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Development of Data Reporting

Case Finnish Olympic Committee, Sports Academy Program

Thesis
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Thesis abstract

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Supervisor: Kimmo Kulmala

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The aim of this thesis was to develop an internal reporting system for the Finnish Olympic Committee by creating a Microsoft Power BI file and a guide for its usage. The objective was to create a reporting model that would assist decision-makers in making decisions based on cloud service data. The final outcome, the Microsoft Power BI file and its usage guide, has been delivered to the commissioner. Attached to this thesis, there is a guide to the created Microsoft Power BI file.

The Microsoft Power BI file was created based on Excel files provided by the commissioner. The Excel files contain confidential information, and the outcome of this thesis was not published. The data used was obtained from the commissioner in March 2023. During the spring and again in the fall of 2023, the author of the thesis focused on consolidating all the data into a single Microsoft Power BI file.

The commissioner has approved the thesis in its entirety. Based on this functional thesis, the Finnish Olympic Committee is now capable of viewing desired information more quickly and clearly. The created Microsoft Power BI file helps decision-makers assess and review desired information at the moment of decision-making. While working on this thesis, it became evident to the author how essential it is to leverage current technology. Artificial intelligence is likely to play a more significant role in the future when business managers or other decision-makers make decisions.

[1] Keywords: Business Intelligence, data visualization, Microsoft Power BI, reporting

SEINÄJOEN AMMATTIKORKEAKOULU

Opinnäytetyön tiivistelmä

Tutkinto-ohjelma: International Business

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Tämän opinnäytetyön tarkoituksena oli kehittää Suomen Olympiakomitean sisäistä raportointijärjestelmää luomalla Microsoft Power BI -tiedosto ja opas sen käyttöön. Tavoitteena oli luoda raportointimalli, joka auttaa päätöksentekijöitä tekemään päätöksiä pilvipalvelun datatietojen perusteella. Lopputulos, Microsoft Power BI -tiedosto ja sen käyttöopas, on toimitettu toimeksiantajalle. Opinnäytetyön liitteenä on opas luotuun Microsoft Power BI -tiedostoon.

Microsoft Power BI -tiedosto luotiin toimeksiantajalta saatujen Excel -tiedostojen perusteella. Excel -tiedostot sisältävät luottamuksellista tietoa, eikä tämän opinnäytetyön tuotosta tulla julkaisemaan. Käytetyt tiedot saatiin toimeksiantajalta maaliskuussa 2023. Kevään 2023 ja jälleen syksyn 2023 aikana opinnäytetyön kirjoittaja keskittyi tuomaan kaikki tiedot yhdeksi Microsoft Power BI -tiedostoksi.

Toimeksiantaja on hyväksynyt opinnäytetyön kokonaisuudessaan. Tämän toiminnallisen opinnäytetyön perusteella Suomen Olympiakomitea kykenee tarkastelemaan haluttuja tietoja nopeammin ja selkeämmin. Luotu Microsoft Power BI -tiedosto auttaa päättäjiä arvioimaan ja tarkastelemaan haluttuja tietoja päätöksentekohetkellä. Tätä opinnäytetyötä tehdessään kirjoittajalle selkeni, kuinka olennaista on hyödyntää nykyteknologiaa. Tekoäly ottanee tulevaisuudessa isompaa roolia, kun yritysjohtajat tai muut päätöksentekijät tekevät päätöksiä.

[1] Asiasanat: Business Intelligence, datan visualisointi, Microsoft Power BI, raportointi

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Terms and Abbreviations

DAX	The formula expression language known as Data Analysis Expressions (DAX) is utilized in Excel's Power Pivot, Analysis Services, and Power BI. For performing complex computations and queries on data in associated tables and columns of tabular data models, DAX formulas comprise functions, operators, and values. (Micosoft, 2023a)
OLTP	The quick, reliable data processing that underpins ATMs, online banking, cash registers, e-commerce, and a plethora of other services we use on a daily basis is made possible by OLTP (online transactional processing). (IBM, n.d.)
SQL	A relational database's structured query language (SQL) is a programming language used to store and process data. (AWS, n.d.)
AI	Artificial intelligence (AI) is the capacity of robots or computers to carry out functions often performed by intelligent beings**.** (Copeland, 2023)

1 INTRODUCTION

The topic of this thesis is Development of Data Reporting, Case: Finnish Olympic Committee, Sport Academy Program. This thesis includes theoretical part and functional part. All the data of this thesis is confidential and will not be published. Data was got from commissioner. There were seven different Excel spreadsheets full of information. This data was downloaded from Urheilijan Pulssi tool by commissioner. Urheilijan Pulssi tool involves general information about the sports academy training centres. Data was delivered to Microsoft Power BI software. There are different tables where all the necessary information is easy to reach in Microsoft Power BI.

The student is obliged to delete the data material from his devices and cloud service after the thesis has been delivered to the commissioner and accepted by them. This thesis will be uploaded to Theseus without restricted data. The commissioner will receive the thesis with the result including restricted data.

The thesis is important because Finnish Olympic Committee (FOC) suggested the topic. With the result of this thesis, Finnish Olympic Committee can develop their reporting system and make information-based decisions easier. The thesis is up to date, because taking to action today's technology which gives a possibility to gather information into the same place and it can be view by one look. The result gives chance to create future implications with IT professionals. Looking at the big picture, developing reporting habits is a timeliness topic.

This thesis has eight different main headings. First there is an introduction which includes basic information about the thesis and its structure. This section is followed by a theoretical part. The theoretical part is divided into several parts, which allows the reader to read and follow the theoretical information more easily. There is section which contains information about the sports markets in generally. One chapter is about the management of reporting, followed by the basic information about the used software. In addition, there is some general information about functional theses. Lastly, there are chapters presenting the result and conclusion. There is also a chapter for suggestions for improvement.

1.1 Purpose and Objective

The purpose of this thesis was developing internal reporting system to the Finnish Olympic Committee by creating a Microsoft Power BI file and a guide to how to use it. The objective is to create a reporting model, which helps decision makers to do decisions based on a cloud service data information.

1.2 Commissioner

The commissioner of this thesis is the Finnish Olympic Committee (FOC) which is recognized by the International Olympic Committee in 1907 (Finnish Olympic Committee, 2021). The FOC is committed to complying with the provisions of the Olympic Charter, the anti-doping regulations of the World Anti-Doping Agency (WADA) and the decisions of the International Olympic Committee. The purpose of the organization is to promote exercise and sports for the entire life cycle, from everyday physical activity to the sharpest elite sports. It develops and protects the Olympic movement in Finland in accordance with the Olympic Charter and decides and takes care of Finland's participation in the Olympic Games. The purpose of the non-profit organization is to strengthen the civic activities of sports and to promote and develop Finnish elite sports and its operational possibilities. One of the most essential tasks is to strengthen the social status of sports culture. Without forgetting to support in the best possible way the versatile activities of its members and regional organizations and these members and the people who work in these organizations. In addition, the Finnish Olympic Committee represents Finnish sports organizations in the national and international activities of its area of responsibility. National registered associations whose main purpose is the promotion of exercise, elite sports or other sports can be accepted as full members of the organization. Each species can be represented in the organization by only one species union.

According to Itani and Tienari (2020, p. 25), the Finnish Olympic Committee is an essential operational model in Finland. Through effective leadership, it can facilitate high quality and cost-effective cooperation among elite sports, sports in general, and physical activity. However, at the same time, individual sports federations should have better opportunities to specialize in the realms of elite sports and recreational physical activity. At the club level,

efforts should be concentrated on strong and vibrant "central clubs" in cities and regions, and these should be further enhanced. Collaboration between these central clubs and smaller clubs should be supported. To a certain extent, centralization is beneficial. In the country with a small population like Finland, every talent should have the opportunity to access high quality coaching early on. The groundwork and nurturing of talents require both voluntary and paid personnel, which justifies resource consolidation.

Itani and Tienari (2020, p. 24) write about elite sports and its operational structure. The elite sports unit of the Finnish Olympic Committee leads and coordinates the activities of the Finnish elite sports network. Together with the individual sports federations, this unit is responsible for long term success. It also manages the allocation of resources related to finance, expertise, and facilities within the network and promotes the dissemination of a collaborative approach to operation.

1.2.1 Sports Academy Program

According to Finnish Olympic Committee (2020), the sports academy program brings together local, regional, and national sports academies and training institutes. The starting point is an athlete-oriented approach, in which all measures and solutions are generated from the athlete's and team's training demands. FOC also emphasizes the "best with the best" operational approach, in which the finest athletes practice together on the basis of continual improvement, under the best coaching, and under the best circumstances. The Olympic Committee's Top Sports Unit maintains the top sports network and is responsible for long term top sports success, in collaboration with the sports organizations and the network. The sports federations are in charge of their respective sport’s competitive activities, the growth of top sports activities and coaching, and the sports worldwide outcomes.

1.2.2 Urheilijan Pulssi Tool

According to Finnish Olympic Committee (2019), the Olympic Committee acts as the data controller for the data of athletes involved in the development and support processes of the top sports unit, which are processed using the Urheilijan Pulssi tool. This includes

athletes, their coaches, and other members of the coaching team. Additionally, other individuals responsible for coaching within sports federations are also covered.

The Competition and Elite Sports Research and Development Foundation can generate summary information from the data entered into the tool on behalf of the Olympic Committee and/or sports federations. This information is used to support the development efforts of both the Olympic Committee and sports federations. Furthermore, this data is employed in the planning, execution, assessment, and management of registrar operations. For statistical and research purposes, the information is used without personally identifying the data subjects. It may also be included in official reports to third parties. In all cases, personal data protection and relevant legislation are strictly adhered to, and data is typically not disclosed to external parties in a form that would allow for the identification of individual data subjects.

1.2.3 Sports Federations

According to Finnish Olympic Committee (2023), there are 49 different sports federations who use Urheilijan Pulssi tool. Below (Table 1) you can find a table listing all these 49 federations.

Table 1. Sport Federations who use Urheilijan Pulssi tool. Finnish Olympic Commitee (2023).

Sport Federations who use Urheilijan Pulssi tool				
1. AKK Motorsport	11. The Finnish Bandy Federation	21. Finnish Speed Skating Association	31. Finnish Baseball Association of Finland	41. The Finnish Orienteering Federation

2. Ski Sport Finland	12. Finnish Archery Association	22. Finnish Snowboard Association	32. Finnish Table Tennis Association	42. The Finnish Taekwondo Federation
3. American Football Association of Finland	13. The Finnish Judo Federation	23. Finnish Canoeing and Rowing Federation	33. Finnish Sailing and Boating Federation	43. Finnish Figure Skating Association
4. Finnish Biathlon Federation	14. Finnish Karate Federation	24. Finnish Fencing and Pentathlon Association	34. Cycling Finland	44. Finnish Dance Sport Federation
5. Finnish Shooting Sport Federation	15. Finnish Handball Federation	25. The Finnish motorsports association	35. Finnish Equestrian Federation	45. The Finnish Tennis Association
6. Finnish Cheerleading Federation	16. Finnish Bowling Federation	26. Finnish Boxing Federation	36. Ringette Finland	46. Finnish Triathlon Association
7. Finnish Curling Association	17. Finnish Climbing Association	27. Finnish Wrestling Federation	37. Finnish Skateboard Association	47. Finnish Swimming Federation
8. Finnish Golf Union	18. Finnish Basketball Association	28. Finnish Weightlifting Federation	38. Finnish Floorball Federation	48. Finnish Athletics Federation
9. Finnish Ski Association	19. Finnish Cricket Association	29. Football Association of Finland	39. Finnish Squash Association	49. The Finnish Gymnastics Federation

10. Finnish Ice-Hockey Association	20. Finnish Volleyball Association	30. The Finnish Paralympic Committee	40. Badminton Finland	

2 SPORT MARKETS

This section talks about how sports markets, data analysis, and data science are connected. It shows how sports markets affect the economy and society and how they relate to other areas. It also talks about how the sports market is expected to grow in Finland and explains how data analysis is used in sports. Additionally, it mentions the ethical concerns when using data from wearables. Overall, it highlights how data science is changing and improving the sports industry in various ways.

According to Aine (2016, pp. 371–372), markets constitute the economic operating environment where the effects of agreements and other arrangements are assessed. Sports markets can be considered as a kind of an overarching concept that encompasses various interconnected markets and the exchange relationships that occur within them. The core of sports markets is built around competitive activities. In these markets, individual athletes, clubs, and other entities engage in economic activities directly linked to participating in or organizing competitions and sporting events. Sports federations' rules and regulations play a central role as regulators of the operation of sports competition markets. Understanding the characteristics of sports markets helps assess the competition effects of various arrangements and regulations in individual cases. It is typical for sports markets that parallel markets interact with each other: the conditions prevailing in one market, or the regulatory decisions made therein have an impact on other markets. Properly structuring this interaction is a prerequisite for a systematic competition law analysis of sports markets.

Aine (2016, p. 374) writes that sports have significant societal importance that extends beyond the economic dimension of sports. Cooperation between sports federations, sports clubs, and other actors is often necessary to advance goals related to the societal significance of sports. One example of this is the arrangements related to the recruitment and training of young players. This is not fundamentally a closed category, but rather, the specific conditions characteristic of each sports market play a part in determining what aspects can be taken into account as the features of competition law consideration in the context of sports.

2.1 Numbers in Finland

According to Statista (n.d.), the Sports and Outdoor market in Finland is poised for substantial growth in the coming years, with revenue projected to reach an impressive US$151.00 million by 2023. This upward trajectory is expected to continue, with a robust annual growth rate (CAGR 2023–2027) of 6.46%, ultimately leading to a projected market volume of US$194.00 million by 2027. It is worth noting that China plays a pivotal role in this market, with an anticipated market volume of US$28,720.00 million in 2023, showcasing its dominance in the industry. Furthermore, the number of users engaged in the Sports and Outdoor market is forecasted to surge to 1.8 million by 2027, reflecting the increasing popularity of these activities. This growth is supported by user penetration, which is expected to rise from 24.8% in 2023 to 32.0% by 2027. On average, each user is expected to contribute US$110.00 in revenue, underlining the market's potential for profitability and highlighting the importance of understanding and harnessing this dynamic industry for future success.

2.2 Analytics in Sports

According to avcontteam (2023), sports analytics is the process of gathering, interpreting, and analyzing data to learn more about player dynamics, team tactics, and athletic performance. Data analytics has become a game changer in the sports business as a result of technological improvements and the increasing popularity of sports. It gives teams useful data they can use to make data driven decisions and perform better. Fans also gain from data analytics by learning more about their preferred teams and athletes.

According to Fried and Mumcu (2017, pp. 17–18), as well as other business, sport industry must execute their operations most efficiency way. Due to the crowded market and competition people's leisure, it is crucial for sport organizations to operate as efficiently as possible and to make wise financial decisions. Sport organizations that adopt an analytical mindset produce and gather data from a variety of internal and external sources, analyze business performance to gain insights, and make facts-based choices to gain a competitive edge and improve organizational efficiency. Analytics may be used by sports organizations on a general level or in specific functional areas. Most of the time, sports

organizations employ analytics to evaluate athlete performance in order to choose the starting lineup, game plans, and players to sign, draft, or trade. Additionally, player injuries are predicted and prevented using analytics, and the contribution of athletes to a brand is evaluated. Analytics are typically used to obtain information on the performance of various marketing initiatives. Sports analytics are also used to categorize current fans, determine their worth, forecast fan retention, and create incident models based on prior occurrences.

Fried and Mumcu (2017, pp. 18–19) continue, considering the market's present position for the sport field, the organization's objectives, and its resources and capabilities, organizations develop operational metrics to assess their effectiveness in accomplishing the objectives and create functional targets. The source of data will vary depending on the kind of data required. Sport organizations may have access to both internal and external data sources and sport organizations may have used large dataset. Sometimes their need is only a small sample. External data might be obtained from vendors and clients as well as bought from an outside source. After the method of data gathering has been chosen, the needed amount of data must be determined. The amount of data required is significant when evaluating data from a sample. The solution is not usually a massive data collection. To provide findings that are credible and trustworthy, quality data is required. Completeness, correctness, consistency, and currency are some crucial components of data quality.

According to Vermeulen and Yadavalli (2018), in addition to sporting disciplines, parallel studies to promote physical activity among the populace may benefit from fresh information concealed in the incredibly vast data sets produced by wearables. The information gathered by wearable monitoring devices is indicative of the actual world and is not constrained by a laboratory or a clinical conditions or time restrictions for experiments. When properly applied, this intelligence may provide decision assistance to athletes, coaches, management teams, and even urban planners, something that was previously impossible with the use of questionnaires, surveys, and self-reported training loads. Data scientists may put raw data into statistical and mathematical models using rigorous and scientific methodologies from the field of data science. These models may be applied to novel methods of instruction, strategy, and urban planning with the goal of enhancing residents' levels of physical activity. However, while determining which indicators are crucial and how much faith should be put in the data, the hazards related to big data must be taken into account.

The knowledge derived from analyzing monitoring data from wearables should provide athletes a tool to make educated decisions, not control them. Researchers in the discipline are required to use wearable data ethically and to respect the ethical issues that come with it in sport science.

According to avcontteam (2023), data science has become an indispensable force in the sports industry, revolutionizing every facet of the game. From optimizing athlete performance to an enhancing fan engagement, increasing revenue, and even transforming the way players are scouted and recruited, data driven insights have redefined the sports landscape. As technology continues to advance and data becomes even more accessible, the role of data science in sports is poised to further evolve, driving innovation and excellence in this dynamic and competitive field.

3 VERSATILE USE OF DATA

This section explains important ideas about how businesses use information and technology. It talks about how computer programs have shifted from just keeping track of things to helping solve problems. It also discusses the role of data science, which involves using both computer skills and data analysis to solve problems. The text also touches on data processing, which is how computers handle and change information. Data reporting is about creating reports or summaries using this information. Data warehouses are like big storage places for information, and they are managed with something called metadata, which makes it easier to find what you need. "Big data" refers to really large sets of information, and it is important because it can help companies learn valuable things if they can sort through it effectively. Lastly, data mining is about finding useful patterns and connections in large amounts of data, often used in fields like insurance, banking, science, and security.

According to Sharda et al., (2018, pp. 11–12) applications for issue analysis and solution have replaced transaction processing and monitoring in computer programs. A large portion of this activity is carried out using cloud-based technologies, which are frequently accessed through mobile devices. The pillars of contemporary management today are analytics and BI technologies including data warehousing, data mining, online analytical processing, dashboards, and the usage of cloud-based systems for decision support. In addition to the obvious expansion of hardware, software, and network capacity, some advances have undoubtedly assisted in the expansion of decision support and analytics in a variety of ways. Improved data management, handling massive data warehouses and Big Data, analytical support, overcoming cognitive limitations in processing and storing information, knowledge management, and anywhere/anytime help are all part of this expansion.

3.1 Data science

According to Cady (2017, pp. 1–2), data science entails performing analytical work that, for one reason or another, necessitates a significant degree of software engineering expertise. Sometimes the ultimate result is something that a statistician or business analyst

would supply, but accomplishing that objective necessitates software expertise that your average analyst lacks. Data science is too broad for being covered by a single person or book. Furthermore, the area is developing so quickly that any comprehensive book would be out of date before it hit the shelves.

Cady (2017, pp. 9–11) continues on how to get into action. The first step is usually to frame the problem: comprehend the business use case and develop a well-defined analytics challenge (or problems) from it. This is followed by a lengthy period of struggling with the data and the real-world items it depicts to extract relevant characteristics. Finally, these characteristics are fed into analytical tools, which provide us with hard numerical findings. The second point is that there are two distinct methods for evaluating results: reporting findings and deploying code. If the clients are humans, they are generally attempting to solve a business problem by utilizing existing data sources. The ultimate result for work like this is usually a PowerPoint show or a written report. The purpose is to provide business insights, which are frequently utilized to make critical choices. This type of data science may also be used to test the waters and see whether a certain analytics method is worth a larger follow up effort that could result in production software.

3.1.1 Big Data

According to Gregersen (2023), large datasets are referred to as "big data" in technology. The phrase first appeared in the middle of the 1990s, and Doug Mashey, the head scientist of the American workstation maker SGI (Silicon Graphics, Inc.), is the most likely responsible for its invention. Volume, Velocity, and Variety are the "three V's" that have typically been used to describe big data. Volume, of course, relates to the amount of such datasets; Velocity, to the pace at which such datasets are generated and processed; and Variety, to the wide range of data kinds, which may be in the form of text, audio, video, or other sorts of data. Veracity and value, which allude to the utility and honesty of the data, are two more “V’s” that are occasionally included.

3.1.2 Data Warehouse

According to Laursen and Thorlund (2017, pp. 162, 164–165), the processed and combined data from the source systems are shown in the real data warehouse (for example, transactions, inventories, and master data). A metadata repository is typically found in a contemporary data warehouse. Information concerning company data is kept here. Data about data is the simplest definition of metadata. For instance, if the data for a camera is a digital photo, the metadata for that photo would normally include details such as the date it was shot, the camera's settings, the name of the manufacturer, its size, and its resolution. In order to use and manage data, metadata makes it easier to comprehend data. The importance of metadata has increased as businesses place higher demands on their paperwork. To make searches easier, libraries have included metadata about books. Title, genre, publishing year, author of the book, and other information are included in this metadata. Finding the pertinent data would be challenging or nearly impossible without metadata.

3.2 Techniques of data use

According to Frankenfield (2023), the concept "data analytics" is broad and covers a wide range of data analysis techniques. Data analytics techniques may be used to any sort of information to get insight that can be utilized to make things better. Techniques for data analytics can make patterns and indicators visible that might otherwise be lost in the sea of data. The efficiency of a firm or system may then be improved by using this knowledge to optimize procedures. Data analytics are significant since it aids in the performance optimization of enterprises. By finding more cost-effective methods to do business and retaining a lot of data, businesses may help cut expenses by incorporating it into their business strategy.

According to Frankenfield (2023) mind, there are four effective steps to do a data analysis:

1. Defining Data Requirements: Determine how data should be categorized, whether by age, demographics, income, or other factors.
2. Data Collection: Gather data from various sources, such as computers, online platforms, sensors, or personnel.

3. Data Organization: Structure and format data for analysis using software like spreadsheets.
4. Data Cleaning: Scrub and validate data to eliminate duplicates, errors, and incomplete entries, ensuring data quality for analysis.

According to *Encyclopædia Britannica* (2021), data processing is often known as computer data manipulation. Data flow via the CPU and memory to output devices, formatting or modification of output, and conversion of raw data to machine readable form are all included. Data processing may be described as the use of computers to carry out certain operations on data. Data processing, as used in the business sector, is the act of processing data that is necessary for the operation of organizations and enterprises.

According to Blackwood (2014, pp. 9–10), report criteria and scope must be specified before creation. As a result, reporting may create, test, utilize, and update your report. The report's base is its data. The data is built upon to create reports. The reports will take longer to run and be more challenging to create if the data structure is poorly organized or isn't full. There are present needs that must be satisfied, but there could be future growth plans that can be included into the reporting model's structure now rather than requiring a significant modification in the future. It is important to keep in mind that report formatting affects how the reports will appear. Another crucial component of the report is color. Both color and layout should be used carefully and sparingly.

More about reporting is in Chapters 3.4 and 3.5

According to Clifton (2023), data mining is the process of identifying intriguing and practical patterns and correlations in massive amounts of data. It is also known as knowledge discovery in databases. To examine huge digital collections, or data sets, the area integrates technologies from statistics and AI (such as neural systems and machine learning) with database administration. In business (insurance, banking, retail), science (astronomy, medical), and government security (the identification of criminals and terrorists), data mining is frequently employed. The majority of data mining techniques focus on gathering generic information about a group rather than detailed information about a single person.

3.3 Business Intelligence

The topic of business intelligence (BI) and its varied dimensions are examined in this section. It emphasizes the significance of BI as a key tool for contemporary enterprises, emphasizing its function in delivering insightful data and assisting decision making procedures. We go into great detail on the various aspects of BI, such as its orientation, centralization, functional scope, query complexity, automation, initiative, velocity, and maturity. The chapter also emphasizes how BI is developing as a result of technical advancements and shifting business requirements. Overall, it presents a thorough viewpoint on the dynamic and important discipline of business intelligence.

Large companies spend millions of dollars on BI solutions, which involve creating and using data visualization tools (Yuk & Diamond, 2014, p. 161).

3.3.1 Definition

Sharda et al., (2018, p. 16) write that BI is an all-encompassing phrase that encompasses techniques, applications, databases, tools, and infrastructures. The abundance of acronyms and phrases connected with BI contributes to some of the uncertainty around it. The main goals of BI are to offer interactive access to data, data modification, and the capacity for business managers and analysts to do suitable analysis. Decision makers gain insightful information through studying past and present facts, events, and performances that help them make wiser and more effective judgments. Data is transformed into information, which is then used to make decisions, and eventually, actions are taken.

According to Frankenfield (2022), there are advantages as to why companies use BI tools. It is utilized by many businesses to support activities as varied as hiring, compliance, production, and marketing. It is challenging to identify a company segment that does not benefit from having better information to work with since BI is a basic business value. Faster, more accurate reporting and analysis, higher data quality, enhanced employee happiness, decreased expenses and increased revenues, and the capacity to make better business choices are just a few of the numerous advantages businesses may enjoy when incorporating BI into their business models.

According to Yuk and Diamond (2014, p. 82), BI entails producing any kind of data visualization (report, dashboard, or infographic) which provides perception into an organization with the intention of making a choice or acting. Many an employee have been long time in the BI industry even knowing about it. BI has two tremendous reasons why it has been seen so important nowadays. Basically, BI drives industry trends. Many additional fields, like Big Data, mobility, social collaboration, and the cloud, are impacted by BI developments. It is crucial to keep up with trends in the BI sector since these trends have an impact on as a consumer or a developer of data visualization. The development of data visualization technologies is driven by BI. Due to intense competition in the BI market, any tool which is used to create data visualization will now be categorized as a BI tool. On the one hand, everyone wins from the rivalry between various software companies to create the best tool. It encourages innovation that prioritizes simplicity of use, increased insight, and less cost.

3.3.2 Dimensions

According to Skyrius (2015, p. 28), an important and continually expanding area of computer applications in business and economy is the field of business intelligence. Debates about the fundamental concepts of BI and the value it produces have been sparked by the many definitions and types of BI applications.

Skyrius (2015, p. 35) illustrates in Table 2 the different dimensions of BI.

Table 2. Dimensions of Business Intelligence (Skyrius, 2015, p. 35).

Dimensions of business intelligence		
Dimensions	**From**	**To**
Orientation	Internal	External
Centralization	centralized	Self-service and Decentralized

Functional Scope	Narrow scope	Wide scope
Question difficulty	Easy Question	Hard question
Automation	Flexible manual support	Automatic support
Initiative	Question-driven	Data-driven
Velocity	Right time	Real time
Relation to decision support	Separated	Integrated
Maturity	Immature	Mature

Skyrius (2015, p. 35) thinks orientation needs to be divided into internal and external dimensions. The internal dimension is built on powerful signals, concrete facts, and clarity. Hard rules are used to integrate data nearly totally automatically. The external dimension means information integration is carried out by soft rules, middleware, and passive integration; it is fairly chaotic and has a limited degree of flexibility. The external dimension comprises a large number of weak signals to be understood.

Skyrius (2015, p. 38) continues explaining dimensions. The resources and control of a BI system might be centralized, decentralized, or a combination of the two, much like any other information system. In a sense that they both should represent the nature of business, whether it be fairly uniform or diversified, centralized, or dispersed, centralization and decentralization (or distribution) are strongly related to coverage by the number of functions. Despite the strengths and weaknesses of each strategy, a centralized BI system appears to be less preferred due to its scale and rigidity. Perhaps the most crucial aspect

of a centralized strategy is that someone at the top should have a broad understanding about the situation.

Skyrius (2015, p. 40) thinks about functional scope: Simple reporting and graphing to complex and versatile functions like search, analytics for prediction, management of performance, data mining, text analysis, information and data integration, and others are all within the functional scope of BI tools and approaches. These capabilities must be accessible across multiple platforms, such as mobile and cloud-based deployment, due to recent changes in IT.

Questions difficulty is complex, thinks Skyrius (2015, pp. 41–42). The cases on this dimension range from basic informing questions that only need a few sources, procedures, and practical instruments for complex or intricate informing questions that need to integrate data from several sources and a large number of support procedures and tools. The complexity of an issue and its solution, the regularity or irregularity of the information demands, the needed performance of a resource unit, or the required flexibility (the capacity to adjust to a changing environment or user needs), are only a few of the several aspects of information needs.

According to Skyrius (2015, p. 47), automation can be divided two, a flexible manual and automatic. Plus, there is also a so-called grey area. We can distinguish between human, or heuristic, tasks that are difficult to automate (such as sense making and semantic integration), and those that are easy to automate (such as database searching and web searching). There is a "grey area" in the center when tasks are attempted to be automated but require a human initiative or a direction owing to unpredictability and limited repeatability (data integration, influence modeling, rule formulation and use). If we categorize the different information activities' tasks according to their automatability, this criterion representing the tasks' routine or irregular character and other qualities defining the necessary efficiency or flexibility.

Skyrius (2015, p. 50) tells that initiative is viewed as a spectrum between user-driven (or question-driven) intelligence and data driven intelligence. In a user driven scenario, an assumption, a claim, a hypothesis, or a desire to learn more exists; in a data driven scenario,

a resource is available – in this example, data, though there may be other resources like software or models as well. It is anticipated that utilization of this resource will provide value.

About velocity, Skyrius (2015, p. 52) writes that since real time business intelligence has gained popularity during the past decade or so, it appears possible to examine the BI velocity dimension. This dimension would include all types of BI systems, such as real time systems that offer data as quickly as feasible and right time systems that use latency that is tailored to the user's needs.

Skyrius (2015, p. 58) says that making management decisions requires a lot of information, and the complexity of the information activities required to make a well supported choice strongly correlates to the structure of the problem that has to be solved. In terms of the variety of information sources and incompatibility of the information obtained from these sources, the use of sophisticated and problem specific analysis and modeling tools, and the use of communication and group support environments to fine tune the interests of stakeholders, such complexity creates challenging demands for the support environment. We may draw the conclusion that decision support systems (DSS) have essentially been replaced by business intelligence (BI) as a strategy for pursuing comprehensive understanding about the company operations and associated issues.

Lastly, Skyrius (2015, p. 67) explains the concept of maturity. The other difficulties mentioned above have a strong connection to maturity. When approaching projections into the future, the distinction between immature and mature BI begins to lose some of its clarity on the left-hand side (what characterizes immature BI). The grey space is probably between the current situation and the strategic horizon (three to five years), where one of the key problems may be stated as follows: How do you preserve and grow your cognitive abilities while technology changes?

3.4 Management of Reporting

The significance of data visualization, reporting, and effective information management inside businesses is discussed in this section. This section highlights how crucial it is to

begin with data and use visuals to give it greater meaning. It goes into detail on how reporting helps different stakeholders understand difficult information. Furthermore, it underlines important guidelines for information management projects, placing special emphasis on leadership, staff a buy-in, concrete advantages, an incremental approach, risk management, and a seamless digital employee experience. This section provides insightful advice on how organizations can manage and utilize data and information in an efficient manner to improve decision making.

According to Yua (2013, p. 242), Data Visualization can be valued by an aesthetic view, but it is got more interesting while the data is worth looking at. That is the reason to start with data, examine it through and after that showing result by visualization.

According to Glöckner (2022), reporting is by definition essentially the methods and tools used inside a business to gather, process, store, and show data. Reporting seeks to impart information while also simplifying the complicated to the essentials. Consequently, data is now more easily available to certain target audiences and stakeholders. In Business internally or externally, this is possible. In order to do this, reports containing information on the firm and its surroundings are created; therefore, the word "reporting." There are many different report types, however tables and diagrams are frequently utilized for display. It is crucial that the consumers have access to the data in a straightforward and understandable way.

Glöckner (2022) continues: People frequently use the phrases regulating and monitoring when discussing reports. However, the difference is frequently unclear. This is due to the frequent equivalence of three words. There are several fundamental distinctions, though: Monitoring generally entails the oversight of numerous operations, which may, for instance, result in the setting off of an alert. Reporting and monitoring are two separate activities that take place side by side. Contrarily, controlling explains corporate management and is based on the information at hand. Reporting, which is a component of this area, serves as the foundation for controlling.

Glöckner (2022) gives 5 points to good reporting. The reporting must be done to the target audience who would work with it. Every information and detail in the report must be right

terms of content. The report must be understood by the audience, and it should be written an objective point of view. Reporting needs to be easy to follow. Coming to this, there must be used the same terminology and structure must not change. Glöckner (2022) advises to keep objectives and a purpose in mind clearly. Only against the backdrop of the target formulation can clear steering information for the receiver be created. Reporting would be good to be easy and fast to create. Daily, weekly, or monthly evaluations should not take much time since the basic structure takes place. Lastly, reporting might only contain the key performance indicators (KPIs) essential for the objective or/and a purpose. It is crucial to keep it simple and avoid including all of the major figures that are currently in existence.

Delivering information might be viewed as reporting (Tedx Talks, 2015). Information may be delivered in a variety of ways. Understanding how to "crack the code" is the first thing you should learn. Johnston means to discover the most efficient method of information delivery by breaking the code to comprehend how to communicate with your audience simply. You can make use of analogies, imagery, or completely original approaches. If information is not understood, the person or technique used to communicate it is at a fault. Reporting is simpler if you have even a basic understanding about audience behavior, responses, and learning styles.

According to Yuk and Diamond (2014, p. 110), there are similarities with Glöckner (2022). Yuk and Diamond point out three traits to accomplish effective visual. Their first point is data must be clear, in both purpose and display. Second point: the visual needs to meet the data. It does matter if the data visualized by the chart or text, so the visual needs to be right for the data. Third point give audience chance to spot exceptions easily. Identifying data’s exceptions should be created easy whether which visual type was used.

It is a common mistake when visualizing the data to put too much information into single visual. (Yuk & Diamond, 2014, p. 111). That causes the reports important information to be hidden, shadowed, or distorted. Avoiding misinterpretation must be thought while choosing the visual type for the report. Good visualization gets reader’s attention wanting them more, bad visual might give the opportunity to reject the entire report. According to Yua (2013, p. 248), he points out as common misconception visualizing everything. There might outcome situation when there is not much data available. It is possible the available

numbers are aggregates, not raw data. This situation is okay to show actual numbers. Must be remembered that the pinpoint of visualization is to understand relationships in data and patterns in it. It means when there is no data to show, it's not efficient to trying to squeeze it out somehow.

Most of the times, there are many ways to present chosen data (Yuk & Diamond, 2014, p. 112). The visualization must be meet the data and an audience. For instance, it is effective to use a pie chart to show data with four or less data points. Over five data points in pie charts makes it confusing. The objective of a data report must be keeping mind. Presenting sales margin with the line chart explains trend more effectively than a column chart. Instead, a column chart shows comparison between months for instance more effectively.

Highlighting exceptions can create more value to your data (Yuk & Diamond, 2014, pp. 112–113). While users spot exceptions they can create immediately opinion about how much attention it need. Highlighting gives insight to the potential trends as well and those may require full attention, or not. Yua (2013, pp. 221–222) has a similar view. Highlighting can help readers navigate the information and focus their attention on the most crucial areas of report. It either confirms what some individuals may already be aware of or draws attention to relevant locations or data points. Shifting the point of interest up or pushing everything else down in the visual hierarchy to highlight the most important information. The same level of information receives the same attention.

3.5 Information management

In the realm of information management within complex organizational settings, a set of guiding principles emerges to help navigate the challenges that arise when planning and executing information management projects (Robertson, 2020). These principles underscore the importance of adopting a nuanced approach that acknowledges the intricacies of organizations instead of seeking overly simplistic solutions.

To begin with, these principles stress the significance of recognizing the inherent complexity of organizations (Robertson, 2020). Attempts to oversimplify solutions often result in failure. Instead, they advocate for the necessity of strong leadership guided by a clear

vision to chart the course for information management endeavors. This leadership should ensure that projects align with the organization's business needs, giving priority to the most pressing requirements.

Furthermore, these principles underscore the critical role of staff adoption as a key determinant of success (Robertson, 2020). Information management systems can only be effective if they are actively embraced across the organization. Achieving this necessitates a concerted effort in change management and effective communication. Additionally, the principles emphasize the importance of delivering tangible and visible benefits. Successful projects should not only enhance information management behind the scenes but also provide noticeable improvements in day-to-day operations and services.

Recognizing that there is no universal solution that fits all scenarios, these principles advocate for a holistic and incremental approach rather than grand, centralized plans (Robertson, 2020). They acknowledge that numerous small changes, coordinated across various teams, often yield more significant results. Moreover, risk management is highlighted as a crucial element in identifying and mitigating potential issues, ensuring the successful execution of projects.

Lastly, these principles place a strong emphasis on striving for a seamless digital employee experience (DEX) (Robertson, 2020). This entails making it easy for employees to access the information they need, with systems designed around their specific tasks and requirements, while avoiding unnecessary complexity in system distinctions.

3.6 Microsoft Power BI

This section provides insights into Microsoft Power BI, a versatile cloud-based business analytics platform that allows users to connect, analyze, and visualize data from various sources, fostering data driven decision making. This section highlights the platform's user-friendly interface, collaboration capabilities, and compatibility with other Microsoft products. The section also explores essential considerations for deploying Power BI effectively, including dataset design and the choice between data import and DirectQuery modes. Furthermore, it discusses the benefits of using Power BI, such as cost effectiveness and

accessibility across devices. Additionally, it mentions key competitors in the business analytics software landscape, including Tableau and other notable alternatives. This section offers valuable information for organizations seeking to leverage Power BI for enhanced data analytics and reporting.

According to Microsoft (2023b), Microsoft Power BI is a cloud-based business analytics platform that enables users to connect to and analyze data from a variety of sources, including spreadsheets, cloud-based and on-premises databases, and other applications. Power BI offers a user-friendly interface for building reports and dashboards, as well as a number of data exploration and visualization capabilities to assist users in deriving insights from their data. To assist customers in locating hidden patterns and connections in their data, Power BI also provides sophisticated analytics features like machine learning and predictive analytics. Power BI is a useful tool for teams and companies since it also facilitates collaboration and data and report sharing. Because of its simplicity, adaptability, and compatibility with other Microsoft products like Excel and SharePoint, its use is becoming more widespread.

According to Powell (2018, p. 8), Depending on the resources available and the requirements of the project, organizations use several deployment options for each project or with various business teams. When Corporate BI solutions' technical know-how and governance are paired with the data exploration and analysis tools that can be made available to all users, the value of Power BI installations may be maximized. Provisioning Power BI Premium capacity enables the scalability and accessibility of Power BI solutions to serve thousands of users, including read only users who have not been given Power BI Pro licenses.

3.6.1 Power BI report visualization

According to Powell (2018, p. 16), Datasets are used to build the dashboard tiles and report visualizations in Power BI, and each Power BI report has a connection to a specific dataset. These datasets are the core of Power BI projects, and the way they are designed has a big impact on a lot of different things, such how users interact with the data, how quickly queries are answered, how well source systems are used, and how Power BI

resources are distributed. Datasets can be set up to directly query a single data source to satisfy report requirements or to import data from several sources on a preset refresh a schedule. Therefore, giving dataset design serious thought is essential for enhancing the whole Power BI experience.

Powell (2018, p. 17) continues that the dataset is in charge of the Power Bi dataset's data access layer, which includes data source authentication and the M queries needed to create the data model's tables. In addition, the dataset designer produces the DAX measure expressions for usage in reports like year-to-date (YTD) sales as well as the relationships of the model and any necessary row level security responsibilities. Given these obligations, the dataset designer should routinely interact with both report authors and the owners or SME's of the data sources. To ensure that data access queries are updated appropriately and that report authors are informed of any extra measures or columns required to build new reports, for instance, the dataset designer must be notified of changes to the data sources. Additionally, the dataset designer should collaborate with the Power BI admin on topics like Power Bi Premium capacity and be mindful of the performance and resource use of deployed datasets.

3.6.2 Import or DirectQuery

According to Powell (2018, p. 37), in certain projects, choosing between import and DirectQuery is an easy choice since, given the known needs, only one option is practical or realistic, however in other projects, a thorough study of the advantages and disadvantages of both designs is required. An import mode dataset is most likely the best choice, for instance, if a data source is deemed sluggish or unprepared to manage a large number of analytical queries. Additionally, an import mode dataset is the sole choice if a dataset has numerous data sources, but they cannot be combined into a single DirectQuery data source. Similarly, DirectQuery is the sole choice if access to a data source in close to real time is a crucial business need. The list of inquiries that follows can assist in making a selection between DirectQuery and import:

1. Does Power BI support a single data source that is a DirectQuery source for our dataset?

2. If the answer to question 1 is yes, can Power BI's analytical query workload be supported by DirectQuery?

3. Considering the dataset's size and any need for near real time access to the data source, is it viable to import the dataset?

4. Is the DirectQuery connection more useful than the enhanced performance and flexibility offered by the import mode if the DirectQuery source can handle a Power BI workload as per question 2?

According to Powell (2018, p. 39), an import mode dataset may easily include several data sources, including Excel files, SQL Server, and Oracle. As it uses an in-memory columnar compression structure and transfers a snapshot of the source data into the Power BI cloud service, it often provides reliable query performance in a variety of circumstances. Datasets in import mode have the important benefit of enabling data manipulations without negatively affecting query performance. The activities including data source SQL views and the M queries inside Import datasets are carried out as part of the planned data refresh process, in contrast to DirectQuery datasets.

A DirectQuery dataset is restricted to a single data source and only acts as a thin semantic layer or interface to make the experience of developing reports and exploring data easier (Powell, 2018, p. 39). The requirement to maintain and regularly update a second copy of the source data is removed by DirectQuery datasets, which convert report queries into queries that are compatible with the data source and use the data source to execute queries.

Powell (2018, p. 39) continues about DirectQuery. Power BI DirectQuery datasets are frequently used to deliver reporting on top of tiny databases connected with OLTP applications. Nonclustered columnstore indexes can be utilized on numerous tables required for analytics, for instance, if SQL Server 2016 or later is used as the relational database for an OLTP application. The database engine can continue to use existing indexes to process OLTP transactions, such as a clustered index on a primary key column, while the nonclustered columnstore index will be used to deliver performance for the analytical queries for PowerBI. This is because non-clustered indexes are updatable in SQL Server 2016.

With the help of Power BI capabilities like data driven alerts and notifications, the business value of near real time access to the application may be further increased.

3.6.3 Benefits of using Microsoft Power BI

According to Machiraju and Gaurav (2018, pp. 5–7), there are multiple benefits of using Microsoft Power BI. Choosing any software to any business area, the key feature is cost. Microsoft Power BI there is able to sing up for free. There is no need to give credit card details at any time during sing-in. As mentioned earlier, data can be received from multiple data sources to Power BI. Power BI offers a comprehensive overview of essential business metrics, regardless of where the data originates or its type. In Power Bi there is feature called “The Quick Insights” which uses advanced math formulas to look at data and quickly find different parts of it for a specific time period. By Power BI data driven decisions can be done from anywhere. There is able to use apps for a variety of devices including windows, iOS and android.

3.6.4 Competitors

According to Patrizio (2021), there are several competitors to Microsoft Power BI. The most crucial one is Tableau. Authors’ opinion is that Tableau is an industry leader without doubt. The Tableau in known for its user friendly and it has been accessible from college students to data scientist. As well as Microsoft Power BI, Tableau can be received data from various databases such as, Teradata, SAP, My SQL, Amazon AWS and Hadoop. Most well-known Tableau users are Verizon and JPMorgan Chase and Co.

Patrizio (2021) listed other tools which are Microsoft Power BI competitors: Google Cloud, Excel, Sisense, Zoho Analytics, Google Charts, FusionCharts, Infogram, Looker, IBM Cognos Analytics and Qlik.

4 FUNCTIONAL THESIS

According to Vilkka and Airaksinen (2003, pp. 9–10), a functional thesis aims at instructing, guiding, organizing, or rationalizing practical activities in the professional field. Depending on the field, it can be, for example, instructions or guidance aimed at professional use, such as an orientation guide, an environmental program or safety instructions. There are varieties to the method of implementation such as a book, a folder, a notebook, a guide, a cd, a portfolio, a homepage or even an exhibition or an event. A thesis should be working life oriented, practical, implemented by a research attitude, and demonstrating a good level of the knowledge and skills of the fields at a sufficient level.

According to Vilkka and Airaksinen (2003, pp. 16–17), a good thesis topic is raised from the studies, and which is connected to working life. Probably a functional thesis helps a student maintain connections to previous internship places and it helps a student to going deeper of knowledge and skills area of interest. It is essential to find commissioner for the functional thesis. The commissioner creates more sense of responsibility and teaches project management. A thesis topic from current working life helps professional growth.

In functional theses, a concept of the field and its definition is often sufficient as a theoretical point of view (Vilkka & Airaksinen, 2003, pp. 42–43). It is not always necessary or even timewise to implement a functional thesis from the point of view of the whole theory.

According to Vilkka and Airaksinen (2003, p. 51), the result of the functional thesis is always something concrete. That is why the report of a functional thesis must consider how the result was accomplished. Functional theses have one common feature: communicative or visual means are used to create an overall look that can identify the goals pursued.

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