Best practices for adopting agility in Business Intelligence

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Abstract

September 2017

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Degree programme BITe15S	
Title Best practices for adopting agility in Business Intelligence	**Number of pages** 40

Increasingly competitive market scenarios and IT field are persistently pushing enterprises to adopt agile Business practices. The practices which can maintain competitive edge. Nowadays, enterprises are constantly frazzled due to non-responding BI systems and poor data quality. Continuously changing customer-driven requirements and emerging technologies are pushing to adopt agile work-environment.

The aim of thesis is to find out the best practices for adopting agility in Business Intelligence. Business intelligence includes the application, infrastructure and methodologies that enable organizations to improve and optimize decision and performance through data-analysis.

This report contains three parts. The theoretical part covers all the theory required for the understanding the agile BI and the differences between traditional and Agile BI. The empirical part is composed of interviews and the organizational research.
The thesis started with reading books, academic journals and researches. The practices listed in this report are developed by leading organizations as well as the methods listed by experts.

The result of this thesis were principles and methods best suited for adopting agility in BI. The empirical research can be used by organizations and individuals looking for adopting agility.

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Terms and Abbreviations

BI	Business Intelligence
BA	Business Analytics
ETL	Extract Transform and Load
OLAP	Online Analytical Processing
TDWI	The Data Warehousing Institute
ABA	Agile Business Analytics
AII	Agile Information Infrastructure

1 Introduction

In a rapidly evolving Information technology field, Business Intelligence methods and solutions have to become more agile to keep with the competition. This thesis attempts to find out agile methods for the organizations by discussing some questions such as: what is agile? Why agile methods will maintain a competitive edge? What are the key elements and frameworks that promotes an agile BI solution?

The Data-warehousing institute (Eckerson,2017) has defined Business Intelligence as "the tools, technologies and processes required to turn data into information and information into knowledge and plans that optimize business actions".

Improvement of the BI systems have been a massive and intimidating task for the most IT organizations. In a research conducted by Forrester Research stated that BI decision-makers frequently experience the change in market situation and customer-demands. Almost 70% of enterprises experience this change. The fact is that traditional BI processes have never been considered as agile or responsive or flexible. (Caruso, 2011.)

The need to develop BI systems which can react to unforeseen or volatile requirements in a given time frame results from increasingly complex and dynamic organizational environments. This adaptation capability of BI systems is usually referred to as "BI agility". (48th Hawaii international conference on system sciences 2015, 1.)

Agile methods promote closer collaboration among stakeholders, businesses and developers by adopting iterative cycles to deliver value incrementally. This approach allows organizations to elaborate on the requirement details in a just-in-time manner, prior to the actual solution which omits the chances of mistakes and staying ahead of the competitors. This thesis focuses on agile strategies and to find out how well they suit for BI development. The targeted audience of this research paper are individuals interested in agile BI methodologies and small to mid-size organizations looking for adopting agile methods.

1.1 Goal of this Thesis

The purpose of the research is how agile strategies can be adopted for BI development. This thesis will focus on the methods listed by pioneers in BI field such as Forrester, TDWI and Mckinsey.

1.1.1 Research questions

In this thesis, the following research questions will be answered:
1. What are the methodologies and frameworks for adopting agility in BI development?

To answer this main question, it is further divided into sub questions. The thesis is structured in a way that sub question's answer will lead to the main research question answered.

Sub Questions:
1. What are the similarities and differences between the traditional BI and agile BI?

2. How to implement agile strategies in BI development?

1.2 Scope of this thesis

This research is conducted to study the agile strategies and find out how well they suit for BI development. The research is based on the verified books, academic journals, science conferences, frameworks listed by conglomerates and the interviews conducted by the author.

1.3 Out of scope

Since agile methods are organization specific, there is limited to no information on how to adopt agile methods for specific BI projects. The research focuses on BI development specifically and is primary involved in finding best suitable agile methods and the differences between traditional and agile methods.

2   Theoretical Background

To find out the best practices, an individual must understand what BI is and its aspects, foundations, related terminologies and frameworks.

Henceforth, this chapter will discuss BI, which includes definition, architecture of traditional BI and agile BI and the concepts of agile BI. The advantages over traditional BI will be discussed in this chapter as well.

In agile BI chapter, the key components to promote agility will be introduced and agile business analytics will be discussed in depth. Theoretical part of this research will be concluded by having an in-depth discussion of agile information infrastructure.

2.1   Business Intelligence

BI is a set of methodologies, processes, architectures and technologies that transform raw data into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and decision-making. A narrow definition is used when referring to just the top layers of the BI architectural stack such as reporting, analytics and dashboards. (Evelson, 2010.)

BI is a broad category of application programs and technologies for gathering, storing, analyzing and providing access to data to help enterprise users make better business decisions. BI applications include the activities of decision support, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining. (Rossetti,2006.)

2.1.1   Definition of BI

BI is the process of gathering information in the field of business. It can be described as the process of enhancing data into information and then into knowledge. A popularized umbrella term used to describe a set of concepts and methods to improve business decision making by using fact-based support systems. The term is sometimes used interchangeably with briefing books and executive information systems. (Mirum.net, ND).

According to Turban (2010,28), "Business Intelligence (BI) is an umbrella term that combines architectures, tools, databases, analytical tools, applications and methodologies." However, there is no unified definition available of BI, it can be defined several ways. Gartner (2011, 15) states that BI as "an umbrella term that spans the people, processes and applications/tools to organize information, enable access to it and analyze it to improve decisions and manage performance."

According to author's opinion, BI is a set of practices utilize to convert data into information and information into knowledge which will help decision makers to take right decision and to maintain competitive edge.
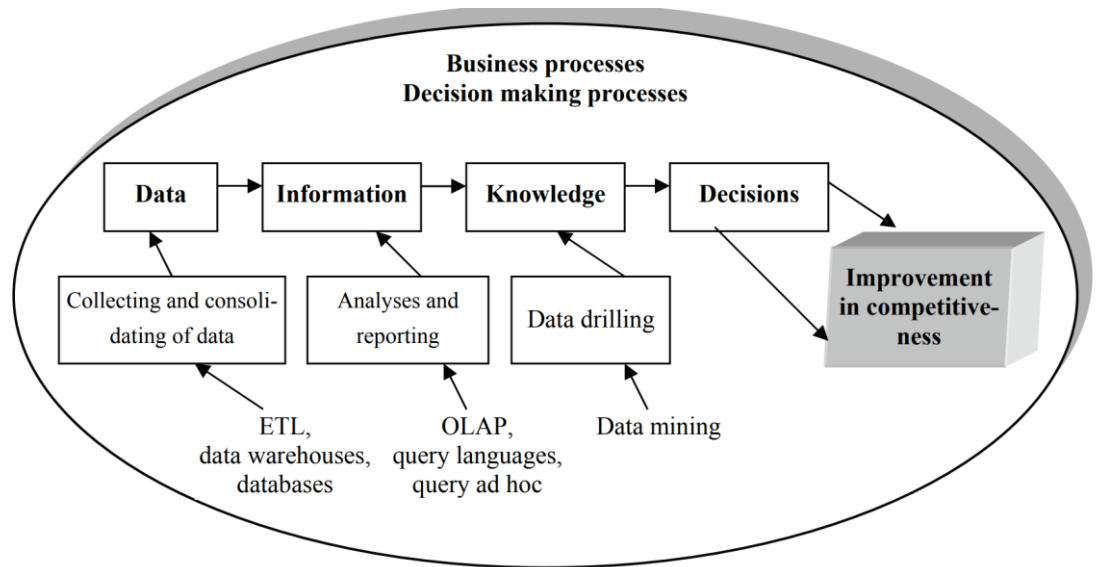
Figure1.The role of BI systems in decision making (Olszak and Ziemba 2007, 137)

2.1.2 Traditional BI architecture

BI architecture is a set of physical devices and software use to generate insights by utilizing the available data. It ensures the smooth operation of business intelligence. It can be comprised of several layers which will be discussed further in this chapter. However, this research is focused on agility but still it is very important to understand the BI architecture. There are several types of architecture defined by experts. In this thesis, it will be defined by using existing thesis and architecture defined by notable authors and academic journals. The architecture discussed here will be based on Ong, siew and Wong (2011)'s representation. The reason behind choosing five-layered architecture is its easy availability on Haaga-Helia's Moodle and deeply discussed all the aspects of BI architecture.

Figure2. DW/BI Architecture (Devarapalli 2013a, 24)

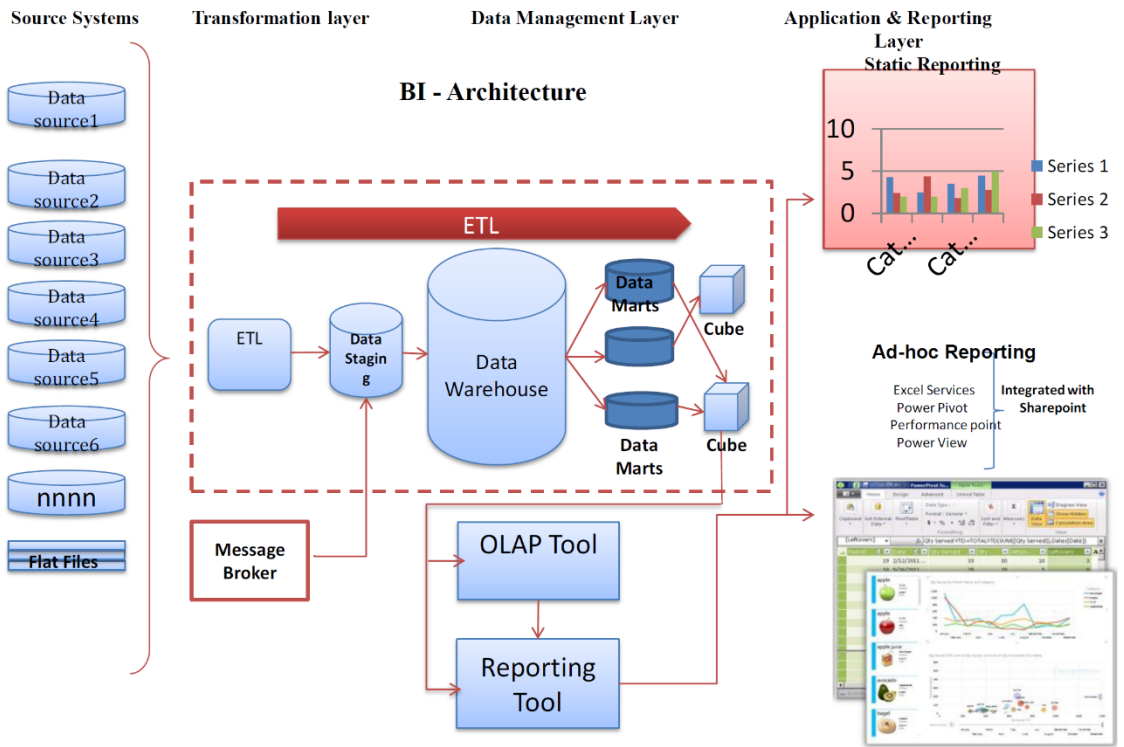Usually traditional BI is comprised of the stages mentioned in the figure 2 above. It includes data warehouses, ETL and reporting tools.
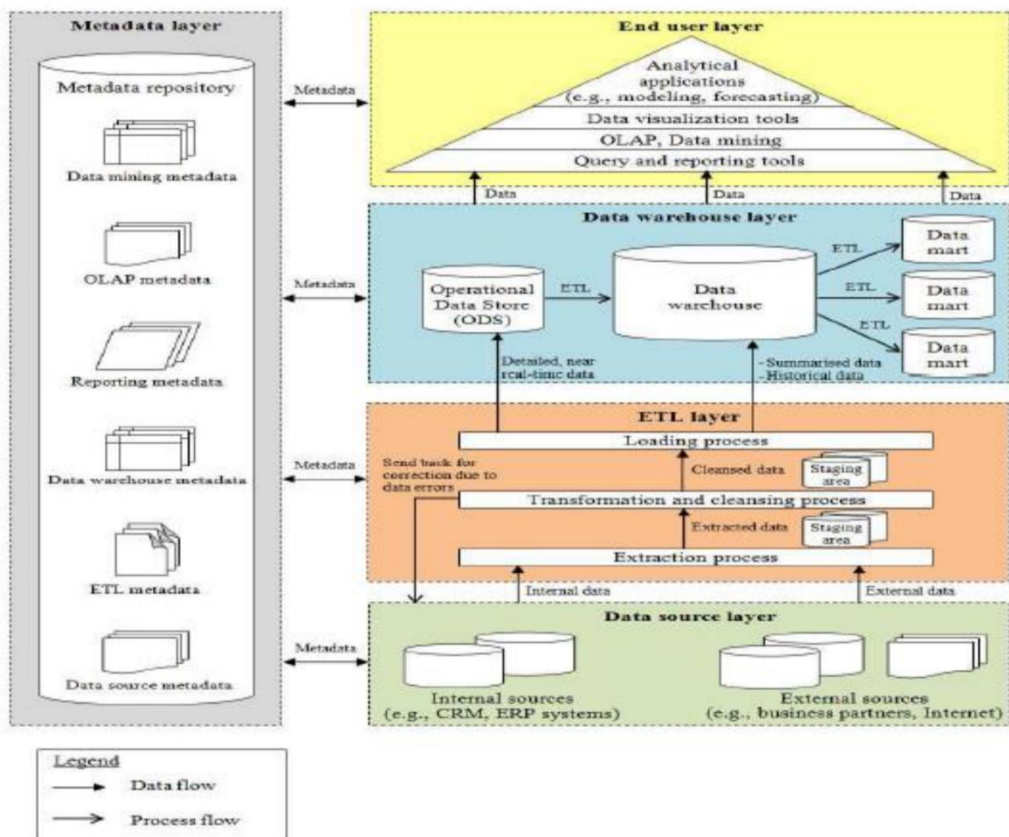

Figure 2. Five-layered BI Architecture (Ong et.al 2011,3)

A business intelligence architecture is composed of several components such as data, information and technology that are used to build BI systems for analysis of user stories and reporting. The BI architecture is a backbone of BI projects since it determines the quality of analysis and its influence on development and implementation decisions. The data component as name suggests is all about data, data sources whether it is external or internal, data formats and the multiple sources of the data flowing into the organization. It also determines what technologies are using for storing and availability of data such as OLAP, Data virtualization or Data Lake. Furthermore, it has to keep in mind what kind of data is flowing into organization since it keeps check on data overlapping and redundancy. Information component are used to transform data into information which is utilized by BI users to further help in decision-making. This component of BI architecture includes data integration, data cleansing and developing business rules which corresponds to the architectural guidelines. The technology component is the last part of architecture which is used to develop the final solution. This component includes ad hoc query, dashboards, reporting tools etc. It enables business users to perform the final analysis by utilizing BI applications such as Excel, PowerPivot, QlikView etc. (Rouse, 2017.)

ETL layer:

ETL stands for extraction, transformation and loading. Extraction is used to gather data from multiple sources. Transformation is used to shape the data in form needed by cleansing and removing data redundancy and duplicate data. Loading can be defined as storing data into the targeted locations such as data warehouses and data marts. The objective of ETL is to get rid of junk data and load the clean and needed data into the specific location.

Data Source layer:

It is comprised of internal and external data sources layer. Internal data source refers to data that is captured and maintained by operational systems inside and organization such as Customer Relationship Management (CRM) and ERP systems. External data source can be defined as that is generating outside an organization. This type of data is gathered from external source such as business partners, internet and market research organization.
This layer is the source of all the data flowing into the organization. It is also used to identify the location of data.

Data Warehouse layer:

Data warehouse is simply a single, complete and consistent store of data obtained from a variety of sources and made available to end users in a way they can understand and use in a business context (Devlin, 1996).

Data warehouse is used to store all the data for analytical uses. It can be consisted of the data from the beginning of analysis to the end. It can be defined as the backbone of BI architecture.

Metadata layer:

Metadata is data about data, which defines the structure and meaning for data. In this architecture, Metadata management is applied to all other four layers. The purpose of this layer is that by using the well-structured metadata, organizations is able to track and monitor the data flow in a BI solution. Furthermore, it can help to avoid misunderstanding of data. (Ong et. al 2011, 2.)

End user layer:

It is used by business users for the analysis of data by appropriate tools such as reporting tools (Power BI, Excel etc.) The reporting tools allows users to access the data and generate insights or decision-making support reports for management.

OLAP (Online Analytical Processing) and data mining are used to manage the data for analysis. Data mining as the name suggests use to identify the required information and data for further analysis.

2.1.3 Agile BI

Agile means the ability to adapt to the current scenarios or problems persisting in the real time. The Forrester Research defines agile BI as ""an approach that combines processes, methodologies, organizational structure, tools and technologies that enable strategic, tactical and operational decision –makers to be more flexible and more responsive to the fast pace of changes to business and regulatory requirements". (Evelson, 2011.)

The following are the key components that promotes agile BI:

> ➢ Agile development

> ➢ Agile business analytics

➢ Agile information infrastructure
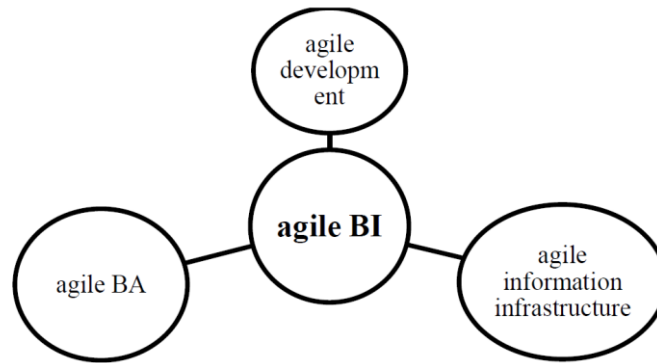
Figure 3. Vital components that promote an Agile BI solution

2.1.3.1 Agile Development

According to Forrester research the objective of agile BI solution: "is to 1) get the develop-ment done faster and 2) react more quickly to changing business requirements" (Evelson, 2011).

There are several approaches for implementing BI solution but the most frequent used are Waterfall development and agile development. Since this report is about agility hence the discussion will be based on agile development.

According to Ambler and Beck, agile development refers to a collection of software devel-opment methodologies, frameworks based on the characteristics such as collaboration between cross functional teams, iterative development and adaptability for changes. (Ambler & Beck 2001.)

There are several agile development frameworks such as

  ➢ Scrum,

  ➢ extreme programming,

  ➢ crystal,

  ➢ dynamic systems development

  ➢ Lean etc.

The most used and easiest to implement agile methodologies are: Scrum and agile data warehousing. Scrum is consisted of user story, product backlog, sprint backlog, sprint and daily scrum (Sutherland, 2010).

Figure 4. An agile BI solution utilizing scrum method (Muntean & Surcel 2013a, 118)

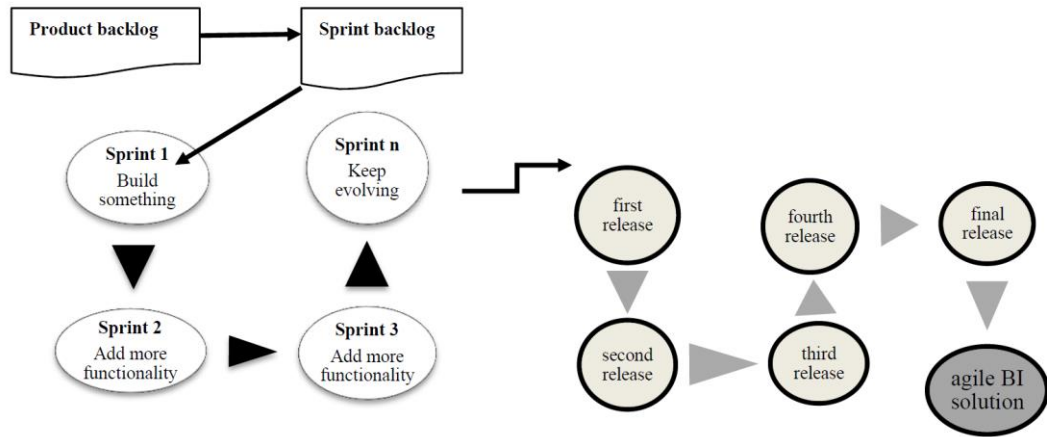BI projects are consisted of several user requirements and stories and to make the project agile, each user story is developed, tested and released to the user by using sprint methods and these small sprints last for 1-2 weeks. BI projects are all about users hence, users must be allowed to participate in each sprint task designed by teams. The user participation will list the exact requirements and demands in each sprint which in turn make the project agile. Users stories are classified in two categories: Product backlog and sprint backlog. Sprint backlog is what the team expects to complete the task related to user stories in one sprint. Product backlog is a list or requirements by the highest order which is required in sprint. The product backlog is developed by the user not the team involved in BI project since these are highest order requirements set by users. The last but not the least part is followed by daily scrum which keeps track of task conducted by team during sprint. The questions asked in daily scrums are: What was done yesterday? What will you do until next meeting? Do you have any problem with the outcome? Are you satisfied with the result of sprint? What could be done to make it better? The main reason why daily scrum is done to achieve the better result in upcoming sprint. (Muntean & Surcel, 2013b, 117.)

2.1.3.2 Agile Business Analytics

Not everybody is familiar with the advance analysis concepts. Agile BA is about making people less reliable on IT department. An agile BA should be able to let business users to do the analysis without relying on IT department. This can be achieved by providing office suit integration, a business appendix and visual features such as dashboards for instance, Power BI desktop and drill down capabilities where user can simple do the analysis by just moving rows, tables and developed measures (Muntean & Surcel, 2013c, 117).

Software as a Service (SaaS) and in-memory analysis significantly boosts organization's agile capability. The reason why in-memory analysis is used because of the fact it eliminates the need of disk-based BI analysis which are relational databases or OLAP. In-memory systems enhances the speed of analysis because it eliminates the need to store pre-calculated data in OLAP cubes.

➢ Visual interface

➢ Dashboards

➢ Self-service

➢ In-memory processing, speed of response, low costs

➢ And quickly to deploy

IBM Cognos TM1, MicroStrategy, Microsoft PowerPivot and QlikView are some of the leading provider of in-memory solution. There is one significant drawback of in-memory solution which is, they are very expensive since, the in-memory task is based on RAM but for small organizations it can be very expensive because massive memory RAMs are considerably expensive (Muntean & Surcel 2013d, 118).

Table 3. A SWOT analysis for implementation of in-memory BI solutions

S (STRENGTHS)	W (Weaknesses)
• in-memory processing • faster speed of response, rapid access to reports, analysis and business metrics • improving self service through analytic flexibility • allows companies to integrate data from transactional systems, external data sources, spreadsheets or data warehouses • quickly to deploy • eliminates the need to store pre-calculated data in OLAP cubes or aggregate relational tables • visual interface, dashboards • ease of use for end users • low costs	• a limited metadata management • limited by physical memory • data quality • limited ETL • sometimes requires multidimensional data modeling
O (Opportunities)	T (Threats)
• allows for real time business intelligence without a DW • eliminates the need for a pre-built OLAP cube or data mart • cloud computing	• not a real-time analysis because data is analyzed in memory, not in the data store.

Figure 5, A SWOT analysis of in-memory BI solution (Muntean & Surcel 2013e, 118)

2.1.3.3 Agile Information Infrastructure

An organization cannot achieve or adopt agility until it has made its components, teams and infrastructure agile. Agile infrastructure uses advance and modern technologies which can react to unforeseen situations and changing user stories without any problems. Since infrastructure is agile the data depositing there will be agile as well. An agile infrastructure is capable of extracting data from multiple sources with different format so it is advantageous for enterprises who are using outdated data storing marts. One of the most used agile data storing method is data virtualization. (Muntean & Surcel 2013f, 119.)

Data virtualization is defined as "the process of offering data consumers a data access interface that hides the technical aspects of data stores, such as location, storage structure, API, access language, and storage technology" (Van Der Lans, 2011).

The data virtualization offers several advantages over ETL methods. Some of the advantages are listed below:

- ➢ Data's location is secured,

- ➢ Eliminates chances of duplicate data,

- ➢ Data modelling capabilities,

- ➢ Data profiling capabilities,

- ➢ Data transformation capabilities,

- ➢ and On-demand data integration capabilities (Loshin & Russon 2010).
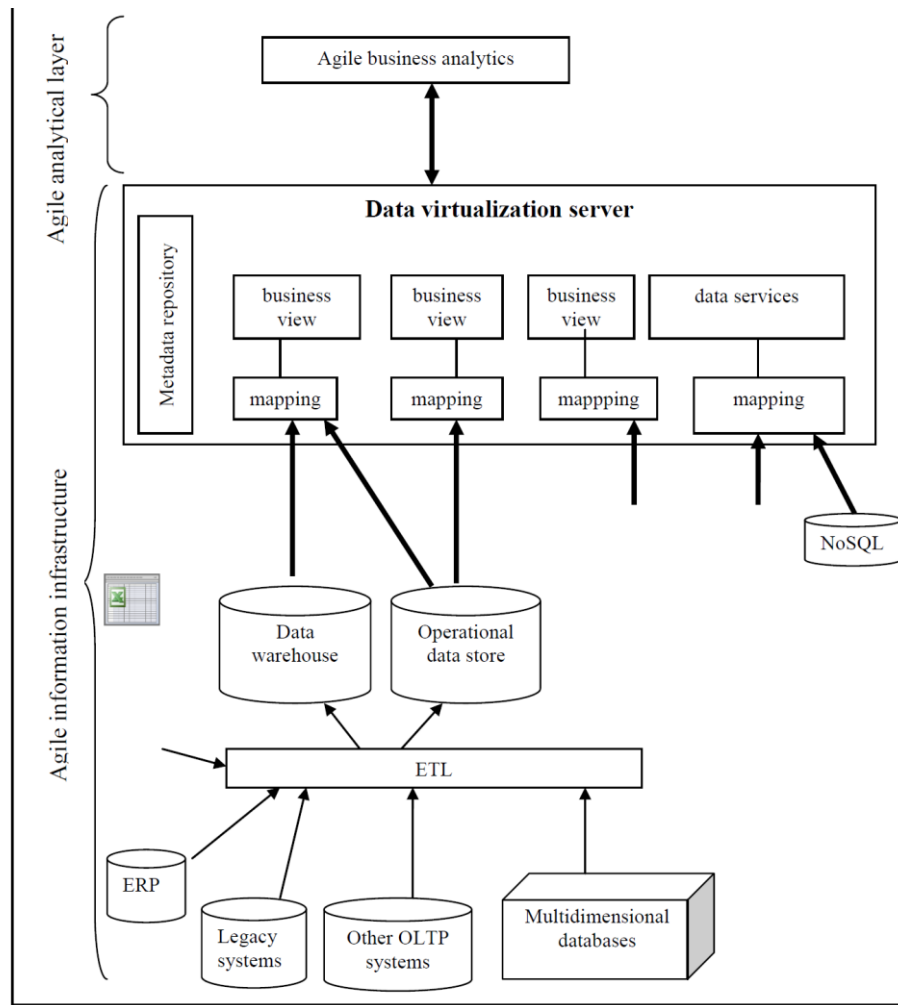
Figure 6. A high-level architecture of an agile BI system (Muntean & Surcel 2013g, 120)

There are several organization which offers data virtualization servers such as: Composite Information Server, Denodo Platform, IBM Infosphere Federation Server, and Amazon etc.

2.1.4 Theoretical conclusion, advantages and disadvantages

The theoretical chapter will end by discussing key components of agile solution and advantages of agile BI over traditional BI.

2.1.4.1 Primary components that promote an agile BI solution
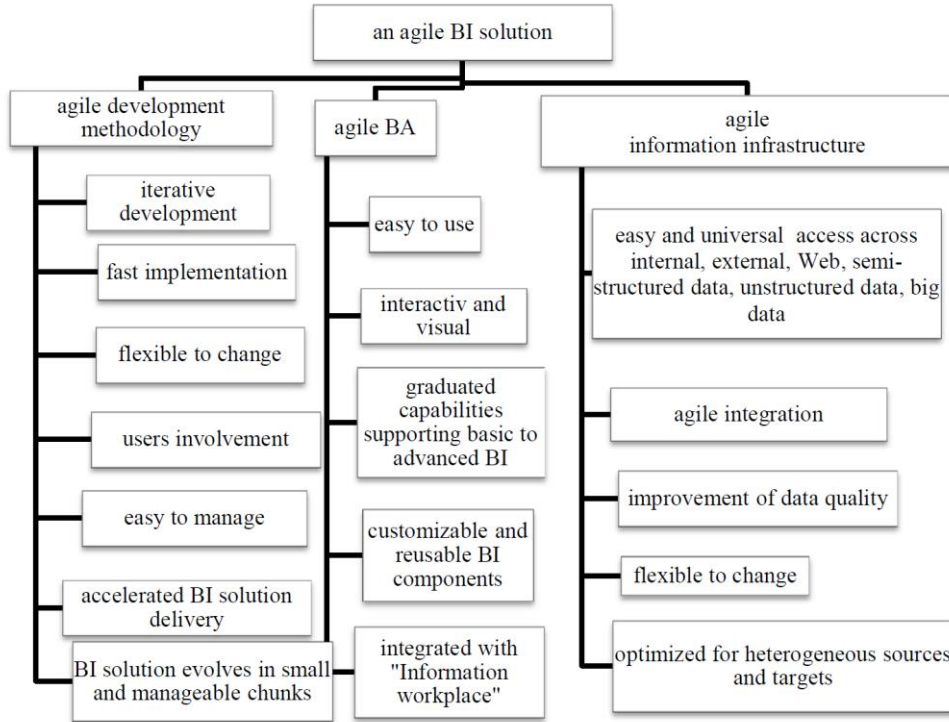
Figure 7. Primary components that promote an agile BI solution (Muntean and Surcel 2013h, 121)

To make an entire BI solution agile, it is recommended to have agile development methodology, agile business analytics and agile infrastructure integrated together and working towards developing an agile BI solution. The aforementioned methodologies are already explained thoroughly in the theoretical chapter.

As in agile development, all the projects are broken down into a series of multiple smaller projects that are strategic oriented, carefully planned, tested and rolled out on a continuous basis. This iterative development followed by incremental development helps organizations to adapt to changing market scenarios and customer requirements.

Agile BI solutions are cost-effective as well as risk covering that reduces the cost significantly and providing effective time management. Since agile BI projects are released on a regular basis depending upon the changes, changes to tools and data warehouse can be made functional in a matter of days. These solutions are users tested and developed towards markets scenes henceforth it heavily promotes to adopt agile BI rather than traditional BI following developments such as waterfall.

2.1.4.2 Advantages of agile BI over traditional BI

There are several criteria that use to define major differences between traditional BI and agile BI and the workflow. According to research conducted by department of economics informatics and cybernetics, Bucharest, Romania, it is compare by using the following features:

- ➢ User requirements

- ➢ Incorporation approach

- ➢ Data timeline and history

- ➢ Data refresh rate

- ➢ Information delivery

- ➢ Data source format whether it is structured, semi-structured or unstructured includes all sort of formats

- ➢ Development frameworks

- ➢ Development cycles and iterations

- ➢ Business analytics and advanced algorithms for developing solutions for massive data using enterprises

The following table discussed below deeply investigates the advantages of agile BI based on above-mentioned criteria:

Criteria	Traditional BI	Agile BI
Business requirements	➢ Stable requirements ➢ Well defined ➢ Not change significantly	➢ User discovers the requirements during the project ➢ Changes come quite often
Integration approach	➢ ETL	➢ Data virtualization

	➤ Data is gathered from several sources such as internal or external ➤ Duplicate data issue	➤ Data is gathered on demand ➤ Eliminates the redundant data
Data timeline	➤ Historical data	➤ Real-time data
Data refresh	➤ End of work day/ end of last load	➤ Real-time
Information delivery	➤ Takes significant long time to deliver	➤ Almost instantly
Data source format	➤ Relational databases ➤ Semi-structured data ➤ CSV, excel files ➤ Multidimensional databases(OLAP)	➤ Big data ➤ Structured data ➤ Semi- structured data ➤ Unstructured data
Development methodologies	➤ Waterfall or some other traditional methods	➤ Agile development methodologies such as SCRUM, extreme programming
Development cycle	➤ Slow ➤ Inflexible ➤ During the project room for changes is negligible	➤ Faster ➤ Changes can be adapted at any given time
Type of business analytics	➤ Traditional BA	➤ Agile BA

3   Research plan

It is always crucial to carefully plan the research before starting the research. The research started by dividing working hours evenly for each chapters of this report. The role of theoretical and empirical study has to be clearly stated and defined. This research is heavily based on the literature available online, thesis, supervisor's guidance and the knowledge obtained from the courses(BI) attended during the studies.

Author made the decision to write thesis on the mentioned topic was because of the Business intelligence course conducted in Haaga-Helia. The BI is the field which intrigues authors and the ability to do the analysis by utilizing the data.

In this research, the author is exploiting the inductive approach. It includes the empirical information gathered by the qualitative methods like interview and white-papers. The data obtained from the empirical study and the information from the theoretical research are combined and compared to each other.

3.1.1   Data gathering methods

The data gathering method started by reading book "Agile Analytics" by Ken collier. This book discussed deeply about the components and aspects of agility in business intelligence. After reading the book thoroughly it gave the solid idea to proceed with research. The actual research started by finding out the relevant study materials, academic journals and white papers published by industry leaders such as Mckinsey, TDWI and Forrester. There were some other materials available as well but they were identified by determining the sources which answered best the research questions and sub-questions developed by thesis author. According to stake, researchers are encouraged to gather the data from multiple sources which validates the research findings. Hence, numerous sources were identified for validating the data and the most suitable one chosen for publishing in this report. (stake, 1995.)

3.1.2   Interview

The interview data is based on the in-depth interview conducted by author. There were two interviews conducted by authors. The first interviewee was a BI consultant working in the IT field for over 25 years. The reason author chose to interview him is because of his experience with IBM Cognos and then being the founding member of one of the leading data analysis company in Finland (Midanos OY).

The second interview was done over the skype due to the interviewee working in MuSigma, India. The interviewee is a data scientist working for developing advanced algorithm in MuSigma. Due to his familiarity with agile analytics, it gave solid idea of agile way of working in big data analytics organization.

The procedure and the questionnaires for the interview were structured and the questions were related the way their organization work and which way they solve problems. This will be explained properly in the empirical chapter of the report.

3.1.3 Documents and literatures

This is the major source of all the information and data which is used to write the report. Mostly data has been gathered through the previous researches and the academic journals published by the universities.

There will be several practices, frameworks and methodologies discussed in the empirical part which is based on the leading organizations such as Forrester research, IBM and Mckinsey.

3.1.4 Primary and secondary data

The primary data is collected by industrial researches, white-papers, academic journals and the interview. The main source of the primary data was academic research conducted by leading universities. The second source of primary data is the science conferences and the research papers published by the conferences.

The secondary data is combination of primary data and observations such as BI courses and reading BI related material. Author has utilized the vast amount of material available online which has been authenticated and cited.

4 Empirical Research

This is the most important chapter of thesis. In this chapter, all the methods listed by chosen leading organizations, academic journals and the interview will be combined to form the best practices for adopting agility in BI solution. First the frameworks, methodologies and recommendations will be explained thoroughly and after that combination of the chosen practices will be explained. In the end, the result of the report will be published.

Before drilling down to the details, it is important to discuss the terms and definitions listed by the organizations. The most used terms will be explained to give the proper understanding of the frameworks for adopting agility.

The reason for including already conducted researches by McKinsey and Forrester because this thesis is hugely based on the researches already conducted and to find out the most suitable methods for adopting agility. Since aforementioned organizations are the leading members of the agile community. It was appropriate to include this research in empirical part of this thesis.

4.1.1 Definition of agile methods and frameworks

There are numerous agile methods that can be incorporated into enterprises. Extreme programming and Scrum are most used because of the easy implementation and cost-effectiveness. Some of the agile methods which are discussed briefly: Feature Driven Development, Crystal methods, Dynamic Systems Development Methods, Lean method, Adaptive Software Development. (Devrapalli 2013b, 29.)

The methods are:

- Scrum

- Dynamic System Development Method (DSDM)

- Crystal methods

- Feature-Driven Development (FDD)

- Lean Development (LD)

- Extreme Programming (XP)

- Adaptive Software Development (ASD)

Scrum

Scrum method was developed by Ken Schwaber and Jeff Sutherland in early 1990s. The term "Scrum" is adopted from Rugby. Generally, Scrum focuses on software development where backlog is delivered to user in a month by following frequent sprints. It is followed by daily scrum method where frequent meetings are conducted amongst sprint team to find out what objectives have been reached in one sprint cycle. (Schwaber & Beedle, 2002.)

DSDM

The Dynamic Systems Development Method is an extension of Rapid Application Development developed in UK. According to the surveys, it is most frequent used method for agile software development in Europe. Currently there are nine methods employed to follow DSDM frameworks which are Active User involvement, frequent delivery, team decision making, integrated testing throughout the lifecycle of project, and changes which are reversible in project development. (Stapleton, 1997.)

Crystal Methods

The term "Crystal Methods" was coined by prominent author Alistair Cockburn. This method is focused on people rather than technological or other aspects. Alistair has stated in book "Crystal Family" what actually works from what people say should work. Crystal methods are people centric which focuses on collaboration and cooperation. (Cockburn, 2002.)

Feature driven Development

Feature Driven Development method is developed by Jeff De Luca and Peter Coad. FDD follows very simple approach consisted of five processes which are: Developing an object-model, devising a feature list, which is followed by three crucial features such as planning-by-feature, iterative design-by-feature and build-by-feature processes respectively (Palmer & Felsing, 2001).

Lean Development

Lean Development is least known agile method developed by Bob Charette. It follows the model of Lean production. This method focuses on risk management principles which are guided by restrictive management practices. Furthermore, opportunities enterprise get are pursued using" risk entrepreneurship". According to Schmidt & Lyle, Lean development is strategic oriented. (Schmidt & Lyle, 2010.)

Extreme programming

Kent Beck, Ward Cunningham and Ron Jeffries developed Extreme programming. XP's principles are Community, ease, response, and courage. It emphasizes on technical superiority. The practices listed by XP's frameworks are dynamic. This approach has attracted the most interest of any of the agile methods. (Beck, 1999; Highsmith. J, 2002a.)

Adaptive software development

Adaptive software development focuses on adopting the changing market scenarios rather than avoiding them. It is consisted of several methods but the most prominent ones are: iterative approach and development, strategies based on features, customer oriented group reviews and leadership-collaboration management. (Highsmith. J, 2002b.)

4.1.2 Research based on Mckinsey's Data-management principles

Mckinsey has clearly defined several guidelines and frameworks for adopting agility in business intelligence. This chapter will elaborate on the Mckinsey's data management methodologies.

According to Mckinsey, data-management has an enormous impact on organizations' agility. The proper management of data can create value from analytics. The way data is available for analysis determines the company's agile principles since data is the backbone of any organization involved in BI practices.

The data whether it is structured or unstructured collected by companies has the potential to maintain the customer acquisition and retention. The data can be analyzed or studied to reveal the process or loopholes in an organization that could be completely changed or made more efficient.

Furthermore, Mckinsey has stated that the most widespread problem faced by an organization when it comes to data-management is the "skilled talent gap". The acute shortage of experts, IT people who has little to no knowledge about newer data-migration technologies, capabilities, frameworks and architectures. The defined approached towards data analysis is not currently keeping up with the emerging market trends and new data delivery.

According to a research published by Mckinsey, about 60% of global banks, say they have never quantified the potential value to be gained from investments in data-migration

tools and capabilities. Lack of clearly defined objectives, vision and outcome-based metrics to guide executives' strategies and decisions, data-transformation projects can drag on for years. (Mckinsey, 2016a.)

The definition of agility according to Mckinsey is, "agile is a time-tested methodology used in IT organizations to build software or manage processes more effectively. Broadly, it is a collaborative approach in which cross-functional teams design and build minimally viable products(MVPs) and features quickly, test them with customers, and refine and enhance them in rapid iterations". (Mckinsey, 2016b.)

4.1.2.1   Mckinsey's Agile Principles

There are certain frameworks devised by Mckinsey to introduce agile principles in any organization. These principles focus mostly on agile data and big data infrastructure. The companies who have introduced agile data and infrastructure has experienced significant performance gain and effective time management.

- ➤ How to get the agile data?

  The agile data can be gathered through several processes but the first method to understand and getting the agile data is a business-driven approach. This approach is started by generating a master list of business cases, as well as opportunities for new or enhanced products or processes. During this process, the most important most important customer characteristics and patterns are identified across a broad range of business domains. (Mckinsey, 2016c.)

- ➤ Joint ownership

  Usually in big organization the commonly faced problem is little to no communication between different business units. To successfully deploy an agile data approach, representatives from the business and IT units need to communicate altogether. This way business people can get better understanding of IT technology and the product developed by them will be dedicated to the business company is doing. If the IT unit has no interaction with the business unit then the product or solution developed with be of no use.

- ➤ Cross-functional, or scrum, teams

  Mckinsey has stated that assigning dedicated teams to their data-transformation can benefit organizations. A well-balanced team includes members from business

units and IT- for instance, data scientists, data engineers, business-architects, IT developers, and quality-control specialists. This type of assimilation helps to deliver viable data migration products and processes that could be released, tested and refined quickly. Henceforth, speeding up company's ability to generate insights and business value from the data which is agile and developed or gathered by the mixed team of business and IT experts.
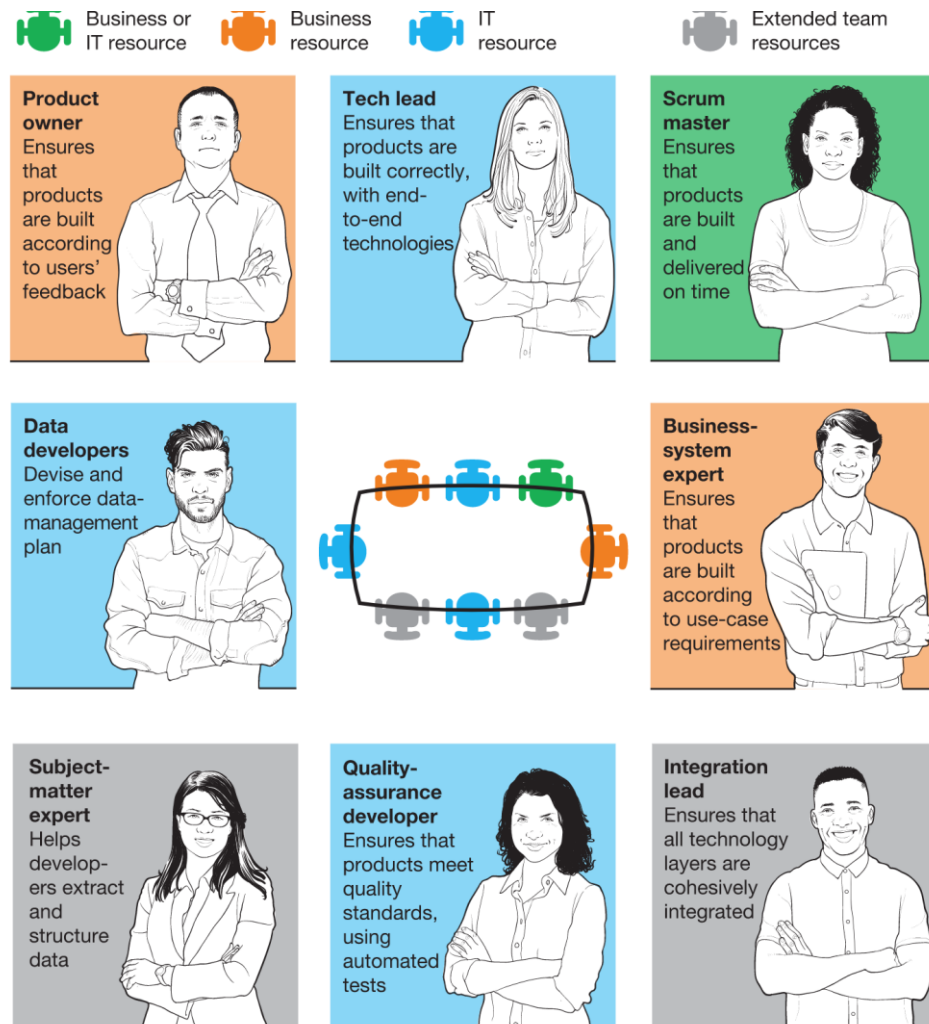
Figure 8. An agile data tab (Mckinsey,2016d)

The above figure details the interaction between the business and IT units of an organization. The joint ownership helps to build the agile solution with the complete assimilation of an entire organization.

➤ Ready to adopt emerging technologies

Due to the ever-evolving IT field, organizations must be ready to adopt the modern technology to cope up with the market trends and changing customer patters and

characteristics. The one mentioned by Mckinsey for getting the data agile is Data lake.

A data lake is a repository for all structured and unstructured business information collected from the myriad systems located in different business units and functions in a company. It would include current and archived data and, through the use of APIs, could be enriched with information from external providers such as Facebook or Twitter. Data in data lake remain in their original formats. Data lake is compatible with standard data-discovery tools. To fully utilize the data lake, it must be integrated within a company's existing data architecture and serves as the primary source of information. The biggest benefit of data lake is that data stored there is reliable which can be accessed anytime for analysis by broad range of applications. (Mckinsey, 2016e.)
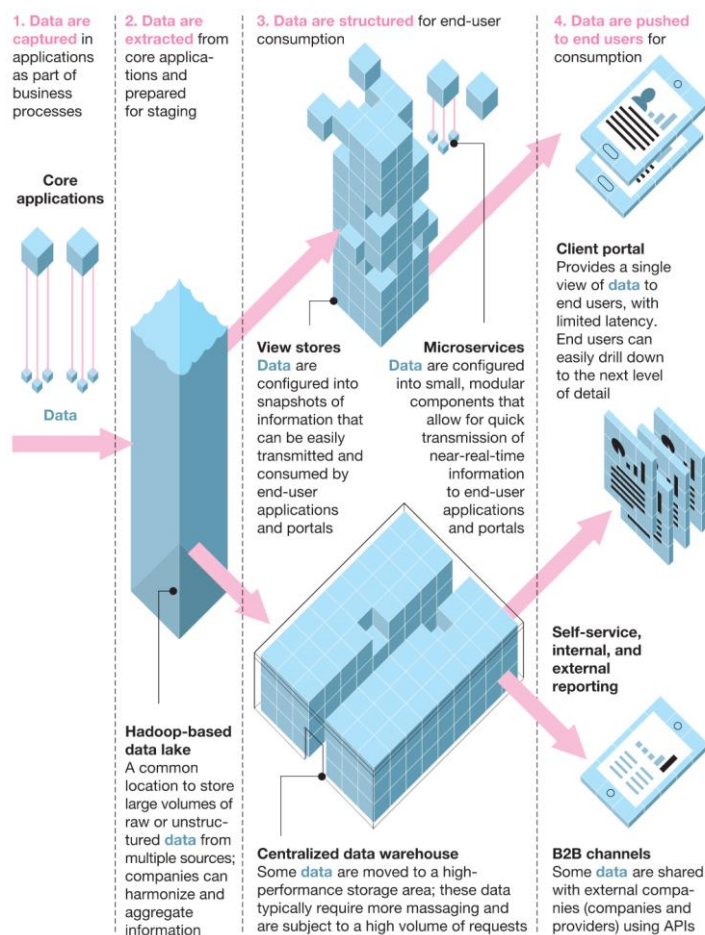
Figure 9. Data lake depiction (Mckinsey, 2016f)

The above-mentioned diagram is constructed by experts from the Mckinsey to get the better understand of Data lake.

4.1.2.2 Mckinsey's key points for adopting agility

➢ Use pilot projects to test out the unique features and ability

➢ Empower agile teams

➢ Updated IT infrastructure

➢ Enhanced and effective communications amongst all business unit

➢ Devising KPIs for company's internal growth and performance review

4.1.3   Interview data

The interview data is the primary part of this research which gives an insight into the practical BI world. They were primarily focused on the organization's working and the methods they use to solve the problems. The questions are related to the interviewees every day's task and the agile approach they use to deliver the final solution.

4.1.3.1   Data scientist's interview (Mu Sigma Inc.)

Mu Sigma is an Indian based analytics firm that primarily offers advanced analytics services and decision sciences. It is headquartered in Bengaluru, India. Mu Sigma's clients includes more than 125 Fortune 500 companies.

Website: www.mu-sigma.com

The interviewee answered the questions by explaining the several business cases he has solved with his team. Hence, the interview data will be heavily based on the real-life business cases. The data was gathered by formulating several questions and the conclusion was based on the answers given.

Author: What is the approach Mu Sigma follows to deliver the solution?

Interviewee: There are 4 key pillars which forms the foundations of Mu-Sigma way of working. These are the reasons which set Mu-Sigma as market leader in big-data analytics. These 4 keys aspects are following:

➢ A well-defined and guided analytical process

Analytical frameworks and methodologies are defined in a structured and guided way which has user-driven workflows

➢ Sharing and collaboration

Collaboration and communication with multiple stakeholders and departments is done on real time via in-house developed application which has flexibility of multi-user sharing

➢ Analytical consumption

Through this approach the output is consumption-ready which generates insights and reporting frameworks based on the current scenarios or the problems identified in earlier stages. Henceforth, the analysis process goes agile which addresses the situation or problems depending on the current scenario. This is the most crucial part of the entire problem-solving processes.

➢ Knowledge and learning management

It is like a never-ending loop of learning which capture, retain and modify the problem-solving approaches of recurring and persisting problems.

Author: How would you define agility in your organization?
Interviewee: It can be defined as a loop which never iterates through the processes. The following mentioned diagram will be able to explain properly. This loop defines the agile way of working in Mu-Sigma. The entire analysis is based on this loop. Due to being extremely efficient, it is currently now adopted by several other organization involved in big-data analytics.
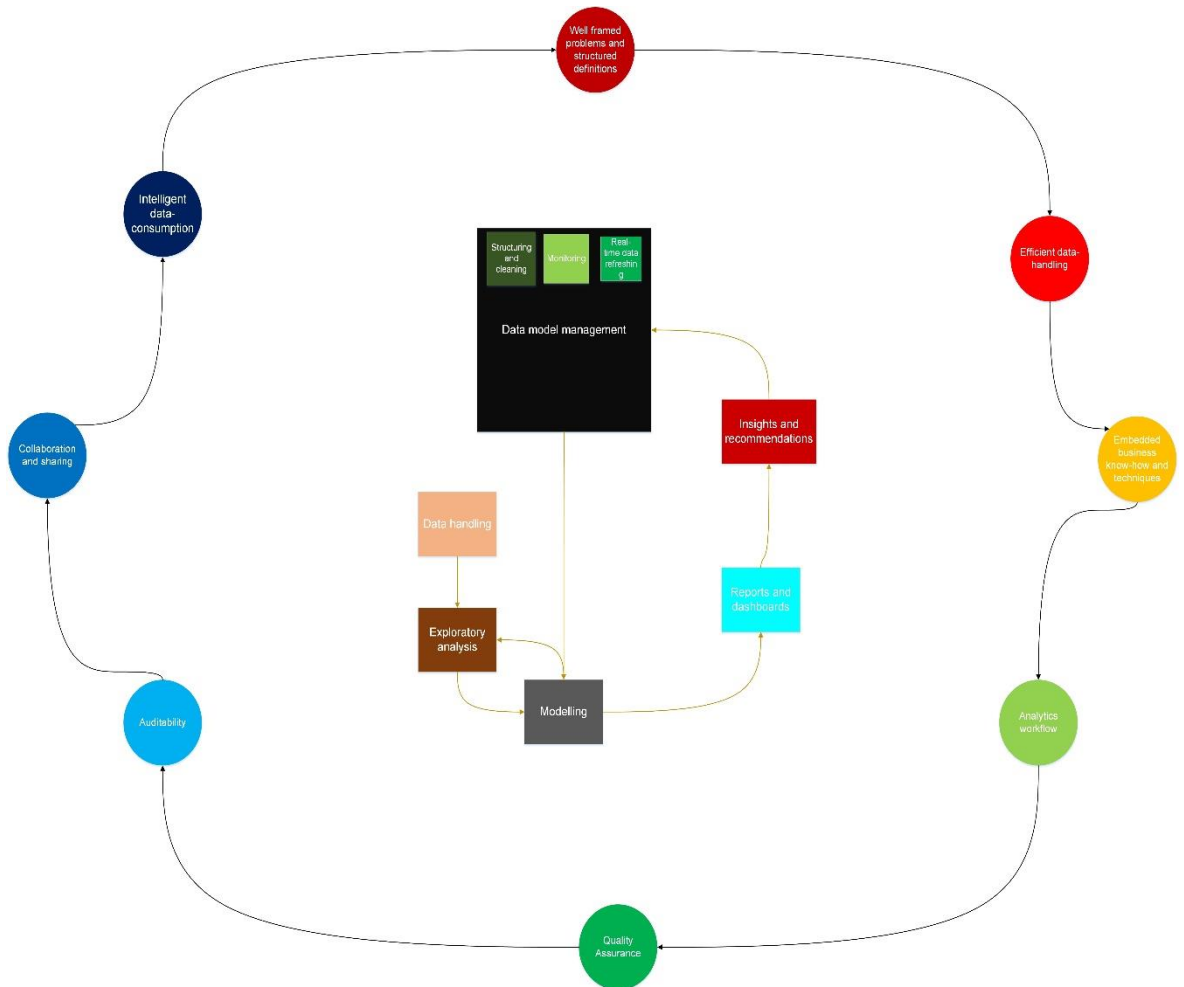
Figure 10. Agile Analytics Loop of Mu-Sigma

Furthermore, this strategy has helped to achieve the agility in every aspect of organization. There are some benefits which this loop helps to achieve the agility in problem-solving methods. The following are some benefits listed by interviewee:

➢ Eliminating the data redundancy and data quality by early detection which is achieved by profiling and finding out missing values detection.

➢ Provides significant transparency to analytics methods- devising early models and statistics for comparing iterations.

➢ Enable auditability and quality checks for each iterative stage which helps to conclude the results without errors.

➢ Suggestions are received and implemented if needed for various projects through embedded checklists and earlier examples.

The above-mentioned methodologies and frameworks helps to achieve clarity of purpose with all stakeholders and departments within Mu-Sigma. This ensures to identify right business priorities by teaming up with multiple stakeholders. The final stage delivers the "decision design" result which brings back to desired outcomes.

Author: would it possible to give an example of the real-life business case solved by Mu-Sigma?

Interviewee: The most suited example in this case would be solving an issue faced by Johnson and Johnson. The statement of the problem is, "Johnson and Johnson wanted to retain the customers by understanding the buying patterns".

To elaborate it more deeply, it can be stated as that client serves to a diverse set of customers with changing buying patterns and habits. The existing analysis methodology was not able to generate actionable insights due to this reason Johnson and Johnson suffered a loss of several million dollars.

Mu-Sigma found out that customer's buying patterns were not analyzed by existing methods for anomalies. Lack of this data led to customers lost without any prior information, making it challenging for Johnson and Johnson to retain them.

Author: What approach was followed by Mu-sigma to get the positive results?

Interviewee: Mu-Sigma utilized its decision science teams to eliminate this problem. The advanced mathematics techniques were applied to derive the solutions. The first approach was to perform the analysis on active customers. The team designed a linear Regression model based on active customers to predict the next purchase. The second model was based on inactive customers to predict the probability of the next purchase.

Author: How the model was validated?

Interviewee: These models were built on the data since client started losing customer. These models were based on the data given by Johnson and Johnson which was 4.5 years of data. The model was validated for 1 year because of being one of the biggest consumer oriented company. Henceforth, everything had to be tested before rolling out the actual solutions.

Author: what were the results?

Interviewee: As a result, 9 critical issues were observed for calculating customer lapse and order gaps like revenue and financial loses. The final model showed the customer who were not active and deviated from their buying patterns. The Johnson and Johnson understood what factors are responsible for activating customers. Finally, client could retain 15% more customers what they couldn't do with existing methods.

Johnson and Johnson Data Centre

Data Flow into MuSigma

MuSigma's Agile Data Warehouse

Data Classification by Data Engineers

Data engineers

Active Customers

Non-active customers

Data-Model

Data Scientist's analysis

Prediction of active customer's next
Purchase

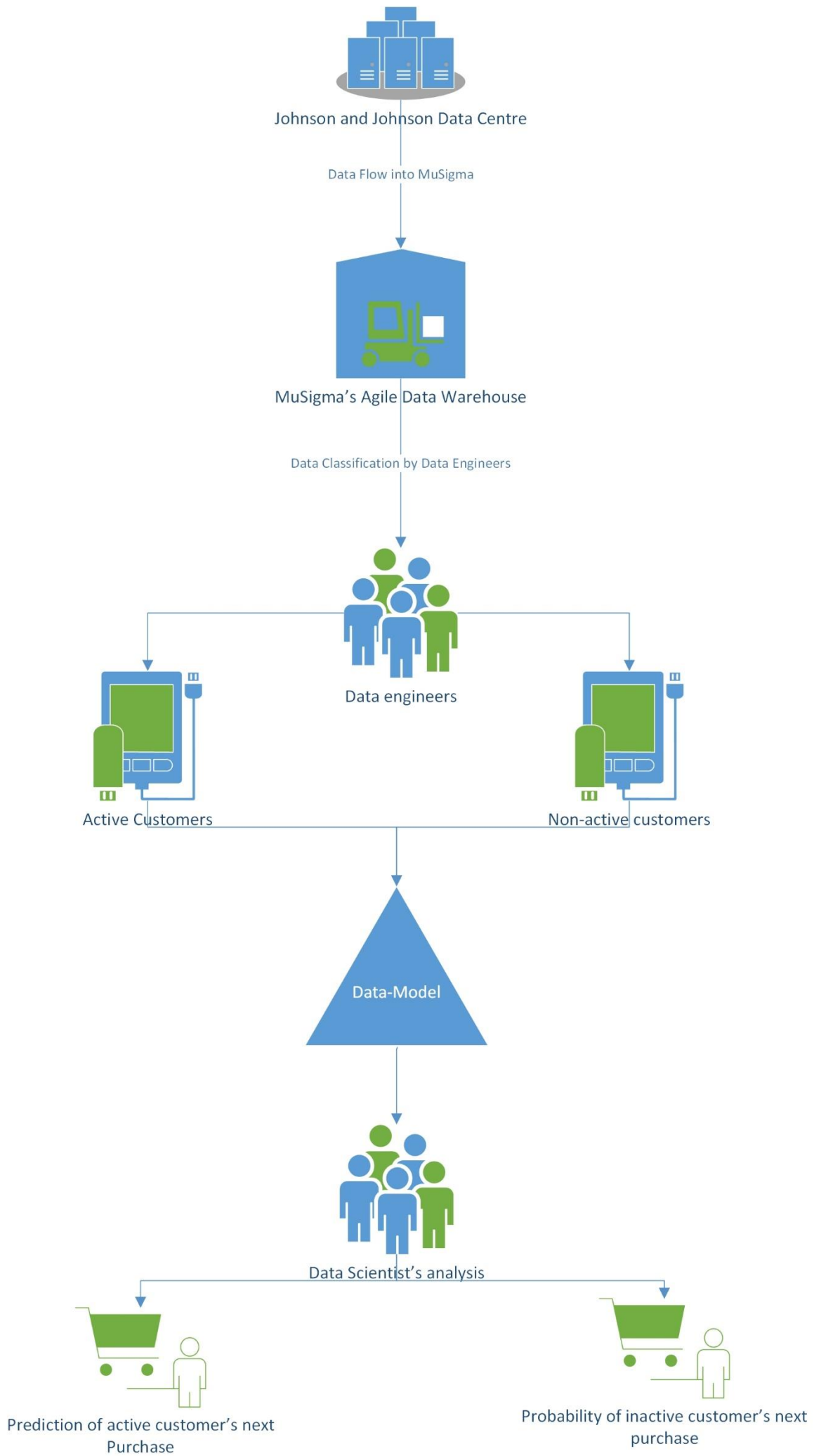Probability of inactive customer's next
purchase

Figure 11. Data model developed for Johnson and Johnson

4.1.3.2   BI Consultant Interview (Midanos OY)

Midanos OY is a company specializing in designing and developing business intelligence and planning solutions with IBM Cognos tools. The clients are some of the largest companies in Finland.

Website: http://www.midanos.com

This interview was completely focused on which was Midanos has adopted agility. The method this company follows for delivering agile solution is scrum and mostly focused on sprint solutions. The following interview data will give thorough understanding of adaptation of agility in an organization.

Midanos' architecture is based on IBM Cognos platform particularly TM1/Planning consulting.

Interview data

Midanos' core business is about business intelligence so it generates huge amount of data. Midanos was early adopter of the concept of data warehousing to manage and store the data and information. There was dire need of adopting agility in delivering solutions for some persistent problems which was negatively effecting the business.

The key problem faced was that transactional system could hold only a month's worth of data so obviously it had to be fixed because of that processes couldn't integrate and analyzed properly. Even though they had a good success, but in terms of metrics and monitoring there was a bit of crisis. The crisis was clients were unhappy about the delivery. Before the adoption of scrum method, waterfall approach was the way to deliver the solution due to that solutions were very rigid and non-tangible which made business upset. Delivery of solution was slow and expensive. It was too rigid in terms of accommodating changes in requirements. This in turn made the delivery team quite concerned because business and IT units were not engaged in what they were doing. The management was upset because solutions were never on budget and delivery dates were slipping. Furthermore, QA team was less upset because solutions that were being delivered were fairly accurate their concern was solutions generating were reaching beyond the delivery data and warehouse was not supportive. Therefore, a department was created called Agile department whose job was to develop rapid application development.

The newly developed team's concerned was focused around the structure both from a project delivery and from an architecture perspective. After having several meetings, management decided to follow an approach which could deliver the value to the business quickly but in a matter, that is sustainable. The chosen method was Scrum and the most

focused part on the Scrum framework was Sprint. Sprint is the backbone of Scrum methodology.

Sprint is all about taking a backlog but only the portion of backlog is taken so that team can focus on it in a brief period. No matter how big the project is but the team is only going to focus on what they can do in brief time. The solution is build but the important thing to keep in mind is that it should be tangible. By tangible it means whosoever can analyze it, has an opinion about it whether it's done or not which in turn provides a retrospective to review the entire process that how do we do? What do we need to do to improve? The retrospective part of the sprint is critical because through that team has a room for continuous improvement and that allows the team to move forward with continuous improvement. In other words, take a big backlog reduce it to just what the team can focus on and make sure that whatever the solutions are, whoever is going to use it has a say if it's finished. The process is reviewed to identify what could have done better. This entire process is repetitive.

It turns out that this approach in software development can also be used to implement agile data warehousing on existing projects and that's exactly what Midanos did. They took the sprint product concept and superimposed it right on top of the existing project plans which in turn generated the improved framework to get the projects going forward.

The next thing Midanos focused on was to get some predictability around sprint methods. It was needed to make sure that to make sure that delivery date predictions are right. It was achieved by going back to the waterfall plans and recasting the requirements as epic theme user stories and developer stories. This wasn't hard for Midanos because requirements were good in terms of traceability between the developments and epics but the Midanos specifically focused on recasting on that particular components of the requirements that was needed to feed the particular sprint. Once it was achieved, more technologies like story point estimation process.

In simple terms, story estimation process according to interviewee is, "you are taking your backlog and you are doing a high-level estimate to say I think this is twice as big as that this is probably a third of big as that and if you can reference that against things that you have already delivered, you can start to say this is what we can commit for the next sprint".

The story estimation process is followed daily progress tracking. According to interviewee daily progress tracking is, "it keeps check of each iteration for instance, are we going? Are we meeting? Where would we be with respect to this at the end of this day, at the end of the week, or at the end of the sprint". To keep track of this Midanos implemented sprint chart control to keep track of everything and to bring sprint iterations under the control.

In addition, Midanos was able to achieve the constant sprint velocity they were able to commit to deliver the solutions in defined time manner. Through these processes, Midanos could achieve the agility by adopting Scrum frameworks. This enabled them to deliver the solutions cheaply and in time.

Midanos' Current approach to deliver solution

First the requirements are gathered, these requirements are profiled against the data to see where the gaps are, how usable is the data for whatever the clients want you to do, then the high-level conceptual architecture is drafted which is followed by user story de-composition. These processes are done in several sprints until the concrete solution has been reached. Since, these deliverables are tangible there is always room for changes and modifications.
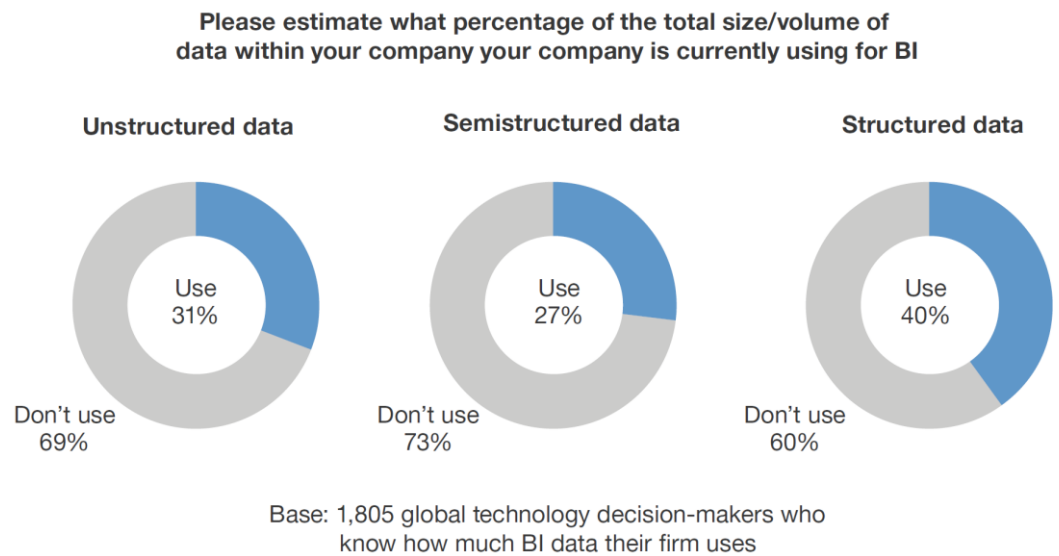
4.1.4 Forrester's Prediction and Agile wave

Forrester conducted a massive research on 3rd quarter of 2015 about the enterprises way of working in BI environment. This chapter will discuss Forrester's prediction and recom-mended guidelines for adopting agile business environment.

Forrester stated that "agile BI is a key element in the business agility equation". This equation is consisted of business agility and information agility. Forrester says that this is the age of the customer, which elevates business and technology priorities to achieve.

Business agility: It is enterprise's ability to adopt, react, and succeed in rapidly changing customer-driven requirements. It is achieved by engagement of employees with customer problems, market-changes and nonviable processes. These challenges are solved by en-gagement of business and IT unit of any agile enterprise. The response to this challenge makes business unit highly aware of the customer-driven requirements which in turn has correct response from IT unit. This is what make enterprises agile, competitive, and suc-cessful.

Information agility: This supports business agility. Agile enterprises have workers utilizing agile, flexible, and responsive BI tools and applications. This department's key objective to manage data and information and incorporating agility in way of working.

All the companies using earlier generation nonagile BI tools and applications have very little chance to stay ahead of the competitors. This lack of BI agility leads and organization to use of very small portion of available data. Some key points and research mentioned by Forrester is following:
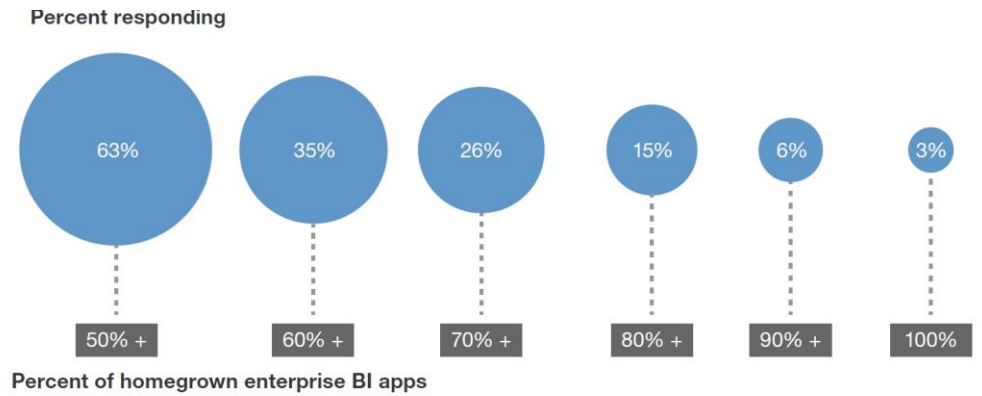
- Only a small amount of data is leveraged by organizations for business insights. Only 40% of structured, 31% of unstructured and 27% of semi structured data is used for business intelligence and quantitative decisions (Forrester 2, 2015a).

- Majority of BI tools are developed on base of shadow IT process. The shadow IT process is term developed by IT experts to explain the describe IT systems and solutions developed and used inside enterprises without the organizational approval. Forrester research finds that majority of organizations (63%) still build most (more than 50%) of the Bi applications based on desktop tools such as spreadsheets. more than a quarter of respondents (26%) share an even more dreary story — 70% or more of all Bi apps are built in a shadow it environment. (Forrester, 2, 2015b.) For details refer to figure 13.

Please estimate what percentage of the total size/volume of data within your company your company is currently using for BI

Unstructured data	Semistructured data	Structured data
Use 31%	Use 27%	Use 40%
Don't use 69%	Don't use 73%	Don't use 60%

Base: 1,805 global technology decision-makers who know how much BI data their firm uses

Note: The percentages shown are estimates based on reported ranges; the values are not exact.
Source: Forrester's Business Technographics® Global Data And Analytics Survey, 2015

Figure 12. Forrester's Prediction about Agility (Forrester 2015c,3)

This figure explains the utilization of the data types in organizations. This research was conducted on top 2000 global technology companies by Forrester in 2015.

Percent responding

63% 50% +
35% 60% +
26% 70% +
15% 80% +
6% 90% +
3% 100%

Percent of homegrown enterprise BI apps

Base: 249 North American business decision-makers

Source: Forrester's Business Technographics® Global Data And Analytics Survey, 2014

Figure 13. Use of shadow IT application (Forrester 2015d,3)

4.1.4.1 Forrester's recommendation for acquiring agile capabilities

Enterprise should work towards making business users self-sufficient in their BI work environment without relying on IT professional. These practices are supported by following ways as stated by Forrester:

➢ Self-provisioning applications and data

Business user must be able to connect to data sources and applications efficiently and immediately. For instance, data virtualization, mobile delivery techniques help to achieve it.

➢ Data integration, mashups, and wrangling

Business user must be able to perform analysis task. This include capabilities such as auto modeling, calculated measures, data mashups, data wrangling etc.

➢ BI automation

Self-service processes that let business user to do more with less by enabling automation processes is BI automation. For instance, capabilities such as actionable BI, Self-service BI, suggestive BI are some of the examples of the Automated BI platforms.

➢ Effective user interface

Users must be able to generate reports and insights very easily and other relevant tasks. These capabilities include data exploration and discovery, features like point-and-click and drag-and-drop etc.

(Forrester 2015e,4.)

4.1.5   TDWI's research

This research was conducted by The Data Warehousing Institute in 2013 for listing out the factors responsible for hindering agile adaptation. Following is the result of the research:

To what degree are the following business factors having a disruptive impact on your organization, requiring increased business and IT agility?

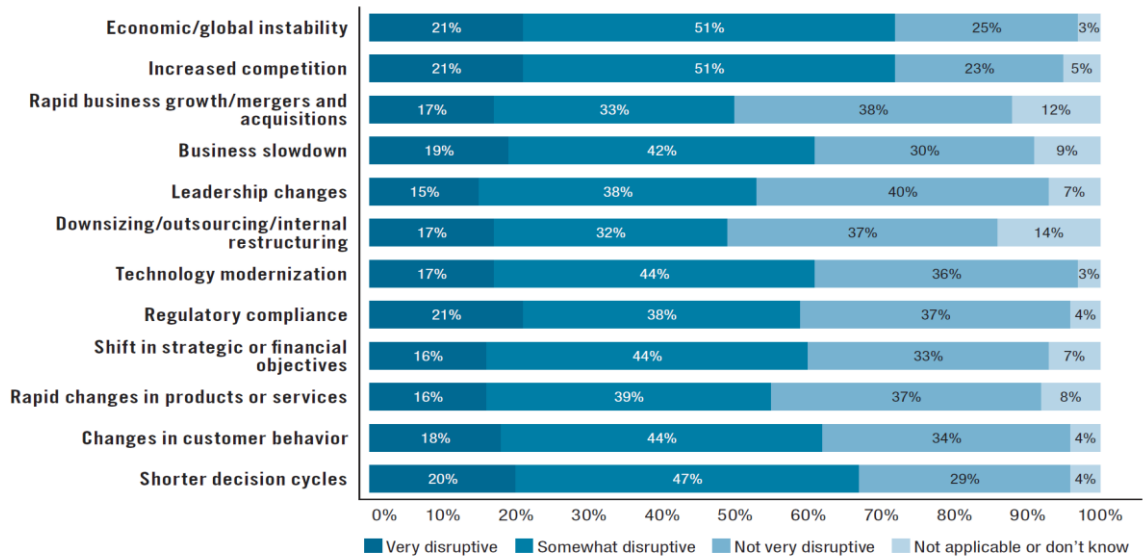| Factor	Very disruptive	Somewhat disruptive	Not very disruptive	Not applicable or don't know
Economic/global instability	21%	51%	25%	3%
Increased competition	21%	51%	23%	5%
Rapid business growth/mergers and acquisitions	17%	33%	38%	12%
Business slowdown	19%	42%	30%	9%
Leadership changes	15%	38%	40%	7%
Downsizing/outsourcing/internal restructuring	17%	32%	37%	14%
Technology modernization	17%	44%	36%	3%
Regulatory compliance	21%	38%	37%	4%
Shift in strategic or financial objectives	16%	44%	33%	7%
Rapid changes in products or services	16%	39%	37%	8%
Changes in customer behavior	18%	44%	34%	4%
Shorter decision cycles	20%	47%	29%	4%

Figure 1. Based on answers from 402 respondents; about 12 responses per respondent, on average.

Figure 14. factors responsible for interfering with agility (TDWI 2013,7)

These are the leading factors which don't let organizations to adopt agility. According to TDWI by addressing these factors will significantly make the processes agile.

5 Results

The results publish in this chapter are the combinations of various frameworks and methodologies explained in the theoretical and empirical part. Since agility is organization the results published are concerned for general solution not the specific BI projects.

There are multiple key points to keep in mind when implementing agile BI solutions such as:

- A well-defined analytical approach

- Collaboration of business and IT units

- Guided knowledge and information management

- Adaption of agile BI tools

- Well-defined problem statements

- Keeping up with the customer-driven requirements

- Analyzing the changing market requirements

- Room for improvement on continuous basis

- Empowering employees with agile frameworks, practices and BI tools and applications

- Accelerated BI solution delivery

- Easy and universal access

Before adopting agile methodologies, it is important to address the issues mentioned above. Most of the companies fail when they adopt agile methods because they don't address the issues listed above. Agile is not about only IT department. To adopt agility in each aspect, it should be in incorporated or implemented in each department whether it is business or IT department.
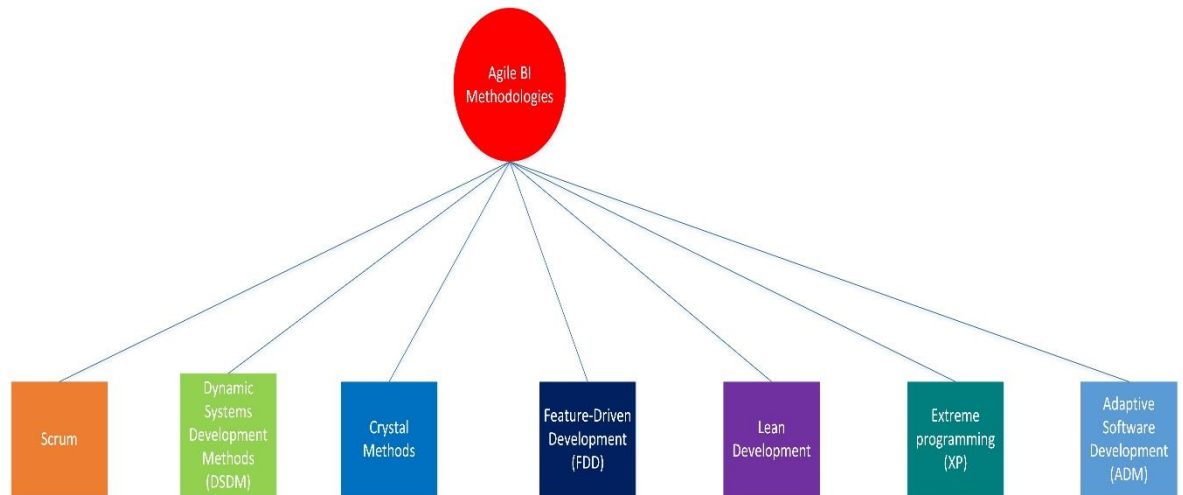
Figure 15. Agile BI methodologies

The easiest to implement is Scrum. Due to its working in short sprints and multiple itera-
tions make businesses agile. For instance, in Midanos OY it is adopted to deliver BI solu-
tions. The key part which makes this method very adaptable is because of working in
sprints. In sprint, a huge backlog is identified and then a small portion of backlog is taken
what employees or team can finish it in brief time.

Since Business Intelligence revolves around data whether it is structured, semi-structured,
unstructured or in any format it must be agile to get the BI solution which is agile. Mckin-
sey has listed several methods for making data agile. The recommended method by
Mckinsey is Data Lake.

A data lake is a storage repository that holds a vast amount of raw data in its native format
until it is needed. While a hierarchical data warehouse stores data in files or folders, a
data lake uses a flat architecture to store data. Each data element in a lake is assigned a
unique identifier and tagged with a set of extended metadata tags. When a business
question arises, the data lake can then be analyzed to help answer the question. (Rouse,
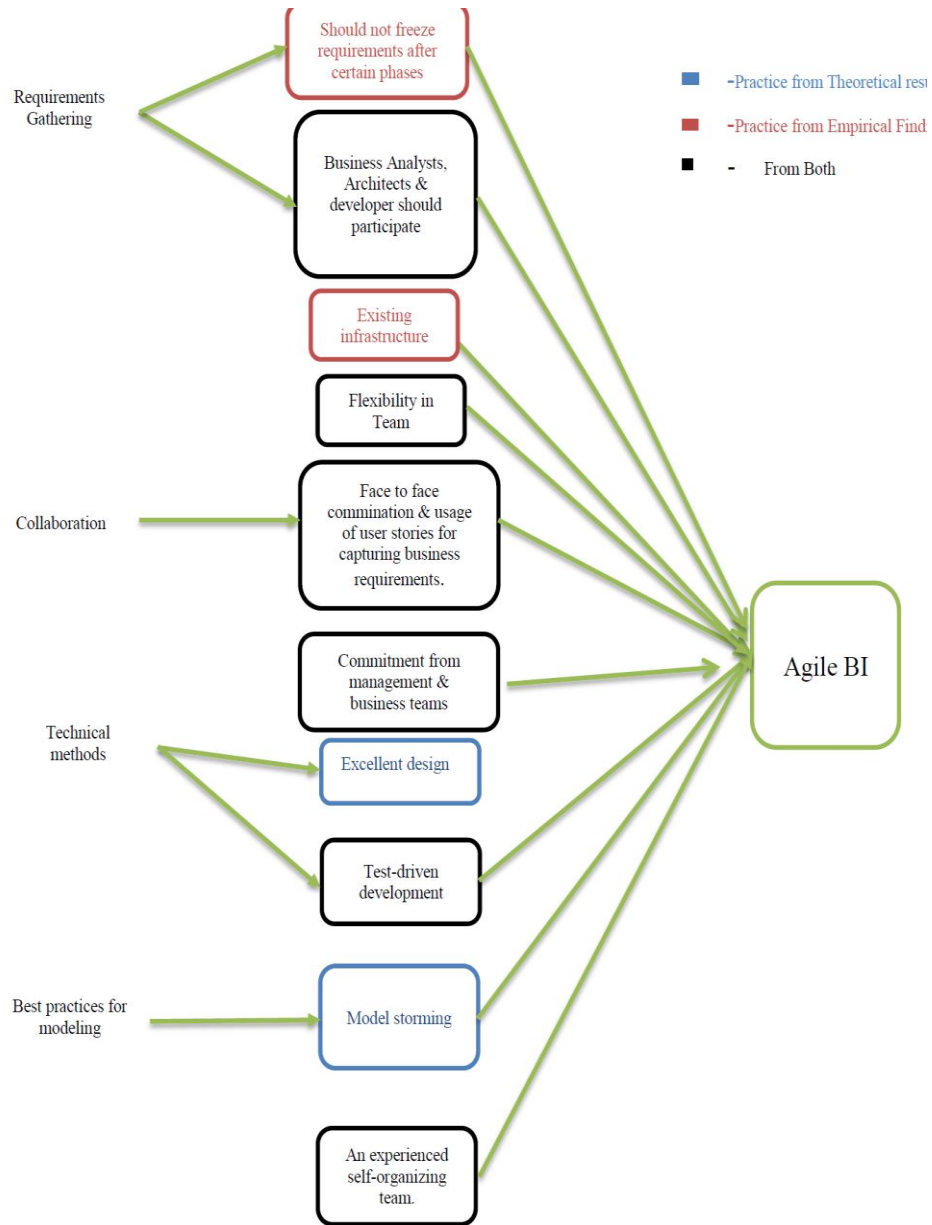2017.)

Figure 16. Core practices for bringing agility to BI development projects (Devarapalli 2013c, 64)

The above figure elaborates the core principles employed to get an organization agile. It is comprised of all the departments in an enterprise participating together to develop agile BI solution. This figure was developed by University of Borås' Master degree student.

6 Conclusion

According to the research conducted by author and the studies based on theoretical and empirical part it was analyzed that Scrum is the most suitable method for achieving agility in Business Intelligence. Scrum can't alone make an entire organization agile. There are some issues which should be rectified or solved to adopt agility. For instance, not effective use of data, outdated technology and inefficient communication between business units.

Furthermore, organizations fail to successfully implement agile methodologies and frameworks because of inadequate experience with agility and its aspect, management's misunderstanding about agility and ineffective collaboration. However, these challenges can be overcome by following certain guidelines recommended by industry experts. To overcome these challenges a pilot project can be introduced to see what aspects are lagging.

As Forrester said most of the organization's data is just sitting in the data mart without any use. Enterprises should adopt agile data where only the data which is needed can be stored since it omits the chances of data overlapping and data redundancy. Since unused data lead to silos of information which limits organization's capacity to react to unforeseen situation and disorientates ability to act with focus and agility.

In conclusion, this thesis can be used as reference for adopting agility in any organization. The theoretical part covers all the basics of traditional BI and agile BI, differences between agile and traditional BI. The methods suitable for adopting agility and as well as persistent issues and how to remove them is covered as well.

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