflicting information. A few organizations figure out how to give their leaders exact, pertinent information in a simple-to-get format. These organizations have found the estimation of viable business intelligence capabilities (Kearny, 2018).

In view of Kearney (2018), for some organizations, new innovations are causing data over-burden, leaving chiefs overpowered with insufficient, mistaken, in-reliable and misdirecting data. Without a doubt, the different demonstrations of recovering and preparing this regularly pointless data can tie up various assets. However, there are organizations that figure out how to give their chiefs prepared and naturally united crude information, introduced in a justifiable, simple to-get format. These organizations give savvy data to fast, significant basic leadership. What do these organizations have that the others don't? Business Intelligence (BI) capabilities and processes. Business intelligence is an exploration field that spotlights on hypothetical and viable parts of accomplishing a strong data reason for decision making (Kearney, 2018).

Figure 1
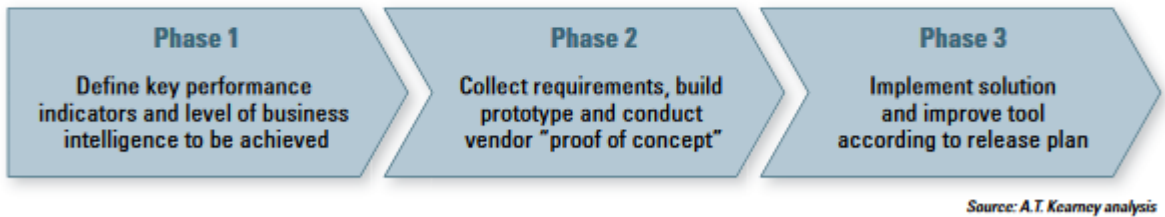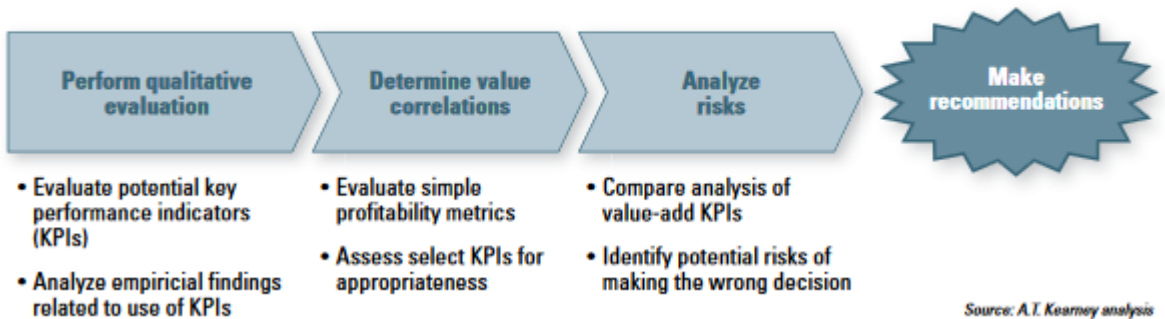**Three phases of a business intelligence solution**

Phase 1	Phase 2	Phase 3
Define key performance indicators and level of business intelligence to be achieved	Collect requirements, build prototype and conduct vendor "proof of concept"	Implement solution and improve tool according to release plan

Source: A.T. Kearney analysis

Figure 2
The main tasks in Phase 1

Perform qualitative evaluation	Determine value correlations	Analyze risks	Make recommendations
• Evaluate potential key performance indicators (KPIs) • Analyze empirical findings related to use of KPIs	• Evaluate simple profitability metrics • Assess select KPIs for appropriateness	• Compare analysis of value-add KPIs • Identify potential risks of making the wrong decision	

Source: A.T. Kearney analysis

Three Phases of Implementation

According to Kearney (2018), a productive corporate BI usage has three stages (see figure 1). In actualizing BI frameworks, it is essential in any case business necessities, since undertakings that are in fact activated normally come up short (Kearney, 2018).

According to Kearney (2018), a successful corporate BI implementation has three phases (see figure 1). In implementing BI systems, it is important to begin with business requirements, because projects that are technically triggered usually fail (Kearney, 2018).

Phase 1: Define the necessary KPIs on a management dashboard.

Considering Kearney's (2018) article a key action in the primary stage is to characterize future reports and KPIs, which frequently means taking out some current reports, the same number of are superfluous and don't really mirror the organization's destinations. Next, is surveying information accessibility to figure characterized KPIs; a sound information premise is a key achievement factor for framework usage. Outer apparatuses associating with existing information stockrooms and extra counts ought to be kept to a base. Likewise, the different layers of a BI

framework are assessed to characterize which territories ought to be tended to and recognize explicit parts that ought to be removed. It is critical to explain toward the starting which territories will be secured by the task: Is it a BI framework for fund KPIs just or does it likewise incorporate inventory network the executives? Will the undertaking coordinate other practical territories, divisions or even explicit business lines inside activities? Regularly HR and client relationship management (CRM) are the following possibility to improve money BI and coordinate a greater amount of the business. The connection to tasks is increasingly troublesome as KPIs from assembling, creation or coordinates are unique in relation to back KPIs and are regularly hard to associate with existing KPI trees. Indeed, even between comparative business lines, KPIs are some of the time somewhat extraordinary since they speak to various plans of action — for example, inner creation for transitional items or outer generation for conclusive items. On the off chance that the long-haul procedure is to dissect operational KPIs, this ought to be tended to at the start. When these inquiries are replied and all influenced business regions are tended to, the second stage can start (Kearney, 2018).
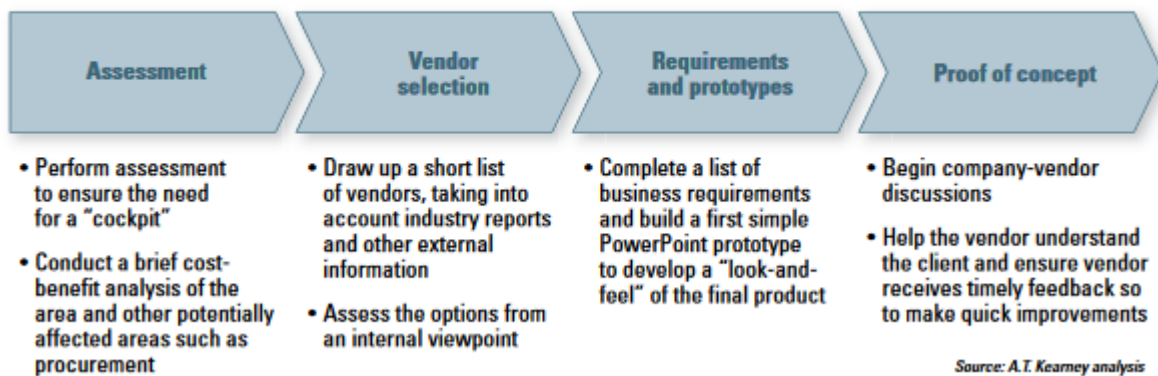
Phase 2: Create a design and navigation prototype and build a "proof of concept."

Four errands are engaged with arrangement for framework usage dependent on Kearney (2018). The outcome is a "proof of idea," structured before the extensive usage starts. Now, programming merchant choice is autonomous of explicit plan necessities and regularly determined by vital strategies or IT land-scape prerequisites. In view of IT engineering rules, a short rundown can be formulated in advance to choose fitting instruments to fit the organization's necessities, IT system and IT scene (Kearney, 2018).

As indicated by Kearney (2018), Phase 2 isn't just about gathering necessities with respect to the usefulness of a future device (route and investigation profound plunges, for instance) yet additionally about report structure, dashboards and instrument usefulness. One point must be expressed all around obviously: An unadulterated administration "cockpit" or dashboard can't supplant the inward or outside detailing. As an initial step, it tends to be viewed as a second channel (constantly accessible), however with an alternate dimension of detail (the board satisfactory). All administration cockpit devices offer a revealing usefulness used to print-out the dashboard content. Supplanting the total paper-based interior (or outside) announcing requires huge endeavors as the point by point structure of each page is laid out forthcoming. Both the dashboard screen structure and the report formats, which spread most of the portrayed substance in regard

to noteworthy numbers and correlations, in addition to other things, at last get characterized before the definite idea is given over to a framework integrator for usage. The acknowledgment of the screens and the relating KPI representation are the principle drivers of the framework execution and the testing. Subsequently, dependability is required (Kearney, 2018).

The tasks in phase 2

Assessment	Vendor selection	Requirements and prototypes	Proof of concept
• Perform assessment to ensure the need for a "cockpit" • Conduct a brief cost-benefit analysis of the area and other potentially affected areas such as procurement	• Draw up a short list of vendors, taking into account industry reports and other external information • Assess the options from an internal viewpoint	• Complete a list of business requirements and build a first simple PowerPoint prototype to develop a "look-and-feel" of the final product	• Begin company-vendor discussions • Help the vendor understand the client and ensure vendor receives timely feedback so to make quick improvements

Source: A.T. Kearney analysis

The confirmation of idea builds the designers' comprehension of the organization's prerequisites before beginning the genuine frameworks usage. As far as we can tell, a brisk model enables an organization to check the structure of all conceivable pre-chosen devices and test the ability of the potential arrangement supplier. Work bundles can likewise be tried to evaluate sellers' development capacities in fathoming configuration questions. At long last, the company's prerequisites can be tried and tested.

Phase 3: Implementation.

As indicated by Profitable Venture site (2019), Implementation is a commonplace IT anticipate. Be that as it may, because of high perceivability and the executive's mindfulness, the usage ought to be quick and professional with speedy arrangements. A discharge plan guarantees first outcomes are conveyed rapidly, while the last and extensive arrangement is made in a few stages, lined up with announcing cycles and information accessibility. The principal discharge ought to give all required dashboard capacities (plan, route and drill-down) and a portion of the revealing prerequisites, which are nitty gritty in the pursue on execution stages and can be conveyed successively. Normally, first discharges do not have the full informational index. A basic action in the BI undertaking is to wash down existing information and build up a procedure to record new information in an appropriate manner, which regularly requires building up the whole information engineering, including measurements, pecking orders and equations. Close cooperation

between framework supplier and business divisions (as the last clients and customers of the framework) is critical to the accomplishment of the task. The administration cockpit or dashboard satisfies the plan and useful prerequisites since it gives clear perceivability to the board and the fundamental usability. Albeit every required datum or KPIs may not be incorporated into the start, they are given all through the means (Profitable Venture Site, 2019).

How Business Intelligence Helps in Decision Making

a. Concerning the advertising division (marketing department), it encourages them develop the top line. It inspires them to investigate the aftereffects of their battle and limited time yields. Also, it encourages them tweak their spending to show signs of improvement ROI (Profitable Venture Site, 2019).

b. In the business office, business knowledge encourages them locate the best way and best practices, the expense and length of client procurement, process improvement, and year-by-year examination of turnover and deals (Profitable Venture Site, 2019).

c. Business knowledge enables the human asset office to follow and oversee things like worker turnover, wearing down rate, enlistment process, etc.

Aside these, each other office inside an organization will profit straightforwardly or by implication from business insight. Right utilization of this system has indicated great outcomes over all divisions; be it online business, media, non-benefit associations, social insurance, media transmission, money related administrations, vitality, etc. (Profitable Venture Site, 2019).

Business knowledge helps in decision-making because of the numerous ground-breaking components it involves. These incorporate intuitiveness, information perception, database association, versatile business insight, prescient investigation, application coordination, and specially appointed revealing. Presently, how about we investigate every one of these components (Profitable Venture Site, 2019).

Ways Business Intelligence Help in Decision Making

1. Interactivity

As indicated by Profitable Venture Site (2019), there ought to be an abnormal state of intuitiveness between the dashboard and the distinction report. For instance, if an individual is seeing and investigating the absolute deals report, some collaboration ought to be included. This will enable the individual to delve further into the report to make sense of district shrewd deals, item insightful deals, timeframe savvy deals, etc.

The more the dimension of connection, the more the volume of crucial data that will be recovered; and the better the choices that will be made (Profitable Venture Site, 2019).

2. Data Visualization

In view of Profitable Venture Site (2019), having information imagined in a right organization is significant, as this encourages better comprehension of the information. For instance, month-on-month deals could be spoken to as a line chart as opposed to simply words or verbal correspondence. Essentially, a part savvy commitment could be best spoken to with a pie diagram. Just when information is spoken to in the right arrangement can any valuable knowledge be separated from it (Profitable Venture Site, 2019).

2. Connection to databases

As indicated by Profitable Venture Site (2019), during a business insight technique, the experts in control ought to have the option to bring data by interfacing with various databases and web administrations, so they will gain admittance to the correct data independent of its source. With the correct data, supportive proposals can be made that will enable an organization to develop (Profitable Venture Site, 2019).

4. Predictive analytics

As Profitable Venture Site (2019) guarantee, with the guide of authentic information and top of the line calculations, certain expectations can be made, for example, the probability of clients returning for rehash business, anticipated income, anticipated area shrewd deals, machine disappointment, etc. This can assist an organization with being proactive (Profitable Venture Site, 2019).

5. Application integration

A business knowledge apparatus, in view of Profitable Venture Site (2019), ought to be effectively coordinated with your current application or programming paying little mind to whether it is created in Java, C, Ruby, PHP, or some other stage (Profitable Venture Site, 2019).

6. Mobile business intelligence

As indicated by Profitable Venture Site (2019), with increasingly more workforce going portable and taking care of assignments moving, they need the correct data on their mobile devices, for example, smartphones and tablets. Thus, all reports dashboards and charts ought to be well-matched with such devices (Profitable Venture Site, 2019).

As per a study, as Profitable Venture Site (2019) recommends, a choice made dependent on information investigation has 79% odds of progress more than one made dependent on unadulterated instinct. Business knowledge enables organizations to investigate information while giving profound translations. It helps basic leadership through ongoing, intuitive access to and examination of significant corporate data. What's more, it connects the holes between data storehouses in an association (Profitable Venture Site, 2019).

Automated Decision Making

According to Sheshasaayee and Bhargavi (2017), the ERP systems will interconnect all the departments of an organizations and provides information required for all workers in different departments for making better decisions. The ERP systems contains information only about what had already happened, it will not contain the information of the current scenario and about the future.

The ERP frameworks utilizes scientific choice administration framework for defining deals objectives, generation levels, appropriation plans. The computerized basic leadership frameworks are utilized to take choices on the board issues, which are dreary. The operational administration is a well-upheld possibility for computerized basic leadership frameworks since it has momentary concentration and dreary. To manage various parameters at various business organizes, the ERP frameworks utilizes various models of investigation for better basic leadership. The distinction between Predictive, Descriptive and Decision models utilized in ERP frameworks for investigating information are given beneath (Sheshasaayee and Bhargavi, 2017).

Predictive models	Descriptive models	Decision models
• Predicts the relationship and patterns between explanatory variables and dependent variables and focus on a specific variable • Eg) Fraud Detection, Credit Worthiness	• Clusters the data elements with similar characteristics. Focus is on as many variables as possible • Eg)Profitability, Product preference	• Finds an exact outcome for a specific decision. Focus on specific decision • Eg) Scheduling, Resource Optimization,

As Sheshasaayee and Bhargavi (2017) proceed, the Automated basic leadership frameworks are basically utilized in business examination and informatics. The basic leadership frameworks can be automated by applying certain business rules which are created and worked by business analytics. The choices taken by the computerized basic leadership frameworks are a piece of the business informatics. The ADMS are exceptionally helpful in circumstances which expects answers for redundant issues utilizing the electronically accessible information. The information required for the ADMS must be all around unmistakably clarified and organized. The business issues that are connected to the ADMS must be clear and surely known. The associations utilize the ADMS to deal with its interactions with its clients, representatives and providers. Associations utilizes the ADMS to improve its esteem, through every choice that is taken. The fundamental point of utilizing ADMS has five key attributes-accuracy, consistency, dexterity and the diminished time and cost of making manual decisions. There are numerous methodologies for basic leadership, in like manner they have three stages choice distinguishing proof and demonstrating, advancement of a mechanized framework, observing and dealing with the choices to keep up the principles and prescient investigation forward-thinking (Sheshasaayee and Bhargavi, 2017).

Application of Automated Decision-Making Systems

Based on Sheshasaayee and Bhargavi (2017), by examining automated decision-making systems in enterprises that incorporate banking, protection, travel and transportation, we can comprehend that mechanized choice applications are viably to create valuable solutions in various distinctive business territories (Sheshasaayee and Bhargavi, 2017).

Product Configuration

As indicated by Sheshasaayee and Bhargavi (2017), it is one of the most punctual uses of ADMS. The ADMS will choose a best and most suitable arrangement dependent on the arrangement of variables accessible, which is hard to do physically. Eg) cell phone administrators will have various administration designs, the ADMS will locate a suitable administration plan for a specific client (Sheshasaayee and Bhargavi, 2017).

Yield optimization

As indicated by Sheshasaayee and Bhargavi (2017), the aircraft companies utilize the ADMS to fix the prize of the tickets dependent on the accessibility of seats and the day of procurement (Sheshasaayee and Bhar-gavi 2017).

Routing or segmentation decisions

As indicated by Sheshasaayee and Bhargavi (2017), by planning computerized channels, a few organizations can accomplish huge improvement in profitability. Eg) insurance companies have set up need paths to deal with the protection cases of normal clients with great profiles (Sheshasaayee and Bhargavi 2017).

Corporate and regulatory compliance

As per Sheshasaayee and Bhargavi (2017), numerous normal strategy choices, for example, deciding if the individual meets all requirements for protection benefits (Sheshasaayee and Bhar-gavi, 2017).

Fraud detection

According to Sheshasaayee and Bhargavi (2017), banking areas and government organizations utilizes some mechanized screening to recognize charge card cheats (Sheshasaayee and Bhargavi 2017).

Dynamic forecasting

As per Sheshasaayee and Bhargavi (2017), via robotizing the demand forecasting the producers can adjust their clients conjecture intimately with their assembling and deals plan (Sheshasaayee and Bhargavi 2017).

Operational control

As indicated by Sheshasaayee and Bhargavi (2017), the ADMS are likewise used to detect the physical and condition changes and reacts quickly dependent on guidelines and calculations. Eg) temperature, precipitation (Sheshasaayee and Bhargavi 2017).

Automated Decision-Making Technologies

Based on Sheshasaayee and Bhargavi (2017), there are various sorts of Automated decision-making technologies (Sheshasaayee and Bhargavi 2017).

Rule Engines

As indicated by Sheshasaayee and Bhargavi (2017), Rule engines will process a progression of business decides that utilization restrictive explanations to address intelligent inquiries (Sheshasaayee and Bhargavi 2017).

Industry specific packages

According to Sheshasaayee and Bhargavi (2017), the industry explicit bundle will deliver robotized choices for questions looked by the businesses (Sheshasaayee and Bhargavi 2017).

Statistical or numerical algorithms

As per Sheshasaayee and Bhargavi (2017), these calculations will process quantitative information to touch base at its objective. Eg authorization of credit sum (Sheshasaayee and Bhargavi 2017).

Workflow Applications

As indicated by Sheshasaayee and Bhargavi (2017), the work process applications are softwares that empower information-intensive business processes. In the wake of settling on a choice the workflow process framework will pass the remainder of the record through the required advances. Eg) advance preparing (Sheshasaayee and Bhargavi 2017).

Enterprise systems

As per Sheshasaayee and Bhargavi (2017), enterprise systems are programming applications that robotize, interface and deal with the data streams and exchange forms in the associations. The computerized choice frameworks in the undertakings will be utilized distinctly in specific procedures. Decision making is the way toward making explicit move because of the issues looked by the associations. Great choice will result the course of activities that causes the association to be viable, the inverse is its turn around. The development or the disappointment of the association relies upon the choices made by its individuals. The basic leadership frameworks have four main stages:

Intelligence

As indicated by Sheshasaayee and Bhargavi (2017), it is hunting down the conditions calling for decision making (Sheshasaayee and Bhargavi 2017).

Design

As indicated by Sheshasaayee and Bhargavi (2017), it is concocting, creating and breaking down potential choices. This will make the procedures to comprehend the issue, to create arrangements and testing of answers for plausibility (Sheshasaayee and Bhargavi 2017).

Choice

As per Sheshasaayee and Bhargavi (2017), it is choosing an option or choices from those factors accessible (Sheshasaayee and Bhargavi 2017).

Review

As per Sheshasaayee and Bhargavi (2017), it is checking the decisions made beforehand. This model was later coordinated by George Huber into an amplified model of the whole critical thinking task (Sheshasaayee and Bhargavi 2017).

Expanded model of the entire problem-solving process

Although the electronic frameworks give veracity, adaptability and brief choices for directors, Sheshasaayee and Bhargavi (2017) suggest that there are a few issues that are looked by associations. The absence of information about the details, restriction and factors of the frameworks are the most concerning issues looked by the associations. On the off chance that the learning about the frameworks are not surely known by the associations, at that point the frameworks won't give the arrangements expected by the administrators. The Automated basic leadership framework must be registered in such an approach to educate the administrator to deal with the basic leadership process on the off chance that it does not have the expected information to settle on dependable choice. Another issue looked by the associations about the modernized decision-making framework is to locate the talented people who can construct and keep up the computerized frameworks. Despite the fact that the Automated decision-making frameworks are improved and utilized generally, and it has more favorable position over the manual choices, it has certain limitations and numerous organizations neglect to ignore those requirements and to keep up them in like manner. Subsequently, the organizations should cautiously regulate the frameworks which they are applying, and they should comprehend the arrangements that are given by the frameworks (Sheshasaayee and Bhargavi 2017).

Different Degrees of Automation in Decision Making Systems

Nonetheless, Sheshasaayee and Bhargavi (2017) recommend that in some decision-making paths, the decision-making frameworks are just mostly computerized, and it alarms the clients where a manual decision-making is required. The computerized frameworks control the clients, utilizing the data gathered and such frameworks settle on judgments all through the basic leadership process, while maintaining a strategic distance from the repetitive pathways and now and again, the robotized frameworks will give an ultimate choice. The robotized frameworks may likewise manage the clients when a manual choice is required by social event and giving significant data to the clients to take right choice. Now and again, the framework may gather and store the important data, and records the reasons of the result come to by manual choices. Computerized frameworks can be utilized in various routes in authoritative basic leadership framework. For instance;- To settle on the choice.- To prescribe a choice to the manual chief.- To direct a client through applicable certainties, enactment and approach, shutting off superfluous ways as they go.- Can be utilized as choice emotionally supportive networks, giving helpful data to the leader during the basic leadership process.- Can be utilized as a self-evaluation instrument,

giving fundamental appraisal to people or inward chiefs. The decision-making with incompletely automated framework model utilized in loaning libraries (Sheshasaayee and Bhargavi 2017).

As indicated by Sheshasaayee and Bhargavi (2017) the more information that exist, there is more the degree for robotization. The associations can take Effective choices just on the off chance that it contains precise, convenient and important data. The Management information encourages the associations arranging, control, and operational capacities to be done sufficiently by giving the accurate and suitable data expected to facilitate the basic leadership procedure and MIS additionally helps the chiefs by giving wide scope of alternatives to settling on their favored decisions. This guarantees whatever the decisions are taken by the chiefs, the outcomes will be sure. Numerous leaders will in general use the executive's data framework while taking intense business choices. The decision-making framework center around basic leadership while the board data framework center around data. The administration data framework targets just on impeccably organized information however basic leadership framework tar-jumps on structure just as semi organized information (Sheshasaayee and Bhargavi 2017).

6 CONCLUSION

In view of Kearney (2018), Business Intelligence is "an absolute necessity have" for Business Success in to-day's reality. Organizations in all ventures are utilizing BI frameworks for effective decision-making. These organizations beat their opposition and distinguish new chances to enhance their organizations. They additionally diminish assets for manual exertion and rededicate individuals to examining information and getting ready choice reminders. For organizations that grip the genuine potential in business insight, they should act as soon as possible — time, as usual, is of the substance (Kearney, 2018).

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