# Mémoire-projet

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# ACHIEVING SUCCESS IN THE IMPLEMENTATION OF BUSINESS INTELLIGENCE IN THE PHARMACEUTICAL SECTOR: EXTRACTING SUCCESS FROM A PROJECT FAILURE CASE STUDY

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# Abstract

Implementing business intelligence is a complex process that few companies achieve successfully. The pharmaceutical sector, with its legal and business specificities, is a unique environment that is not well explored by the scientific literature on BI. This master's thesis addresses how to successfully implement BI in the pharmaceutical sector. It approaches this topic through the lens of the critical success factors (CSFs) that drive success and the methods for evaluating success.

To answer this question, a case study of a failed BI implementation project in a pharmaceutical company is used to dive into the topic. In addition, five semi-structured interviews were conducted with BI experts specialized in the pharmaceutical sector.

The results showed that there are specific CSFs for BI implementation in the pharmaceutical sector. In addition, this research found that the methods of assessing success depended on the integration of BI into the core processes of the pharmaceutical company.

From a practical point of view, the findings of this master's thesis can be used as guidelines to successfully implement BI in a pharmaceutical company.

*Wordcount: 31256 (28508+2748)*

# Résumé

La mise en œuvre de la business intelligence (BI) est un processus complexe que peu d'entreprises réussissent. Le secteur pharmaceutique, avec ses spécificités juridiques et commerciales, est un environnement unique qui n'est pas bien exploré par la littérature scientifique sur la BI. Ce mémoire traite de la manière d'implémenter avec succès la BI dans le secteur pharmaceutique. Il aborde ce sujet sous l'angle des facteurs de succès critique (CSF) qui conduisent au succès et des méthodes d'évaluation du succès de la BI.

Pour répondre à cette question, une étude de cas portant sur l'échec d'un projet d'implémentation de la BI dans une entreprise pharmaceutique est utilisée pour plonger dans le sujet. En outre, cinq entretiens semi-structurés ont été menés avec des experts en BI spécialisés dans le secteur pharmaceutique.

Les résultats ont montré qu'il existe des CSFs spécifiques à l'implémentation de la BI dans le secteur pharmaceutique. En outre, cette recherche a révélé que les méthodes d'évaluation du succès dépendaient de l'intégration de la BI dans les processus fondamentaux de l'entreprise pharmaceutique.

D'un point de vue pratique, les résultats de cette thèse de maîtrise peuvent être utilisés comme lignes directrices pour mettre en œuvre avec succès la BI dans une entreprise pharmaceutique.

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# List of Abbreviations

| ABBREVIATION | MEANING |
|---|---|
| **IT** | Information Technology |
| **BI** | Business Intelligence |
| **ERP** | Enterprise Resource Planning |
| **CRM** | Customer Relationship Management |
| **ETL** | Extract Transform Load |
| **KPI** | Key Performance Indicator |
| **AI** | Artificial Intelligence |
| **SAAS** | Software as a Service |
| **ML** | Machine Learning |
| **DM** | Data Mining |
| **BA** | Business Analytics |
| **CSF** | Critical Success Factor |
| **DSS** | Decision Support System |
| **DW** | Data warehouse |
| **SSBI** | Self-Service Business Intelligence |
| **LUB** | Lundbeck Belgium |
| **QV** | QlikView |
| **QS** | QlikSense |
| **UAT** | User Acceptance Test |
| **HCP** | Healthcare Professional |
| **MSL** | Medical Science Liaison |
| **N05A** | Antipsychotics |
| **N06A** | Antidepressants |
| **DDD** | Defined Daily Dose |
| **DOT** | Days of Treatment |
| **GDL** | Grand Duchy of Luxembourg |
| **IS** | Information System |
| **RSQ** | Research Sub Question |
| **EXF** | ExFactory |

# Chapter 1: Introduction

According to the European Union, the healthcare sector spent 188,7 billion € in research and development in 2020, which represent 20,8% of the total R&D expenditure across all industries (European Commission Joint Research Centre, 2021). However, the digital maturity of this sector is among the lowest across all the industries due to their low information technology (IT) budget and employee skills in IT (Remane et al., 2017) . This situation leads to a hindrance to the growth of the sector because digitalization could generate numerous opportunities in their manufacturing processes (Hole et al., 2021) but also in the sales and marketing operations (Abha, 2018).

In the wake of the Covid-19 crisis, the pharmaceutical sector has faced many challenges. Especially the sales and marketing departments that were unable to fulfill their mission without digital tools (Khan & Basak, 2021). To face this situation, the pharma sector has taken a drastic shift towards digitalization and has started to build its long-term strategy on the benefits that digital can provide (Vara, 2021).

With the explosion in the amount of data available due to digitalization (Berisha & Mëziu, 2021), the pharmaceutical sector needs tools to process this data into useful and operational insights. Which is why the sector is increasingly turning to Business Intelligence (BI) solutions (Ronan, 2020). However, while BI is the solution for handling this influx of new data, implementing it in a company is an extremely complex process (Yeoh & Popovič, 2016).

> ***"Nearly 70% to 80% BI projects fail to yield the expected returns, or often results in little or no benefits for organizations"*** (Ain et al., 2019)

The introductory chapter of the dissertation cannot begin without briefly describing the context in which this research took place: the pharmaceutical company Lundbeck Belgium. With this background, the core of the dissertation can now be described and shaped in the form of research questions. For each question, the main theories that serve as a basis for this study are introduced, as well as the potential practical applications that can be extracted from their answers. The methodology used to forge these answers is then discussed and its limitations addressed.

## 1.1 Context of the Study

Lundbeck is a Danish multinational pharmaceutical company specialized in the treatment of psychiatric and neurological diseases. Its main activities are research, development, production, and commercialization of medicines. It operates more than 50 subsidiaries around the world from its headquarters in Valby, Denmark, and employs more than 5,600 people. The company achieves a turnover of € 2.2 billion and a net profit of € 180 million in 2021 (Lundbeck, 2022).

Lundbeck's subsidiaries are organized into business areas, which are groups of several subsidiaries based on geographical criteria, headed by the one with the largest market. The Belgian subsidiary is twinned with the Dutch one and they are managed by the French one. The financial, human resources and IT functions of Belgium are largely managed by the French subsidiary.

Lundbeck Belgium is a relatively small subsidiary, its main functions are market access, promotion and sales of Lundbeck products on the Belgian and Grand Duchy of Luxembourg (GDL) markets. It employs 10 people and has a turnover of € 17.4 million and a profit of € 450,000 in 2020 (Lundbeck Belgium, 2021). LuB only sells drugs that require a prescription, mainly in two markets: antipsychotics (N05A) and antidepressants (N06A). The codes used to designate these markets come from the WHO (2022) and categorize the different medicines into therapeutic classes.

Since Lundbeck only produces prescription medicines, the company cannot sell directly to its final customer, the patients, which is why all sales and promotion activities are directed towards physicians. The evolution of medical research forces the healthcare professionals (Hcp) to stay up to date, therefore they need scientific information on the pathologies they treat and on the available treatments (Rollins & Perri, 2014). The role of the sales team, consisting of four medical representatives and a sales & marketing manager, is to convince them to use Lundbeck medicines by using data from scientific research. In order to ensure the scientific validity of the information transmitted to healthcare professionals, LuB employs two medical science liaisons (MSL). Their purpose, beyond scientific validity, is to train the sales team, engage with key opinion leaders and conduct scientific presentations (Dumovic & Chin, 2008).

## 1.2 Focus of the Study

Lundbeck has been using a BI tool for several years to analyze the two markets in which it operates. This tool is fully integrated into LuB's processes, such as defining its commercial strategy and sales reporting. However, BI is a fast-moving technology (Tavera Romero et al., 2021). That is why LuB decided it was time to upgrade its tool. A consulting firm was hired to modernize and improve the BI tool. The goal was to get a more user-friendly tool, potentially allowing better analysis and having modern functionalities. However, as seen before, BI implementation projects have a very high failure rate. The LuB project added to these failure statistics.

This outcome put LuB in an exceedingly difficult situation, their BI tool is vital to their operations and the company is left with a barely functional tool. LuB must replace this tool and start a new implementation project. It is critical that the next implementation project is successful. In order to avoid another failure, it is necessary to consider the following question:

***How to Successfully Implement a Business Intelligence Solution in a Pharmaceutical Company?***

In order to answer this question, it is necessary to know what factors greatly influence the outcome of a BI implementation in the pharmaceutical sector. Therefore, this first research sub-question (RSQ) is formulated:

***What are the Critical Success Factors of BI Implementation in the Pharmaceutical Industry?***

The answer to this question will be built on the seminal theoretical foundation established by Yeoh and Koronios (2010) who identified several of these critical success factors (CSF) whose adherence leads to a successful BI implementation. However, this study was conducted in a relatively neutral context. It does not identify whether there is any CSFs specific to the pharmaceutical market. For this reason, this master's thesis is also drawing on the study by Moflih et al. (2020) on the topic of CSFs for BI implementation in the pharmaceutical sector. This paper concludes with the absence of identification of new CSFs specific to the pharmaceutical sector but expresses the need for further research on the subject.

The RSQ defined above will therefore first test whether the CSFs described by Yeoh and Koronios (2010) are applicable to the pharmaceutical sector and then attempt to fill the gap identified by Moflih et al. (2020) in the scientific literature.

The practical application of the answer to this question lies in the successful implementation of BI in pharmaceutical companies. According to Yeoh and Popovic (2016), the discovered CSFs can be translated into practical instructions for BI implementation. Uncovering pharma-specific CSFs could improve the success rate of BI implementation in pharma companies by allowing them to focus their resources on critical areas.

CSFs are the key leading to a successful BI implementation project. But when can a project be considered successful? How can we measure its success? It is in response to these concerns that the second research sub-question was developed:

***How to Assess the Success of a BI Implementation in the Pharmaceutical Sector?***

Different authors have addressed different perspectives on the issue. The seminal models of Delone and McLean (2003), Doll et al.(2004) and Davis (1989) have dealt extensively with the technical and usage aspects. They concluded that if the tool is perceived as useful and easy to use, then this will lead to the use of the tool which will generate business value in return. Ramirez-Aristizabal and Moraes (2014) conducted a case study of measuring BI success in a pharmaceutical company. They add that it is important for a company to measure the technical aspect and user satisfaction in order to improve the tool and generate value. No specificity in measuring BI success in the pharmaceutical sector was identified.

The aspect of the value generated is very broad, there are many ways to qualify success such as the financial point of view, change management, corporate culture (Lönnqvist & Pirttimäki, 2006). Olszak (2021) states that the objectives of BI can vary from one sector to another and that some of these objectives are easier to achieve than others. Brijs (2013) describes one potential industry-specific objective for the pharmaceutical sector: the adequacy between sales forecasts and actual sales in the field.

To address this RSQ, the different methods of evaluation of the technical and user aspects will be tested in a pharmaceutical context. Then, the possible specific objectives of the pharmaceutical sector will be explored to shed light on this grey area of the scientific literature.

Defining an effective method to evaluate the success of a tool implementation adapted to the pharmaceutical context could allow evaluating what are its flaws or weak points. This would provide valuable insights for pharmaceutical companies looking to improve their BI tool.

## 1.3 Brief Methodology

This research will be conducted on the basis of a case study. This method allows for an in-depth analysis of the subject. The different theories used earlier will be applied to the data extracted from the LuB BI implementation project in order to draw findings.

As the case study is based on the specific context of LuB, the possible findings are difficult to generalize to other settings. In addition, the researcher's involvement in the subject being studied can alter the findings generated by the case study. Therefore, semi-structured interviews with BI experts specialized in the pharmaceutical sector are conducted. They allow reinforcing the data of the case study, facilitate the generalization of the results and limit the influence of the researcher's subjectivity.

# Chapter 2: Literature review

The main focus of this research is the successful implementation of business intelligence in the pharmaceutical sector. The scientific literature related to this concept is reviewed in this chapter.

This first part is dedicated to describing BI, the evolution of its definition, its expected business value, its technical and commercial aspects and the latest trends shaping it.

Secondly, the scientific literature on BI implementation, the theoretical core of this research, is critically reviewed by focusing on three core concepts: Critical success factors of BI implementation, Stages constituting the life cycle of a BI implementation project and Methods to evaluate the success of the implementation. These concepts are examined in the context of the pharmaceutical industry.

Finally, the gaps identified in the literature review are outlined and addressed by research sub-questions that will attempt to shed light on these unanswered topics. A conceptual framework concludes this chapter by underlying the three core concepts of a successful BI implementation, the gaps and their research sub-questions.

## 2.1 Business Intelligence

This first section of this literature review aims to give a clear and comprehensive overview of business intelligence in all its aspects, its benefits and the latest trends shaping it. The technical aspects of BI is covered as they are essential to the global understanding of this tool but without digging into overly technical details as this master thesis focuses on the managerial perspective. The information covered in this section is not the core of the subject of this master's thesis, but this knowledge is mandatory in order to understand the following section and the ins and outs that are exposed in the case study

### *2.1.1 Definition*

Business intelligence (BI) is a concept hard to define because it falls between performance management and Information Technologies (IT) disciplines (Rausch, 2013). There are many different interpretations, often influenced by the status of their originators (Howson, 2014). A lot of research has been conducted to create a definitive definition but currently there is no consensus among the scholars (Božič & Dimovski, 2019; Chee et al., 2009; Järvinen, 2014).

The first mention of BI was made by H.P. Luhn (1958) from IBM. He stated that as the amount of information required to run a business was drastically increasing, an automatic way of gathering, encoding and disseminate information was needed in order to create intelligence (i.e., making the connection between information and the goal to attain). This description highlights two main components of BI, the process of managing data and the decision based on the information gathered. This article lays the foundations of what will be the Business intelligence several decades later.

The term business intelligence was popularized in 1989 by Howard Dresner of the Gartner Group when he defined it as a range of tools and software that deliver fact-based information necessary for decision-making (reported by Power, 2008). This definition focuses on the software side of BI and has spread over a decade.

It is the basis for the approach of BI consultants and vendors when presenting their product to their customers (Arnott & Pervan, 2005). On the Tableau (2019), a leading company in BI sales, website It is defined as:

> *"Business intelligence combines business analytics, data mining, data visualization, data tools and infrastructure, and best practices to help organizations to make more data-driven decisions."*

It integrates business intelligence into IT while designating it as a product in its own right. This has led to confusion in the understanding of the term because it only refers to BI as a technology (Trieu, 2017).

According to Popovič et al. (2010), the definition that encompasses all aspects of BI was made by English (2005) and is:

> *"Quality information in well-designed data stores, coupled with business-friendly software tools that provide knowledge workers timely access, effective analysis and intuitive presentation of the right information, enabling them to take the right actions or make the right decisions."*

This definition of BI emphasizes the importance of matching information to the right person at the right time, resulting in the right decision. This definition will be used throughout this master's thesis.

### 2.1.2 Business Value of Business Intelligence

The goal of BI is to collect and disseminate quality information to improve decision-making. Without an information distribution system, decision-makers must use the information they have at their disposal (potentially incomplete or false), relying on their experience or even their intuition (i.e., guesswork) (Dresner, 2010). Delivering quality information to the right person allows them to make a data-driven decision and therefore potentially improve the effectiveness of their choice (Brynjolfsson et al., 2011). However, the benefits of BI are not just limited to better decisions.

In order to fulfill its role, the BI solution must be fed by data, one of the major sources being the operational processes that activate the company's core business (Ramakrishnan et al., 2012). Without BI, the data from these activities is collected manually or not collected at all (Rouhani et al., 2016), which limits the view on the functioning of these vital processes. BI, by automating and presenting this information in a clear way, provides a much better understanding of these process, which in turn enables them to be optimized and thus generate value (Williams & Williams, 2007). For example, a clear view of the processes allows to improve the understanding of the customers (profitability, loyalty, segmentation, churn), of the production of goods, of their desirability and of their logistics (Ranjan, 2009).

One of the essential conditions for BI to work is the ability to centralize, standardize and eliminate redundancies in the data used by the company in one place (Sherman, 2015),such as a data warehouse (DW). By doing so, a single version of the truth is created. This allows for a common information base shared by all business units of the organization, which improves communication and cooperation between departments (Frolick & Ariyachandra, 2006), and improves the speed of decision-making by eliminating questions about the source and validity of the information (Ramakrishnan et al., 2012).

The improved decision-making and the value generated by BI allows companies to differentiate themselves and perform better than their competitors, creating a competitive advantage (Rouhani et al., 2016). But BI is not only based on internal data, leveraging external data also enables companies to gain insights into the market situation (Skyrius, 2021). Collecting and converting competitor data into actionable information, i.e., creating a competitive intelligence (CI) strategy (Liebowitz, 2006), helps to identify threats and opportunities as well as to reduce reaction time and thus gain a competitive advantage (Tyson, 2006). CI is a process that can stand alone (Combs & Moorhead, 1993) or be integrated as a sub-process within business intelligence (Negash & Gray, 2008).

In addition, BI brings many benefits related to the activity and the sector of the companies in which it is implemented such as identify a promising molecule for the creation of pharmaceutical products (Ranjan, 2009), better patient management in healthcare (Madsen, 2012), optimize productivity, logistics and inventory management for manufacturers (Williams, 2016) and detect fraudulent transactions in banking (Maheshwari, 2015) just to name a few.

These benefits are the result of a complex process that mixes many different technologies that must be mastered in order to achieve the advantages offered by BI.

### *2.1.3 Business intelligence as a technological process*

The BI technological process is centered around the company's data and is broken down into several stages, each supported by different technologies. Together these tools form the BI architecture that structures the information flow until it reaches the end user (Sherman, 2015). This leads to a complex process using different sophisticated technologies. From a managerial point of view it is not necessary to master these technologies but it is important to understand what they are and their function in the overall BI process (Howson, 2014). In order to give a clear view of the technological process, this framework adapted from several sources and integrating the latest technological developments is introduced. It includes the major and most common components of BI but as it is a highly customizable process (Bulusu & Abellera, 2021), it is not exhaustive.

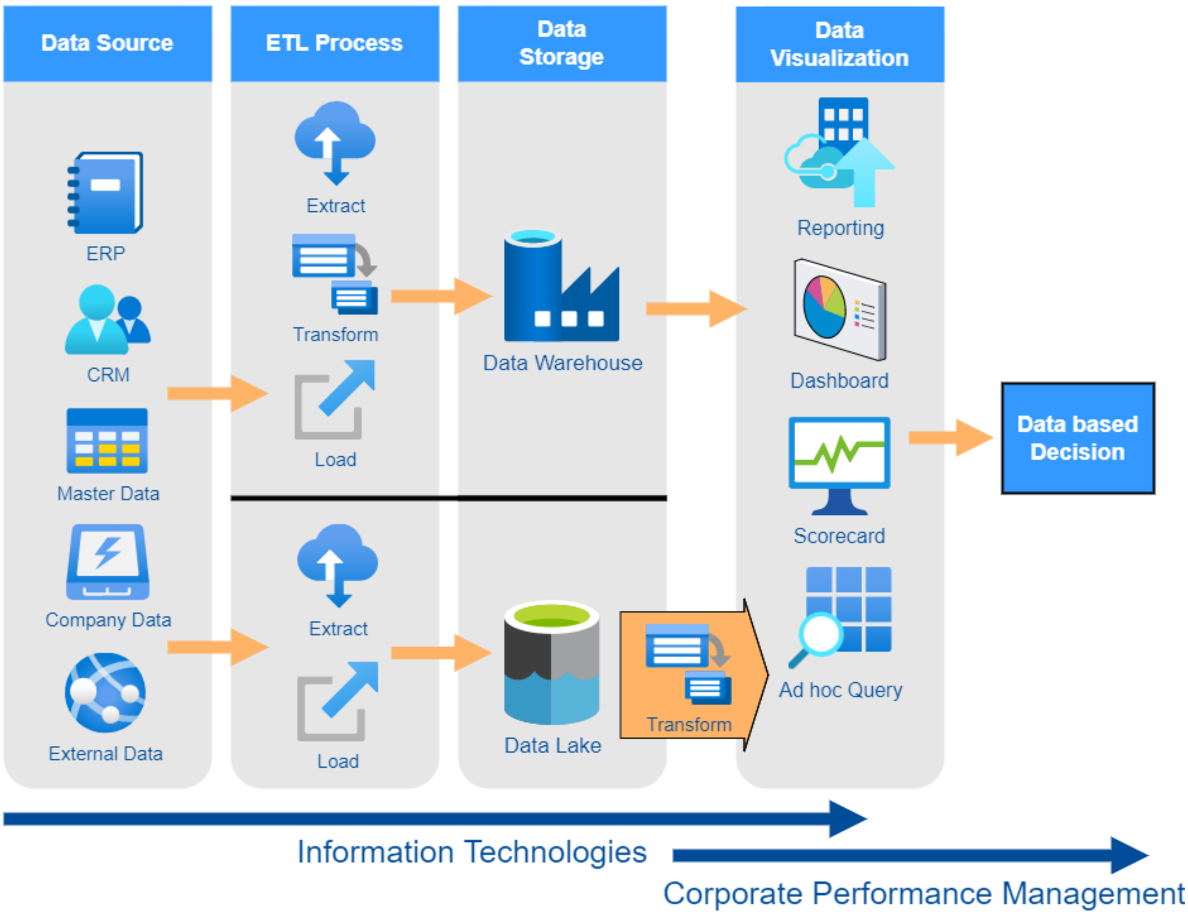



*Figure 1 : Business Intelligence Process created by merging frameworks from (Sharda et al., 2020; Sherman, 2015) and updated with data lake theory from (Llave, 2018)*

As the BI process contains many specific technological components, they are simplified and briefly defined in this table.

| Terms | Source |
|---|---|
| **ERP :** Enterprise resource planning is a software that centralizes information from different departments and links the value chain of a company to improve its management | (Momoh et al., 2010) |
| **CRM :** Customer relationship management is a tool that manages the information of a company's customers in order to optimize its relationship with them | (Navarro et al., 2020) |
| **Master Data :** are the data that references and identifies the different entities of a company such as products, employees, customers, suppliers, etc. | (Spruit & Pietzka, 2015) |
| **ETL :** is a process in three steps; firstly, it extracts the data from the sources, then transforms it to the proper format and finally load it into a database. | (Souibgui et al., 2019) |
| **Data warehouse :** this is a database that store and centralize structured data (e.g., financial results, prices, and customer characteristics) considered relevant to support data-driven decision-making. | (Kimball & Ross, 2002) |
| **Data lake :** this is a new, modern type of database where all the structured and unstructured data (e.g., pictures and video) available are stored, its goal is to have as much data as possible at disposal for current or undetermined future use. The data is transformed when requested by a user. | (Llave, 2018) |
| **Reporting :** Reporting is the transmission of data, often static, understandable to businessmen in order to support their decision-making. | (Sherman, 2015) |
| **Dashboard :** is an interface that combines multiple types of visualizations (e.g., charts, scorecards, etc.) in order to monitor the key performance indicators (KPI) of a company. | (Gowthami & Kumar, 2017) |
| **Scorecard :** this is a tool that evaluate the performance of a company in relation to its strategic goal. | (Sherman, 2015) |
| **Ad hoc query :** this is a type of reporting used when a user explores the data to answer a specific information need | (Howson, 2014) |

*Table 1 : Business Intelligence Process Components*

The fact that the business intelligence process includes many different technologies adds confusion and complexity to its understanding and handling from a management perspective (Laursen & Thorlund, 2017). In addition, the marketing of BI vendors often represents it as an end-user visualization tool, thus obscuring the complexity of the whole process (Williams, 2016) by not mentioning the need for a storage database and an ETL technology.

### 2.1.4 Business Intelligence as a Product

As seen earlier, IT consultants and vendors have been appropriating business intelligence early on in order to integrate it into their offer. The numerous benefits that BI can potentially bring make it a very attractive product for companies (Ain et al., 2019). Moreover, the complexity of creating the BI process limits the possibility for some companies to do it successfully in-house (Yeoh & Popovič, 2016). This leads to a very flourishing business intelligence market. The data used to describe this industry comes primarily from the component organizations.

Several companies are trying to estimate the size of the business intelligence market, ranging from 15,2 (Statista, 2021) to 25.5 (Gartner, 2021) billion dollars by 2020. The increase in available data and the need for relevant information is pushing more and more companies to invest in BI (Olszak, 2021). Furthermore, 45% of the companies already using BI intend to increase their budget and another 45% to maintain it at its current level (Dresner Advisory Services, 2021). This combined with the COVID crisis (Gartner, 2021) is driving an estimated average growth of around 8% per year (Evelson, 2019; Markets and Markets, 2020).

Numerous companies sell software that are only designed to cover the data visualization stage of the business intelligence process, the more flexible ones can cover ETL and data storage but with less efficiency than dedicated programs (Fransman, 2021).

In the case of large-scale BI projects, companies often use consulting firms that act as intermediaries between the vendor and them (Schroeder et al., 2009). There is some evidence that using a consulting firm increases the chances of a successful implementation project, but further research needs to investigate this assumption (Yeoh & Popovič, 2016).

Among these firms, Gartner stands out; it has developed two instruments that are widely used by the industry and sometimes by researchers. The first is a maturity model (that will be explained later in this section) used to evaluate the degree of BI integration in an organization (Mach-Krol et al., 2015). The second is a two-dimensional matrix that compares different BI vendors on their “ability to execute” (i.e., performance) and “completeness of vision” (i.e., ability to innovate) (Snapp, 2013).


*Figure 2 : Gartner 2021 Magic Quadrant for Analytics and Business Intelligence Platforms (Gartner, 2021a)*

The 3 companies considered as leaders by Gartner are Microsoft with Power BI , Salesforce with Tableau and Qlik with QlikView & QlikSense. The business intelligence industry heavily emphasizes the importance of the choice of the vendor (Exe Software, 2017; Scott, 2019). However, even though they each have their own strengths and specificities (e.g., cloud for Qlik (Gartner, 2021a), data preparation for Tableau (TechnologyAdvice, 2022)). As it will be seen in the next section of this chapter, the scientific literature on the success of the BI implementation either does not consider the choice of the vendor as a factor influencing success (Mesaros et al., 2016; Sparks & McCann, 2015; Yeoh & Koronios, 2010) or as a factor with limited significant impact (Gottschall, 2020; Moflih et al., 2020; Olszak & Ziemba, 2012).

Finally, as business intelligence is a rapidly developing and evolving technology, the integration of innovations by vendors plays a key role in this market (Gartner, 2021).

### 2.1.5 Latest evolutions in Business Intelligence

Over the last decade, IS has undergone a number of transformations led by the democratization of the cloud, mobile computing, artificial intelligence (AI) and the boom in the amount of data available "Big Data." These developments have had a significant impact on users and the ways in which BI is used (Sharda et al., 2020; Williams, 2016).

This is also the case for the Lundbeck Belgium implementation project. The trends described here are related to the case study and have had an impact on it, so it is necessary to be familiar with them in order to properly understand the role they played in the project.

### Big Data

Big data represents a mass of fast and varied data so huge that it is complex for conventional data analysis tools to process it (Deepa et al., 2022). However, big data is more than a large amount of data, it can be characterized using various models, the most popular being the 3 V (volume, variety and velocity) (Kwon et al., 2014). Nevertheless, it focuses on IT characteristics, the 5 V model (Demchenko et al., 2014) adds two additional dimensions (value and veracity) more relevant to the business use of big data. This method will be used in the case of Lundbeck to characterize its data.

Volume : the rise of internet and social networks is responsible for a huge expansion in the amount of data available. It's very dependent on technological progress, what was considered big ten years ago is not big today. For example, in 2010, 2 zettabytes (ZB) (i.e., a trillion of gigabytes) were generated per day worldwide, in 2020 it increased to 44 ZB and it is estimated that in 2025 this amount will be 163 ZB (Berisha & Mëziu, 2021).
Variety : Traditionally, the data used was structured (e.g., an excel sheet organized as: Client ID - Location - Mail - Phone number in column heading with client data in line is structured data). This type of data is estimated to represent 50% (Mathrani & Lai, 2021) of the data exploitable by companies, but other forms of digital content have emerged: unstructured and semi-structured data (e.g., videos, images, SMS, and emails). Big data seeks to converge on these types of data in order to leverage them.
Velocity : the speed of data generation and transfer increases exponentially, the more data is generated the faster it has to be processed.
Veracity : the adequation of the data with the truth, in order to be used, data must be considered as reliable.
Value : The sheer amount of data is only of interest if it can be used by the company, more data equal more useful information but this leads to greater difficulties in identifying and processing data and bringing value.

In conclusion, big data offers a huge challenge but also an important opportunity for business intelligence. It represents a massive new and very different source of data that could fuel the analyses carried out by BI (Williams, 2016). The challenge is that it is very difficult to use big data as a source, it requires a lot of investment because traditional analysis tools are not suited to it, big data software are too complex for average users, the size, speed, and diversity inherent in big data makes the business intelligence process very sophisticated. An organization wishing to integrate big data into its analysis needs a real and strong business need (Sharda et al., 2020).

### Software as a Service

With the development of cloud computing, it has become possible to outsource the entire business intelligence process in the form of Software as a Service (SaaS). It can be defined as renting the use of software hosted on the provider's server and accessible via the internet (e.g., Gmail, Office 365, Zoom) (Allen et al., 2012). In the case of BI, the company provides its data to the host who carry out all the stages of the process on its server up to the visualizations which is accessible to its client through a simple internet browser (Howson, 2014).

There are many benefits to using this model, it reduces operational cost, moves from a high initial cost to a subscription system, reduces or eliminates the need for an internal IT department and reduces the financial risk associated with failure to integrate BI into an organization as the business pays for what it uses and can terminate the contract when desired (Thompson & Van der Walt, 2010). However, using BI in the cloud raises some concerns about security (e.g., confidential data stored in another company's server) and the ability to manage the costs associated with the transfer and storage of increasingly large databases. As evidence of the multiple benefits of cloud-based BI, in 2018 66% of successful BI organizations were using this model (ElMalah & Nasr, 2019).

The SaaS model, thanks to its lower cost and flexibility, also makes it possible to introduce BI in smaller companies with fewer resources (Horakova & Skalska, 2013).

### Mobile Business Intelligence

The development of cloud computing and the rise of mobile devices such as smartphones and tablets have made business intelligence mobile. The workforce can access visualizations through their mobile devices and have access to the data they need to make decisions anywhere, anytime (Verkooij & Spruit, 2013). The goal of this system is to optimize access to business insights and thus improve the speed and accuracy of decisions (Yee Fang et al., 2018). Mobility is seen as a very important feature in many businesses and BI is no exception (Weichbroth et al., 2022), mobility has been identified as a most important and required development by industry professionals (O'Donnell et al., 2012).

### Self-Service Business Intelligence

Thanks to advances in IT, business intelligence applications are becoming simpler and therefore allowing more users to dive in (Järvinen, 2014). The concept of self-service business intelligence (SSBI) consists of two elements: a BI architecture specially designed for ease of use and empowering users by allowing them to search for the desired information themselves in the databases without involving the IT teams (Sherman, 2015). This allows users to go further than predefined analyses and therefore potentially accelerate and make their decision-making more flexible (Skyrius, 2021). It is a form of generalization of the use of ad hoc queries to make them the standard use (Johansson et al., 2015). The need for a simpler and more flexible BI application has quickly emerged and become popular within companies already using business intelligence tools (Kabakchieva et al., 2013).

This mode of operation requires adapting the architecture of the data flow from the ETL process through access to the database to the visualization (Williams, 2016). This also requires investment in user training, in the skills to use the tool but also in analytics to avoid misinterpretations. To exploit the full benefits of SSBI, users must become self-reliant gradually moving from casual users to power users (i.e., business users with technical skills) (Lennerholt et al., 2021). These two challenges slow down the penetration of SSBI in organizations and decrease the chances of success of projects implementing it (Lennerholt et al., 2018).

Finally, despite the potential positive aspects of SSBI, the simplification of the BI tool limits the possibility of conducting more complex analyses (Howson, 2014). To overcome this and take advantage of the benefits of SSBI, it can be used as a complement to a traditional BI tool (Johansson et al., 2015).

### Business Analytics

Traditional BI focuses on descriptive analytics, it uses historical data of the organization in order to visualize the current situation and to understand the trends and causes that led to it (Sharda et al., 2020). However, two major developments have allowed BI to expand its scope of analysis. Machine learning (ML) is a subset of artificial intelligence that allows algorithms to learn by themselves using historical data in order to make predictions with new data (Bishop, 2006), data mining (DM) is a process that uses statistical models, mathematical algorithms and ML methods to discover unknown patterns and trends in large databases (Ge et al., 2017). With these two methods, it is now possible for BI to access the next stage of analytics: predictive analytics.

If descriptive analytics uses the past to explain the present, predictive analytics uses the past to try to predict the future (Horakova & Skalska, 2013). Predictive analytics uses ML and DM techniques to predict future possibilities based on historical business data (Shmueli & Koppius, 2010). Applications are numerous such as sales forecasting, gaining customer insights (e.g., churn rate, purchase probability), creating customer segmentation (Janiesch et al., 2021) and improving inventory and production processes (Reshi & Khan, 2014).

Business analytics (BA) is the application of predictive analytics methods in a business context (Bayrak, 2015). However, there is no consensus among scholars about the relationship between BA and BI (Power et al., 2018). Some argue that BA is the evolution of BI and therefore replaces it (Laursen & Thorlund, 2017). Others consider business analytics to be a subgroup of business intelligence (Božič & Dimovski, 2019; Williams, 2016).

Since the definition of Business intelligence used above emphasizes the transformation of data into information and its transfer to the right user at the right time, it could be argued that BA falls within this category and is therefore an additional stage of BI.

## 2.2 Implementation of BI

Now that the necessary aspects for a good understanding of BI are covered, this literature review enters into the core of the subject, the implementation of BI. The critical factors influencing the success of BI implementation projects are explored in the scientific literature. The limited information available on this topic in the pharmaceutical sector is also discussed. Then, the steps constituting the BI life cycle are exposed and detailed. Finally, the different methods to evaluate the success of BI are presented and analyzed.

BI has gained a lot of attention and spread widely in the business world over the last two decades (Ain et al., 2019). It has penetrated all types of organizations, from the largest to the smallest and is present in many industries (Brijs, 2013). Nevertheless, companies encounter many challenges in achieving the goals defined in their BI projects and end up being unable to capture the benefits of BI as pointed out by Audzeyeva and Hudson (2015). Indeed, the implementation of BI is much more complex and time consuming than a conventional IT project because it involves the integration of several different technologies and the scope of these projects is much broader and incorporates the entire infrastructure of the organization (Yeoh & Koronios, 2010). It is estimated that up to 70% of implementation projects fail to achieve their objectives (Ahmad et al., 2020).

### *2.2.1 Business Intelligence Implementation Project Lifecycle*

The creation and implementation of a business intelligence tool is a complex and long process that involves several phases. In this section, the major steps of the development and implementation of BI in a company is identified and detailed based on many different studies. The integration of BI, as a field of study rooted between IT and management, is often segmented in different ways. From a management point of view, the organizational stages prior to technical development and the stages of integration of the finished tool in the company are the most elaborate (Brijs, 2013). On the IT side, however, the implementation follows the technical process of BI based on the data sources as a starting point until the delivery of the information to the users as an ending (Grossmann & Rinderle-Ma, 2015). Nevertheless, it is necessary to merge these approaches because a business intelligence project is inseparable from the combination of these two fields (Laursen & Thorlund, 2017).

In order to clarify the BI integration process, it has been divided into 3 broad phases. The organization phase focuses on organizational challenges, planning and business requirements. The technological phase, which addresses designing and building all the necessary tools needed to perform the technical IT operations. Finally, the deployment phase, which deals with the challenges related to the integration of the solution with the staff and the company's operations. These phases are composed of several distinct steps that together form the BI implementation life cycle.

### Organization Phase

The starting point of a BI project is the need for information, when it arises, a first reaction could be to turn directly to BI. However, before even thinking about implementing business intelligence in a company, it is necessary to ensure that the company is ready to conduct a project of this magnitude (Brijs, 2013). The creation of a business case allows to evaluate the degree of BI readiness of a company (Kimball & Ross, 2013) but also to justify the project to the top management by clarifying several questions such as the anticipated benefits, the scope of the project, the return on investment, the future users, the challenges and opportunities addressed. (Sherman, 2015).

The next step is the project planning, which is conducted by defining the tasks, estimating the effort and time required as well as the stakeholder who will perform them to (Dobrev & Hart, 2015). Then, the different stakeholders who will drive the project are involved. The creation of a cross-departmental team that links the business and IT sides is mandatory for the successful achievement of the objectives (Kimball & Ross, 2013). The business sponsor whose goal is to promote the project internally (Sherman, 2015). The project manager who links the business and IT team while carrying out the different aspects of the plan (Pejić Bach et al., 2017). Finally, a technical architect and a business lead to manage the different teams and coordinate the actions to be taken with the project manager (Pirttimäki et al., 2005).

The last step of the organizational phase is the definition of requirements. Interviews with the identified end-users are conducted in order to collect their information needs and business requirements (Williams & Williams, 2007). Then, these needs are evaluated in terms of feasibility and business value in order to prioritize them (Kimball & Ross, 2013). This crucial stage shapes the rest of the project because the required business information is the basis of the BI.

To summarize, during the organization phase, the background of the project must be clarified, the support of top management obtained, the various stakeholders and the responsible team appointed, the various tasks planned and above all, the business requirements identified and understood by all parties involved.

### Technological Phase

The technological phase is deeply rooted in IT and is described without going into overly technical details that are beyond the scope of this research.

Once the business requirements are defined, the technology architecture must be designed. The first thing to consider is identifying the data needed to create the required information. If this data is not currently collected, a system will have to be developed to solve this problem (Grossmann & Rinderle-Ma, 2015). Based on the required data, the different technologies to carry out the information process should be carefully selected (Boyton et al., 2015). Finally, a prototype can be built to test the feasibility of the BI architecture planned by the IT team (Gangadharan & Swamy, 2004).

The construction of the BI architecture as such is a long and complex task. Indeed, the business intelligence process incorporates many different technologies such as a Data warehouse and an ETL program, which have to be seamlessly linked to each other. Beyond the software, the data must also be processed. It has to be cleaned, standardized and made understandable for all users (Olszak, 2021). Master data has to be created to identify the different aspects of the company (e.g., Ids of products, employees, competitors) and to link the different data collected together (Moss & Atre, 2003). Then, the visualizations that convey the information to the end users need to be done. Finally, when all the components of the architecture have been built, it is necessary to perform an end-to-end system test to be ready for the last phase (Kimball & Ross, 2013).

### Deployment Phase

The final phase consists of the production launch of the system (i.e., delivery to the end user). During this phase, the user gets his hands on the tool and can start using it to meet his information needs. However, several actions must be taken beforehand to ensure that the first use of the tool is as fluid as possible. First of all, a communication channel between him and the BI team must be set up (Sherman, 2015). Then, the user must be trained on the use of the application but also on the analytical possibilities it provides (Ul-Ain et al., 2019). A support system between IT and the users in case of problems must also be set up (Yeoh & Koronios, 2010). Finally, as with any change project, the implementation of BI must have meaning and added value for the user (Pichault, 2013), so it is important to communicate and motivate them regularly about the tool to ensure their adhesion (Howson, 2014).

If during the deployment, the BI tool does not encounter any major technical problems, the user is trained and has been able to experiment with it over a defined period; then a user acceptance test is conducted with each user. This test collects feedback on perceived usefulness and ease of use which are considered as the two main factors of acceptance (Davis, 1989) to which we add the intention to use the BI system (Davis & Venkatesh, 2004). The results and feedbacks obtained allow to evaluate the success of the implementation (Sangar & Binti, 2013) but also to identify the elements to be improved and potentially the future development needs (Kimball & Ross, 2013).

The BI lifecycle consists of many steps, often involving different dimensions such as organization, change management and IT. In order to clarify the relationships between the stages and these aspects, two seminal frameworks from two different fields, IS and change management, are analyzed and criticized.

Business intelligence is an iterative and incremental process by nature, information needs, available data and user feedback within an organization drive constant evolution (Larson & Chang, 2016). In addition, the implementation of BI in an organization can itself be a vector of new information requirements (Williams & Williams, 2007). Therefore, implementing and testing the BI application does not represent the end of a project but rather the start of a new phase (Boyton et al., 2015).

The Kimball Lifecycle diagram (Kimball & Ross, 2013) in Figure 5 is one of the first representations of a BI implementation. It encapsulates the different aspects of BI and underlines the crucial importance of the definition of business requirements and the proper conduct of project management. BI is represented as an iterative process, there is no end but a continuous growth after each iteration. As a framework deeply rooted in IT, the technological aspect is the most developed and detailed. Deployment is seen as a source of new requirements and technical maintenance instead of a change management process. Overall, the different relationships between the tasks are clearly established. Nevertheless, the implementation and planning aspects are overlooked which limits the extension of the framework to the managerial perspective.

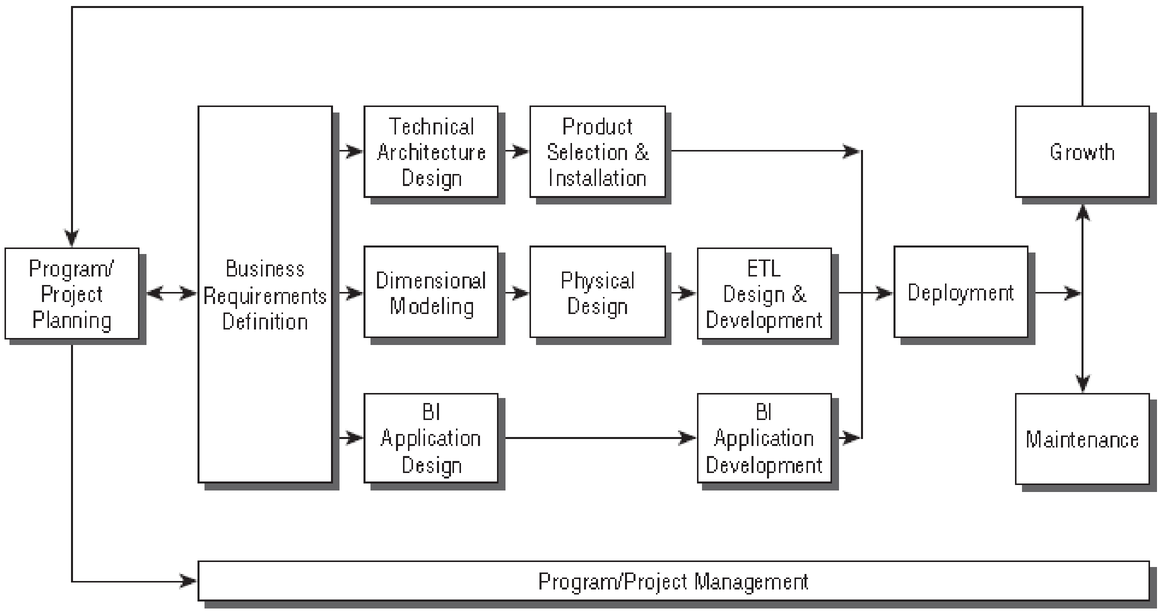



*Figure 3 : Kimball Lifecycle diagram (Kimball & Ross, 2013)*

The other framework presented in Figure 4 comes from Moss and Atre (2003), the project steps take the form of a cascade sequence. The importance of the preparatory phase is underlined by its development in several detailed steps, the planning is preceded by the realization of a business case and the evaluation of the structure. Similarly, the implementation phase is completed by an evaluation of the BI tool release. The authors did not represent the iterative aspect of the BI life cycle in this framework but state that "Building a BI decision-support environment is a never-ending process" (p361). Like the previous framework, the technical aspect is highly developed. However, its place is less predominant because the organizational and change management aspects are also developed. Overall, this framework gives a clearer view of the key steps in the managerial approach of a BI implementation, but the relationships between the different aspects are less marked than in the Kimball and Ross framework.

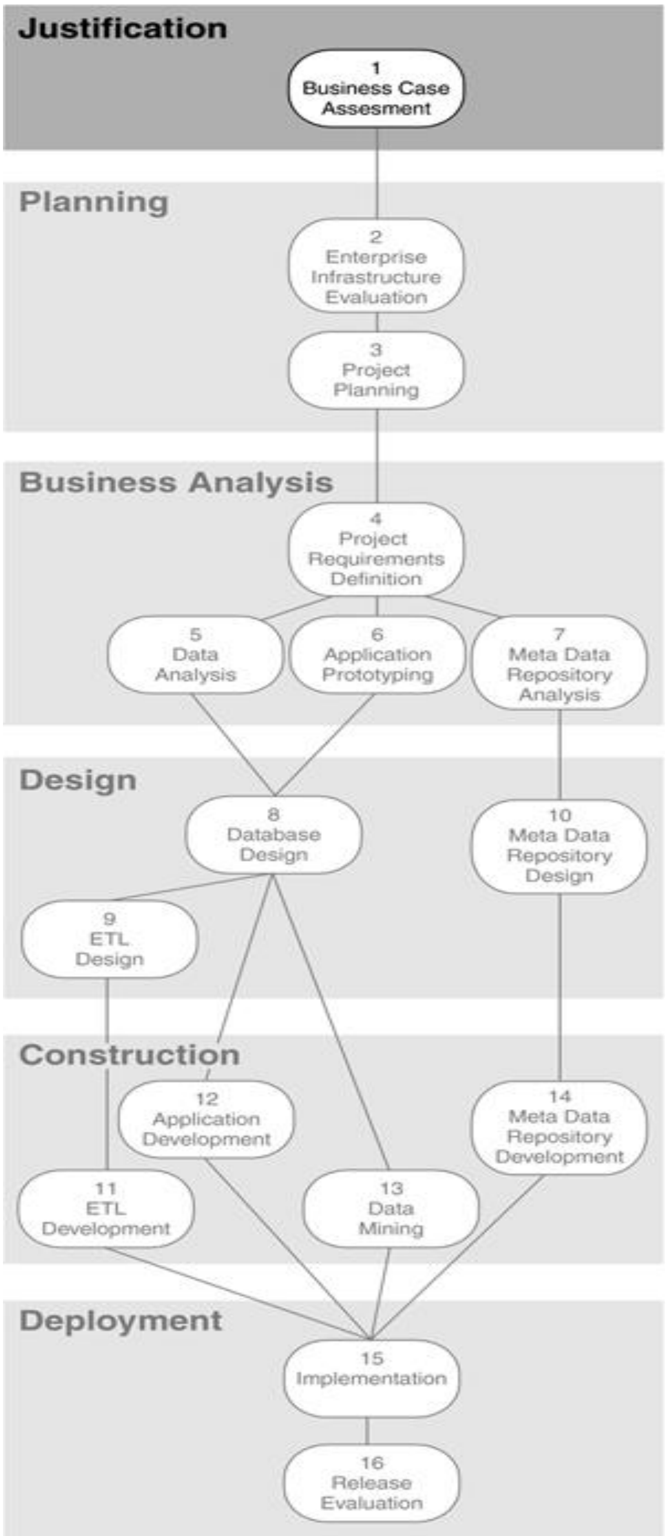



*Figure 4 : Business Intelligence Complete Project Lifecycle (Moss & Atre, 2003)*

The frameworks and sources presented in this chapter give a clear view of the steps needed to successfully complete a BI project. They are often described in such a way that they can be carried out successfully (e.g., emphasizing the collaboration between IT and business teams).

### *2.2.2 Critical Success Factors of BI Implementation*

This high failure rate in the BI implementation projects has led scholars to intensify their research on the fundamental critical success factors that profoundly influence the outcome of BI implementation in an organization (Ain et al., 2019). The idea is to highlight factors with so much impact that they are considered as tasks and procedures that should be realized and followed in order to successfully integrate BI (Olszak & Ziemba, 2012). Many frameworks using more or less CSF to determine the most important ones.

However, there is very little research that examines the links between different factors such as the size of the organization and its sector (Hejazi et al., 2016). There is some weak evidence that a link exists (Gottschall, 2020), but this needs to be investigated much more rigorously.

One issue with most of these frameworks is that they are derived from quantitative studies of members of organizations wherea BI has been implemented. Although their findings may be influenced by the sector and size of their company, few studies have attempted to find a correlation between these variables.

It is for this reason that the seminal study conducted by Yeoh and Koronios (2010) is highlighted in this master's thesis. It was performed with business intelligence integration experts from major BI associations, consultancy firms and vendors. Their methodology allows for a focus on global and relevant CSFs regardless of the size and industry of the organization. In addition, many studies have corroborated the result obtained by this research (Mesaros et al., 2016; Olszak & Ziemba, 2012; Sangar & Binti, 2013). The framework and results from their study were then clarified by Yeoh and Popovic (2016) with additional qualitative research. Nevertheless, it is important to keep in mind that the application of this framework, which can be considered as more global, is limited until research on the relationship between CSF and the moderator variable sheds light on the issue.

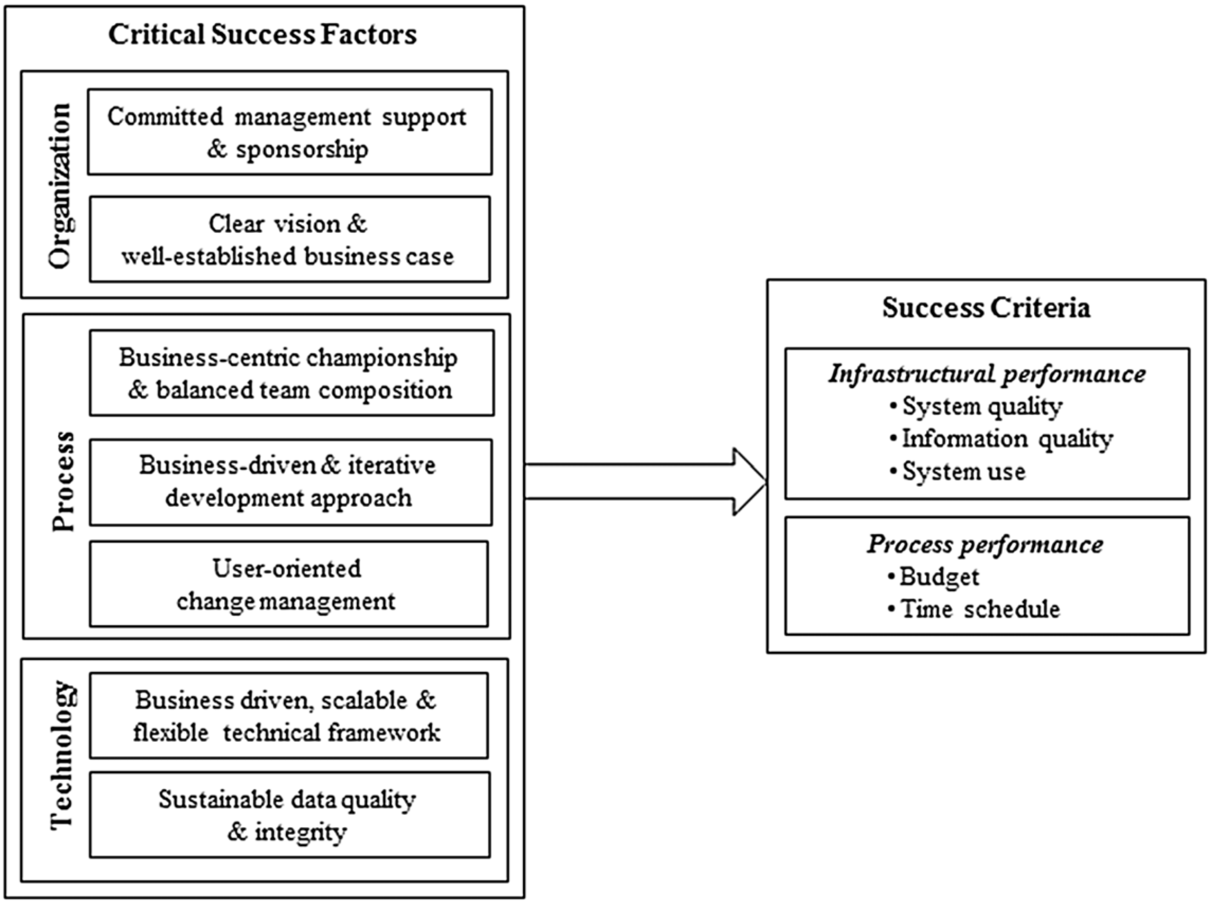



*Figure 5: CSFs Framework for Implementation of BI Adapted from (Yeoh & Koronios, 2010) by (Yeoh & Popovič, 2016)*

There is a relative consensus as to the classification of the different success factors of BI implementation, there are 3 categories grouping these factors: organization, process and technology (Gottschall, 2020; Mesaros et al., 2016; Yeoh & Popovič, 2016).

### Organization

The organizational category may be the furthest from the BI process itself, but it should be considered as the driver of the BI implementation strategy as it is the one that most impacts the success of the project (Olszak & Ziemba, 2012).

*Support and sponsorship from the management* is a widely (Yeoh & Koronios, 2010) recognized as the most important CSF in every IT implementation project, and BI is no exception in this case (Olbrich et al., 2012). As BI implementation is a costly and time-consuming process, securing resources such as staff, work time and funds throughout the entire project is extremely important (Yeoh & Koronios, 2010). In addition, since business intelligence is a cross-departmental process, it was identified that having a sponsor (i.e., an executive manager who serves as a spokesperson to promote the project to the entire organization (Pichault, 2013) should come from a business function rather than IT in order to drive adherence (Watson et al., 2001).

*A clear, long-term vision* aligned with the company's strategy is needed to drive the implementation project (El-Adaileh & Foster, 2019). In order to explain and communicate this vision clearly to the management, it is important to create a *business case* (i.e., the presentation of a project that justifies its importance and benefits) that will give a shared meaning to the BI project. This case ensures the alignment of the project with the company's strategic vision and helps to obtain the support of management (Sherman, 2015).

### Process

In order to lead the process of implementation, a *project business-centric champion* should be appointed. He should have a deep understanding of the business and knowledge of IT innovation. He often comes from management and stands out by his enthusiasm for the project (Moflih et al., 2020). His role is to gather and lead the team in charge of implementing BI (Meyer, 2000).

As this type of project is cross-departmental, this team should also integrate members of the different departments involved in order to have a holistic approach to the implementation (Järvinen, 2014). In addition, Pichault (2013) states that having a *multi-departmental team* facilitates the adhesion of a change project within the departments represented.

A *business-driven* scope and planning should be established in order to capture opportunities for improvement. This helps to strengthen the common understanding of the project and adds flexibility to new requirements (Yeoh & Popovič, 2016). Since BI implementation is a lengthy process, it is best to adopt an *iterative development approach*. Carrying out the project step by step reduces the risks by limiting the number of variables to be handled (Ang & Teo, 2000) but it also allows to evaluate the project, to adapt it and to quickly involve the users (Arnott & Pervan, 2005).

This is all the more important as *user-oriented change management* is considered as a critical success factor of BI implementation. Figure 6 describes the adaptive development approach which is similar to the iterative approach but more flexible to change, usually called Agile method nowadays (Beck et al., 2001). The user plays a crucial role in the development of the system (Olszak, 2021), by engaging with the technicians they ensure a better understanding of their needs (García & Pinzón, 2017). Interactions with the system also allow for testing and refining it to match the user's needs. This in turn enables them to train upstream in its use (Keen, 1980).

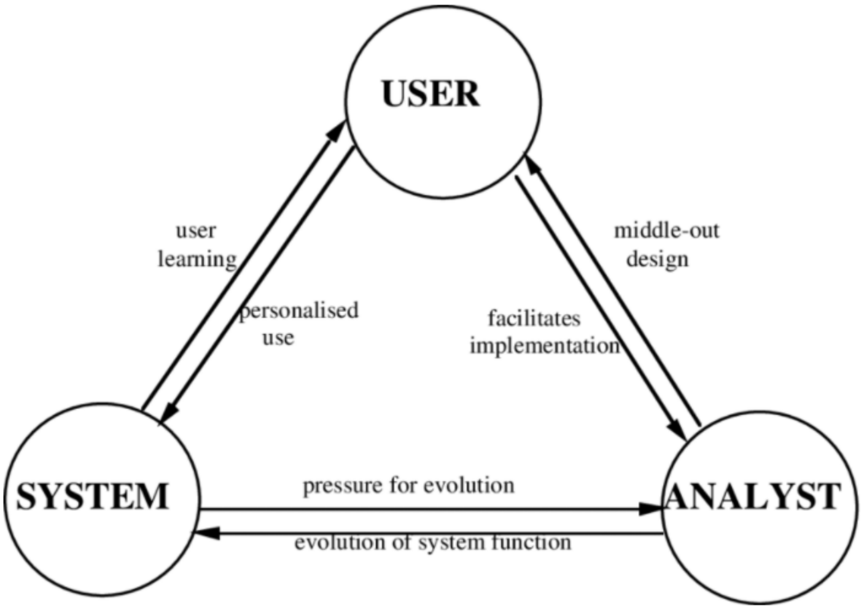



*Figure 6 : Adaptative design framework (Keen, 1980)*

### Technology

The technological challenge of integrating business intelligence is posed by the need for a *business-driven technical framework that is scalable and flexible* to changing business directions and needs (Fink et al., 2017). BI systems are particularly conducive to the emergence of new information needs, and each new iteration of the project is accompanied by new requirements. This underlines the importance of an adaptive infrastructure (Olszak & Ziemba, 2007).

The heart of business intelligence lies in data. Every activity performed by companies generates data, but if they are not collected, it is impossible to exploit them. One of the major prerequisites before starting a BI project is to have software that collects data efficiently (e.g., ERP, CRM) in order to feed the BI process (Noguès & Valladares, 2017). However, it is not enough to just gather data, it must be usable in the decision-making process, so its value must be assessed through a model that establishes the characteristics of *data quality and integrity*. For example, Sherman's (2015) 5 C's model :

Clean : data should neither contain any errors nor be empty.
Consistent : data should be identical regardless of their location in different databases.
Conformed : data should have a common, shared meaning and dimension within the organization.
Current : data should be available and updated at a frequency relevant to the type of data.
Comprehensive : data should be accurate and complete enough to be analyzed in order to address the business issue.

Finally, it is equally important that the flow and quality of this data remain *sustainable* throughout the business intelligence process (Yeoh & Koronios, 2010).

The framework also introduces two criteria for measuring the success of the implementation that are addressed in the next section.

### 2.2.3 CSF of BI Implementation in the Pharmaceutical Sector

When it comes to CSFs to implement BI in the pharmaceutical sector, sources are very scarce. Indeed, only one study, which focuses on Jordanian pharmaceutical companies, was found on this topic. This study first made a systematic compilation of CSFs in the literature to produce a list that contains 21 of them. Then, 75 managers working in the pharmaceutical sector and having participated in integration projects in this sector were surveyed to determine the level of importance of these CSFs (Moflih et al., 2020).

This study focused on refining the CSFs already established in the literature. It identifies 21 CSFs, the majority of which can be considered as sub-categories of the CSFs established by Yeoh and Koronios (2010) in Figure 3. For example, in this study, top management support and resource allocation are considered as two distinct CSFs, in Figure 3 it is a single CSF. This study, by breaking down the broad CSFs into smaller and more specific ones, helps to reinforces and refines the findings established by Yeoh and Koronios (2010) in the pharmaceutical sector.

It also adds a new category of CSFs related to corporate culture, which includes success factors such as collaborative culture and continuous improvement culture. However, the result of the study concludes that these factors are not critical (Moflih et al., 2020). They will not be included in this master’s thesis because the small size of LuB precludes testing them in the case study and because of their lack of critical importance.

The study concludes with the relative lack of significant difference in importance between the CSFs in the literature and in the Jordanian pharmaceutical sector. Furthermore, it highlights the importance of further investigating the relationship between sector and CSFs in BI (Moflih et al., 2020).

### 2.2.4 Business Intelligence Success Assessment

Measuring the success of a project of the scale of business intelligence is essential (Solomon, 1996). However, it is a task made difficult by the very nature of BI. Measuring the business value generated by a decision based on information provided by a BI tool is rather complex (Lönnqvist & Pirttimäki, 2006). Moreover, the organizational aspect is not the only parameter to be measured, BI is also a technological and operational tool. In this section, methods to evaluate the success of BI implementation in the three different dimensions are explored.

### Technological Success

The success of an information system is largely influenced by the quality of its infrastructure (Wixom & Watson, 2001). The seminal Delone and McLean (1992) Information System Success Model (Figure 7 : updated version of 2003 which adds the service quality variable that will be developed in the next sub-section) distinguishes two variables in the IS infrastructure, the quality of the system and the quality of the information. The quality of the system integrates the concepts of linkability, flexibility, availability and accessibility (W. H. DeLone & McLean, 1992). For example, a system that is not available when a user needs it, has functionality that does not work as expected, is difficult to adapt to business requirements and is difficult to handle cannot be considered to be of high quality (Etezadi-Amoli & Farhoomand, 1996; Goodhue & Thompson, 1995). Information quality on the other hand integrates accuracy, timeliness, completeness relevance and consistency (W. H. DeLone & McLean, 1992). To be deemed of quality, information must be accessible when needed, be correct and allow to satisfy the user's need. In other words, to have a positive impact on the quality of the work based on it (Ang & Teo, 2000; Seddon & Kiew, 1996). The impact of the quality of information is also, by the intrinsic purpose of BI, a measure of success and a success factor (Yeoh & Popovič, 2016). Finally, the scalability of the infrastructure is extremely important (Kalelkar et al., 2014), BI being an iterative process by nature (Kimball & Ross, 2013), an architecture unable to evolve with the information needs will be quickly abandoned because it will no longer be able to fulfill its function (Chan & Lau, 2018).

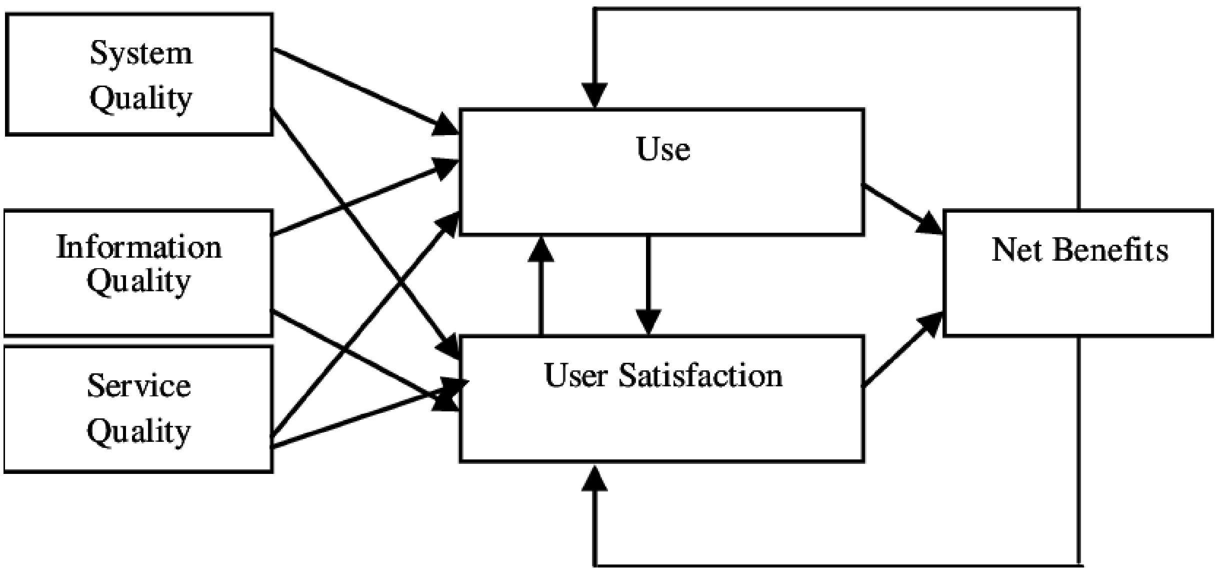



*Figure 7 : D&M Information System Success Model (DeLone & McLean, 2003)*

### User Success

User acceptance can be defined as "the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support" (Dillon & Morris, 1996, p. 4). The acceptance of a technology is determined by the concepts of perceived ease of use and perceived usefulness which lead to attitude towards using, intention to use and actual usage as described in the Technology Acceptance Model of Davis (1989).

Many models exist to measure user satisfaction. The Delone & McLean (1992) Information System Success Model (Figure 7) has been updated by its authors in 2003 by adding the concept of Service quality. It is an adaptation to IS of the seminal Servqual model used in marketing (Parasuraman et al., 1985). This concept states that beyond the quality of the information and the system, the quality of the support (e.g., having the interest of the users at heart, giving them a prompt service, being dependable) delivered by the administrators of the BI platform to the end users was a driver of satisfaction (Jiang et al., 2002; van Dyke et al., 1997).

The End User Computing Satisfaction Model of Doll & al. (2004) adds that the format of the tool influences its acceptance by users. This parameter is even more important in the case of mobile use (Kaasinen, 2005). The adaptation of the design of BI visualizations to mobile is also a factor impacting the acceptance of mobile BI (Brockmann et al., 2012).

To summarize, if the BI tool meets the business requirements of the user in time, is simple and pleasant to use. Then it will be more easily accepted and integrated into the business processes performed by the users. The success of BI is directly linked to user acceptance (Kimball & Ross, 2013) and therefore by extension to the measurement of its usage (DeLone & McLean, 2003; Turan et al., 2015), which allows to assess its success from a user perspective.

On the other hand, the studies reviewed on the subject postulate that if the user is satisfied, then they will use the BI tool. These models suggest that the user has a choice to use the BI system or not. However, with the increasing integration of BI into business processes, some users (e.g., data analysts) may no longer have the option to use these tools whether they are satisfied with them or not. This situation could lead to the necessity to redefine the place of satisfaction in these frameworks.

#### Organizational Success

At the organizational level, the success of BI is correlated to the value generated by the investment in BI (Sabherwal & Becerra-Fernandez, 2011). There are many different ways to consider a BI project a success (Boyton et al., 2015). First of all, from a financial point of view, achieving Return on Investment, reducing costs or improving profitability are all measures of success (Ghobakhloo et al., 2011; Lönnqvist & Pirttimäki, 2006). These results can be achieved when BI positively influences management processes (e.g., control, planning) and flows to the improvement of operational processes (Sparks & McCann, 2015; Williams & Williams, 2007). Another way to apprehend the success of BI is the achievement of predefined business goals as a value driver (Popovič et al., 2012). In this respect, the success of BI is strongly dependent on the industry in which it is implemented as some industry-specific goals are more easily achieved by BI than others (Olszak, 2021). From a change management perspective, achieving the internal project milestones on time and within the implementation project budget can be considered a success in its own right (Newell & Grashina, 2004; Yeoh & Koronios, 2010). Finally, in an intangible way, the use of a BI tool in an organization tends to create business intelligence communities (Hallikainen et al., 2012). These communities have a positive influence on the acceptance of BI and spread an evidence-based decision-making culture (Yoon et al., 2014). This culture contributes to the successful integration of BI within the organization (Trieu, 2017). The diffusion of an evidence-based culture can therefore be considered as a way to measure the success of the BI implementation (Skyrius et al., 2018).

In conclusion, there are many ways to evaluate the success of a BI implementation. There is a strong link between the technological quality of the tool, its acceptance and satisfaction by users and the generation of value at the organizational level. However, the multiplicity of approaches to success makes the assessment complex and unclear. In addition, the main business objectives of BI implementation vary from one sector to another such as improving customer care in the healthcare sector (Madsen, 2012) and workflow optimization in delivery companies (Howson, 2014). This means that the evaluation of a BI project varies according to the sector of activity of the company in which it is implemented. Given the multiplicity of approaches to organizational success, it is not possible to consider them all. Therefore, this master's thesis focuses on the BI goals specific to the pharmaceutical industry.

### 2.2.5 BI Success Assessment in the Pharmaceutical sector

With regard to the pharmaceutical industry, very few studies have been conducted on this subject. Brijs (2013) points out that marketing departments of pharmaceutical companies need BI to gain insight into their indirect sales. Measuring the adequacy of these forecasts against the reality on the ground can be seen as a way to evaluate the success of a BI tool in pharmaceutical marketing. Finally, Ramirez-Aristizabal & Moraes (2014) conducted a case study in the pharmaceutical sector whose goal was to determine which evaluation methods would allow a better analysis of the defects of a BI tool. They identified that the usability aspect was of critical importance in evaluating a BI tool.

They did not detect any particularities related to the pharmaceutical sector. However, they noted that the status of a multinational company has an impact on the evaluation. This, given the very international structure of the pharmaceutical sector, could potentially lead to a link. They conclude their paper by stating that the implementation of BI in the pharmaceutical sector would benefit greatly from additional research, especially in the area of CSF and the evaluation of success of BI systems.

## 2.3 Gaps, Research Questions and Conceptual Framework

This section reintroduces the gaps identified in the literature review, then the probable reasons for their existence are outlined and finally RSQs are formulated in an attempt to address them in this master's thesis.

The scientific literature on the subject of Business Intelligence as an information system is extensive. However, most of the research focuses on the IS aspect and covers considerably less the business management perspective (Ul-Ain et al., 2019). This approach neglects the business specificities of the industries because it is focused on the technological part of BI. As a result, research on the subject is not well grounded in the reality of the field.

There is a wealth of research focused on identifying the critical success factors of BI. Yeoh and Koronios (2010) seminal paper on the topic has been validated by numerous other studies (Mesaros et al., 2016; Olszak & Ziemba, 2012; Sangar & Binti, 2013). However, the majority of this research is based on quantitative data and there are few qualitative studies that analize this topic in depth. Consequently, Yeoh and Popovič (2016) further investigated the topic with a qualitative study that confirmed their findings empirically. The authors argue that further research needs to be done to shed light on specific industry cases and to allow for generalization of the state of research on critical success factors of BI implementation.

A quantitative study conducted in the Jordanian pharmaceutical sector (Moflih et al., 2020) found that the CSFs identified by experts in that sector are similar to those described by Yeoh and Koronios (2010) but argue that more research needs to be conducted in the pharmaceutical sector to support these findings.

In light of this lack of empirical research on this topic in the pharmaceutical sector, the first research sub-question (RSB) of this master thesis is:

***RSQ 1 : What are the CSFs of BI implementation in the pharmaceutical industry ?***

Secondly, there are different perspectives on the assessment of BI success. The technical aspects and methods related to user acceptance and satisfaction are rooted and demonstrated in the IT literature (Davis, 1989; W. DeLone & McLean, 2003; Doll et al., 2004). they have been extended and adapted to BI with success by several research (Işık et al., 2013; Yeoh & Koronios, 2010; Yeoh & Popovič, 2016). The more global perspective of the business value in the organization is also widely documented but not very consensual (Lönnqvist & Pirttimäki, 2006; Newell & Grashina, 2004; Popovič et al., 2012), there are many evaluation methods and some of them like the achievement of predefined business objectives depend on the sector where the BI implementation takes place (Howson, 2014; Olszak, 2021).

With regard to the pharmaceutical sector, these specific objectives to which BI must respond are explored by the scientific literature (Brijs, 2013; Robson, 2012) but their achievement and the evaluation of their success are barely investigated (Ramirez-Aristizabal & Moraes, 2014).

It is on the basis of this lack of knowledge about the measurement of BI success in the pharmaceutical sector that the second research question is developed :

***RSQ 2 : How to assess the success of a BI implementation in the pharmaceutical sector ?***

Based on the theory developed throughout this literature review and on the research gaps identified, a conceptual framework is developed to clarify the relationships between the different topics of this study and the related research sub-questions.

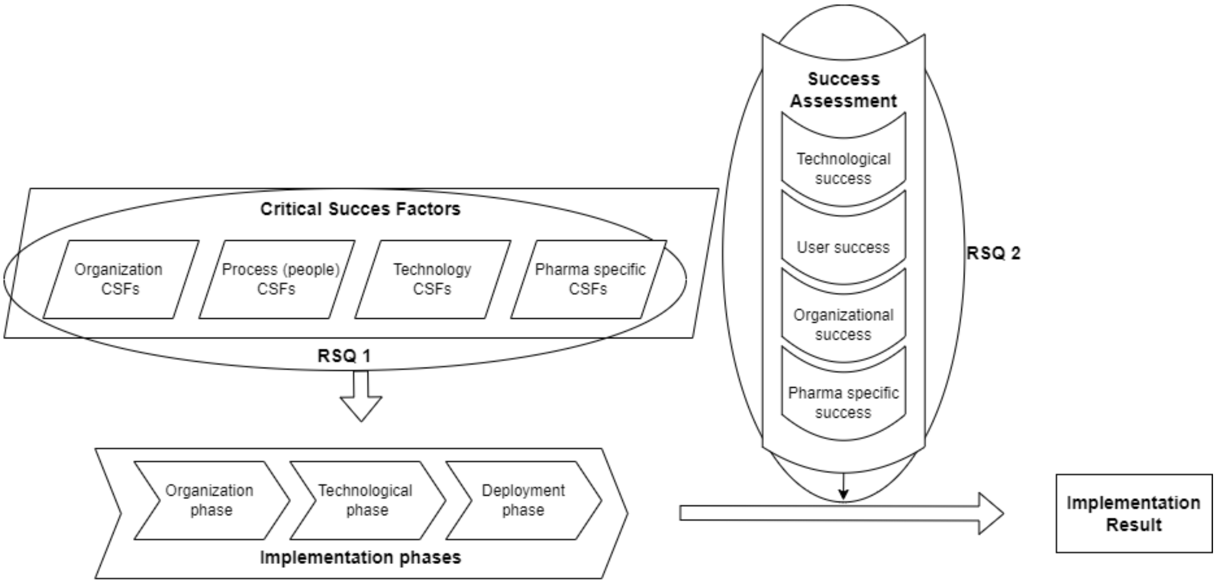



*Figure 8 : Conceptual Framework of BI Implementation in the Pharmaceutical Sector*

As seen earlier, following the CSFs allows a BI implementation to succeed in a general context (Yeoh & Popovič, 2016). However, too little research has been done on the CSFs in the context of the pharmaceutical industry. RSQ 1 will attempt to shed light on this issue.

Evaluating the success of BI is a difficult exercise that can be conducted in many different ways. Moreover, the industry in which BI is implemented can influence these methods. RSQ 2 will try to contribute to this topic in the context of the pharmaceutical sector.

This framework will be applied in the context of a project to implement a BI tool in a pharmaceutical company. The data obtained and analyzed will allow determining whether it stands up to field evidence.

# Chapter 3: Methodology

In this chapter, the methodology used, the data collection and analysis methods are explained. First, the context of this master thesis is briefly reintroduced, the methodology is detailed, justified and its limitations are addressed. Next, the five data collection methods used in this study are discussed, contextualized and motivated. Finally, the methods used to analyze the collected data are presented.

## 3.1 Methodological Approach

The qualitative approach seeks to give an explanation to a phenomenon by exploring numerous aspects that impact it (Hancock & Algozzine, 2006). The data collected to conduct this research is therefore solely qualitative, as developed further in this section.

The qualitative case study research methodology is used to structure this research. Case studies revolve around the in-depth analysis of a phenomenon (i.e., BI implementation) in its specific environment (i.e., Lundbeck Belgium). By collecting different sources of data, case studies allow us to understand all aspects of this phenomenon while acknowledging that its context impacts it (Rashid et al., 2019).

Case study is particularly suited to answer the "why" and "how" questions (Yin, 2014). Questions that seek to fill an information gap are also very well covered by the case studies (Crowe et al., 2011). These types of questions deal with the explanation of a phenomenon, and the case study approach is ideal for gathering the information needed to answer these questions (Crowe et al., 2011). The research sub-questions developed for this master's thesis being one "what" and two "how" questions whose goal, as outlined in the previous chapter, is to explain the relationships between different aspects of an implementation and fill an information gap, the case study was thus a very appropriate approach. Moreover, the case study is an approach particularly used in the disciplines of management (Crowe et al., 2011) and information systems (Baškarada, 2014), which is very fitting given that the subject of this research revolves around Business Intelligence, which falls between these two areas.

Various authors have refined and categorized the case studies into several different types. Some categories are not mutually exclusive (Crowe et al., 2011), only the types that apply to the specific case of this master's thesis are explained. First of all, this case study is instrumental, i.e., based on a single particular but not unique case, the goal is to analyze it and then generalize (Stake, 1995). The case of Lundbeck is particular in the sense that its context is not exactly the same as that of another pharmaceutical company. However, this context is not particularly different either, which allows us to generalize the findings to a certain extent. Then, it is explanatory, its purpose is to try to explain the relationships between causes and effects (Yin, 2014). This is in line with the aim of this master's thesis, which seeks to explain the relationships between the CSFs, the implementation steps and the evaluation method and the effect they have on the final result of the project. Finally, as an implementation case study, the focus is on the managerial aspect of the implementation and on the process itself (Hwang et al., 2020).

The case study approach has its limitations, a regular criticism of the case study is the influence of its context and the fact that the study is based on a single case makes generalization to other situations difficult (Tellis, 1997; Zainal, 2007). Another concern in relation to the case study is subjectivity. The researcher participates in the studied phenomenon, and therefore influences the result and the data collection by his cognitive biases. In order to address this issue, Yin (2014) identified several solutions: multiplying the sources of data (i.e., triangulation of data), creating a chain of evidence (i.e., clearly identifying the data from its source to its use in the study) and having a key stakeholder of the case study to review the research. The first two ways to avoid subjectivity in research will be developed in the next chapter, while the last one is solved by having the key stakeholder, namely the country manager of LuB, in the jury of this master's thesis.

## 3.2 Data Collection

The purpose of this section is to outline the different data collection methods used to conduct this research, to justify the validity of these methods and to identify the source of the data. They are presented in an ascending order of perceived quality.

A key aspect of the case study approach is the triangulation of data, using multiple sources and types of data to improve the validity of the study (i.e., the fit between the method and the answer to the research questions) (Stake, 1995). This principle was formally followed in order to strengthen the validity of the findings of this study.

First, due to the nature of this master's thesis, the researcher participated in complete observation of most of the stages of the phenomenon studied. This method of data collection is double-edged, it allows for a very high degree of understanding of the phenomenon (as demonstrated in Schouten and McAlexander's (1995) seminary study on subcultures of consumption) but involves a strong risk of subjectivity (Spradley, 1980). For this reason, data collected by this method must always be supported by at least one other source of data.

Secondly, numerous documents (i.e., secondary data) related to the implementation of BI at Lundbeck Belgium were collected. These are internal documents (e.g., e-mails, user acceptance tests) but also external documents, coming from the consulting company that participated in the project (e.g., presentations, training material) and from Lundbeck headquarters (e.g., IS policy, BI guidelines). As secondary data, it is used as a means to support the primary data.

Third, the in-depth mailing method was tried with the medical representatives of Lundbeck. This method was used because they are field staff, and it is difficult to gather them in a focus group. The data generated by this method is less rich than an interview or focus group, but still allows for meaningful data to be collected (Fritz & Vandermause, 2018). Since the medical representatives are not key stakeholders, this was considered sufficient.

Fourth, two mini focus groups were conducted 6 months apart with key stakeholders, namely the country manager and the sales & marketing manager. The purpose of these focus groups was to collect data from the debate between the two key stakeholders on the research topic and to monitor the change of perspective after 6 months.

Finally, semi-structured interviews were conducted with external BI experts. The recruitment conditions were that the expert was specialized in the pharmaceutical sector and that he had led at least one BI implementation project in the pharmaceutical sector as a consultant or project manager. Moreover, the decision was made to interview only one expert per company in order to obtain more diverse data. These conditions were taken because the purpose was to prioritize the richness of the data rather than the quantity. As a result, few interviews were conducted but the sample contains interviews from each of the only two valid companies in Belgium and one from the world leader in BI in the pharmaceutical sector. This method of data collection was adopted to gather firsthand data but especially to facilitate the generalization of the data outside the case study (Yin, 2014) because these experts have no links with the BI implementation in LuB. The experts interviewed preferred to remain anonymous.

## 3.3 Data Analysis

The data collected is predominantly qualitative, the two methods used to analyze the data is open coding and axial coding. The inductive approach (i.e., not applying a categorization already established by the scientific literature) is adopted because one of the objectives of this master thesis is to discover if there are specificities to implement BI in the pharmaceutical sector. A deductive approach could conceal these specificities (Miles et al., 2014). The tool used to perform the coding is Nvivo, the one used to transcribe the audio interviews is Descrypt.

Open coding is about analyzing data sentence by sentence. When an idea relevant to the research sub-questions emerges in a sentence, it is coded to identify and conceptualize it. This method is carried out until no new concepts emerge from the analysis (Khandkar, 2009).

When all concepts are extracted from the data, the axial coding phase begins. This consists of grouping all the concepts into sub-categories, which in turn are grouped into categories. For example, a concept related to the perceived ease of use of a BI tool falls into the User success sub-category which is part of the BI implementation success assessment category. Axial coding allows to capture the main aspects of the data while allowing identifying emerging concepts (Matthes et al., 2017).

# Chapter 4: Case Study

Now that the existing theory on the subject has been reviewed and the methodology structuring this master's thesis has been established. This chapter gets to the heart of the matter: the implementation project of a business intelligence tool in the Belgian subsidiary of Lundbeck. It is divided into two parts, one descriptive and one analytical.

The first describes the case study starting with the contextual elements that impacted it. Then, the implementation project and the tool itself are described simultaneously, following the chronological order of events and the development stages of the tool respectively. This part can be considered as a reflection of the first part of the literature review. It sets the scene for the case studied in a holistic and descriptive manner based on the researcher's participant observation, interviews with key stakeholders and documents collected on the subject. Its purpose is to provide the information necessary for the analysis carried out in the following section.

The second part of this chapter focuses on the analysis of the case study using two lenses: the previously developed theoretical framework and insights from pharmaceutical BI experts gathered during semi-structured interviews. The data collected in relation to the three previously defined research questions are used to test the established theory. Then, the insights gathered from the professionals are used to complete the analysis and refine the answers to each of the questions structuring this master's thesis.

## 4.1 Description of the Case Study

The case study is first recontextualized in order to provide the necessary information to understand what happened next. The project really starts with the organization phase that describes the Kick-off meeting, the LuB business requirements and begins to shape the BI architecture of the company with a presentation of the data sources and users. Then, the technological phase is briefly addressed with a description of a workshop on the BI tool followed by LuB and the technological part of the architecture: ETL and database. Finally, the description of the case study ends with the deployment phase of the tool which presents the two UATs that LuB passed, the visualizations that are the end of the BI architecture and concludes with the major problems encountered by LuB during this project.

### *4.1.1 Contextualization*

The implementation of an IS tool like BI is fundamentally a change management project. As such, the internal and external context in which it is implemented has a profound impact on its execution and results (Donaldson, 2001). This is why, before getting to the heart of the matter, it is important to describe the timeline, the influence of the head office IT policy and the surrounding projects that have shaped the environment in which this research has taken place.

#### Temporality

Business intelligence is a long-standing practice at Lundbeck Belgium. From the beginning of 2010 until today, this process has undergone many changes over the years, both in form and in purpose.

The first application was developed in-house in the early 2010s. After the restructuring of Lundbeck Belgium, there was no longer the capacity to manage this tool internally. It was then decided to call on a consulting company in 2017 to create a new application using QlikView (QV). In order to modernize it, the choice was made to migrate from QV to QlikSense (QS), the cloud-centric evolution of QlikView, in 2020. This project was completed at the end of the year after a data check and a user acceptance test (UAT). The result of the test was relatively positive but some additional development needs were identified and the two companies quickly agreed on a contract to perform these enhancements.

After 6 months of using the application, users' satisfaction with the business intelligence solution has drastically decreased. This situation led to a deterioration of the commercial relations between Lundbeck Belgium and its consultant and ultimately resulted in the end of this partnership. The decision was made to look for a new Business Intelligence partner in order to create a new QlikSense application more in line with the current needs of the company.

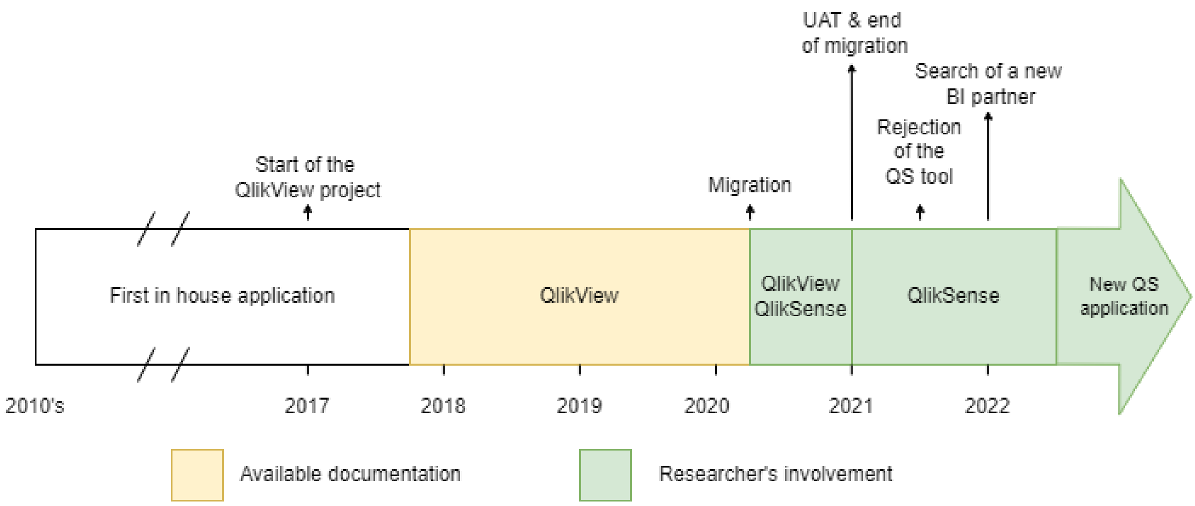



*Figure 9 : Timeline of Business Intelligence in Lundbeck Belgium*

Figure 9 allows situating the temporality in which this case study is inscribed, the scope of this research begins with the researcher's involvement that started during the QlikView to QlikSense migration project and ended during the new application creation project. However, past projects have a crucial impact on future ones (Pichault, 2013), and this is even more true for a project as intrinsically linked as a software migration (Fleurey et al., 2007). Therefore, internal documents and information about the QV project were collected to analyze it and determine its impact on the current and future project.

### Headquarters BI Policy

Lundbeck Belgium has relative autonomy in its activities, but this is not exactly the case when it comes to IT. Lundbeck's head office imposes a fairly strict IT policy. In the case of business intelligence, there are certain obligations and recommendations that the subsidiaries must follow. These requirements have had and still have a considerable impact on the different projects LuB has carried out. Therefore, it is necessary to describe this policy that frames the possibilities of action of the Belgian Lundbeck branch when implementing business intelligence tools.

First of all, all applications and their data must be on premise, i.e., hosted on the headquarters' servers. This may seem anecdotal, but this system prevents subsidiaries from using the SaaS method to manage their BI tools. Each subsidiary must therefore hire a consulting firm to build the desired BI applications directly on the headquarters server. This implies numerous exchanges of information between the subsidiary, its consultant, and the head office, which leads to slowdowns and a more complex implementation. For example, when a problem occurs, it is sometimes difficult at first to determine whether it comes from the infrastructure (headquarters) or from the software itself (consultant), and therefore to know whom to contact. The objectives of the subsidiary and the head office IT department are very different. While the subsidiary wants a BI process that meets its needs while being as simple as possible to manage, the IT department must ensure that the subsidiary's strategy fits with the one of the headquarters, even if this means complicating the local BI process.

In terms of vendor selection, QlikView was highly recommended by headquarters. This was not a firm requirement, but many branches followed this suggestion. With the advent of QlikSense and the evolution of storage strategies, this recommendation is slowly becoming a requirement as centralization and standardization of data become more and more important to headquarters. As seen earlier, the choice of the vendor is not considered particularly important because they all have common functions and the differentiation between them is relatively minor. Lundbeck Belgium followed this recommendation in order to facilitate exchanges with headquarters and not to waste resources on a step that was considered avoidable.

Finally, subsidiaries have almost total freedom regarding the content of their business intelligence applications. The only requirement is to have national sales figures for Lundbeck products. Beyond that, they can determine their BI strategy and information needs without restrictions. The result of this policy is that most local applications are very different from each other. Nevertheless, more and more business areas are starting to build common applications across their countries to create a single source of truth and avoid information misunderstandings.

#### Related Projects

Lundbeck Belgium is currently working on two projects that have a direct impact on its business intelligence process. Due to the Covid crisis, the pharmaceutical sector has had much less access to its customers. Companies have been forced to digitalize their marketing approach and are adopting the omnichannel strategy (Kaiponen, 2021). Omnichannel is the integration of different communication channels, digital or physicals, into a single communication system that matches the customer's preferences in order to create a seamless and constant communication with him (Azoev et al., 2019; Mirsch et al., 2016). It is a strategy that requires a lot of data (Nash et al., 2013) and an IT architecture (like BI) able to exploit it in order to work and succeed (Cordon et al., 2016). LuB is in the preparatory phase of adopting this strategy, it will take a lot of time and will require, in the future, the creation of a business intelligence application dedicated solely to it. Even if this application is not on the agenda, the adoption of this marketing strategy is already impacting the information needs of the company's existing communications channels.

The second project is the migration of the CRM tool used by Lundbeck Belgium. As seen previously, the IT policy of the head office is very restrictive, this is even more true with CRM. The Belgian subsidiary has no control over this project, its only involvement is to adapt certain secondary functionalities to local legal rules. Since CRM is an important source of business intelligence data, especially for monitoring the activity of medical representatives, this has a direct impact on the BI strategy. LuB does not control the time aspect of the project, which may cause the delay of new developments. The new CRM is expected to be much more powerful and will also generate much more data, so the BI process will not only have to integrate this CRM but also adapt to this new information flow.

### 4.1.2 Organization Phase

The preliminary stages of the project, such as obtaining the budget and selecting the consulting firm partner, were carried out before the researcher's participation and are not well documented. They will therefore not be included in the scope of this case study. The kick-off meeting will therefore be considered as the start of this research.

The main goal of this project is to move LuB's BI architecture from the QlikView software to its QlikSense evolution while creating modern BI applications aligned with the company's current information needs. When the consultancy contract was signed, it was agreed that LuB's project leaders would come to the consultancy company's premises to hold the kick-off meeting. This would allow the different stakeholders of the project to meet each other. Secondly, to train the consultant in LuB's business and in the specificities of the pharmaceutical sector, as he had no experience in this field. Also, to transmit the business requirements (e.g., users, data sources) and the information needs for the new BI tool. Finally, to plan the project and to establish milestones such as data validation and UAT.

Above all, this meeting allowed to lay the foundations of the BI architecture, i.e., the end users, the data and their sources. It was decided that 3 applications addressing 3 specific information needs would be developed.

### LuB Business Requirements and Information Needs

The definition of information requirements is the first step that shapes the entire BI implementation (Vuori, 2006). Lundbeck Belgium's operation is articulated around 3 activities, market access and promotion are only there to enable sales of Lundbeck’s products. The rest of the activities are outsourced to other subsidiaries. Since commercialization is the sole purpose of the company, the majority of its information needs is driven by sales and marketing. The majority of the sales department's processes (e.g., market intelligence, strategy definition) are centered around the information generated by the BI tool, as the country manager stated during a workshop, *“I couldn't imagine a life without Business Intelligence."*

Since the sale of prescription drugs does not involve a contract, the only way to get insights into the two markets where LuB is active is to have data on consumption and competition in these markets in order to analyze opportunities and threats. This information allows LuB to develop its commercial strategy. On the other hand, it is also important for the company to track its sales to distributors and hospitals in order to monitor its supply chain and results.

Moreover, the progressive digitalization of LuB's marketing and sales activities makes them increasingly complex and increases the amount of data generated, which leads to new information needs. The product promotion activity is particularly impacted by these changes, it is currently relatively unintegrated into the BI process, but its incorporation is planned by the company. The last activity, market access, is not at all concerned by BI because it is not an iterative activity, it generates little data, and it is considered that the business value of its integration in the BI architecture is presently not worth the effort.

### LuB BI Architecture : Data Source and Users

The BI architecture built during this project is composed of three applications: N05A N06A and ExFactory. Their components are described throughout this chapter following the chronology of their integration or creation by the consultant. In the case of the kick-off meeting, it is the data source and the users that are considered for the architecture of the BI tool.

#### N05A & N06A

These two applications will be described together because they are essentially the same in terms of structure and visualizations, they have been separated to avoid concentrating too much data in one application which would reduce its technical performance as well as to avoid confusion between the visualizations of the different markets.

The purpose of these two applications is to give a detailed view of the monthly sales of their market (N05A: Antipsychotics & N06A: Antidepressants). They display the results of all companies present on the market as well as patient demand at a relatively precise geographical level of detail. They allow analyzing the two markets in order to extract trends, opportunities and threats. Ultimately, they provide the data needed to build Lundbeck Belgium's sales strategy. They are also used to report the subsidiary's results to the upper hierarchical levels.

The main source of data that feeds these applications comes from a company that negotiates and purchases sell through data (i.e., packs of drugs purchased from suppliers) of pharmacies and then creates a large database that it resells to pharmaceutical companies every month. 62% of Belgian pharmacies provide their data, an algorithm is used to extrapolate them in order to give a complete view of the market. Unfortunately, this process takes a lot of time, which means that the data is usually only available at the end of the following month. This creates a gap between action in the field, obtaining the data and making decisions based on it. This reinforces the need for a clear and efficient BI tool to limit the time gap between receiving data and making decisions based on it. Given that this data is derived from pharmacy purchases, which are supplied by wholesalers, they are labeled retail.

However, Lundbeck also sells directly to hospitals in the N05A market, so a second data source is needed. The orders placed by the hospitals are transmitted from the company's ERP to the application in order to capture the total sales. It is therefore only possible to compare the results of the different companies in retail sales because LuB does not have the hospital sales data of its competitors.

These data are expressed in packs, the problem is that we cannot really compare one drug to another in terms of boxes. The number of drugs in a pack and the dosage can vary by region and country, in order to overcome this problem the WHO has created a unit of measurement, the Defined Daily Dose (DDD) which represents the average daily dose expected for its main treatment for an adult (WHO Collaborating Centre for Drug Statistics Methodology, 2018). This unit of measurement allows comparison of commercial results between different drugs and is therefore preferred to the number of packs sold or by value in the pharmaceutical industry.

Another unit is also used in the case of long-acting injectables : the days of treatment (DOT). Because this type of drug is intended for a specific duration, the dosage does not allow comparison between them (Polk et al., 2007). For example, a drug with a DDD of 5 that lasts 1 month will be overvalued compared to another with the same duration but a DDD of 3, even though in commercial terms, the consumption is comparable between the two. For this reason, the DOT is used to compare LAIs.

In terms of geographical dimension, the sales data are organized on 3 levels. The most granular level (i.e., with the most detail) is the IMS 147, a classification created by the company that provides sales figures and that divides Belgium into 147 geographical areas called bricks. The second level is represented by the division of Belgium between the 4 medical delegates of LuB, 2 in the north and 2 in the south, each of the territories assigned to them is made up of IMS bricks. The last level is simply the national total. The data from the Grand Duchy of Luxembourg is also incorporated as a 148th brick.

The last data source used is the master data, it contains all the information attached to the products (e.g., hierarchy: molecule > drug > product packaging), geographical data (e.g., transformation of a group of IMS zones into the territory of a medical representative), units of measurement (e.g., transformation from pack to DDD), etc. They allow to link and structure the data between each other to form the backbone of the application.

These applications have three types of users and two levels of user access. The users are the management team, the medical representatives and the finance/BI team of the French subsidiary. The delegates only have access to the territories assigned to them in the application, the other users have access to all data. Each type of user has its own purpose when using the applications as seen in Figure 10.

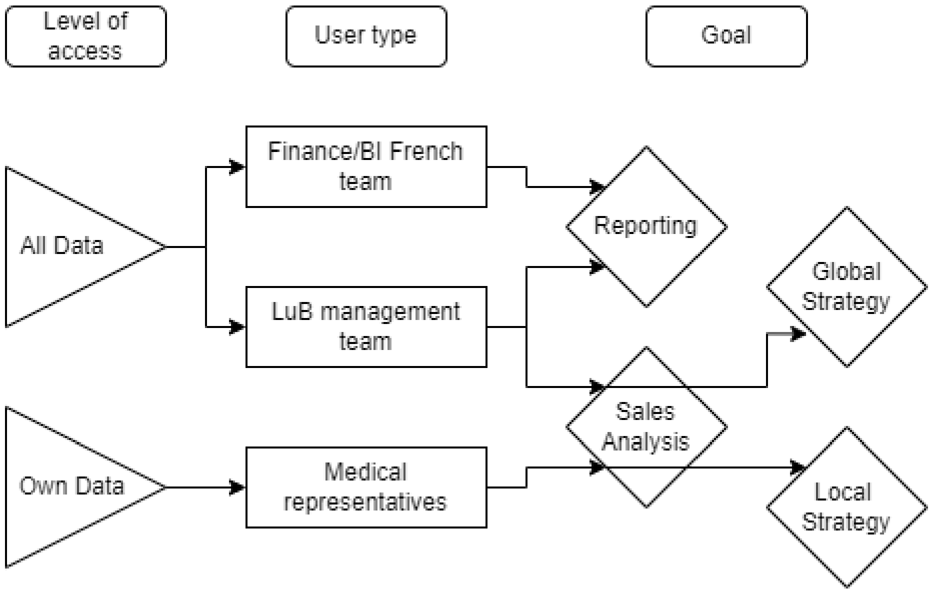



*Figure 10 : User Diagram of the N05A and N06A applications*

The members of the management team are the central users of these applications, they have been designed to meet their needs and they are the ones who use it the most. Of the two objectives, reporting is the simpler, when the data arrives each month, the results are transmitted to the upper hierarchy. Sales analysis represents the majority of the time spent on the applications because the number of elements to be considered is significant in order to adapt the strategy to the variations of the market and the competitors. Medical representatives have access to their territorial data in order to be informed of their results and to be able to react to certain local changes such as an increase in the market share of a competitor. These users are constantly on the go, they mostly use the BI tool on their tablets, so the applications must be able to be used in a mobile format. Finally, the French subsidiary finance/BI team only collects data in order to carry out financial analyses encompassing the 4 countries (i.e., France/Netherlands/Belgium/GDL) of the business area.

### ExFactory

The ExFactory (ExF) application is less complex than the other two because it is centered on internal data. Its main purpose is to monitor the results of LuB's product sales to distributors and hospitals in relation to the sales targets set by the French subsidiary.

The company's ERP is the main data source for this application. Every day, the orders placed in the ERP are transmitted to the application in order to monitor the results of each product on a daily basis. It also allows to keep an eye on the different distributors of Lundbeck products. Just like the other applications, specific master data has been created to identify the different hospitals and distributors and to integrate the sales objectives. Since there is no comparison with other drugs, the only units of measure used are the classic packs and the monetary value.

It is also easier in terms of users. Management team members are the main users for the reasons explained above. The analysts of the French subsidiary also have access to the data to carry out their financial analysis. Medical representatives, on the other hand, do not have access to this application because sales data to distributors is of little interest to their function. Hospital sales, on the other hand, are included in the N05A application because it is more in line with their needs.

## Data Assessment

Big data is raising more and more interest in the field of management (Deepa et al., 2022). But can the data used in the LuB BI architecture be considered as Big Data? By using the 5 V model of Demchenko et al. (2014) previously defined, it is possible to characterize the data collected, used and analyzed by LuB.

| V Characteristics | LuB Data | Big Data |
|---|---|---|
| Volume | Tables with millions of rows but whose weight does not exceed one gigabyte | Very large data measured in Terabytes (i.e., 1000 gigabytes) or more |
| Velocity | Daily and monthly | In real time or almost |
| Variety | All data used are in table form with columns and rows (i.e., structured data) | Includes structured and unstructured data |
| Veracity | The data coming from the ERP are perfectly reliable, the sell through data feeding the N05A and N06A on their side are based on a sample representing 62% of the reality of the field which is then extrapolated by an algorithm | The data must be trustworthy, authentic, available and from a valid source |
| Value | The data used in the BI tool has been selected only for its perceived value | The data collected must be in adequacy with the information needs |

*Table 2 : Assessment of LuB data using the 5 Vs model of Big Data (Demchenko et al., 2014)*

Table 2 compares the characteristics of LuB's data with what is expected from Big Data. It is rather clear that the data used by LuB are far from being able to correspond to Big Data in terms of technical characteristics: volume, velocity and variety. On the business side, the data has been selected specifically to meet LuB's current needs to generate value efficiently. In the case of veracity, part of the data is partially based on reality and then extrapolated by an algorithm whose operation is not known by LuB because it is confidential. On the one hand, this creates a risk of information bias, on the other hand, it is currently the most accurate representation of the market reality available. It can therefore be considered as the truth for the moment.

The data collected is relatively small, not very dynamic and uniform. However, they are critical to the proper conduct of the company's business operations. LuB's choice of BI architecture can be illustrated by Pareto's law: 20% of available data generates 80% of value by improving decision-making.

Although this is to be put into perspective, one of the known effects of BI is that the dissemination of information in a company improves the understanding of many operational aspects, which in turn leads to new information needs. In addition, the digitalization of some of the LuB's operations that takes place in parallel with this project may also influence these needs. It is important to expect that the BI architecture of the company will have to evolve after its implementation, and it must therefore be scalable.

### *4.1.3 Technological Phase*

A few months after the kick-off meeting, a workshop was organized so that Lundbeck users could test the applications during their development. The LuB employees concerned went to the consulting company. The workshop started with a presentation of the applications followed by a demonstration of their functioning. Finally, the users were able to test them on their professional laptops.

Many problems were identified during this workshop. Some of them were technical, such as slow loading, non-scalability of the application to the screen size of the laptop used. Others were more related to the lack of understanding of LuB's business and the pharmaceutical sector. For example, the use of DDD for drugs that should be calculated in DOT, the use of hospital data (only available for LuB) in the calculation of the market share, which completely distorts the result, etc.

Obviously, the purpose of this meeting was to identify possible problems in order to solve them. Although some of them were perfectly understandable since the application was still in the making, others started to worry LuB's project managers. For example, the applications were built by the consultant on a large screen, but when LuB's managers tried them out on their 15-inch laptops, the visibility and ergonomics were terrible. Even though this is an easily solvable problem, it was seen as a lack of skill of the consultant with the QlikSense software, as the Sales & Marketing manager said during a focus group, "After this meeting, we lost a little bit of confidence in our consultant."

Nevertheless, the problems were identified and listed to be solved before the further development of the tool could continue.

#### LuB BI Architecture : ETL and Data warehouse

In the first section of the literature review, the ETL process and the data warehouse were very briefly defined because of their technical complexity. This is appropriate because in this project, these tools were not specifically developed by the consultant. In fact, most BI software includes an alternative to ETL and data warehouse. This is the case of QlikSense which can use a specific file called QVD as a data warehouse. This can be seen as a massive excel file designed to contain all the data needed to run the application. The extraction of data from a source and loading it into the file can be automated. The data transformation step is very limited, so the QVD file must be specially built to match the raw data. The consultant chose to use these basic QS features.

The advantage of this approach is that it reduces costs and development time enormously. The tradeoff is that it does not allow to benefit from the many advantages of a data warehouse (e.g., a single version of truth) but it also greatly limits the flexibility of the BI tool as it requires modifying the QVD file each time a new data type or source is added to its application. In the case of this project, the consultant justified this choice on the basis that the data sources used to meet LuB's business needs are stable.

### *4.1.4 Deployment Phase*

#### User Acceptance Test

At the end of 2020, the applications had passed a data check (i.e., checking the consistency of the data between the visualizations of the former tool and the new one) and were ready to be put into production (i.e., deploying it). But before the guidelines provided by headquarters advised performing a UAT to verify that the applications work and meet the users' requirements. The head office also proposes a relatively simple UAT template for its subsidiaries, LuB has chosen to use it. Normally, each user should answer this test personally. But the project managers decided to do it as a team to get a general opinion. The analysts of the French subsidiary and the medical representatives were not included because they could not test the application beforehand.

Application Name: *QlikSense N05A/N06A & ExF*
User ID: [redacted]

| Statement | Response (1-5) | Comments Lundbeck (Text) |
|---|---|---|
| It is easy to get access to the application | 4 | The application is too much browser sensitive |
| It is easy to navigate the application | 4 | Still, we need a navigate training to get the best of the application |
| It is easy to understand the business logic in the application | 3 | 1 : Too much information on the landing page of a market<br>2 : Not clearly explained the way hierarchy of the data was built vs business needs<br>3 : Not clear why totals are on top<br>4 : The clear advantages of QlikSense weren't so far explained to us (vs QlikView) |
| The response time is acceptable | 3 | QlikSense is slower than QlikView |
| I can take actions based on the insights gained from this application | 4 | ExFactory and retail data are the same, but we gain some graphics |
| I find this this application beneficial for my work | 4 | |
| Other Comments Lundbeck: maintenance model not crystal clear, who's doing what when, e.g., new user creation, access rights, master data maintenance, who's first, second line if issue…<br>How to roll-out on the reps iPad? | | |

*Table 3 : User Acceptance Test of Lundbeck Belgium before deployment*

Table 3 shows the result of the UAT performed by LuB to validate the application. In general, the applications were perceived as relatively acceptable by the users. Even if some technical problems persisted, such as slow loading and screen problems. The most problematic aspect was the business logic of the application. Some choices were questionable, the most striking for LuB was the great resemblance with the previous QlikView applications and therefore raised the question of the added value of switching to QlikSense. There were also some concerns about the post-deployment elements such as maintenance, access management and master data updates. However, despite these questions, the agreement was made to be able to put the applications into production.

## Visualization

The applications were built around two major needs, reporting and sales analysis. Two types of visualizations have been developed to meet these goals. One of the user's requests was to be able to dive into the data in detail, so the application had to feature a self-service part so that they could create their own analyses within the tool. A pivot table loaded with a massive number of filters was therefore developed. This visualization allows navigating through all the data, from the most aggregated to the least. Despite this filtering, the applications remain very rigid, there is no way to manipulate the data. For example, it is impossible to make a sum in the application and thus to see the sales by years. When a user needs to do a more advanced analysis, he is forced to select the data he is interested in and then export it to Excel. In conclusion, the self-service part of the three applications works like a search engine in the LuB sales database.

LuB's other requirement was to facilitate the reporting and monitoring of business results. The goal was to have clear and convenient visualizations to share with the upper management or during meetings with the sales team. To meet this need, the company asked its consultant to create dashboards focused on LuB’s two main products and containing charts monitoring the main KPIs used by the management team (e.g., market share, growth).

The second type of application visualization built by the consultant for Lundbeck is a scrolling page that contains many graphs monitoring random KPIs. In a way, it meets the information need, but it is not exactly the form that was expected for this visualization. LuB was expecting a classic dashboard that would fit on a laptop screen and would allow appreciating the result of a chosen product in one glance.

#### Problems

After the applications went live, the consultant organized a training day where he presented the applications and their functionalities, had the users do exercise, showed how to add new users and explained the master data management. Then, he transmitted documents that included the points discussed during the training but also described the entire architecture of the BI tool. Finally, the structure of the maintenance was established, LuB would have the equivalent of 10 days of support hours from the consultant in order to solve potential problems. This should have marked the end of the project and concluded the scope of this research. However, right after deployment, many issues quickly became apparent.

One of the biggest problems encountered with this tool is the number of stakeholders involved in its architecture. This became very noticeable when the main data from the N05A and N06A applications started to arrive late or incorrect in the visualizations.

As seen previously, the source of data that irrigates these two applications comes from an external supplier. This data is transmitted monthly to a server belonging to Lundbeck's head office and is extracted by the BI tool designed by our consultant, which is also hosted on the headquarters' servers.

When users detect a problem in a visualization, the consultant is contacted to identify and fix the problem. However, if it comes from the data source or the IT infrastructure, the consultant relies on LuB to go to them to solve the problem because as a consulting company not specialized in pharmaceuticals, it has no specific contact with these actors. Solving problems involving so many actors is a complicated task, especially since it requires technical skills that are not present at LuB.

This leads to a heavy workload for LuB and especially to an excessive complexity of its BI activity. The goal of this project, beyond the construction of the BI tool, was also to take advantage of the expertise of a consulting company to manage the activities related to BI for LuB. But this was never really the case, and each new problem encountered was a big waste of time for the company. Which in the case of a subsidiary with a small structure like in Belgium is damaging because the time available is a scarce resource.

Moreover, there was a perceived lack of added value of the new BI tool on the part of LuB. The decision was made to upgrade the tool by adding new KPIs, modifying the dashboards and improving the ergonomics of the visualizations. This new iteration of the tool was aimed at improving user satisfaction, which was decreasing the more it was used because they had to use Excel in addition to other applications to find answers to their business information needs.

A new, smaller contract was signed with the consultant to implement these new developments. An application with more information, better ergonomics and fewer problems would have been considered a success for LuB. However, the work delivered still showed many problems related to understanding the intricacies of pharmaceutical data and LuB's business. The final result was still far below what was expected.

In parallel, the technical aspect of the BI tool was audited by another consulting firm linked to a LuB partner to understand why it was so error-prone. The result of this audit was very critical of the quality of the architecture built. It was in this context that a meeting between LuB management and the consulting firm was held. It became clear that this partnership would not be fruitful for LuB and that it was better to look for a new partner.

A second UAT (see Table 4), using the same questionnaire as the previous one, was carried out with the Sales & Marketing Manager and the Country Manager at the researcher's instigation. It was conducted some months after the end of the business relationship with the consultant in order to evaluate the evolution of the user’s acceptance of the BI tool after an extended use.

Application Name: *N05A/N06A & ExF*

User ID: [redacted]

| Statement | Response (1-5) | Comments Lundbeck (Text) |
|---|---|---|
| It is easy to get access to the application | 4 | **The feedback was given orally and used as information to analyze the case study.** |
| It is easy to navigate the application | 2 | |
| It is easy to understand the business logic in the application | 1 | |
| The response time is acceptable | 2 | |
| I can take actions based on the insights gained from this application | 3 | |
| I find this this application beneficial for my work | 2 | |

*Table 4: Second User Acceptance Test of the LuB's BI Applications*

Without going into too much detail, it is relatively easy to notice that acceptance has dropped sharply between the two ATUs. This will be developed in detail in the analysis of the success of a BI implementation project in the next section.

## 4.2 Findings

This master's thesis is based on three main data sources. First, the scientific literature, which is already very dense on the subject of BI implementation but very sparse when applied to the pharmaceutical sector. Secondly, the case study of a BI implementation project in the Belgian subsidiary of a pharmaceutical multinational. Third, interviews with BI experts in the pharmaceutical sector.

The case study is a research method that can generate a massive amount of information (Hancock & Algozzine, 2006), which is particularly the case in this master's thesis because the project followed spanned 18 months. In order to answer the two research sub-questions clearly and in a meaningful way, the data analysis will follow a predefined structure. The theory (which is in majority global and not pharma-centric) presented in the literature review will serve as a basis for the analysis of the data collected in the case study. The interviews with experts will reinforce these findings. Finally, when the general theory is exhausted, the data specific to the pharmaceutical sector, if any, will be developed to complete it.

The first RSQ aims at identifying the different CSFs of a BI implementation project in the pharmaceutical sector. First, the CSFs already established by the literature review will be analyzed in light of the data collected. Then, the success factors specific to the pharmaceutical market are presented and justified.

The second RSQ seeks to establish a way to assess the success of a BI implementation project in the pharmaceutical sector. First the different aspects and methods of success evaluation presented in the literature review are used to analyze the case study. Secondly, new insights specific to the pharmaceutical sector are described and explained.

### *4.2.1 Identification of the CSFs of BI implementation in the pharmaceutical sector*

Yeoh and Koronios (2010) seminal research identified 7 critical success factors that should be fulfilled in order to ensure the successful implementation of a BI tool in an organization. As outlined in the literature review, these 7 CSFs, already detailed in the literature review, are widely recognized by other scholars as a solid theoretical foundation on the subject.

Each of them is first briefly re-introduced, analyzed in the context of the LuB BI implementation project and finally, the data collected from experts are used to confront these findings with professional practice. The aim is to confront the already existing global theory in the context of the pharmaceutical sector with the LuB case study, in order to verify its applicability in this sector. The expert opinions allow us to move away from the microenvironment that is the LuB project to generalize if the opinions are consistent with the findings taken from the LuB case.

Two other CSFs more specific to the pharmaceutical sector and not present in the reviewed theory were identified during the analysis of the data collected. They will be described and justified in detail. Then they will follow the same structure as the general CSFs, analyzed in the LuB case and confronted with the views of experts in the field.

***What are the CSFs of BI implementation in the pharmaceutical industry ?***

#### Organization

The *committed management support and sponsorship* is the CSF widely recognized as the most important for the success of a BI project. In Yeoh and Koronios' theory (2010), BI implementation is treated as a cross-departmental project spread throughout the company, the management here considered are the top business executives. The reason this CSF is so important is because BI implementation projects are iterative and evolving, so they require constant investments in time, skilled staff and funds. This is why the support of the managers in charge of allocating these resources is vital.

Before analyzing the LuB project in light of this CSF, it is necessary to determine the organizational level of the project. LuB being a subsidiary, the implementation of BI within it is not a project of the same scale as what is described in the theory because it is a much smaller structure, relatively autonomous and it is hierarchically distant from top management. Nevertheless, the management team of the subsidiary cannot be considered as the supporter and sponsor of the project because they manage it directly and are not in charge of the budget allocation.

In the case of LuB, it is the managing director of the France Benelux business area who validates the budgets of the subsidiaries under her responsibility. Funds were not a problem during the project, the allocated budget was generous and the process of obtaining it did not cause any obstacles either during the initiation of the project or during the new contract to improve it.

Lundbeck's headquarters has its own BI tool, and the top managers are convinced of its benefits. That's why they support the subsidiaries' BI implementation projects by providing QlikSense licenses, documented guidelines and the IT infrastructure on which the applications are hosted. Members of the BI department at headquarters have provided support to the project managers in carrying out the implementation.

LuB has received all the financial and technical support necessary to complete the BI implementation project. As for the competent staff at headquarters, their support was helpful but mostly focused on the technical aspects of BI, more help with the choice of the consulting firm would have been valuable. In conclusion, it is reasonable to consider that this success factor was relatively well met during this project.

The decision to start a BI implementation project should be driven by business requirements. A *clear vision* of the project strategy and organization is necessary to meet the objectives and needs. In order to clarify and promote the project within the company, a *well-established business case* that identifies the strategic benefits, resources, risks, costs and timeline should be established (Yeoh & Koronios, 2010).

The implementation project studied in this master's thesis is a new iteration of the previous archaic BI tool. It was already being used to achieve defined business objectives but suffered from a poor technical architecture and lack of functionality. The project managers had a very clear vision of their business needs when they launched the new project because they were the same as before. As far as the business case is concerned, none was established for LuB in particular because the stakeholders were already motivated and prepared. The head office conducted several demonstrations of the Spanish subsidiary's BI tool (which is considered a big success in the multinational) to the other subsidiaries in order to convince them of the strategic benefits of switching to QlikSense. This convinced LuB's management team that this BI tool migration would be valuable. This success factor can therefore be considered fulfilled for the LuB project.

The alignment between the project and the business needs it fulfills is also a consensus among the experts interviewed, for most of them it is even the most important CSF. As stated by an expert:

> *"I think that the most important thing is to start with the end in mind, you have to establish who the users are and what their business requirements are. When you know what business objectives the tool will meet, then the project can begin."*

Another example of the critical aspect of this success factor can be taken from the BI tool of the Dutch subsidiary of Lundbeck. The project was initiated with the sole purpose of fulfilling the request of the head office that each subsidiary has a BI tool that collects and displays local sales figures. The result is a tool that is completely unused in the subsidiary and therefore provides no business value.

#### Process

To successfully complete a BI implementation project, it is considered critical to have a ***business-centric champion***. His objective is to keep the business aspect at the center of the project and to ensure the good collaboration between the different business and IT actors of the project. Indeed, even if the focus must be on the business, BI being an IS, a ***balanced team composition*** between IT and business is essential to achieve the technical objectives that will enable the satisfaction of the business goals (Yeoh & Koronios, 2010).

LuB had its business-centric champion in the person of the Country Manager. He constantly reinforced and shared his business vision with all project stakeholders. He ensured the communication between LuB and the consulting company (which in this case assumed the role of the IT team). On the IT side, the main contact was a business analyst (less technical skills) who had the possibility to be supported by an IT technician. This could have been considered a balanced team, but in the file containing the work done by the consulting company it is indicated that all the technical construction was done by the business analyst. This may explain the constant technical problems encountered by the applications. The project did have a business-centric champion who fulfilled his role well, but the team that carried out the project lacked technical expertise. The success factor can therefore be considered as partially met.

Several experts stated that in this type of project the balance between the business and IT sides was critical to the success of the project. One of them went into more detail and stated that:

> *"We always work with two profiles of people in a BI project, there is a business analyst and a data scientist, one who is an expert in the business and one who knows how to program [...] This allows us to give our customers the most from both sides."*

A BI implementation project should follow a *business-driven development approach*, i.e., the scope and planning should be established with the final business objectives in mind before launching the project. An iterative development approach that executes the project in small milestones also makes it easier to adapt to business changes and technical issues (Yeoh & Koronios, 2010).

The LuB implementation project was entirely focused on the business aspect because the management team set the objectives and scope of the project. As for the iterative development, the project was relatively small in size, but the consultant developed it gradually, application by application. This allowed LuB to control the progress but also to adapt it to new small business needs (e.g., new KPIs) that appeared.

All the experts interviewed stressed the importance of establishing a business scope well in advance but that the execution of the project must be done step by step in order to constantly test what is created with the users. One expert pointed out that:

> *"What works best is a hybrid approach between a waterfall methodology and an agile methodology. What I mean is that normally we recommend defining everything at the beginning and then we implement with sprints or with small modules that we can start testing and using each of them separately."*

As stated many times, business requirements must be at the heart of a successful BI implementation project. This is why a *user-oriented change management* should be adopted. When users participate in the project, it improves the communication of their needs, as well as allowing them to test the tool and give feedback. This ultimately aligns the project with the actual business requirements (Yeoh & Koronios, 2010).

During the LuB project, the consultant allowed the users to test the applications throughout the project. This allowed the detection of many technical and business problems and for some, their resolution. They also regularly communicated their feedback to the consultant in order to realign the developments with their needs. This was not enough to achieve the project objectives, but it probably prevented worse results. Overall, the project used a user-centered change management methodology.

The experts do not distinguish between iterative development and user participation. For them, one goes with the other. This is possibly due to the influence of the agile method which was regularly cited by the experts, and which links these two principles (Beck et al., 2001). What is certain, according to them, is that the lack of interaction between developers and the business leads to a reduction in the alignment between the project and its objectives, which results in failure.

### Technology

Business intelligence is an evolving process, information needs change and therefore the tools should be able to adapt to them. That's why the *technical framework should be business-driven, scalable and flexible* to allow the BI tool to adjust to technical and business changes (Yeoh & Koronios, 2010).

As seen in the previous section, the technical architecture of the BI tool works with the default features of QlikSense. These features are not designed to evolve because each modification of a data source must be done manually. Furthermore, the use of the native QS file as a database greatly limits scalability as it is not designed to store a lot of data. Thus, if the tool were to evolve to integrate new needs, it would require a heavy workload to be manually adjusted, or even completely redone if the amount of data becomes too heavy. This would have been a problem in the long run because LuB's information needs are evolving with the digitalization of some of its activities and many developments would probably have been necessary. This could have caused problems with the current architecture.

This CSF was moderately addressed by the experts interviewed. However, one added that in the pharma context scalability and flexibility is important because medical data laws can change quickly, each sales data provider has different databases and commercial activity data is evolving rapidly as the sector has embarked on a rampant digitalization. The technical framework must therefore be able to adjust to these changes.

As the heart of BI lies in the data. The *data quality and integrity should be sustainable*, if not, then not it doesn't improve decision-making but worsens it. Moreover, errors in visualizations can reduce the confidence of end users in the data used by the company, which can lead to many inconveniences for management (e.g., if used for bonus calculation of a salesperson then he may seek to negotiate by questioning the quality of the data). This is why the data sources used by the BI tool should be evaluated and controlled (Yeoh & Koronios, 2010).

In order to verify whether the quality of the data used could have negatively influenced the BI implementation project in LuB, an assessment of LuB's data quality was performed using Sherman's 5C model (2015) in Table 4.

***Table 5: Evaluation of LuB data with Sherman's 5C model***

| Characteristics | Lundbeck Belgium Data |
|---|---|
| Clean | The data used in Lundbeck's applications are mostly purchased from a supplier who ensures their cleanliness. |

| | |
|---|---|
| Consistent | LuB uses only one database, so there is currently no risk of consistency |
| Conformed | There is a shared meaning around the data and users are familiar with the dimensions used. |
| Current | The data is very rarely delivered on time by our supplier. Moreover, the technical framework used obliges users to regularly update the master data, which entails the risk that this is done late or badly. |
| Comprehensive | As seen in the previous section, the data is compensated by an algorithm, its validity can be questioned but it is the data that is closest to the truth possible. |

The quality and integrity of LuB data have some shortcomings, particularly in terms of the frequency with which it is obtained from the supplier and the degree to which it matches the reality on the ground. This has a definite impact on the speed of decision-making, reporting and generates internal negotiations on the validity of the data. However, in the context of the pharmaceutical sector, it is the only way to obtain geographically located sales data. These minor problems are therefore relatively unavoidable, have a limited negative impact and cannot reasonably explain the failure of the LuB implementation.

There is a strong consensus among experts on the importance of data quality. They advise to always focus on the data sources first and to avoid thinking about visualization first because it is only a reflection of the quality of the source data. An expert explains that:

> *"There are a lot of companies that try to focus on how they are going to consume the data, but they do not spend enough time on preparing the data. At the end you have a nice consumption solution, a nice dashboard, but if your data is not correct... This is useless."*

The adequacy of the data with the reality of the field is also a point strongly addressed by the experts because the data itself is only a representation (often quantitative) of reality, so it is important that it does not lead to a misinterpretation of what is really happening. As stated firmly by an interviewee:

> *"For me the critical point is the quality of the data, but it must also give the big picture, it must cover what is really happening in reality."*

#### Non-Critical Success Factor

Another factor discussed related to BI technological aspect is the choice of the vendor. As seen in the literature review, scholars do not consider this factor as critical. The data from the expert interviews corroborates this statement. The experts who discussed this topic all agree that the choice of the tool has little influence on the success of the BI implementation. One expert insists:

*"There are specific advantages to Power BI, QlikSense, Tableau or other tools but it is never critical. For me what is critical is the quality of the data used."*

### Pharmaceutical Sector

Now that the CSFs already established by the theory have been tested in the LuB case study, the next sub-section will focus on exploring other critical success factors specific to the pharmaceutical sector that potentially have influenced the outcome of the BI implementation project at LuB. Since these CSFs are not present in the literature review, their description will be much more detailed than the previous ones.

The first CSF identified during this master's thesis is not specifically derived from the pharmaceutical sector per se but rather by the typical structure of pharmaceutical companies. The laws governing the pharmaceutical market are always different from country to country. To overcome this problem, these companies have adopted an organizational structure based on geography(Contractor et al., 2010). When a company wants to establish itself in a new country, it sets up a subsidiary that will adapt more easily to the local legal framework. At this point, it is not particularly different from other sectors, but it's the impact that these specific pharmaceutical laws have on the activity of these subsidiaries that will have a differentiating effect on the IS used.

Some IS are strongly linked to the activity of a company like CRM or BI because they measure the activity but are sometimes also directly part of the operational processes measured. BI is even more sensitive to these particularities generated by the laws of the sector because they directly affect the available databases. For example, in Belgium, a pharmaceutical company cannot legally own a doctor's sales data, but in the US it is legal.

These particularities limit the possibility for pharmaceutical headquarters to create a single BI tool that would encompass the business requirements of all their subsidiaries. Therefore, subsidiaries manage their own BI projects to meet their specific information needs. However, the head offices also need some data from the subsidiaries to feed their own BI tools and make decisions. Therefore, the head offices develop their own global BI strategy which consists of obligations and prohibitions for the subsidiaries' BI projects. Moreover, since BI is evolutionary in nature, changes in the direction of the headquarters' BI strategy can also heavily impact the subsidiaries' BI tools.

Therefore, in a BI implementation project in a pharmaceutical company, there should be a strong *alignment between the local and corporate BI strategy*.

At LuB, this factor had a strong impact on its BI implementation project because to align with Lundbeck's headquarters, LuB had to make significant choices. As described in the context of the case study, the BI strategy of the head office excluded the use of BI in Software as a Service (for data security reasons). In the case of LuB, which does not have the relevant technical knowledge to implement BI and does not necessarily have a lot of time resources to devote to it, the use of SaaS would have avoided certain problems and constraints (e.g., master data management).

LuB's project managers were particularly careful to stay in line with the headquarters' BI strategy. Obligations and restrictions were rigorously respected during the LuB BI project. However, it is very difficult for the subsidiary to follow the strategic vision of the headquarters because its BI department communicates very little to the subsidiaries and focuses on the corporate level. As the Country Manager explains:

> *"When you are in an international group, you have to take into account the dynamics of the group, the decisions, the coordination. It's important […] We need a vision, we need consistency and guidelines."*

Most experts discussed the importance for headquarters and its subsidiaries to be aligned on two points. On the one hand, on technical aspects in order to benefit from synergies between local and corporate systems and to avoid incompatibility. And on the other hand, on the business aspect so that the information gathered and used by the subsidiaries feeds the BI of their headquarters with the aim of creating value for the group. Another aspect that makes this a success factor is the risk associated with a misalignment of the two stakeholders. One of the interviewees states:

> *"A key aspect, especially for the big companies, is the alignment between the local needs and the corporate ones. [...] Be sure that you are aligned, because if not, maybe in one year someone will come from the corporate and then you will have to redo some things or worse."*

A recent out-of-bi but similar example at LuB is its CRM migration project, the kick-off meeting had been launched and the project was ready to move forward quickly. But due to a large and complex restructuring of the headquarters' database management, the project was postponed without a restart date. A project, no matter how good it is that conflicts with the strategy of the head office is probably doomed to failure.

An underlying factor that is constantly present throughout the case study is the specific <u>*knowledge of the pharmaceutical sector*</u>. As explained in the description of the case study, the pharmaceutical sector has many specificities such as its regulation, its organization and its available data. Aspects that can easily be linked to a BI implementation project. In most sectors companies know their customers and their turnover is based on contracts. In the pharmaceutical sector, the customer is unknown, as is the doctor who decides whether or not to prescribe. The only sales figures available are the warehouse outputs which give very little information about the sales situation. The company must therefore buy its own geographically located sales data from an external supplier. Data specific to the pharmaceutical sector which can be a source of problems as seen in the previous section.

Another aspect not developed in this case study but particularly important in the pharmaceutical field is patient data, which is subject to heavy legislation. An expert stated that when using this type of data in a BI architecture, it is necessary to create a specific database hosted on a server physically located in the country of the patient data.

A large part of the problems encountered in the LuB BI implementation project can be found in the visualization part of the architecture. In the previous section, the visualizations were factually described, the one of the BI self-service has tons of filters. However, after reviewing them, only a few are useful because the others filter the same data. Another recurring problem concerns the units of measurement of pharma, DOT & DDD. When the consultant created the graphs, there were many confusions, and some graphs were built on the wrong data. The same was true for some KPIs. For example, the consultant used LuB's hospital and retail sales data to calculate market share, but the company only has the retail sales of its competitors, which falsely inflated the market share of LuB products. This kind of error when the project was in its initial stages was perfectly acceptable, even if the project manager had trained the consultant beforehand. The problem is that this particular mistake was made at the end of the second contract after 18 months of collaboration.

Moreover, these errors can easily go unnoticed because the formula is not directly displayed in the visualization. In fact, most of the errors were detected because the end users had lost confidence in the applications and were checking the information generated by the BI tool in Excel. The two project managers of the LuB implementation identified the lack of knowledge of the pharma as one of the main reasons for the project failure. The country manager adds that:

> "They did not understand that the BI tool is a cornerstone of our business, their perception remained very theoretical and rigid due to their lack of competence in the tool and their lack of knowledge in pharma and its classical KPIs."

BI experts agree on the specificity of pharmaceutical data. However, where they are divided is on whether it is crucial or not. Some say that the differences are not that important but that it is still necessary to be trained in their specificities. For others, the differences in the pharmaceutical market and its data plays an important role in pharmaceutical BI. As one expert explains:

> *"I have always found working with pharma data more interesting than other sectors. It is one of the only ones where it is possible to have data on the whole market [...] There are many*

*additional insights that are very interesting in the pharmaceutical market. On the other hand, what makes pharma more difficult is that it's a very regulated industry."*

Another point raised by an expert is that experience in pharmaceutical BI also allows one to foresee specific potential problems as he claims:

*"I think it is important to find the necessary expertise in the required industry. For pharma, I would never recommend going, especially if it is a complex project, with a company that knows nothing about the industry. [When you are involved in the same type of project many, many times, you can foresee the types of problems that can happen and there will definitely be issues in a project."*

### 4.2.2 Assessing the Success of a BI Implementation Project in the Pharmaceutical Sector

***How to assess the success of a BI implementation in the pharmaceutical sector ?***

#### Technology as a measure of BI success

The most straightforward aspect of assessing the success of the BI implementation is to evaluate its technological components. The seminal model of DeLone and McLean (1992) states that this consists of two variables: the quality of the system (linkability, flexibility, availability, accessibility) and the quality of the information generated (accuracy, timeliness, completeness, relevance and consistency). There are many models that include questions to evaluate the different components of these technological variables by the users. The most seminal being, among others, the Delone and McLean model (1992) and Doll et al. model (2004).

In the case of LuB, only the availability and accessibility of the quality of the system and the relevance of the information quality were formally tested during the UAT carried out under the advice of the headquarters guidelines. The data check carried out by LuB before the release of the applications verified the consistency between the information in the old tool and the new one. The results obtained from these tests are fairly poor.

There is a very strong consensus among experts on the importance of testing the technological aspect during implementation and each time a new iteration of the tool is carried out. They add that testing should be repeated and not a one-time event before going into production. One expert considers that beyond the classic technical tests focused on system and information quality, it is also important to focus on the technical problems encountered. He explains:

*"Technically, if you have fewer issues than before, it is already a success because there will always be problems. So, you need a process that monitors maintenance."*

Another consensus on the topic is that despite the criticality of technical success, a project that succeeds on this level alone cannot be considered successful. One interviewee states:

*"How do you measure success ? You can have just the technical success: my application works […] But is that enough ? No, of course not. You have to take a look at how it is impacting your business."*

### Usage as a Measure of BI Success

Davis' Technology Acceptance Model (1989) states that if users perceive the application as easy to use and useful, then they will be more inclined to use it. Delone and McLean (2003) then adds that the quality of the service provided by the IT team to users also has a strong influence on usage intention. This frequency of use is therefore considered to be the measure of the success of the BI implementation.

The UAT conducted by LuB, measured the perceived ease of use and the perceived usefulness in a very broad way. Frequency of use is not measured for two reasons. First, it is difficult at LuB to obtain this measure. Currently, only the BI team at Lundbeck headquarters is able to measure the frequency of use of the LuB BI tool. So, the subsidiary has to ask every time they want to get the information. But that's not the main reason why it's not measured. Indeed, as the Country Manager stated, the BI tool is a cornerstone of LuB's business. Whatever happens, as long as the applications work, they will be used because they are part of several of LuB's core processes. This means that the frequency of use cannot be used to assess success for the management team users.

Nevertheless, small email interviews were conducted by the researcher with medical representatives to gather various insights including their frequency of use. They all use the application once a month. The main reason mentioned was the difficulty of using mobile BI applications on their Ipads.

Again, the experts almost unanimously agree that the acceptance of the BI tool by users can already be considered a success. One of the interviewees nuances and specifies that for him, it is necessary that beyond the acceptance, the user should really be happy to use for him to consider it as a success. They also add that it is important to frequently test user acceptance to react more quickly in case of deterioration. They point out that the frequency of use is the simplest and most effective way to measure this success.

On the link between usage and success, one expert explains that:

*“If what you have created is useful, then it must be used, no matter how often it is used, it must be used and continuously improved over time so that if you come back a year later, it will still be used. For me that would make a success […] Because in the past I did a project that was really good, we delivered it and the customer was happy. But after two months, they stopped using it […] For me then, that’s not a success.”*

There is also a strong consensus among experts on the impact that training has on user acceptance of the BI tool. They also agree on the impact that training has on user acceptance of the BI tool. Some experts note a particularity of the pharmaceutical sector in the training aspect. One explains that:

*"Here, in the pharmaceutical sector, as we provide BI solutions to people who are not used to it, we do a lot of training, which is a very important point. [...] In addition to the training, you can do a hyper care period where you are particularly attentive to feedback or requests for improvement."*

### Business value as a Measure of BI Success

There are many approaches to consider when it comes to measuring the business value of BI at the organizational level of an enterprise. This can be measured in terms of financial, project management, process improvement, achievement of specific information objectives, etc. In the end, the only clear consensus in this approach is that it is difficult to properly measure the success of a BI implementation project.

In the case of Lundbeck Belgium, it is almost impossible to effectively exploit sales data acquired from a supplier without a BI tool. Without this data, LuB would have no insight into its market, which would severely hamper all processes in its Sales & Marketing department. The ability of LuB's BI tool to provide a factual representation of the situation in the pharmaceutical markets where the company is present based on the acquired sales data could be considered the measure of its success at the organizational level. To some extent this is already the case, as mentioned in this thesis, the Country Manager considers BI as a cornerstone of his company's business but also of his own activities.

Experts all agree that the ultimate goal of BI is to support users' decisions to generate value. They also add that it is complex to measure the value generated by a data-driven decision. As explained by an expert:

*“You need to take a look at how is it impacting your business, and that's more difficult to to measure. [...] But what's better is checking: are there data driven decisions created out of your dashboard. Meaning do I use this to make or to change the decisions.”*

An interesting point raised by an expert concerns the positive impact that analytics-based user training can have on improving the processes targeted by BI, which ultimately leads to value creation for the company, he clarifies:

> “I think something that I'll a lot of companies are underestimating is the training, and training is not just to know how to access the solution. [...] This is not a training for me, with training I mean: How to use this? How to make your work better ,being more efficient with the time, planning your physicians calls in a more efficient way, having a better understanding of your competitors. [...] But focus on how to analyze, you can analyze with Excel or with a pen and paper probably but you need to know how to analyze and which kind of data you have to look at. […] So I think for these projects, something that is key is to train your users.”

# Chapter 5: Discussion

The presentation of the data for this master's thesis is now complete. Throughout this chapter, the results extracted from the data are analyzed. First, the key findings that allow the RSQs to be answered are presented, then they are described and justified in detail. Next, the academic contribution and managerial implications that can be derived from these findings are outlined. The limitations of this research are identified and a question that could not be supported by sufficient data is stated. Finally, the findings are transformed into practical recommendations for the case study company.

## 5.1 Key Findings

After 18 months of work, the BI implementation project at the pharmaceutical company Lundbeck Belgium failed. In order to understand this outcome and to draw lessons from it, this master's thesis attempts to answer the research question "How to successfully implement Business Intelligence in a pharmaceutical company?" To answer this question, it was first necessary to discover the critical success factors and methods for evaluating success in a BI implementation in the pharmaceutical industry, which formed each a research sub-question.

***RSQ 1: What are the CSFs of BI implementation in the pharmaceutical industry ?***

The data collected during the case study and the expert interviews suggest that the 7 general CSFs already established by the seminal research of Yeoh and Koronios (2010) could also be applied to the implementation of BI in the pharmaceutical sector. Moreover, two other CSFs were identified based on the data collected, namely knowledge of the pharmaceutical sector and alignment with the local and corporate BI strategy, related to the pharmaceutical sector.

***RSQ 2: How to assess the success of a BI implementation in the pharmaceutical sector ?***

The analysis of the data supports the theory on the presence of 3 main interconnected aspects of evaluating the success of BI implementation. While the data suggest that these aspects are applicable to the pharmaceutical sector, some particularities specific to the evaluation of BI success in this sector emerged from the analysis such as the questioning of the classical means of evaluation due to the complete integration of BI into business processes.

## 5.2 Interpretation of the Results

After the overview of the key findings in the previous subsection, the researcher explains the reasoning used to transform the data into findings for each of the two RSQs. This begins with the unsurprising results of applying theory to case data. Then, the new findings are explained and justified. Finally, when the result is surprising, it is explored in depth.

### *5.2.1 Critical Success Factors of BI Results*

There is a lot of research about the CSFs of BI implementation. The seminal framework developed by Yeoh and Koronios (2010) and which includes 7 broad CSFs that focus on more general aspects of success. They are therefore more likely to be generalized to many BI implementation cases. However, the authors tempered this by admitting that certain contextual elements such as sector could limit the application of these results.

This is why the first objective of this thesis was to verify whether these research results could be applied to the LuB case study and in the pharmaceutical sector. Not surprisingly, as with the study by Moflih et al (2020) which also took place in the pharmaceutical sector, the LuB case study data and expert interviews support the replicability of these CSFs in the pharmaceutical sector. The only CSF that was not strongly addressed by the experts was committed management support & sponsorship. This is probably due to the fact that the vast majority of the expert group is composed of consultants and therefore not very involved in the success factor.

Technology CSFs are considered the least important by Yeoh and Popovic (2016). However, the influence played by legislation and the particular data of the pharmaceutical sector on the technical aspect may alter this consideration. A tool that is unable to adapt to changes in pharmaceutical legislation would instantly set the BI project up for failure.

Applying these CSFs to LuB's case should have resulted in moderate success at worst. The majority of the problems came from the technical aspect (considered as the least impactful) and the failure of the CSF related to the scalability of the technical framework did not had time to strongly compromise the project. Since the failure experienced in the case study could not reasonably be explained by the already established CSFs, other factors should have had a critical impact on the outcome.

The data obtained from the expert interviews shed light on this gap in the scientific literature. Thanks to the analysis of the case study and the expert opinions, two CSFs related to the pharmaceutical sector were identified.

The first one, is the alignment between local and corporate BI strategy, it is strongly linked to the classical structure, based on national subsidiaries, of pharmaceutical companies. However, this relationship with structure limits its application to pharmaceutical companies that have a different structure, such as small or medium-sized enterprises. Nevertheless, this relationship can potentially allow this CSF to be applied to other sectors with a similar structure to pharmaceutical companies.

It can be considered as part of the organizational CSF. It is relatively close to the CSF clear vision & well-established case, as both emphasize a need for an alignment between BI and the strategic business vision for one and the strategic corporate BI vision for the other.

The second one is the importance of the specific knowledge of the pharmaceutical sector among the stakeholders. It can be considered as part of the process-related CSF level because it is strongly linked to the stakeholders and the implementation process. It is justified by the specificity of the laws that govern the pharmaceutical sector. These laws impact, among other things, the available data sources, a very sensitive point for BI.

Yeoh and Koronios (2010) emphasize the importance of being business-centric in BI, which is essentially the alignment between the business requirements and the IT aspect of the project. In the case of the CSF developed here, this goes beyond that in the sense that even if the technical team has incorporated the business requirements but is not able to understand in detail the specifics of the pharmaceutical data, then the visualization part for the end-users is likely to be flawed. This can lead at worst to decisions based on errors, at best to a loss of confidence in the data and thus the opposite of the goal of BI. The failure of this CSF added to the other issues of the BI implementation project at LuB can potentially explain the failure of the project.

### 5.2.2 Success Assessment of BI Results

The data collected on the measurement of the success of the implementation of BI among experts is based on three major aspects: technology, usage and business value. Similar to the scientific literature (e.g., W. DeLone & McLean, 2003; Doll et al., 2004).

Experts also suggest a relationship between these three aspects. The success of BI in the technological aspect drives the acceptance of the application among users, which leads to their use. Finally, the use of the BI tool can potentially lead to improved decision-making, then to business value generation and ultimately to overall success. This is also supported by the state-of-the-art analysis performed by Ain et al (2019).

However, something does not add up with the case study analysis. As seen in the previous chapters, the LuB BI implementation project is considered a failure. When the three aspects of measuring BI success were applied to LuB, it was found that technologically it is a failure, the application is not accepted but used, and finally it provides the information used to set the company's business strategy.

The explanation for the use is that despite the lack of acceptance and the technical failure, LuB is relatively obliged to own and use a BI tool. As explained earlier, pharmaceutical companies do not have access to their sales data unless they obtain it from a vendor. This data is in raw form and can, depending on the market, easily exceed millions of rows. The use of a BI tool to analyze this data efficiently is therefore essential for LuB, because without it, the company cannot decide on its commercial strategy, calculate the bonuses of the medical representatives and transmit the data to the headquarters.

In this particular situation, whether users perceive the tool as easy to use or useful, whether they accept it or not and how often they use it, is irrelevant to measuring the success of the BI tool. As long as the application is usable and functional, it will be used because users have no real choice. The only way to measure the remaining success is the business value generated by BI and its ability to meet business objectives. As the tool enables many of LuB's core processes, it is clear that it generates value for the company. <u>Shouldn't it therefore be considered a success rather than a failure?</u>

The quote from an expert posted in the previous chapter may provide an insight into the answer. He stated that:

> *"Focus on how to analyze, you can analyze with Excel or with a pen and paper probably, but you need to know how to analyze and which kind of data you have to look at."*

In a way, the data LuB purchases could theoretically be analyzed with several tons of paper, or a little more simply using Excel. This would still be less efficient than using LuB's current tool, despite its huge flaws. Since the purpose of the BI tool at LuB is to enable processes such as global strategy definition and reporting, one measure of its success could be the improved performance of these processes. Is the tool able to perform them faster than its previous version? Does it improve the outcome of these processes ? In the case of LuB, the answers are negative, which could explain why the management team considers the project a total failure.

The difference between the data from the case study and the scientific literature supported by the experts could be explained by the paradigm applied by the latter. In the literature, the focus is on the factors that lead to user acceptance and satisfaction which are the drivers of usage. The BI tool here is seen as optional because if the user is not satisfied with it, he will not use it. This vision seems to be shared by the experts as well, as one expert quoted in the previous chapter said, when one of his clients stops using the tool he implemented then the project is a failure.

The fact that the experts and the research reviewed do not take into account the situation where BI is already fully integrated into an organization's processes can perhaps be explained by the fact that this is not yet a very common situation. The special situation of the pharmaceutical sector, where accurate sales data is only available through an external provider and unlike other sectors not directly in the company's tool like an ERP or CRM, could also be an explanation for the lack of scientific literature because research on BI in the pharmaceutical sector is still very rare. However, there is not enough evidence to explain at this point whether LuB's situation is due to its status as a pharmaceutical company or to its own management.

In the classical case where BI is not yet fully integrated in the internal processes of the company and necessary to achieve them, the technological aspect, usage and business value should be measured together and regularly. Their results should allow considering a project as successful.

In the opposite case, there is very limited data to clarify the issue. The hypothesis developed in view of this meager evidence would be that success should be measured on the impact of BI on the processes where it is integrated. This master's thesis cannot answer this question without further research.

## 5.3 Implications

The academic contributions and managerial implications of each of the two research questions are described in this section. It outlines how the results of this study have contributed to existing knowledge and the practical applications that the findings may have for the pharmaceutical industry.

### *5.3.1 CSF Implications*

This master's thesis contributes to the scientific literature on the topic of CSFs in BI implementation by replicating the findings of Yeoh and Koronios (2010) in the context of the pharmaceutical sector. The literature review highlights the existence of a gap on CSFs specific to BI implementation in the pharmaceutical sector. This research shed light on the topic by identifying two new CSFs specific to this sector and in this way contrasts with the study of Moflih et al. (2020) who did not discover any new CSFs specific to pharma using a quantitative method.

These findings provide insight for pharmaceutical companies wishing to implement a BI tool. Indeed, as stated by Yeoh and Popovic (2016), CSFs can be considered as good practices for BI implementation.

Thus, by exporting the already established CSFs and adding two specific ones in the pharmaceutical sector, this master's thesis provides the best practices specific for BI implementation in the pharmaceutical sector. Implementing a BI tool in a pharmaceutical company in the light of these best practices could allow these companies to avoid wasting their resources on irrelevant elements and to focus on the essentials in order to maximize their chances of success.

### 5.3.2 Measure of Success Implications

The research conducted on the evaluation of the success of BI implementation has examined the various theories already established on the subject in the context of the pharmaceutical sector. Part of the data, especially from pharmaceutical BI experts, corroborates the scientific literature. The analysis of the data from the case study did not fit with the theory or the other data recovered. This leads to the discovery of a gap in the scientific literature related to measuring the success of BI implementation in companies that have already integrated BI into their processes.

The specific findings reported in this master thesis are insufficiently backed up by evidence to make practical managerial recommendations to pharmaceutical companies.

## 5.4 Limitations and Unanswered Question

All studies have limitations, whether they stem from methodology, subject specificities, uncontrollable variables or the sample studied. This master's thesis is no exception, therefore the limitations identified and the measures taken to mitigate them (when possible) are described in this section. An unanswered question raised by the results obtained in this research is also presented.

The use of the case study as a research method allows one to dive deeply into a phenomenon. The counterpart of this deep analysis is that the specific context in which it is carried greatly limits the generalization of the results obtained. To overcome this limitation experts were interviewed but the LuB case study remains the focus of this master's thesis. The results obtained in this study should therefore be validated by further research before they can be applied to other companies in the pharmaceutical sector.

Another limitation concerns the population sample used. They are all experts in BI in the pharmaceutical sector, which made it possible to collect very oriented opinions on this subject. But the absence of non-industry BI experts in the sample makes it difficult to identify aspects specific to the pharmaceutical sector. In order to mitigate this issue, the subject of specificity was discussed during the interviews.

Finally, Business Intelligence is an information system that is constantly evolving, and more and more companies are integrating it into their operational processes. The results obtained in this research are therefore rooted in the temporal context in which this study was conducted, which potentially limits the applicability of these results after an undetermined period of time.

Finally, although elements of answers were found for RSQ 2 in "classic" BI implementation cases, the difference between the data of the case study and the theory supported by the experts raises many new questions. In particular:

> *How to evaluate the success of a new BI implementation in a company where BI is an integral part of the processes ?*

The pharmaceutical industry variable is not included in this question because even though there is some evidence pointing to a link, it is not sufficient to demonstrate it.

## 5.5 Practical Recommendations

In this section, the findings discovered during this research will be translated into practical recommendations so that Lundbeck can take advantage of them to successfully implement its next iteration of business intelligence. First, the results of its project will be analyzed in light of the 9 CSFs discussed in this research. The factors that failed during the implementation will be interpreted in order to transform them into guidelines. Finally, a suggestion is formulated on how to approach the evaluation of the success of the BI implementation taking into account the particular situation of LuB discovered during this case study.

### *5.5.1 CSF as Guidelines*

Yeoh and Popovic (2016) consider that the CSFs are in fact the theoretical form of practical guidelines, this perspective is embraced here in order to advise Lundbeck Belgium. The experience gained from the project studied in this research can be used so that LuB can conduct its next iteration of BI successfully.

Table 6 shows the results of the studied project in the light of the 9 CSFs identified. The factors that failed can be used as a basis for recommendations so that they can be fulfilled in the next iteration.

***Table 6: Evaluation of Critical Success Factors in Lundbeck Belgium***

| BI Critical Success Factor | Lundbeck Belgium results |
|---|---|
| Committed management support & sponsorship | Successful |
| Clear vision & well-established business case | Successful |
| Business-centric championship & balanced team composition | Partially successful |

| | |
|---|---|
| Business-driven & iterative development approach | Successful |
| User-oriented change management | Successful |
| Business driven, scalable & flexible technical framework | Failed |
| Sustainable data quality & integrity | Partially successful |
| Alignment between local & corporate BI strategy | Successful |
| Knowledge of the pharmaceutical sector | Failed |

In the light of the results obtained in Table 6, the following can be observed: 2 of the CSFs are partially fulfilled and 2 others have failed.

The CSF business-centric championship & balanced team composition was partially met because the team that worked on the LuB BI implementation project was not really balanced. LuB had its business-centric champion in the person of the Country Manager. On the consulting side, all the work was done by a business analyst, whose traditional task is to bridge the gap between the client's business requirements and the technical side, which means that no technical specialists worked on the project. The consequences of this breach can be directly observed on the technical CSFs.

In the future, LuB should ensure that the consulting firm that will be in charge of its next BI iterations always uses a team composed of at least one business specialist and one technical specialist. On the one hand, this will avoid LuB having to deal with technical aspects like during the project under study, on the other hand, it will improve the architecture of the BI tool and perhaps avoid problems in the technical CSFs.

The failure of the CSF business driven, scalable & flexible technical framework can be attributed to two reasons. First, because of the semi-failed CSF described in the previous paragraph. But mostly because of the design choice of the architecture made by the consultant. Using QlikSense integrated tools reduced the costs for LuB, but also strongly limited the flexibility and scalability of the BI tool. Yet it is a tool that is expected to evolve constantly. Especially since, as seen in the description of the case study, the upcoming digitalization of some of LuB's activities may lead to new information needs.

In the next project, LuB could greatly benefit from the creation of a true data warehouse dedicated to all its data. This would meet the criteria of scalability and flexibility because there would theoretically be no limit to the size of the data stored and the addition of new data sources would be greatly simplified in the BI tool. Moreover, the data warehouse, although included in the BI architecture, can be used on its own, which means that when a BI tool needs to be changed, all the contributions of the data warehouse are preserved.

There is little to say about the partial success of the CSF Sustainable data quality & integrity, it is strongly related to the data situation in the pharmaceutical sector. Consider switching vendors to address some of the issues with the regularity of data delivery. Choosing a consulting firm that specializes in pharmaceutical BI can potentially improve this situation as they are supposed to be familiar with this kind of issue.

This leads to the last problematic CSF knowledge of the pharmaceutical sector. As seen throughout this master's thesis, the pharmaceutical sector has many particularities that influence the implementation of BI in companies. The data uses specific units, is created with algorithms, is only available from suppliers, etc. This is probably the CSF that has had the worst negative impact on the LuB project, as most of the problems identified in the application visualizations stem from the consultant's misunderstanding of the data and how the sector works. These repeated errors in the information transmitted by the BI tool gradually undermined the confidence of LuB members in the data and ultimately led to the failure of the implementation.

Engaging the services of a consulting company specialized in the pharmaceutical sector avoids some of the pitfalls specific to the sector and saves LuB from having to train the consultants extensively in the pharmaceutical business. This saves LuB time while potentially ensuring a better BI tool tailored to the specific needs of the pharmaceutical sector.

### 5.5.2 BI Tool Performance as a Measure of Success

As seen previously, the findings in measuring the success of BI implementations are hardly applicable to the case of LuB. However, the hypothesis can be formulated that the best way for LuB would be to focus on the performance of the tool to drive the processes in which it is involved.

Thus, when LuB can test its future tool, instead of relying on traditional measures such as UAT, frequency of use, perceived ease of use, or perceived usefulness, etc., it might be more relevant to compare the performance of the two tools in fulfilling their role in the processes. For example, by organizing practical scenarios in which the user must perform an analysis using each of the tools in order to compare which performs better using simple criteria such as the quality of the analysis, the time taken to perform it, etc. This would allow testing the new tool but also to get used to it faster.

# Chapter 6: Conclusion

This chapter concludes this master's thesis by reintroducing the research problem and summarizing the key findings that helped answer the problem. It also presents the contributions to the theory and the insights provided to improve the managerial practice. Finally, the limitations of this master's thesis are discussed and suggestions for future research are made to overcome these boundaries to continue building on this research topic.

## 6.1 Contributions

Achieving success in BI implementation is a difficult task that many companies are failing at. This failure case study has shed light on two major points of BI success in the pharmaceutical sector: the CSFs that influence the success of the implementation and the measurement of its success.

This research generalized the seven broad CSFs to the pharmaceutical sector. It then provided evidence of the existence of two CSFs specific to the pharmaceutical sector: local and corporate BI strategy alignment and pharmaceutical sector knowledge. This enables the existing common guidelines for BI implementation to be adapted to a pharma-specific version of the best practices in BI implementation.

This master thesis provided evidence that the technical, user acceptance and value generation aspects in the pharmaceutical sector can be used as a measure of success if the company has not already integrated BI into its core processes. These findings help to identify weaknesses in the BI tool in order to improve it.

Finally, the answer to the question:

***How to successfully implement a Business Intelligence solution in a pharmaceutical company?***

Should look like this:

If a pharmaceutical company wants to successfully implement BI, it should first focus on fulfilling the 9 CSFs identified in this research. It should then evaluate its BI tool on the technical aspect, the frequency of use and the business value it generates to identify the potential issues and solve them.

If BI is already integrated in its processes, the evaluation should focus on the impact of the new BI tool on the outcome of these processes.

## 6.2 Limitations and Future Research

The case study approach greatly limits the possibility of generalizing the findings to other contexts. Therefore, developing other case studies in the pharmaceutical sector could allow, if there is a concordance, to transfer the results to other situations.

The two pharma-specific CSFs were conducted using a qualitative method, so it is difficult to conclude that they apply to the entire sector. Quantitative research on a larger sample that includes these two CSFs could, depending on the results, validate them. Another possibility would be to conduct quantitative research using a control group of non-pharma companies and a group of pharmaceutical companies to verify whether the two CSFs are specific to the pharmaceutical sector or generalizable outside of it (the CSF knowledge of the pharmaceutical sector should be standardized to sector knowledge).

Finally, measuring the success of BI in a company that has already integrated it into its processes should be further explored through additional qualitative studies to determine if traditional measurement methods can still assess the success of the implementation. Quantitative studies could determine if the integration of BI into processes has an impact on the success of future implementations.

# Chapter 7: Internship Reflective Report

*Note: this chapter is not related to the research conducted in the master's thesis.*

The main purpose of this reflective report is to critically reflect on the learning outcomes that have emerged from the two years of internship experience at Lundbeck Belgium (LuB). During the two years of internship, many activities and projects were undertaken. They have obviously generated knowledge and skills, but on a derisory scale compared to the two major projects, which encompassed several activities, entrusted to the student. This reflective report focuses on these two projects that not only shaped the internship through their importance, but above all carved out the student's professional future.

The first part of this report describes and briefly justifies the choice of Kolb's reflective framework used to structure the presentation of the two projects that are addressed in this chapter.

The second part of the report focuses on the two experiences chosen by the student to illustrate and demonstrate the skills and knowledge gained during this internship.

Finally, the third part concludes this reflective report by summarizing the key learning and explores the future perspectives stemming from the internship.

## 7.1 Reflective Model and MSMA competency framework

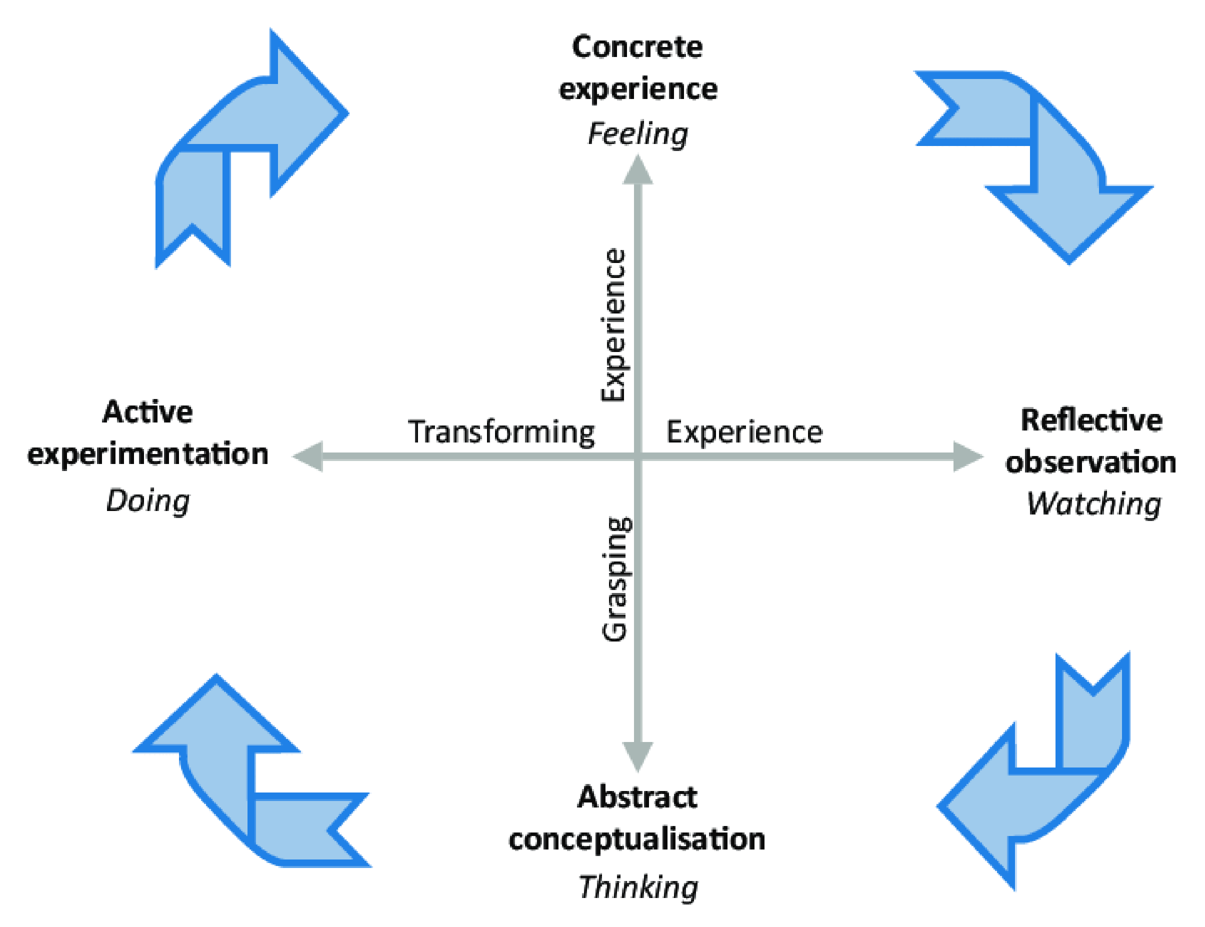
### *7.1.1 Reflective Model*

Kolb's (1984) framework illustrated in Figure 1 is generally used in educational management to describe the process of transformation of an experience into learning (Vince, 1998). This process is divided into four stages, the experience, the reflective observation, the abstract conceptualization and the active experimentation.

In the case of this report, this translates into the description of the project, the personal critical reflection of the outcomes of the project, the skills and knowledge acquired and finally the assessment of the relevance of these learning for a future Sales Manager.

This framework is used because, on the one hand, its process coincides with the stated objectives of this chapter and, on the other hand, it allows to illustrate the structure followed to describe the two projects discussed.

*Figure 1: Kolb's Learning Cycle*




## 7.1.2 MSMA Competency Framework

The strategic vision of a business manager as envisioned by the MSMA is built around five categories of key competencies. These are described and illustrated in detail in Table 1.

This framework will make it possible to anchor the skills and knowledge acquired by the student during the internship in a reference system that will allow him to prove that his learning is in line with the strategic vision of a business manager.

***Table 1: MSMA Competency Framework***

| Category | Skill and Knowledge |
|---|---|
| **Strategy** | **Establish a marketing, sales and customer-oriented strategy to optimize the value chain of a company, an organization or a project:**<br>• Analyze the context of the different functions of the company<br>• Take into account the economic, geographical, sociological and competitive context<br>• Take into account the national and international legal constraints that apply to it |
| **Implementation** | **Implement the commercial management of a company, organization or project:** |

| | |
|---|---|
| | • Implement the business strategy established for the company, organization or project<br>• Develop a holistic approach, being attentive to the interactions between its various functions<br>• Take advantage of the specificities of an increasingly digitalized environment<br>• Integrate effectively into the work of a multidisciplinary and international team, especially in the position of leader<br>• Analyze the critical and ethical aspects of its business practices |
| **Monitoring** | **Implement performance and commercial quality control within a company, an organization or a project:**<br>• Use the appropriate dashboards |
| **Communication** | **Communicate effectively about his/her company, organization or project, both internally and externally:**<br>• Express oneself in at least three languages, including English (minimum B2)<br>• Take into account the specificities of a multicultural and international environment in his/her communications<br>• Mobilize the attitudes and relational skills and the appropriate communication/animation techniques |
| **Adaptability** | **To adapt its managerial practices to the needs of a constantly changing world:**<br>• Identify the societal, economic, political and environmental issues related to its context and practices<br>• Apply a critical perspective based on scientific rigor at the university level in their analyses<br>• Use creativity techniques<br>• Develop one's expertise in the logic of continuous training. |

## 7.2 Projects as a Source of Learning

In this section, for each of the projects, there will be a justification of the choice, a description, a critical reflection, an analysis of the skills and finally their transposition into learning relevant to management practice using the MSMA competency framework.

### *7.2.1 Business Intelligence Management at Lundbeck Belgium*

Obviously, it was inconceivable to produce a reflective report based on the acquisition of skills and knowledge without addressing the Business Intelligence (BI) implementation project at LuB. This project was included in this report for many reasons. First, it is the first project the student has been involved in and it will also be the last one before the end of the internship. Next, the skills and knowledge obtained during the conduct of this project are, on the one hand, relatively rarely gained during a management internship and, on the other hand, more and more important for sales managers. Then, because it is the project that occupied the most time of the student. Finally, because all the difficulties encountered during its conduct and its negative outcome have been a source of many lessons.

### Description

Before describing the project, it is important to define BI:

> *"Quality information in well-designed data stores, coupled with business-friendly software tools that provide knowledge workers timely access, effective analysis and intuitive presentation of the right information, enabling them to take the right actions or make the right decisions."* (Popovič et al., 2010)

The goal of this project is the implementation of a new BI tool for LuB and to get rid of the old one which was outdated and to benefit from the advantages of a more modern one. A consulting firm was hired to build this new tool. As mentioned earlier, the student's involvement in this project started right at the beginning of his internship when the implementation project was still in its initial stages. The student's first activity was to learn how to use the BI software QlikView (the old one) and QlikSense (the new one).

After this training, the student took part in the implementation project, his first objectives were simple, to test the data, the tool and to have some meetings with the consultant in order to solve minor problems. In parallel, the student started to perform his first sales analysis using the BI tool. Soon, Lub's management entrusted him to analyze the results of the salespeople, to establish a local sales strategy based on the analyses and to start presenting the results during the monthly national sales meetings. These activities continued until the end of the internship.

As for the implementation project, despite the efforts of the student and the LuB management team, the situation gradually deteriorated. There was a glaring gap between LuB's business requirements and the result provided by the consulting company. In addition, communication with the consultant was becoming increasingly problematic as there was a lack of understanding between the two companies. To try to solve this problem, the student trained more in BI in order to be able to improve the collaboration with the consultant and to identify the technical problems more quickly encountered. This was not enough and the project failed.

### Critical Reflection

The failure of the LuB's BI implementation project is relatively simple to figure out. What is difficult to understand is how LuB or the student could have at least improved things. In hindsight, the attempt to solve the communication problems with the consultant by training on technical aspects was not the most relevant idea. In a way, the project was probably doomed to fail sooner rather than later. The best solution would have been to assess the project's chances of success more quickly. This way, LuB could have given up and started again, learning from its initial failure. Financial resources would have been lost regardless, but the company would have saved time and human effort.

In retrospect, it was a rewarding experience but also a trying one for the student who had to digest the fact that the first major project he was involved in ended in total failure.

### Skills and knowledge

The opportunity to be trained in BI and to participate in this project was invaluable to the student. First, it allowed him to learn how to use this type of tool that is becoming increasingly integrated into business processes (Järvinen, 2014). Second, the utility of this tool for LuB is to perform sales analysis, so the student was trained in analysis by his manager. This trained his analytical mind and made him adhere to a data-driven culture. The student was then tasked with making presentations of the sales results to the rest of the company at national meetings. This has allowed him to become accustomed to speaking for a large audience and to continually improve his ability to convey a message through a presentation. Finally, the participation in the project, beyond the experience gained in communication, collaboration with a partner and project management, also allowed the student to learn how to manage crisis situations in a company.

### Learning for Sales Management

In order to link the learning gained from this project to the strategic vision of a business manager. These learning will be reviewed under the relevant categories established by the competency framework in Table 1.

The student's strategic competence benefited greatly from his immersion in business intelligence and sales data. After being trained in the specifics of the pharmaceutical business and its data, the student was able to begin analyzing and then defining business strategies at the local level.

The implementation skills of the student have been nurtured by the sales strategy presentations which was aimed at implementing a more data-driven strategy among sales representatives.

The monitoring of the results skill which represents the ability to control business performance was also highly developed through the use of BI and its dashboards.

The communication skills of the student are called upon on a daily basis, especially when he presents the sales results. Indeed, LuB is a trilingual company, so the use of English, Dutch and French is required during each meeting, sales presentations included.

Finally, the student's adaptability was put to the test during this project because most of it took place during the pandemic. The situation pushed the student to grow in autonomy, but this did not prevent him from developing his curiosity and his desire to learn, on the contrary. As explained previously, the student does not hesitate to train himself in order to face issues.

### *7.2.2 Initiation of an Omnichannel Strategy*

This project has a particular importance for the student because it is his first big project in total autonomy. Moreover, it integrates many different but complementary activities carried out by the student. For this reason, this project has been included in this reflective report.

#### Description

As with BI, it is necessary to at least define what the omnichannel strategy is before starting the project description. Omnichannel can be defined as:

> *"Synergistic management of the numerous available channels and customer touchpoints, in such a way that the customer experience across channels and the performance over channels is optimized."* (Verhoef et al., 2015)

Omnichannel is therefore a marketing strategy, often involving digital channels. This is a long-term strategy, which is developed over many years and therefore includes many sub-projects.

The first activity of this project started when the student was asked, in complete autonomy, to allow the company to send e-mails to its customers (who are doctors). The goal was to enable the e-mail communication channel for LuB. Prior to this, it was necessary to find an efficient way for the sales representatives to collect the consent of the doctors to the mailing. The student therefore sought advice from the digital marketing specialist of the French subsidiary. He trained him on a new tool especially dedicated to the creation of forms. Everything was ready to start the collection and to activate the communication by e-mail. And finally, the student experienced for the first time the classic problem of change management: resistance to change.

Prior to the pandemic, all LuB activities were in physics. The sales reps were not used to digital, and they did not particularly like it either. So, the student had to cooperate with them (because it's their responsibility to ask for consent) in order to carry out a project that they perceive as leading to inconvenience for them.

The second part of the project was done in collaboration with the medical-scientific manager of LuB. The goal was to implement a website, created by the head office, especially dedicated to doctors. The student's role was first to settle some technical aspects, in particular to get an identity verification module from an IT provider, because only doctors had to be able to access this site. The student, with the help of an expert from headquarters, negotiated the contract with the IT provider and the site was launched. Finally, the student is in charge of analyzing the marketing data generated by the site and monitoring the result.

Finally, the student participated in a simulation involving several European subsidiaries of Lundbeck whose goal was to train employees in the integration of the omnichannel in their subsidiaries. This resulted in two types of activities for the student. The first is to develop segmentation based on customer preferences with the existing data he collects on marketing channels. The second is to generate support for the project and to communicate regularly on the progress during national sales meetings.

### Critical Reflection

The most interesting and complex aspect of this project is the change management of the sales representatives. At the beginning, the student status was perceived as a handicap to drive the change because of the lack of authority and legitimacy that was linked to it. But it turns out that this was a misperception. With hindsight, this particular status can even be considered as an advantage to drive the change smoothly. Because the lack of authority meant that the sales representatives did not perceive the change as a forced imposition and that the activities carried out with the student for this project were seen as collaboration. The aim of acting with patience during this project was also to not rush the delegates and to make them adhere gradually to the project by communicating regularly with the help of scientific evidence and market studies collected by the student. If this were to be done again, the student would need to communicate with quick wins more regularly to show the progress of the project and create excitement.

### Skills and knowledge

Change management was at the heart of this project, and skills such as managing expectations, generating support, and reducing resistance to change were acquired in this area.

Then, project management was also a part of the experience. The student was able to manage the project independently and therefore create his own schedule and determine the necessary activities. He also learned to communicate his progress to the stakeholders.

The nature of omnichannel has also allowed us to progress in the field of marketing in skills such as marketing analysis, the creation and implementation of a marketing strategy and the management of digital marketing tools like Google analytics.

### Learning for Sales Management

This project allowed the student to establish on his own a marketing strategy taking into account the legal aspects and the context of the pharmaceutical sector.

The strategy was implemented throughout the internship, taking into account the different interactions with the stakeholders.

The results obtained during this project were regularly monitored by the student. In particular by the use of a dashboard created by the head office.

These results were then regularly communicated in the 3 languages of LuB to the company's team.

Finally, the student had to show adaptability because this project was totally managed in autonomy by the student, he used critical thinking, autonomy and training by himself throughout the project.

## 7.3 Conclusion

As seen throughout this reflective report, the student was able to take part in ambitious projects that allowed him to acquire a great deal of diverse skills and knowledge related to the strategic vision of a business manager.

On a personal note, an additional reason for choosing these two projects is the passion it triggered in me for the field of Business Intelligence and Digital Marketing. I have been trained in all aspects of the Sales Manager's activity but in the end, it is these two related activities that I intend for my future career.

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