

ARISTOTLE UNIVERSITY OF THESSALONIKI
DEPARTMENT OF ECONOMICS
MASTER OF SCIENCE
«LOGISTICS & SUPPLY CHAIN MANAGEMENT»



Master's Thesis

Big Data and Supply Chain Management

Vaina Eleftheria

Supervisor: Tsadiras Athanasios

Thessaloniki

January 2018

Abstract

Business has always wanted to derive insights from information in order to make better, smarter, real time, fact based decisions. It is this demand for depth of knowledge that has fueled the growth of big data tools and platforms. The development of the branch network of companies and the continuous commitment for direct provision of high quality services, have brought a new challenge for companies today. Companies are capturing, storing, and analyzing data that has high volume, velocity, and variety and comes from a variety of new sources, including social media, machines, log files, video, text, image, RFID, and GPS. These sources have strained the capabilities of traditional relational database management systems and spawned a host of new technologies, approaches, and platforms. The keys to success with big data analytics include a clear business need, strong committed sponsorship, alignment between the business and IT strategies, a fact-based decision-making culture, a strong data infrastructure, the right analytical tools, and people skilled in the use of analytics. Because of the paradigm shift in the kinds of data being analyzed and how this data is used, big data can be considered to be a new, fourth generation of decision support data management. New analytics techniques should be created so the vast amounts of data generated can be managed efficiently. In this master thesis we introduce the background of Big Data, and we present the benefits they offer today in business. The software we examine is Qlik View. First we make a theoretical approach combined with practical experiences. The benefits of Qlik View software are presented through the analysis of our real data. The contribution of this diploma thesis is the presentation of the benefits of this system and to offer to companies' a modern software through which the company can analyze quickly and flexibly the large amount of data it collects daily in order to get better business decisions in time in order to remain ahead of the competition.

Acknowledgements

This diploma thesis was conducted within the framework of the postgraduate program Logistics and Supply Chain Management program of the Department of Economics of Aristotle University of Thessaloniki under the supervision of the Epicurus Professor Athanasios Tsadiras. I would like to dedicate this page to all the people who contributed to the diploma thesis.

At first I would like to thank my supervisor, Professor Athanasios Tsadiras for his valuable guidance and advice during writing the diploma thesis.

Also I would like to thank my classmates for the experiences during the courses and the other professors of the postgraduate program for the advice and knowledge they have given me.

Finally I would like to thank my family for supporting me through the writing of this thesis.

Contents

Abstract.....	2
Acknowledgements	3
1 INTRODUCTION	10
1.1 Supply chain management and logistics theory.	11
1.1.1 Supply chain management definition.....	11
1.1.2 Logistics definition	12
2 BIBLIOGRAPHICAL OVERVIEW	13
2.1 Definition of Big Data	13
2.2 Why is Big Data important.....	19
2.3 Who uses Big Data?	20
2.4 Big Data applications in SCM	21
2.5 Business Intelligence -Analytics Systems	23
2.6 Architecture of the business information system	26
3 QLIK VIEW SOFTWARE	30
4 DATA ANALYSIS	44
The user asks “What is the product with the highest and lowest inventory.	50
The user asks “which is the store with the highest and which is the store with the lowest inventory”	50
The user asks “who is the customer with the highest life time revenue, and who is the customer with the lowest life time revenue”	50
The user asks “who is the customer with the highest life time revenue, and who is the customer with the lowest life time revenue”	50
The user asks “which order has the biggest and smallest quantity”	51
The user asks “how many orders have high priority? And how many orders have low, medium, critical or not specified priority?”	51
The user asks “Which product has the highest unit price and which product has the lowest price”.	51

The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”	51
The user asks “Which product has the biggest margin and which product has the smallest margin”	51
The user asks “Which product has the highest advertising cost and which product has the lowest advertising cost”	51
The user asks “Which product has the highest unit price and which product has the lowest unit price”	51
The user asks “Which product has the biggest sum of quantity and which product has the smallest sum of quantity”	51
The user asks “Which product has the highest profits and which product has the lowest profit”	51
The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”	52
4.1 INVENTORY	52
4.1.1 The user asks “What is the product with the highest and lowest inventory.	52
4.1.2 The user asks “which is the store with the highest and which is the store with the lowest inventory”	55
4.2 CUSTOMER	59
4.2.1 The user asks “who is the customer with the highest life time revenue, and who is the customer with the lowest life time revenue”	59
4.2.2 The user asks “which age group has the biggest and lowest life-time revenue”	62
4.3 ORDERS	63
4.3.1 The user asks “which order has the biggest and smallest quantity”	63
4.4 ORDER PRIORITY	68
4.4.1 The user asks “how many orders have high priority? And how many orders have low, medium, critical or not specified priority?”	68
4.4.2 The user asks “Which product has the highest unit price and which product has the lowest price”	Σφάλμα! Δεν έχει οριστεί σελιδοδείκτης.
4.4.3 The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”	69
4.4.4 The user asks “Which product has the biggest margin and which product has the smallest margin”	73
4.4.5 The user asks “Which product has the highest advertising cost and which product has the lowest advertising cost”	75
4.4.6 The user asks “Which product has the highest unit price and which product has the lowest unit price”	78

4.4.7	The user asks “Which product has the biggest sum of quantity and which product has the smallest sum of quantity”.	81
4.4.8	The user asks “Which product has the highest profits and which product has the lowest profit”.	84
4.4.9	The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”.	86
4.5	Review about Qlik View Program.	90
4.5.1	Why to choose Qlik?	92
4.5.2	Company overview.	93
4.5.3	Qlik products.	93
5	CONCLUSIONS AND FUTURE RESEARCH	94
6	BIBLIOGRAPHY	96

List of figures

Chapter 2 Figures

Figure 2 1:	Development of the quantity in produced information and storage availability (Gantz <i>et al.</i> , 2007).	13
-------------	--	----

Figure 2 2:	Evolution of the number of Internet users and users with access to high-bandwidth networks (Gantz <i>et al.</i> , 2007)	15
-------------	---	----

Charter 3 Figures

Figure 3 1:	Sample of a sales dashboard through the QLIK VIEW platform.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	32
-------------	---	----

Figure 3 2:	Change the dashboard image after selecting a specific field.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	33
-------------	--	----

Figure 3 3:	Sales for each bicycle subcategory..(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	34
-------------	--	----

Figure 3 4:	Sales and Profit margin for the "Road" category of bicycles in the United States market.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016).	35
-------------	---	----

Figure 3 5:	Sales and Profit Margin for the "Road" type worldwide.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	36
-------------	---	----

Figure 3 6: Total sales and profit margin for every "Road" bicycle model world-wide .(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	37
Figure 3 7: Road models with a high profit margin but wit low sales for the company .(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	38
Figure 3 8: Sales of "Road" bicycle models with high profit margins per country.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	39
Figure 3 9: Sales of "Road" bike models with high profit margins per age.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)	40

Chapter 4 Figures

Figure 4 1 Microsoft BI framework.....	42
Figure 5 3: How to import data in the program.	45
Figure 5 4 : The place where we create visualizations.	46
Figure 5 5: How to create charts	47
Figure 5 6: Excel file of data	47
Figure 5 7: Sum of Inventory per Product ID.....	53
Figure 5 8: Product ID with the biggest sum of inventory	53
Figure 5 9: Product ID with the lowest sum of inventory	54
Figure 5 10 Product ID with the biggest sum of inventory (Power BI)	54
Figure 5 11 Product ID with the lowest sum of inventory (Power BI)	55
Figure 5 12: Pie chart with the 10 highest inventories.	55
Figure 5 13: Sum of Inventory per Store Name.	56
Figure 5 14: The store with the biggest inventory.....	56
Figure 5 15: The store with the lowest inventory.....	57
Figure 5 16 The store with the highest inventory. (Power BI)	57
Figure 5 17 The store with the lowest inventory (Power BI).....	58
Figure 5 18: Stores with the highest inventory.....	58
Figure 5 19: Life Time Revenue per Customer.....	59
Figure 5 20 The customer with the highest Life Time Revenue.	60
Figure 5 21: The customer with the lowest Life Time Revenue.	61
Figure 5 22 The customer with the highest Life Time Revenue. (Power BI)	61
Figure 5 23 The customer with the lowest Life Time Revenue.....	62
Figure 5 24: Life-Time Revenue per Age Group.	62
Figure 5 25 Life-Time Revenue per Age Group.....	63
Figure 5 26: Order Quantity per ID.....	64
Figure 5 27: The biggest order quantity	64
Figure 5 28: The lowest order quantity	65
Figure 5 29 The highest order quantity.....	65
Figure 5 30 The lowest order quantity.....	65
Figure 5 31: All the orders (5496 orders).....	66

Figure 5 32 All the orders (5496 orders) (Power BI).....	67
Figure 5 33: The ten highest orders	67
Figure 5 34: Orders Priority	68
Figure 5 35 Orders Priority (Power BI)	69
Figure 5 36: Shipping Cost per Product ID.	70
Figure 5 37: Product with the highest shipping cost	70
Figure 5 38: Product with the lowest shipping cost.	71
Figure 5 39 Product with the highest shipping cost.....	71
Figure 5 40 Product with the lowest shipping cost.	72
Figure 5 41: Shipping cost.....	72
Figure 5 42: Shipping cost.....	73
Figure 4 43 Margin per Product ID:	73
Figure 5 44: The product with the biggest margin.	74
Figure 5 45: The product with the lowest margin	74
Figure 5 46 The product with the highest margin	75
Figure 5 47 The product with the lowest margin	75
Figure 5 48: Advertising Cost per ID.....	76
Figure 5 49: The product with the highest advertising cost	76
Figure 5 50: The product with the lowest advertising cost.	77
Figure 5 51 The product with the highest advertising cost.....	77
Figure 5 52 The product with the lowest advertising cost.	77
Figure 5 53: Unit Price per ID.....	78
Figure 5 54: The product with the biggest unit price.	79
Figure 5 55: The product with the lowest unit price.	79
Figure 5 56 : The product with the biggest unit price.....	80
Figure 5 57: The product with the biggest unit price.....	80
Figure 5 58 Ten products with the highest Unit Price.....	81
Figure 5 59: ID and sum of Quantity.	82
Figure 5 60: The product with the biggest quantity.	82
Figure 5 61: The product with the lowest quantity.....	83
Figure 5 62: The product with the highest quantity. (BI)	83
Figure 5 63: The product with the lowest quantity. (BI)	83
Figure 5 64: Profits per ID.	84
Figure 5 65: ID with the highest profit.....	85
Figure 5 66: ID with the lowest profit.....	85
Figure 5 67 ID with the highest profit.(BI)	86
Figure 5 68 ID with the lowest profit. (BI)	86
Figure 5 69: Shipping Cost per ID.	87
Figure 5 70: ID with the biggest shipping cost.....	87
Figure 5 71: ID with the lowest shipping cost.....	88
Figure 5 72: Map chart with the 47 regions.	89
Figure 5 73: Map chart with three selected regions.	89
Figure 5 74 Map (BI).....	90

List of tables.

Table 4 1: Table of attributes	48
Table 4 2: Table of attributes	49
Table 4 3: Table of attributes	49
Table 4 4: Table of attributes	50
Table 4 5: Table of questions for analysis.....	52

1 INTRODUCTION

A challenge that businesses face every day is the accumulation of a huge volume of data and the difficulties in managing this information through the use of traditional systems. Businesses gather daily in their databases a large number of documents coming from the internal and external environment such as transactions in point-of-sale systems, data from different production machines, data from applications for immediate customer service, user reviews for company's products in various forums or social media.

Although businesses have created a number of reports that can be found in the ERP systems to deal with this challenge, these actions have not produced the desired results. The use of conventional reporting systems or data mining tools to process stored information is not the best solution as it takes a lot of time or special techniques users' skills to operate these systems and the extraction of useful knowledge through the data.

Businesses need intelligent Business Intelligence Systems which will be very friendly to the users, have great ease of installation, will save considerable time for businesses and will enable the analysis of large volumes of data in a flexible and interactive way. In this thesis there is a study of a business intelligence system and presents the benefits of this Business Intelligence system with its application to real company data. The goals of this diploma thesis are:

- Examination of the relevant literature on the term "Big Data" and Business Intelligence Systems.
- Presenting the benefits of using Business Systems Intelligence in managing large volumes of data.
- Presentation of the possibilities of Qlik View software.
- Application of the software to real company data and visualize the results through them in order to highlight the benefits of using Business Intelligence systems.

The diploma thesis has the following structure. The first chapter is an introduction to diploma thesis and a description of the goals. The second chapter is a bibliographic review of the term "Big Data". The third chapter is the presentation of Qlik View software capabilities. In the

fourth chapter these software applications are applied to real company data and results from data analysis are presented. Finally, the fifth chapter outlines the general conclusions regarding the role and benefits of Business Intelligence systems in today's highly competitive business environment and makes some proposals for future research.

1.1 Supply chain management and logistics theory.

1.1.1 Supply chain management definition

The Council of Supply Chain Professionals (CSCMP, 2013) in their glossary of terms defines Supply chain Management as:

«Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers». In essence, supply chain management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, and finance and information technology.” (CSCMP, 2013, p. 187)

Chopra and Meindl (2013) give plenty of examples of companies such as Dell, Amazon, Wall-Mart, Seven Eleven and others that recognized the importance of applying supply chain management strategies to increase the profitability of their firms. In contrast, the authors provide with examples of companies like Webvan, Kozmo and Borders that failed to identify this importance and gradually failed to adapt to modern business environment. Supply chain management is necessary in a modern company in order to manage the supply chain and adapt it to changing technologies and customer expectations.

1.1.2 Logistics definition

Gleissner and Femerling (2013, p. 4) use the definition of The European Committee of Standardization CEN in order to define Logistics as: «The planning, execution and control of the movement and placement of people and/or goods and of the supporting activities related to such a movement and placement, within a system organized to achieve specific objectives».

Logistics in general has been a field that has been growing for several years and will continue growing for the next years to come (Cheong, 2003). The Logistics field constitutes a very important part of every economy worldwide since for example the costs associated with logistics activities average about the 12% of the World GDP. Globalization was a major trend behind the growth of the logistics sector in the form of the development of the Third Party Logistics (3PLs) companies that are the main conductors of logistical activities since companies focus more and more in their core competencies and outsource the rest.

According to Ansari and Modaress (2010), there are some key drivers at the side of the shippers that lead to the recent growth of the 3PL industry globally. There is a significant pressure to further improve operational efficiency in their operations, to improve the quality levels, to enhance flexibility, to secure short term profitability as well as to maintain a very high level of customer service. These drivers have forced a large amount of shippers to outsource several parts of their supply chain activities to 3PL companies.

2 BIBLIOGRAPHICAL OVERVIEW

In this unit there will be an effort to explain the term of Big Data, their basic characteristics and its application in Supply Chain Management.

2.1 Definition of Big Data

«The term of Big Data refers to huge quantities of data, that a company collects daily and it is difficult to be stored or analyzed by using classic tools.» (Sanders 2014).

«Big Data are datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze» (McKinsey Data Study, May 2011)

According to a research from the IDC Company in 2007, the quantity of the produced digital information was for the first time, higher than the storage capacity. We can see this relationship between the quantity of produced information and available storage in the next graph. (Gantz *et al.*, 2007).

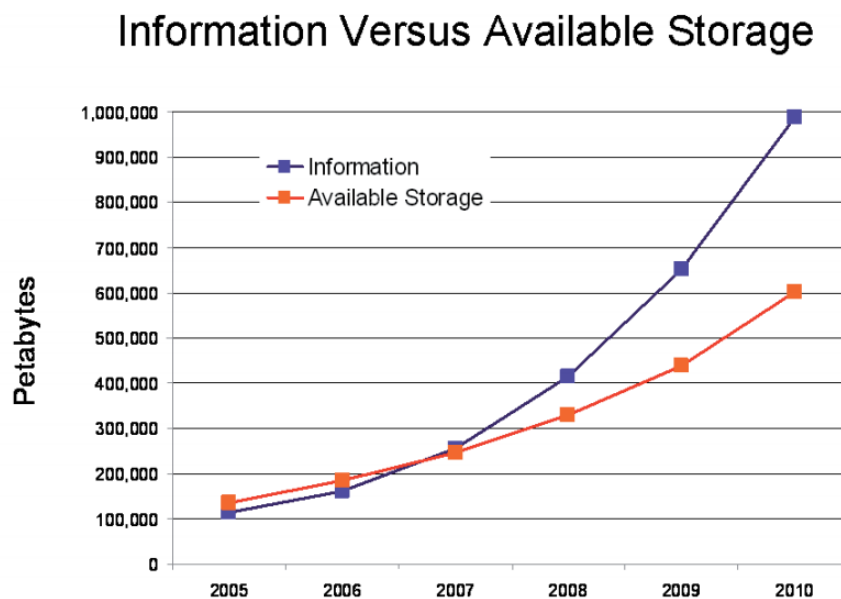


Figure 2 1: Development of the quantity in produced information and storage availability

(Gantz *et al.*, 2007).

The factors that lead according to research by IDC company to this increase in the quantity of data generated in the future is the computerization of several businesses, the creation of new applications and services to better serve customers (such as the web service click-to-talk) the use of new equipment by enterprises (as RFID systems and sensor networks) and increased performance and features that are currently available in mobile phones. A typical example is the database of the company Wal-Mart, which collects daily records of large amounts of information derived from the daily transactions of the company with its customers. According to research company IDC, this database increased from 110 terabytes in 2000 to 500 terabytes in 2004. This large volume of data helps the Wal-Mart company to improve its procedures and functions, but also provides useful information to the suppliers of the company. (Gantz *et al.*, 2007)

Also, an important factor leading to the increase in the amount of generated data is the increasing use of the Internet. The following figure shows the evolution of the number of Internet users.

We observe that the number of people who use the Internet daily has increased significantly in recent years and continues to show upward trends. This means that more data currently recorded in the log files (log files) in web servers. A log file records all of a consumer's activities during a visit to a website. The data collected by businesses with the help of these files is particularly useful as can companies through the analysis of these to gain useful knowledge for the profile and the needs of their customers, and then they can apply appropriate strategies for their attract and satisfy them with the best possible way.

Growth of the Internet

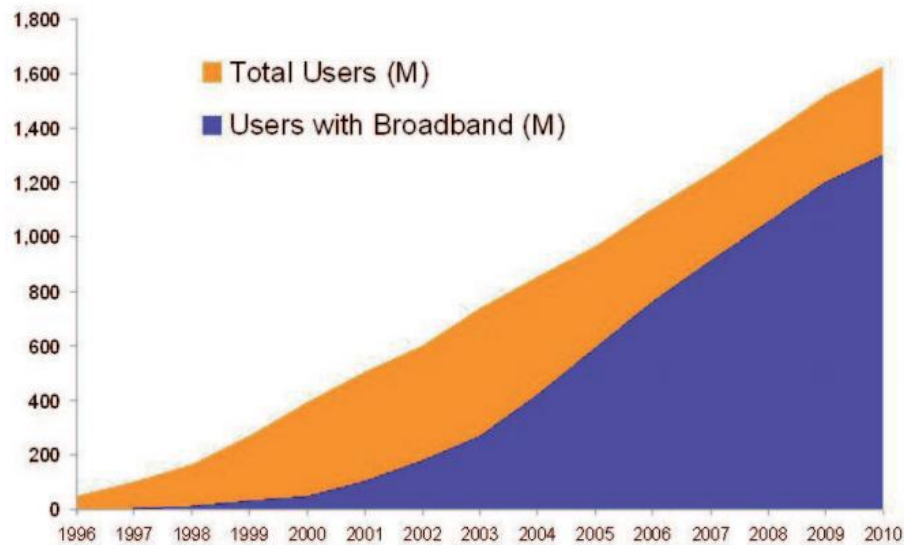


Figure 2 2: : Evolution of the number of Internet users and users with access to high-bandwidth networks (Gantz *et al.*, 2007)

The size of the Big Data (file size) is not the only characteristic of Big Data word. There are other factors such as the variety of data and the speed at which they are produced today, and this is what the companies must reckon (Russom, 2011). The term variety of data refers to the various sources from which today come from Big Data and the various forms in which they may have.

According to Nada R. Sanders (2014) the Big Data can come from sources such as point-of-sale (POS systems), various sensors for monitoring environmental conditions (eg temperature monitoring in a warehouse for protection products), RFID or geographical position detection systems known to us ,as GPS systems. Source of data still are call centers, through which recorded large quantities of telephone conversations, photos and videos, which are produced daily from smart phones, and consumer opinions, which hung on available Internet Blogs. Due to the technological evolution there is a numerous data sources creation which continuously produces large amounts of information. Typical examples are the social media such as Facebook, Twitter, LinkedIn and other similar instruments of which are created daily, reproduced and disseminated rapidly vast amounts of information.

In addition to generating data sources should be mentioned and the different categories of data that exist today. According to Bernard Marr (2015) data included today in one of the following categories

Structured data

In this category of data as specified by the name, are including data stored in a specific structure and easily accessible by the members of a company. The language used for managing such data is the Structured Query Language (SQL), which was developed at IBM by Andrew Richardson, Donald C. Messerly and Raymond F. Boyce, in the early 1970s.

Typical examples of data included in this category are:

- Data from POS sales systems
- Financial data
- Data from the customer base of a company

Although this data category now provides enough information to the members of a company about the progress and the current situation of the company itself, is not enough to understand the market and consumer preferences.

Unstructured data

This matter is addressed in data which cannot be stored in columns, rows or fields in a database. As a result we cannot analyze this data using traditional systems. This category of data may include the following:

- Photos, images, videos
- Data from websites
- Email, PDF files
- Blogs, posts on various social media
- Power Point Presentations

- Clickstream data

This category of data although the disadvantage of the lack of concrete structure is estimated in accordance with IBM that 80% of the data being produced in enterprises classified as unstructured data (Savvas, 2011).

The combination of this category of data with structured data is necessary today for companies to gain competitive advantage and increase the share of the market

Internal data

The term internal data refers to these data that held by an enterprise and the company can access them at any time. Examples of such data are:

- Comments by customers
- Sales data
- Data from various researches conducted by the company
- Data from closed circuit monitoring
- Transaction data
- Data from customer orders and stock inventories

External data

The term external data includes data that is not in the ownership of a business. These data can be public and other companies can have access on them. There are also private data for which a company must pay a certain fee to access them. Examples of such data are:

- Data about weather conditions
- Data published by governments and Ministries
- Data from statistic researches
- Data collected by companies engaged in market research

- Data from Google Maps or Google Trends

The last characteristic of big data is speed (velocity) with which are produced and distributed today. Large amounts of data are created daily rapidly in a company, which provide a clear picture at all times to managers of all segments about the company's situation. Apart from the data generated in the internal environment, companies record and store information from the external environment which are constantly updated and provide useful information on companies in terms of market image and support for the formulation of appropriate strategies.

In addition, a share of responsibility in this increase in the rate at which data are produced is consumers themselves. Everyday many users surf the internet via computer or smart mobile phone, exchange messages with their familiar faces through social networking applications are informed about various hot topics through search engines, publish opinions and comments on websites and forums, and shop online. All these user activities are digital data which contribute to increasing the total amount of data and the rate at which data are generated. Through the registration, the monitoring and analysis on a regular basis these digital data businesses are able to understand better consumer needs and develop new products and services to meet these needs and to improve the consumer experience. The upward trends that are being observed in data generation speed are a challenge for today's enterprises. Because the data produced both at home and abroad environment characterized by short shelf life and high refresh rates, it is essential that companies implement new methods and invest in new technologies, which will offer great help and useful tools to manage and analyze this large data volumes in real time (Villars et al., 2011).

Timely and real-time analysis of this large volume of data is crucial in today's competitive environment because the ability of a firm to discover trends and opportunities in the market faster than its competitors, through data analysis, gives a strong competitive advantage over other companies, strengthen its image in the market and significantly improves its future.(Marr, 2015)

It should be understood by today's businesses as well as new comers entrepreneurs, who are now taking their first steps on the market that we live in an age characterized by a large volume of data and number of sources which produce rapidly large quantities information daily. The data produced today not only in the form of numbers in a database or an Excel file,

but may have various forms and from many sources simultaneously. The focus of a business in a particular set of data is now wrong strategy and does not give any advantage to companies. Businesses must continuously examine all data sources of production and all the various ways to have a complete picture of the market and trends prevailing at any time in them.

Summarizing, the expression of large data, in accordance with Hurwitz (2013), Nugent (2013), Halper (2013) and Kaufman (2013) described a data set having the following characteristics:

- **Volume.** Large amounts of data.
- **Variety.** Wide variety of data from different sources and in different formats.
- **Velocity.** High speed of creation, replication and dissemination of data.

We can also consider two additional dimensions when we talk about big data.

- **Variability.** In addition to the increasing velocities and varieties of data, data flows can be highly inconsistent with periodic peaks. Is something trending in social media? Daily, seasonal and event-triggered peak data loads can be challenging to manage. Even more so with unstructured data.
- **Complexity.** Today's data comes from multiple sources, which makes it difficult to link, match, cleanse and transform data across systems. However, it's necessary to connect and correlate relationships, hierarchies and multiple data linkages or your data can quickly spiral out of control.

2.2 Why is Big Data important

The importance of big data doesn't revolve around how much data we have, but what we do with it. We can take data from any source and analyze it to find answers that enable 1) cost reductions, 2) time reductions, 3) new product development and optimized offerings, and 4) smart decision making. When we combine big data with high-powered analytics, we can accomplish business-related tasks such as:

- Determining root causes of failures, issues and defects in near-real time.
- Generating coupons at the point of sale based on the customer's buying habits.
- Recalculating entire risk portfolios in minutes.
- Detecting fraudulent behavior before it affects your organization.

2.3 Who uses Big Data?

Big data affects organizations across practically every industry. Below we can see how each industry can benefit from this onslaught of information.

Banking

With large amounts of information streaming in from countless sources, banks are faced with finding new and innovative ways to manage big data. While it is important to understand customers and boost their satisfaction, it is equally important to minimize risk and fraud while maintaining regulatory compliance. Big data brings big insights, but it also requires financial institutions to stay one step ahead of the game with advanced analytics.

Education

Educators armed with data-driven insight can make a significant impact on school systems, students and curriculums. By analyzing big data, they can identify at-risk students, make sure students are making adequate progress, and can implement a better system for evaluation and support of teachers and principals.

Government

When government agencies are able to harness and apply analytics to their big data, they gain significant ground when it comes to managing utilities, running agencies, dealing with traffic congestion or preventing crime. But while there are many advantages to big data, governments must also address issues of transparency and privacy.

Health Care

Patient records, Treatment plans, Prescription information. When it comes to health care, everything needs to be done quickly, accurately – and, in some cases, with enough transparency to satisfy stringent industry regulations. When big data is managed effectively, health care providers can uncover hidden insights that improve patient care.

Manufacturing

Armed with insight that big data can provide, manufacturers can boost quality and output while minimizing waste – processes that are key in today's highly competitive market. More and more manufacturers are working in an analytics-based culture, which means they can solve problems faster and make more agile business decisions.

Retail

Customer relationship building is critical to the retail industry – and the best way to manage that is to manage big data. Retailers need to know the best way to market to customers, the most effective way to handle transactions, and the most strategic way to bring back lapsed business. Big data remains at the heart of all those things.

2.4 Big Data applications in SCM

The research domain of SCM is wide and contains several technical points of departures such as sourcing, operations management, logistics, finance, and IT. Many definitions of SCM exist, but for the purpose of this thesis we rely on the following definition provided by Stock and Boyer : «The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing,

production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction.»

The application of big data in SCM has been referred to as SCM data science, predictive analytics, business analytics, big data analytics and supply chain analytics, which are principally similar terminologies for applying advanced qualitative and quantitative analytics for SCM purposes by utilizing the vast amount of fast moving and diversified data available. Overall, there are two distinct approaches of applying big data; it can either improve existing processes by focusing on current business needs and challenges, or data can be explored to create sellable products and services as new value propositions. The potential of big data is not limited to manufacturing companies; retailers, service providers, healthcare professionals, and governments, among others, also see big data potential. A survey of 145 responses shows that large service companies and their supply chains account for more employees and higher revenues than manufacturing companies; the service supply chains are therefore important to include for SCM theory building. In this regard, the supply chain of both physical products and service deliveries can both benefit from big data.

On an overall supply chain level, a structured literature review demonstrates that big data can be applied in SCM for operational and development purposes, value discovery, value creation, and value capture. Analytic applications are best utilized across the supply chain, where analytics operate cross functionally and as an integral part of company strategy. In this context, Sanders identifies source, make, move, and sell as primary areas of application for big data. For “source” big data may be used to segment suppliers, evaluate sourcing channel options, integrate with suppliers, and support supplier negotiations. For “make” it involves granular performance reporting, mitigation of capacity constraints, inventory optimization, facility location/layout, and workforce analytics. For “move” the application of big data involves routing, scheduling, using transportation alternatives, optimizing, and maintaining vehicles. Finally, for “sell” and marketing purposes, big data enables micro segmentation of customers, the capture and prediction of customer demand and behavior, and price and assortment optimizations. These applications are defined as conceptual, but also involve some empirical grounding. Furthermore, another literature review by Wang et al. identifies the application of supply chain analytics in SCM as a strategic asset to be applied in several

operational and strategic SCM processes. They establish a five-level analytic maturity framework for analytic applications in SCM. Level one and two are functional and process-based analytics that can be deployed in supply chain operations covering demand planning, procurement, production, inventory, and logistics. This involves, for example, aligning supply and customer demand at stock keeping unit level, increasing supply-chain visibility, managing and mitigating risks, managing real-time performance, and optimizing processes. Furthermore, collaborative, agile, and sustainable analytics as maturity level three, four, and five can be deployed in strategic SCM settings for strategic sourcing, supply-chain network design, and product design and development. This involves e.g. evaluation and selection of suppliers, the physical configuration of the supply chain, and to meet fluctuating demand requirements and utilizing market opportunities by having a rapid product design process. Further studies include the use of big data in the entire product life cycle from the beginning to end of life and within human resources.

2.5 Business Intelligence -Analytics Systems

As the volume of total data that is available to businesses and the number of customers they serve is steadily rising, businesses have faced a new challenge today. This challenge has to do with finding and incorporating new technologies for faster and better customer service. Businesses in order to tackle these new barriers in the most effective way, adopt Business Intelligence tools and systems. Through these tools the companies are able to anticipate future market trends and to achieve more goals, which are defined through operational strategies.

For a long time, management information systems (MIS) were the main support of businesses in carrying out various day-to-day operations. However the specific IT systems did not always meet the high expectations of executives, who were responsible for decision-making. Business executives wanted new information systems that:

- would be able to offer useful support to businesses for decision-making under tight deadlines and due to high time pressure
- would constantly monitor the market and the actions of competitors by providing useful information to the company's management at any time

- would carry out a continuous analysis of the data from both internally and externally, with the main objective of identifying critical factors for better management and improvement of the company's future course.

In other words, existing information systems were unable to manage the data they collected from a large number of different sources and were not able to properly interpret this data or extract useful information through the analysis of these. The need to create new information systems was imperative for companies to effectively address these barriers and to be able to react more quickly to changes in the market (Olszak & Ziemba, 2007).

The term Business Intelligence was essentially launched by Gartner Group in 1996. Business Intelligence describes the implementation of a set of methodologies and technologies such as Web Services, Data Warehouses, OLAP, Data Mining, Data Replication Technologies, etc. which aim to improve the efficiency of operations within an enterprise and to support business management in the decision-making process to achieve a competitive advantage (Ranjan, 2009).

According to Professor Mykola Pechenizkiy (2006) of the Department of Mathematical Information Technology at Jyväskylä University, “Business Intelligence describes a broad category of technologies that help businesses to understand the past and better anticipate future trends”. More specifically, Business Intelligence Systems provide business executives with the ability to collect, store, access and analysis of data for the purpose of monitoring the daily performance of the company and taking better measures and strategies for the future course of the company.

Professor Jayanthi Ranjan (2009) from the Institute of Management Technology of India in her article entitled "Business Intelligence: Concepts, Components, Techniques and Benefits" in the Journal of Applied and Theoretical Information Technology reports the views of various researchers for the term Business Intelligence. Specifically, Robert Stackowiak, Joseph Rayman and Rick Greenwald (2007) report that Business Intelligence is the process of collecting and storing a large amount of data. Subsequently we analyze these data and extract

useful reports that include the substance of these data and provide useful support to business administration's for taking better, everyday, business decisions.

A different interpretation of the term is that "Business Intelligence is a set of methods and techniques that are useful tools for modern businesses, trying to ensure that all business executives have at all times tangible decision-making information and make a significant contribution to improving the performance of all business functions and the company image in the future" (Cui et al, 2007).

Also, according to Li Zeng, Lida Xu, Zhongzhi Shi, Maoguang Wang and Wenjuan Wu (2006), the increasing use of enterprise information systems to meet their daily needs in today's competitive, heavily changing environment has brought about significant challenges.

Business analysts and executives who are responsible for decision-making have a larger volume of data to manage. But because the data are scattered within the enterprise or stored in systems that require the use of specialized personnel to export them, business executives do not receive the information they need in time to cope with the changing conditions of the external environment. Business Intelligence systems seek to eliminate this uncertainty in the strategic decision-making process by offering a set of tools that gather, analyze and convert these large amounts of data in useful information for executives of a business.

In addition, Milena Tvrdikova (2007) describes that a key feature of business intelligence systems is their ability to gather data from a variety of sources, to possess advanced analysis methods data and be able to support multi-user requests. Mateo Golfarelli, Stefano Rizzi and Iuris Cella (2004), in turn, define business intelligence as the process of converting data into information and then to knowledge.

Such knowledge may relate to customers' needs, factors that significantly affect consumer decisions, market competition, industry conditions and generally the economic, technological, political, demographic and cultural trends that characterize at any time the external environment. This knowledge is then used by executives at the strategic, tactical and operational level within an enterprise to improve the company's performance and achieve the goals set by the company's strategy.

Ganga Dharan and Swami (2004) describe the concept of Business Intelligence as the use of technologies for collecting and effectively managing data collected by companies to enhance their market image and improve their profitability. An ideal system Business Intelligence

provides executives of a business, its external partners, its suppliers and all interested people accessibility of useful information for better execution of their duties.

At the same time, Business Intelligence systems enhance the insight of businesses and can take better and more effective decisions. Businesses through use Business Intelligence systems have a better picture of all internal operations, are able to discover new sources of revenue as well as new ways of saving costs.

In summary, there are several and different definitions in the international literature on the term Business Intelligence. But each one ends up with the same conclusion. One of the most common is the following one that mentions: «Business Intelligence is a set of methodologies, processes and processes technologies that convert raw and raw data into useful and meaningful business information. This information is an important support for business executives in decision-making and can give a business a strong competitive edge over other companies» (Boris Evelson, 2008).

2.6 Architecture of the business information systems

Business Intelligence systems have their own distinctive architecture. The elements from which a Business Intelligence system is comprised are the following:

Data Warehouse

The data warehouse is a systematic approach in which data is collected in a common repository where it is checked for quality and organized in such a way that it can then be analyzed and presented in suitable forms which can provide useful guidance in the process decision making (Cody et al., 2002). This data comes from different databases and sources that can either be installed within the enterprise environment or be part of the external environment in which businesses operate, and their contribution is crucial to the more efficient execution of business operations. The data warehouse is considered as the basic part of a system Business Intelligence.(Olszak&Ziemba,2003). Data warehouses are continually fired with useful business data to ensure that data is available at all times to make business decisions.

According to Mark Hwang and Hongjiang Xu (2007), a well-functioning data warehouse shows the following characteristics:

- Ease of use and quick retrieval of information: Warehouses

Data must be designed in such a way that both end users and the executives responsible for it maintain the information systems, be able to do it easily and efficiently. Still, all the strains in a business must be able to recover quickly useful information through the data warehouse in order to use them in the decision-making process. Otherwise a wrong and ineffective effort creating a data warehouse can lead to significant charges for the companies themselves.

- Greater volume of data and high-quality information: An efficient data warehouse provides storage capability more and better quality information that allows an enterprise to monitor its performance on a daily basis with more detailed control and take measures to improve its image on the market.
- Improving productivity and making better decisions: As the employees and executives within a business have more and high quality information through the data warehouses can make better decisions, which improve the overall productivity of the business.
- Improving business processes and strengthening the competitive advantage of the business: A well-stocked warehouse data is a powerful support tool for the company's staff and provides important guidance on finding new ways to reduce costs, increase revenue, improve business processes, better management of the relationships of the company with customers and the strengthening of its competitor advantage.

To summarize, the main role of a data warehouse is collection of information on a regular basis from both the internal and external environment of a business. Ensuring that the always available information in a comprehensible form about the company's image and providing support to the decision-making process by providing an overview of the problems and opportunities that occur at any time in the company (Hevner & March, 2005).

ETL Tools

“In today's competitive environment, business opportunities are emerging constantly. In order for a company to maintain a strong lead in the market against other companies must be able to take advantage of these opportunities as soon as they appear. To achieve this, the company

needs sophisticated Business Intelligence tools that will provide it with timely and up-to-date information at all times. ETL tools have been developed for to meet this need” (Schink, 2009).

The term ETL comes from the initials of the words Extraction, Transformation and Loading. The purpose of these tools is to extract data from one or more production sources, converting these data into a single structure and importing them into the company's data warehouse. Those tools ensure that a business data warehouse always has timely and up-to-date information. According to Hagen Schink (2009), Celina Olszak (2006) and Ewa Ziemia (2006) the ETL process is divided into 3 stages:

- **Extraction stage:** This stage includes obtaining access and exporting data from different sources, which are involved daily in the execution of business processes.
- **Transformation stage:** This stage is being carried out after data extraction is considered as the most complex stage in the ETL process. The reason is because the data is extracted from different sources and they are characterized by a different way of organization and structure. The purpose of this step is to convert the data into a single structure, which also features the data store in which it is transferred. This conversion is usually done through traditional programming languages, scripting languages, or through SQL language. In addition to converting the data to this stage data purification and control is still done to ensure that business executives always have high-quality information at their disposal.
- **Load stage:** After the data have been checked for their validity, quality and converted into the appropriate form, the final stage is to transfer to the warehouse company data.

There are several suppliers on the market who offer ETL solutions. But choosing the right solution is not an easy task because there are a number of factors, such as the needs of a company, its financial resources, the existence of already established IT systems and the constraints they pose, which play an important role in the decision-making process with which solution is the best.

OLAP Techniques

According to Dinu Airinei and Daniel Homocianu (2009) the origin of the term OLAP or On-Line Analytical Processing is due to the difficulties encountered in the data analysis process due to the fact that the databases on which the data were stored were updated on a regular basis through the transactions recorded by TPSs, and due to the lack of appropriate information systems to analyze this large amount of data in real time.

Through On-Line Analytical Processing it is possible to analyze large volume and high data complexity in real time with the aim of optimizing processes within a business such as tracking the daily performance of a company, managing customer relationships, tracking profitability of products or services, and other similar actions. Also, with the help of OLAP tools, businesses can quickly create customized reports according to predefined criteria, predict market trends and changes in consumer behavior as well as identify weaknesses, threats or hidden opportunities (Olszak & Ziemba, 2006).

On-Line Analytical Processing Technology is an evolution of previous systems and acts as a modern approach to supporting the decision-making process. Through dynamic and multidimensional analysis and data exploration, companies have an overview of the business situation from different angles and are able to find useful information and knowledge.

Data Mining

The term data mining describes the process by which algorithms, knowledge from the statistics, artificial intelligence, engineering and database systems are applied to large data warehouses to find correlations between the data and the extraction of useful information, through this analysis. Information extracted through data mining tools are then presented in the form of reports in order to be understood and easily understood by business executives and can be used as a tool to support the decision-making process.

For example, a business can use data mining techniques to identify the categories of products that are often purchased at the same time as well as categories of products whose market depends to a certain extent on the movement of the other categories.

Real-time BI

In a society that is today characterized by increased use of smart devices, the ability to connect a Business Intelligence system with mobile phones and tablets is an important feature and is particularly popular for the market. Through this capability, all executives of a business are informed at all times of trends in the market. Because information is provided in real time, businesses can use this knowledge to their advantage. Marketing executives can create special offers for consumers, thus improving the level of consumer experience they acquire. In addition, in a storage and distribution company, executives regularly have a clear picture of the status of the warehouse and the degree of coverage of the stores they serve.

Finally, companies who are engaged in e-commerce and the promotion of products over the Internet, have a constant view of the behavior and movements of consumers on the website and can shape appropriate actions to improve the browsing experience on the site.

3 QLIK VIEW SOFTWARE

QlikView platform is offered by the company Qlik. The company was founded in 1993 in Sweden by Bjorn Berg and Staffan Gestrelus. Their vision was to create a new kind of software that would imitate the way the human brain works. The result of this vision was the QuikView platform where the word came from the initials of the words Quality, Understanding, Interaction and Knowledge. In 1996 the platform was renamed QlikView and its name reflected the ease with which users could perform thorough data analysis by means of a simple click. In 1999 the QlikView platform successfully installed in a large number of small companies as well as some large corporations such as Tetra Pak food processing and packaging company and the biopharmaceutical company AstraZeneca. To 2004 after funding \$ 12.5 million secured by firms Accel Partners and JVP (Jerusalem Venture Partners), the company managed to achieve a growth rate of 35% and \$ 13 million in total revenue. Also, by creating a global research and development team and ensuring cooperation with Intel and HP, the company managed to expand greatly the capabilities of QlikView platform and enhance its customer base with new companies like company logistics Schenker, the Dendrite clinical

systems company and the telecommunications company Ericsson. With these new capabilities and continuous updating of key technologies, Qlik company managed to grab the attention of big companies such as Best Buy, the Canon, the Panasonic, Shell and convert their existing customers in warm supporters of the platform QlikView.

A large share of responsibility in this warm support of the QlikView platform was and dissemination of positive comments and experiences by word of mouth (word of mouth). According to Henrik Been, Executive Director of Products, every person who used the QlikView platform was quite excited by the high quality and great ease of its use and this has led to create a climate of trust in the company and to achieve a high prevalence of specific platform. As a result in 2009 the company Qlik, by Lars Bjork directions, managed to increase its revenues to 157 million.

Today the company employs over 2000 people, has more than 1,700 partners worldwide and a customer base of approximately 36,000 customers in over 100 countries. According to Gartner research company (2015) is a leader due to high understanding of market needs, has made significant market penetration compared to previous years and in line with customer references is among the five best applications are widely used within an enterprise.

The QlikView platform, with the help of technology "in-memory associative search" features, allow users to manage in a way analogous to the human brain more easily a large amount of data and unlike traditional Business Intelligence solutions to take daily right business decisions. The simplicity that characterizes QlikView platform and the possibility of making real-time decisions are the reason why more and more businesses worldwide daily trust the QlikView platform for making business decisions.

In Greece QlikView platform is used by sixty-three big companies. Some of them are "ΜΑΣΟΥΤΗΣ", "IPSEN", "HELLENIC BANK", "CARREFOUR", "BAYER GREECE", "BIC", "ELBISCO" and other.

The example below reflects the possibilities it can offer the QlikView platform in a business with international activity. The specific dashboard, as illustrated in the figure 3.1 below includes information about a company's sales per market, per product category, per customer, data on the company's orders and indicators such as profit margin, which help the company's sales managers evaluate the sales image and propose corrective actions.

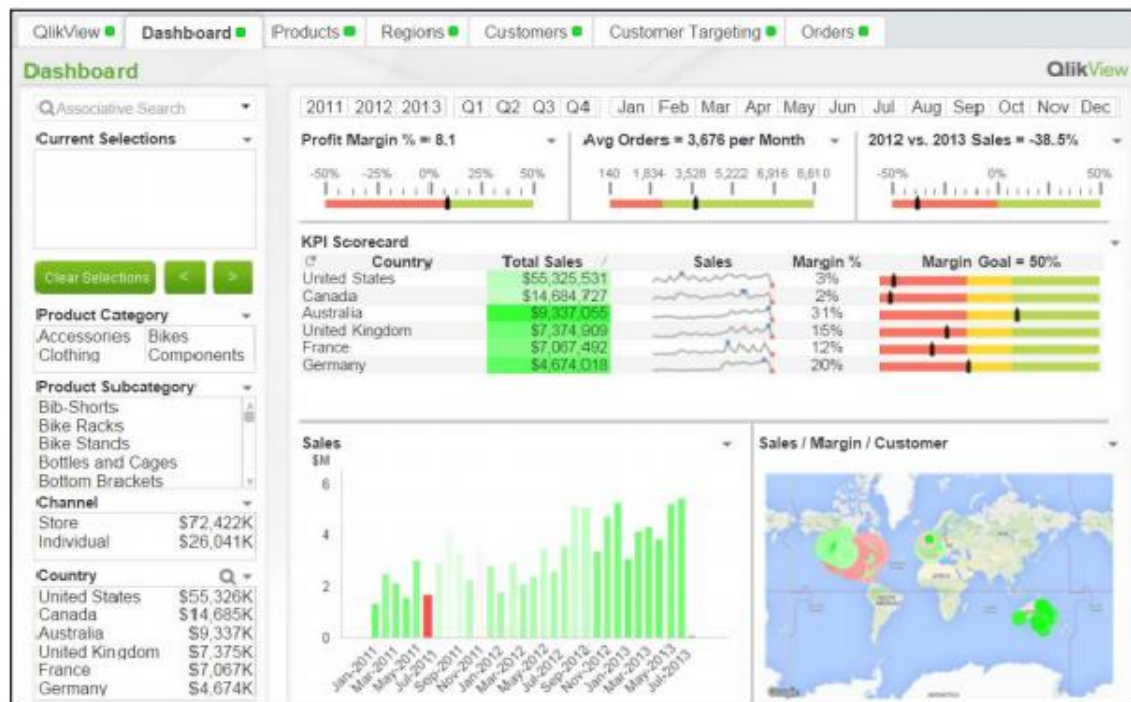


Figure 3 1: Sample of a sales dashboard through the QLIK VIEW platform.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)

We assume that as sales managers for the United States market, we want to look at the sales of the company by product category. On the QlikView platform, the data is browsed interactively by clicking on the corresponding field for which we want to get information. Clicking on the specific country we want, the dashboard image is updated as shown in the Figure 3.2 below.



Figure 3 2: Change the dashboard image after selecting a specific field.(Big Data and Business

Intelligence Software for the Supply Chain,Mant.N.,2016)

We are now monitoring the company's sales status for the United States market by product category.

In this market, the "Bikes" category shows the highest sales but the lowest profit margin, so as a continuation we choose this product category to explore more closely (Figure 3.3) the of Sales for the category "Bicycles".



Figure 3.3: Sales for each bicycle subcategory. (Big Data and Business Intelligence Software for the Supply Chain, Mant.N., 2016)

This choice leads us to discover that although "Mountain" bikes have good sales on the United States market, "Road" bicycles are not profitable in this market. In order to look more closely at the category of "Road" bicycles, we go to the "Products" tab. By going to this tab, we notice that QlikView has retained all the previous choices we have made and this makes navigating the dashboard easier. We also see by analyzing the "Road" category that the "Road-650 Red, 44" marked the smallest profit margin compared to other "Road" bikes on the United States market. (Figure 3.4)

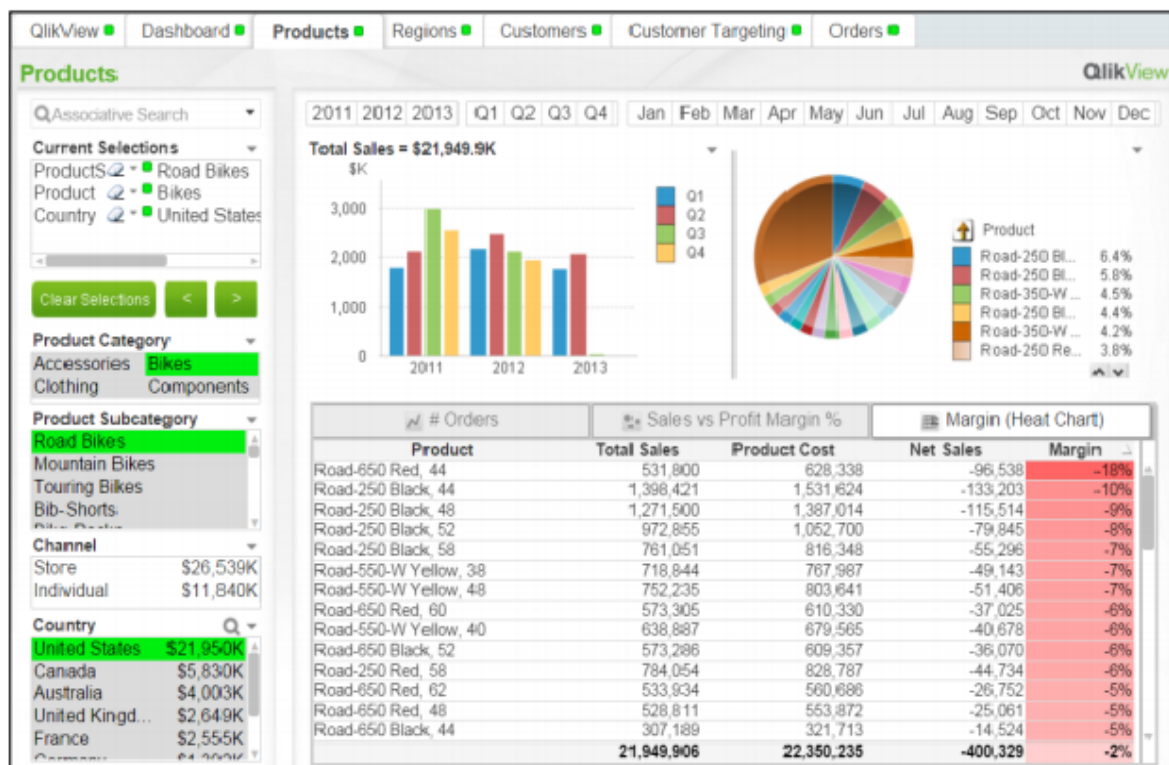


Figure 3 4: Sales and Profit margin for the "Road" category of bicycles in the United States market.(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)

In addition, through QlikView, we can quickly study the sales image and profit margin for "Road" bicycles worldwide, simply removing the "Country" field from our choices. Observing that there is a negative image of the Road-650 Red, 44 and world-wide, this leads us to the conclusion that it is not in the interest of the company to continue creating this type of bicycle. (Figure 3.5)

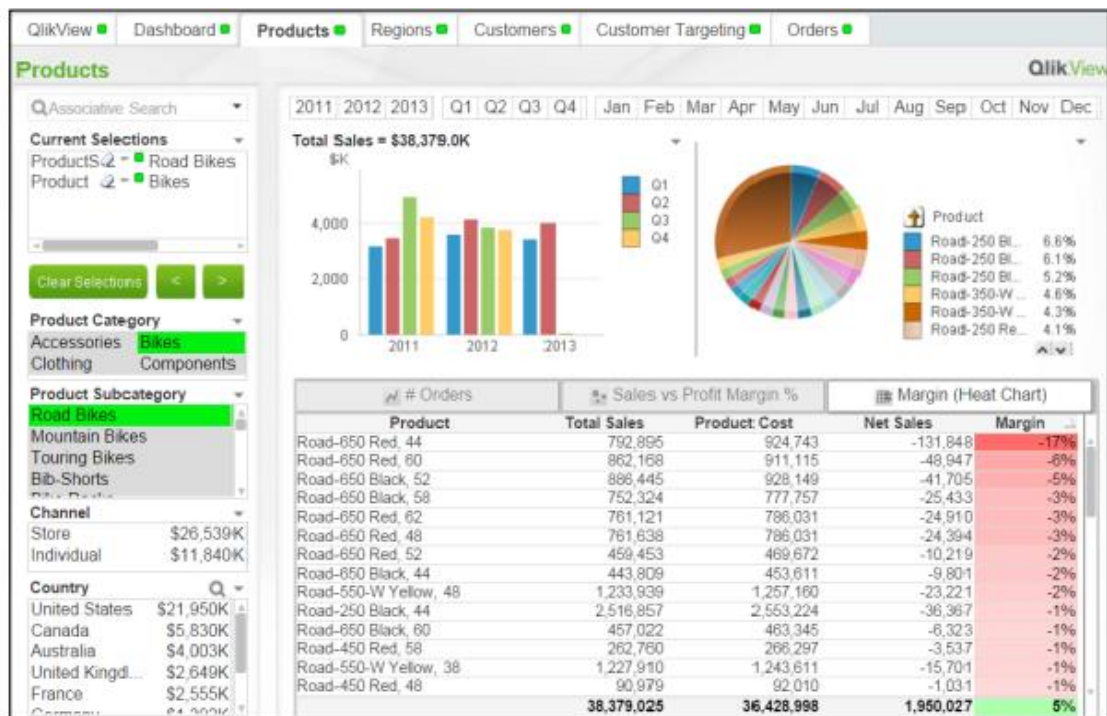


Figure 3 5: Sales and Profit Margin for the "Road" type worldwide.(Big Data and Business

Intelligence Software for the Supply Chain,Mant.N.,2016)

In addition to this information, the company can also make other useful conclusions about the image of the "Road" bicycle class. For example, the company can identify potential model bikes of this type, which should advertise to a greater extent and sell on the United States market instead of the "Road-650 Red, 44 » The Figure 3.6 below shows, with the aid of the scatter plot, the total sales and the profit margin for each "Road" bicycle model world-wide.

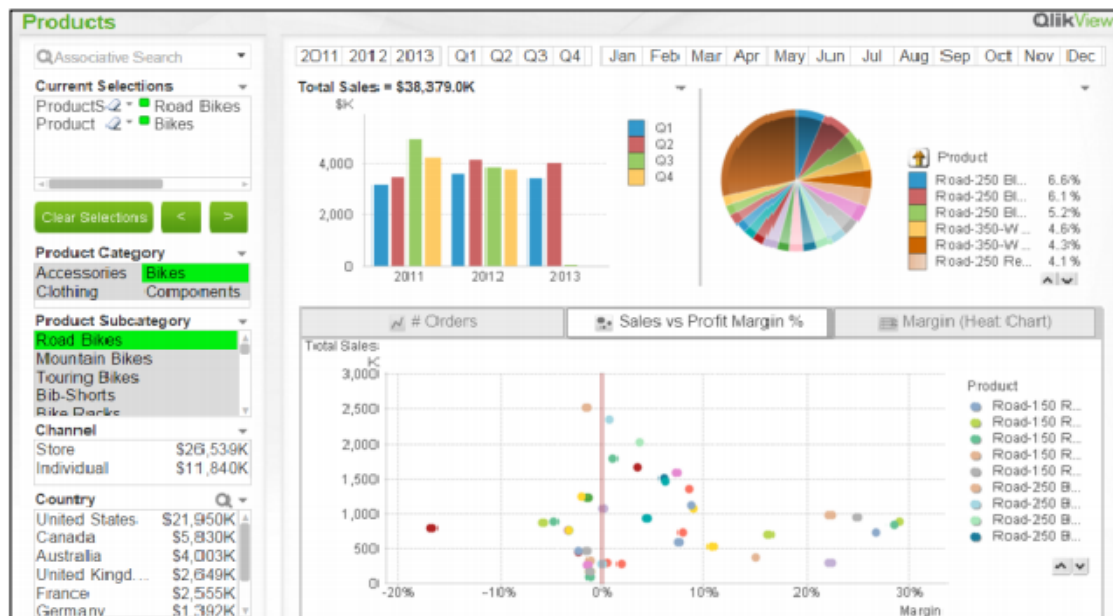


Figure 3 6: Total sales and profit margin for every "Road" bicycle model world-wide .(Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)

Looking at the Figure 3.6 we notice that some "Road" bicycle models appear on the bottom right, although they have a high profit margin, sales of these models are not so high. Perhaps these are the "Road" bicycle models that the company should focus on its promotional activities. In the QlikView environment, a user can get information about these products simply by selecting the specific piece of the chart with the help of the mouse. By selecting only bicycle models at the lower right edge, QlikView converts this user option to the corresponding query and updates the overall dashboard image as shown in the Figure 3.7 below.

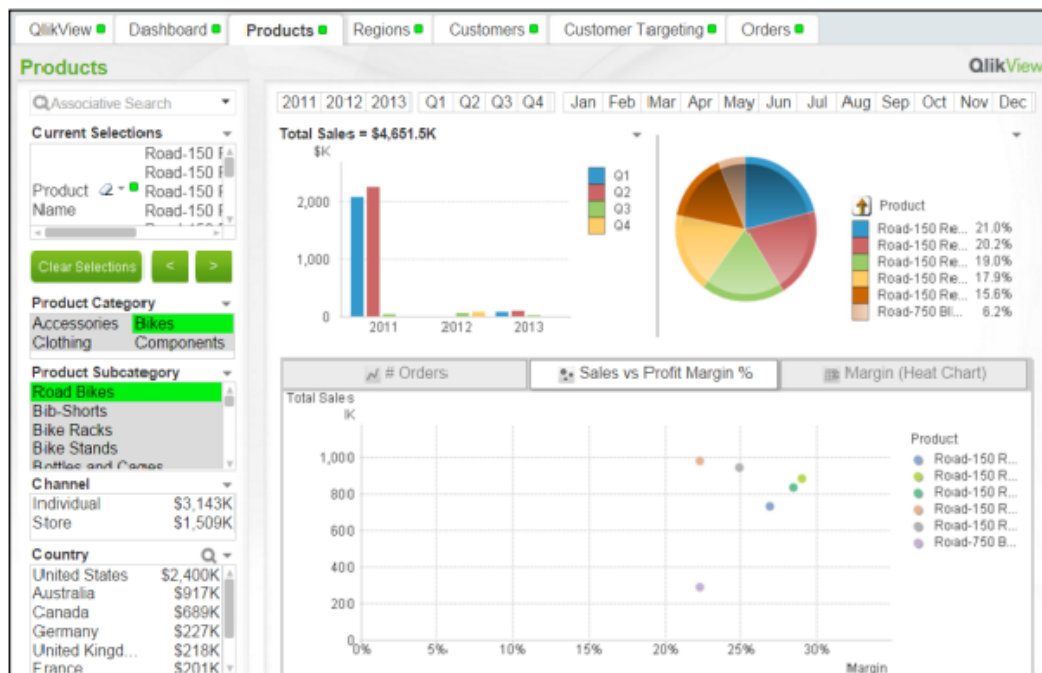


Figure 3 7: Road models with a high profit margin but wit low sales for the company Business

(Big Data and Intelligence Software for the Supply Chain,Mant.N.,2016)

The QlikView platform automatically displays the model of these bikes and also refreshes the charts to keep up with the choices made by a user. Then going to the "Regions" tab we can look at whether these specific "Road" models are the US market bidders for the company to focus on its promotions. Going to this tab, as shown in the Figure 3.8 below we notice that Specific bike models show high sales in the United States market.

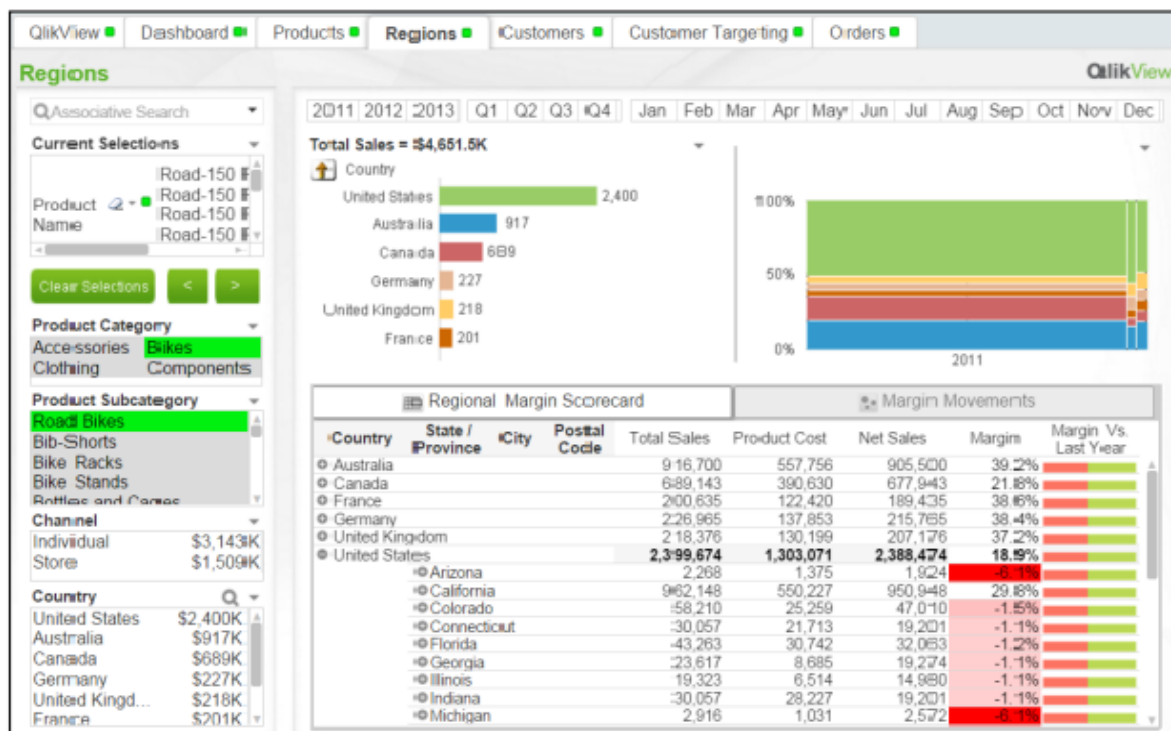


Figure 3 8: Sales of "Road" bicycle models with high profit margins per country (Big Data and Business Intelligence Software for the Supply Chain,Mant.N.,2016)

Finally, through the "Customers" tab, we can see demographics about customers who purchase these bicycle models. According to the Figure 3.9 below we notice that the majority of buyers are between the ages of 40 and 60. The company can use this information to form appropriate promotional actions and promotional messages for these bicycle models.



Figure 3 9: Sales of "Road" bike models with high profit margins per age.(Big Data and Business

Intelligence Software for the Supply Chain,Mant.N.,2016)

This example highlights the great flexibility the QlikView platform offers to business executives in the data analysis process and how easily one can get answers to issues that concern him in real time without the need for specific IT knowledge.

In today's highly competitive environment, the speed at which an enterprise identifies opportunities and makes decisions based on the data it collects is particularly important in order to stay ahead of the competition and maintain its competitive edge. The platform QlikView provides support in this direction, enabling users to explore huge amounts of data in a simpler and easier way and create personalized graphs and dynamic dashboards at the same time to present the results to interested members. As a result, businesses have real-time

feedback on their performance and can quickly identify opportunities to improve their overall profitability.

4 MICROSOFT POWER BI

Microsoft BI is a complete and fully integrated Business Intelligence suite. It can help to reduce the complexity of information interaction and organization. Meanwhile, Microsoft BI helps to gain business competitive advantages through better and smarter decisions. Microsoft provides a series of tools from data warehouse, data analysis to report creation to allow users to access, understand, analyze, collaborate and act on information whenever they want and wherever they are.

Microsoft aims at providing a BI environment which can improve performances of individual, teams and business units, thus, Microsoft delivers BI tools into different categories which can interact to each other: personal BI, Team BI and organizational BI. (Microsoft, 2008b) With the development of technology and other business and market needs, Microsoft provides also now Self-service BI and cloud solution.

Overall, Microsoft BI consists of SQL Server Integration Services, SQL Server Analysis Services, SQL Server Reporting Services, PerformancePoint Server, Excel, SharePoint and Office 365 and Power BI. All these tools are used to achieve the following goals, first of all, to provide quality data. Second goal is to gain deeper insight and improve decision-making process and finally to enable organizations carry out agile decisions to meet the corporate goals and strategy. (Microsoft, 2008b)

Power BI is a suite of business analytics tools to analyze data and share insights. Power BI dashboards provide a 360-degree view for business users with their most important metrics in one place, updated in real time, and available on all of their devices. With one click, users can explore the data behind their dashboard using intuitive tools that make finding answers easy. Creating a dashboard is simple, thanks to hundreds of connections to popular business applications, complete with prebuilt dashboards to help you get up and running quickly. And you can access your data and reports from anywhere with the Power BI Mobile apps, which update automatically with any changes to your data.

For data analysts delivering reporting and analytics to an organization, Power BI can be productive and creative with what is build. Power BI Desktop is a feature-rich data mashup and report authoring tool. Combine data from disparate databases, files, and web services with visual tools that help you understand and fix data quality and formatting issues automatically. With over 20 built-in visuals and a vibrant community of custom visualizations, create stunning reports that communicate your message effectively. With the Power BI service, publish reports securely to an organization and setup automatic data refresh so everyone has the latest information.

Power BI can unify all the organization's data, whether in the cloud or on-premises. Using the Power BI gateways, we can connect SQL Server databases, Analysis Services models, and many other data sources to the same dashboards in Power BI. If there are already have been reporting portals or applications, embed Power BI reports and dashboards for a unified experience.

Microsoft BI Framework

The following picture presents Microsoft BI framework.

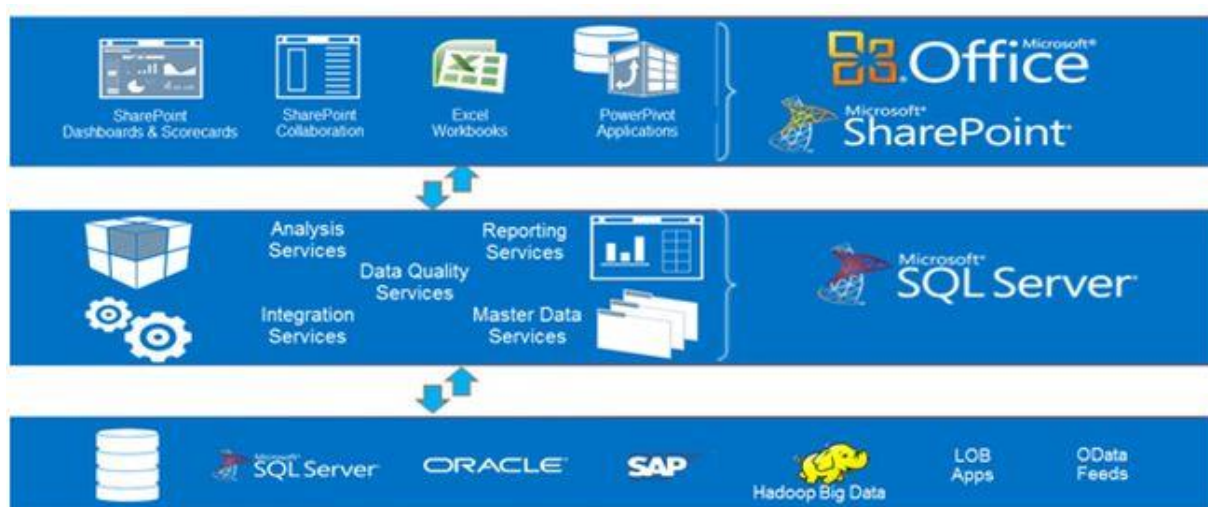


Figure 4 1 Microsoft BI framework

There are three main components in Microsoft BI framework: SQL Server, Office especially Excel and SharePoint. Each of these play vital roles in the BI suite. SQL server is used to deploy and manage data from both on-premises and cloud storage. SQL server also provides services for analysing, reporting, integration, which are the base of Microsoft BI suite. Second, Excel, which can be used as an end-user tool to enhance data discovery and analysis capabilities. The last one is the SharePoint, which enable users to collaborate, share all results and manage the usage. In SharePoint Online, users can get access to reports and information whenever and wherever they want.

It is stated in the figure above, with Microsoft BI suite, data can be gathered from different sources. Then with the help of ETL processs, all the data will be managed within SQL Server. Organizations can use the development tool with analysis service to build own data model. Then in the end user layer, users can use Excel or other tools to analyze data and all these analysis capabilities are supported by SQL Server. Users can also share their solution online with Office 365 nowadays which makes the information exchange more smooth and effective.

Microsoft BI Strengths and Weaknesses

Microsoft offers competitive BI packages to different users from developers, data scientists to business users. As a market leader, of course, there are lots of reasons make it to the position. At the same time, there are also something can be improved in the future.

Microsoft provides business user capabilities which can be easily integrated or applied to the enterprise level platform. Second, Microsoft provides the cloud-based solution, Power BI, which extends BI capabilities in Excel and provides user a platform to share and access information online in a more efficient way. Third, Microsoft offers lots of widely used products with really high reputation and this BI solution is well integrated with other products, which is the main reason why organizations choose to use Power BI. In addition, good support and quality of product, easy integration with other systems and applications, good development tools and capabilities and clear infrastructure and standards are also the strengths of Microsoft BI.

However, Microsoft BI still faces certain challenges in the market. First of all, Microsoft's Mobile BI offering is behind its main competitors. Despite the product improvement, Microsoft still suffers from its functionalities and capabilities. According to Gartner's survey, Microsoft BI's support for complex analysis and adoption is below average. In addition, the way of sales and configurations are also the cautions that Microsoft BI should pay attention to.

5 DATA ANALYSIS

In this chapter will be a presentation of the results of the analysis of the data. As we mentioned Qlik View software enables all users within the enterprise to analyze the large amount of data they collect daily in a simpler and more interactive way and at the same time take innovative business decisions faster than the main competitors.

But except the analysis of the data with Qlik View software, is going to be and an additional analysis using the Microsoft Power BI tool. The purpose of this additional analysis is to compare the two softwares in order to point out the most important differences between them. And to see one more alternative option for Qlik View. Also we are going to compare the results of the analysis, by creating figures using the same data.

In our case we have separated the data in three categories and we examined them separately. These three categories concern the customer, orders and inventory. The data that will be analyzed in the next parts of this chapter are from a Superstore in Japan at 2009, 2010, 2011 and 2012. This Superstore provides goods to everyone. It has three categories of products, Technology, Furniture and Office Supplies and this are split to some subcategories. Also, it has shipments and deliveries to all over Japan and the data give us the states of the orders. For greater ease in analyzing the data we used the application QlikSense. By using QlikSense there is the possibility of an immediate exchange of information and data within a safe environment. QlikSense application enables data to be explored from anywhere and from any device. Information and data is secure, since only users with access rights can receive or edit it. QlikSense instantly encrypts data and preserves it with complete security.

First let's take a more comprehensive look at the basics we need to understand and feel comfortable working with the software. Qlik works with all kinds of source data that can be located almost anywhere as long as it is accessible to the user. That source could be an Excel file. When we first start Qlik, we see the start page shown in figure below (Figure 5 1) . We also see the section My Work; these are the sheets that we have created by using our data.

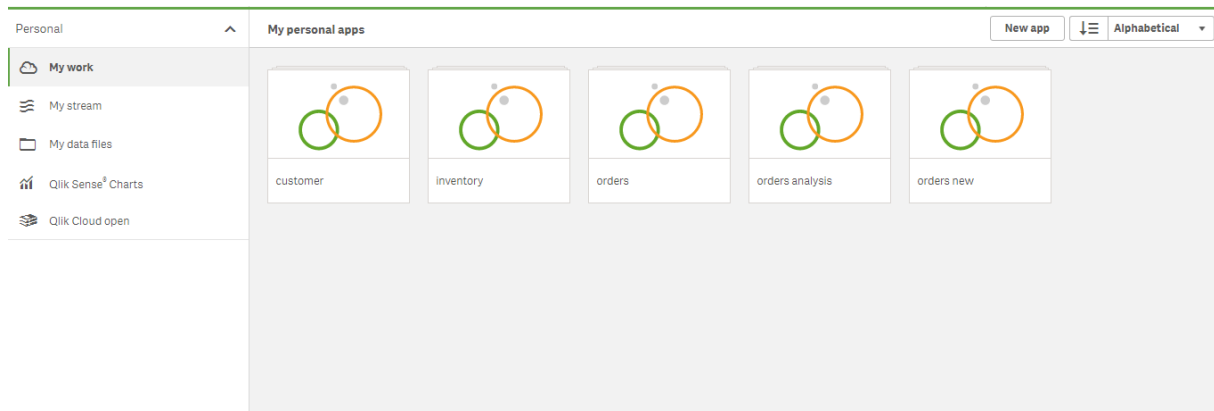


Figure 5 1: The Qlik Start page is the first workspace we see.

Qlik, works using existing data, so we must have access to some type of source data first. In the picture below (Figure 5.2) we can see the section My Data Files. In the right side of the workspace there is an Import Data button, which is used to import the excel files with the data in the program.

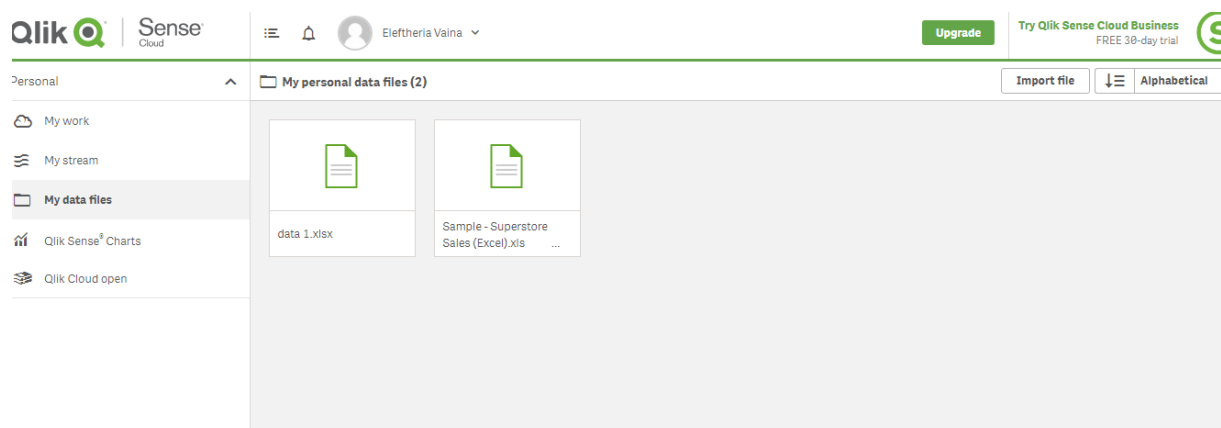


Figure 5 2: How to import data in the program.

As we can see in the next figure (figure 5.4) this is the place where we create the visualizations. On the right side of the screen there is the Edit button, when we click on this we can start creating charts.

In the left side of the screen there are many options of the kind of the chart we want to create in order to display graphically the results of the data analysis. We have options such as, bar charts, combo charts, line charts, maps, pivot table, pie charts, histograms, scatter plots, distribution plots, etc. The type of chart that we will create to visualize the data it depends of the kind of data we have.

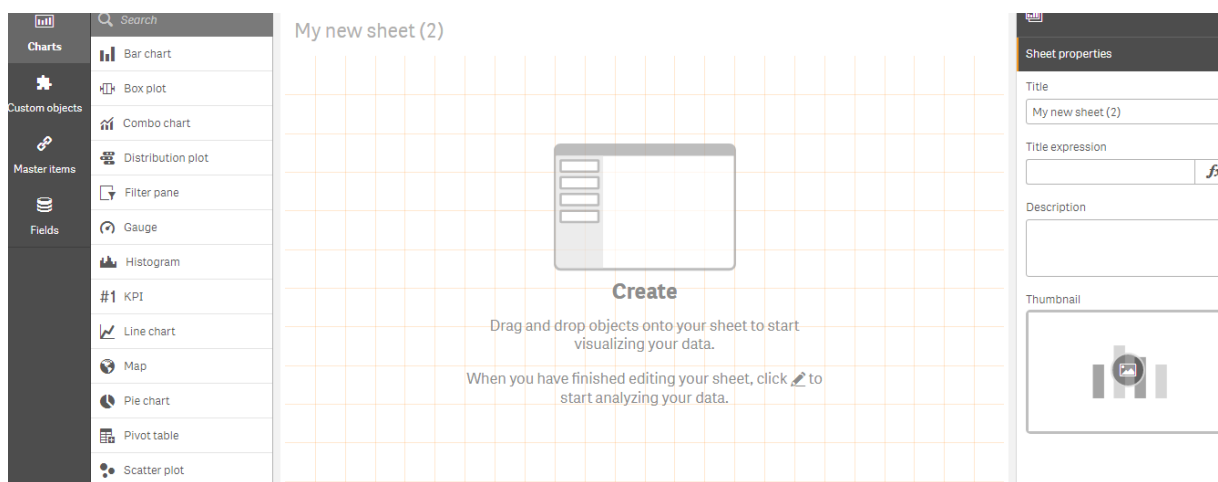


Figure 5 3 : The place where we create visualizations.

If for example we choose to create a bar chart, we click this option and then appear in the screen two fields, as we can see in the picture below. (figure 5.5) Then we have to add the dimensions and measures we want to elaborate in order to create the chart. In the right side of the screen we can see options we have when we are working our chart, and by using them we can adjust the charts in our preferences. We can change the colors, the general appearance, add titles and comments.

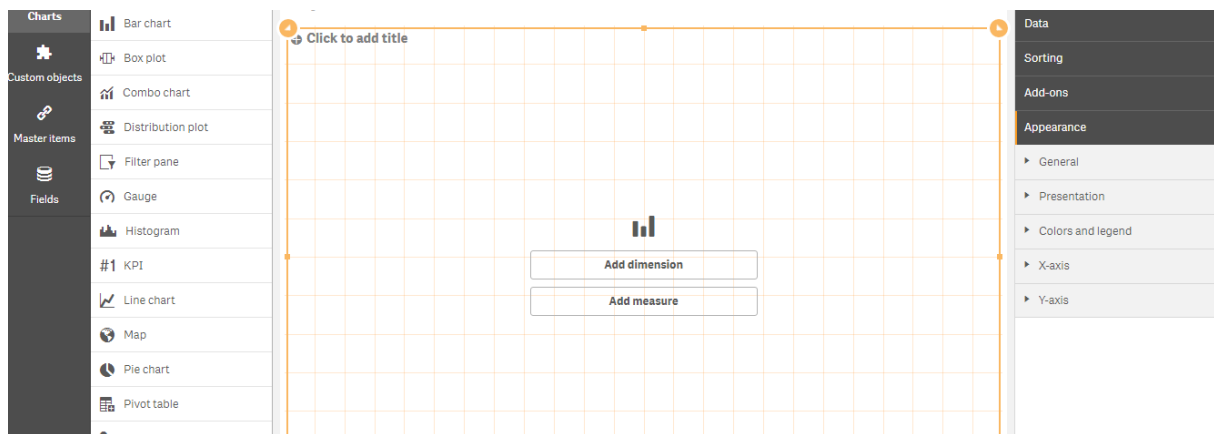


Figure 5 4: How to create charts

The excel file as it shows below (Figure 5.6) has data of 8370 rows and 27 columns. Each row is an order that made in the Superstore and the columns are the details of this specific product.

1	Row ID	Order ID	Order Date	Order Priority	Order Quantity	Sales	Discount	Ship Mode	Profit	Unit Price	Shipping Cost	Customer Name	Province
5523	912	6560	4/1/2011	Low	20	169.18	0.09	Regular Air	-18.73	8.67	3.5	Max Ludwig	Saskatchewan
5524	913	6560	4/1/2011	Low	37	8252.392	0.04	Delivery Truck	1853.19	280.98	35.67	Max Ludwig	Saskatchewan
5525	981	7105	21/6/2010	Low	17	77.19	0.03	Regular Air	-81.35	4.06	6.89	Brian Moss	Saskatchewan
5526	1052	7776	14/3/2009	Medium	36	7223.59	0.07	Delivery Truck	1769.81	200.98	23.76	Michelle Moray	Saskatchewan
5527	1053	7776	14/3/2009	Medium	6	934.216	0.02	Delivery Truck	-4.34	179.29	29.21	Michelle Moray	Saskatchewan
5528	1160	8450	13/4/2012	Not Specified	24	1307	0.02	Regular Air	428.99	54.48	0.99	Eva Jacobs	Saskatchewan
5529	1161	8450	13/4/2012	Not Specified	22	41.39	0.09	Regular Air	-12.02	1.88	1.49	Eva Jacobs	Saskatchewan
5530	2241	16164	3/1/2012	Low	26	2354.15	0.03	Delivery Truck	774.79	90.97	14	Eva Jacobs	Saskatchewan
5531	2601	18789	16/3/2011	High	50	1558.18	0	Regular Air	417.62	30.98	9.18	Craig Rider	Saskatchewan
5532	2639	19105	28/10/2009	High	31	1370.56	0.1	Regular Air	511.51	48.91	5.97	Max Ludwig	Saskatchewan
5533	2640	19105	28/10/2009	High	29	172.98	0.08	Regular Air	-59.75	5.98	5.46	Max Ludwig	Saskatchewan
5534	2642	19136	4/8/2010	Not Specified	44	1372.9455	0	Regular Air	429.89	35.99	1.25	Michelle Moray	Saskatchewan
5535	2657	19206	30/3/2010	Low	40	88.02	0	Regular Air	-6.54	2.08	1.49	Michelle Moray	Saskatchewan
5536	2658	19206	30/3/2010	Low	32	800	0.1	Delivery Truck	-210.30	25.98	14.36	Michelle Moray	Saskatchewan
5537	2725	19654	9/1/2011	High	8	381.69	0.04	Regular Air	256.18	46.94	6.77	Maribeth Yedwab	Saskatchewan
5538	2775	20037	10/1/2009	Low	35	1009.42	0.02	Regular Air	339.58	29.18	8.55	Michelle Moray	Saskatchewan
5539	2776	20037	10/1/2009	Low	49	15137.11	0.03	Delivery Truck	4913.16	297.64	14.7	Michelle Moray	Saskatchewan
5540	2855	20549	12/1/2009	Not Specified	40	1030.09	0.09	Regular Air	-568.71	27.75	19.99	Cindy Schnelling	Saskatchewan
5541	2888	20832	30/7/2010	Not Specified	47	88.7	0.06	Regular Air	-20.45	1.88	1.49	Eugene Moren	Saskatchewan
5542	2889	20832	30/7/2010	Not Specified	39	105.89	0.08	Regular Air	4.13	2.84	0.93	Eugene Moren	Saskatchewan
5543	3191	22887	18/11/2010	Not Specified	34	9107.27	0.07	Regular Air	2463.36	276.2	24.49	Eugene Moren	Saskatchewan
5544	3345	23936	17/12/2009	Medium	27	71.39	0.09	Regular Air	-39.33	2.6	2.4	Darrin Van Huff	Saskatchewan
5545	3407	24326	29/9/2011	Critical	37	1596.86	0.05	Regular Air	418.60	44.01	3.5	Cindy Schnelling	Saskatchewan
5546	3408	24326	29/9/2011	Critical	12	78.36	0.06	Regular Air	8.52	6.68	1.5	Cindy Schnelling	Saskatchewan
5547	3627	25926	20/11/2009	High	20	3300.216	0.1	Delivery Truck	-855.03	218.75	69.64	Michelle Moray	Saskatchewan
5548	3628	25926	20/11/2009	High	23	331.54	0.05	Regular Air	9.41	14.27	7.27	Michelle Moray	Saskatchewan
5549	3878	27687	22/4/2010	Medium	38	251.3	0.1	Regular Air	-112.72	7.1	6.05	Maribeth Yedwab	Saskatchewan

Figure 5 5: Excel file of data

Each product is categorized by some characteristics, specifically the next tables shows the characteristics:

Order ID
Order Date
Ship Date
Ship Mode
Customer ID
Customer Name
Segment
Postal Code
City
State
Country
Region
Market
Product ID
Category
Sub-Category
Product Name
Sales
Quantity
Discount
Profit
Shipping Cost
Order Priority

Table 5 1: Table of attributes

In the next section, will be presented the data of the Japan Superstore more detailed about the amount of the products, extracted from excel.

Initially each row of the above excel shows us the Order ID this ID is a unique number of the order that generated by the system. This order can be found in the order sheet and is given to the client for the tracking of the order. After that follows, the Order Date and the Ship Date. The first of them shows us the date that made the order by the client and the next one shows the date that the products have been shipped. The Ship Mode is the category that have paid the customer and how immediately need the products the customer. Customer ID, Customer Name and Segment are characteristics of the customers and identification about older orders and preferences. The next six categories: Postal Code, City, State, Country, Region and Market are attributes of the location of the customer and where the company should send the products. The following four are the Product ID, Category of the product, Sub-Category and Product Name. These attributes characterize the products that have ordered from the customer more specifically. And finally, the next six attributes characterize economically the product. These attributes are: Sales, Quantity, Discount, Profit, Shipping Cost, and Order Priority. Accordingly, of the quantity of the product also of the Customer Segment and the profit, most times there is a discount in the orders. And depending of the ship mode are characterized by the priority of the order. The next table (Table 5 2: Table of attributes) shows us some orders:

Row ID	Order ID	Order Date	Ship Date	Ship Model	Customer Name	Product ID
14	48388	3/1/2009	12/8/2009	Normal flight	Masafumi Yakushiji	P268
639	15907	15/4/2009	15/4/2011	Express flight transport	Yoshiyuki Ebata	P1048
1011	20261	21/6/2009	24/5/2009	Normal flight	Yuji Jinbo	P1046

Table 5 2: Table of attributes

Row ID	Region	Product ID	Category	Sub-Category
1013	Kyushu	P841	Office supplies	paper
1022	Kanto	P365	furniture	Office furniture
1035	Sabae	P500	Office supplies	Storage-organization

Table 5 3: Table of attributes

Product Name	Sales	Quantity	Unit price	Profit	Shipping Cost	Order Priority
'Eldon® Wave Desk Accessories	7963	27	208	9603	533\$	High
'Staples Standard	16191	24	568	3301	139	High
Avery Non-Stick Binders	2	44	449	5003	149	High

Table 5 4: Table of attributes

Following some graphs that have been extracted from excel file, for more analytical view of the data. For this data analysis we decided to answer is some specific questions that concern the inventory, the orders and the customers. These questions are presented in the next table.

Q1	The user asks “What is the product with the highest and lowest inventory.
Q2	The user asks “which is the store with the highest and which is the store with the lowest inventory”
Q3	The user asks “who is the customer with the highest life time revenue, and who is the customer with the lowest life time revenue”.
Q4	The user asks “who is the customer with the highest life time revenue, and who is the customer with the lowest life time revenue”.
Q5	The user asks “which age group has the biggest and lowest life-time revenue”

Q6	The user asks “which order has the biggest and smallest quantity”
Q7	The user asks “how many orders have high priority? And how many orders have low, medium, critical or not specified priority?”
Q8	The user asks “Which product has the highest unit price and which product has the lowest price”.
Q9	The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”.
Q10	The user asks “Which product has the biggest margin and which product has the smallest margin”.
Q11	The user asks “Which product has the highest advertising cost and which product has the lowest advertising cost”.
Q12	The user asks “Which product has the highest unit price and which product has the lowest unit price”.
Q13	The user asks “Which product has the biggest sum of quantity and which product has the smallest sum of quantity”.
Q14	The user asks “Which product has the highest profits and which product has the lowest profit”.

Q15	The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”.
-----	---

Table 5 5: Table of questions for analysis

5.1 INVENTORY

In this task we examine the data that concern the inventory, mostly about the quantity.

The user by analyzing the data with Qlik Program and Microsoft Power BI can ask for information about the inventory.

5.1.1 The user asks “What is the product with the highest and lowest inventory.

In the first graph (Figure 5.7) we analyze the inventory, every product ID has. The ID with the biggest inventory is P568, and the amount of inventory it has is 472.36k. This ID corresponds to the product *'Global Troy™ Executive Leather*.

The ID with the lowest sum of inventory is P151, and the amount of the inventory of this ID is 20.79. This ID corresponds to the product *Alliance*.

In the next charts below we can see more clearly these data, from Qlik and Microsoft BI program analysis. (Figure 5.8 & Figure 5.9 & Figure 5.10 & Figure 5.11)

PRODUCT ID AND SUM OF INVENTORY

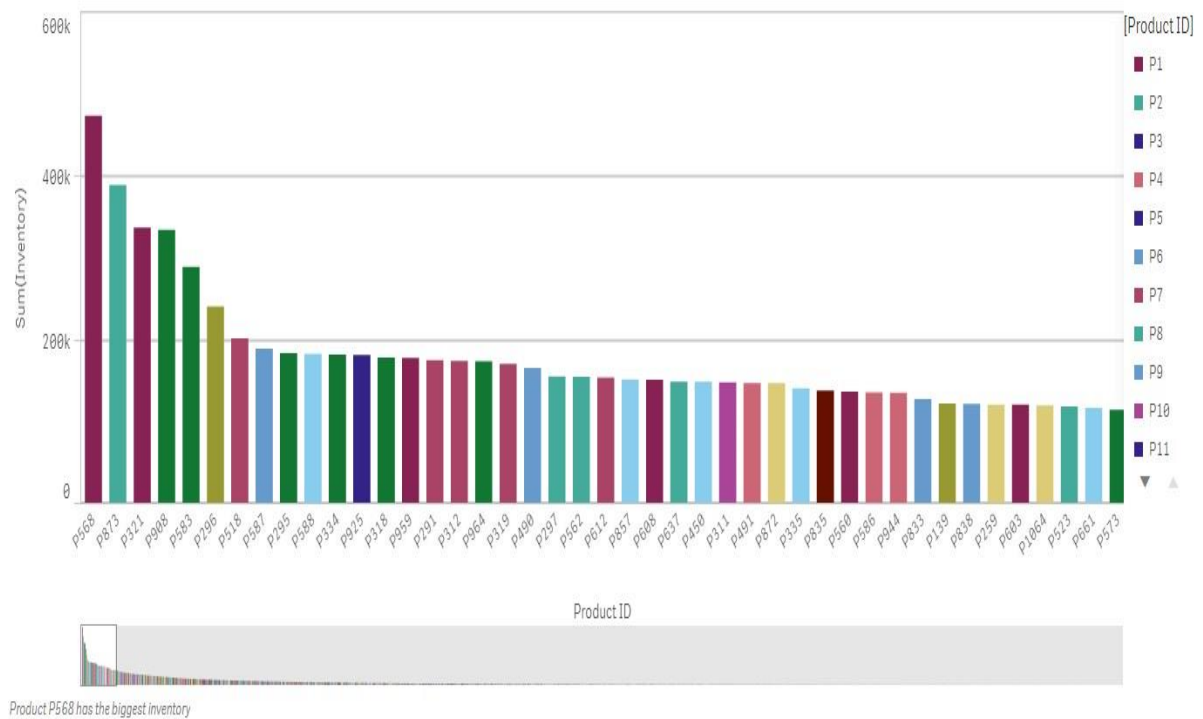


Figure 5 6: Sum of Inventory per Product ID

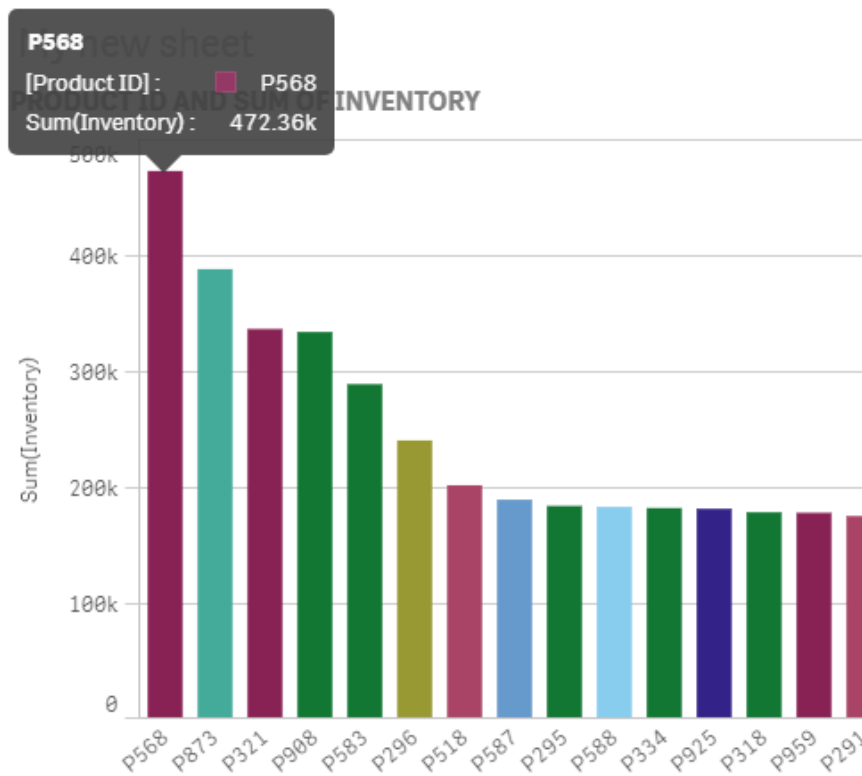


Figure 5 7: Product ID with the biggest sum of inventory

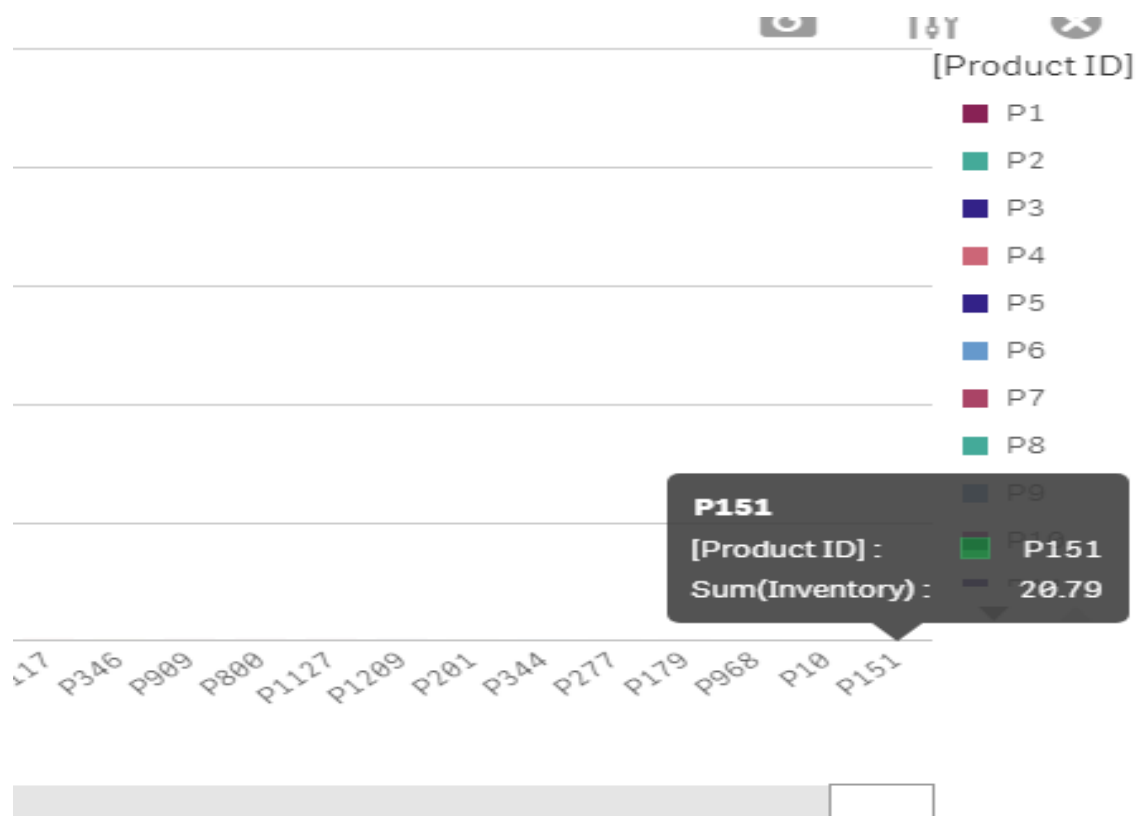


Figure 5 8: Product ID with the lowest sum of inventory

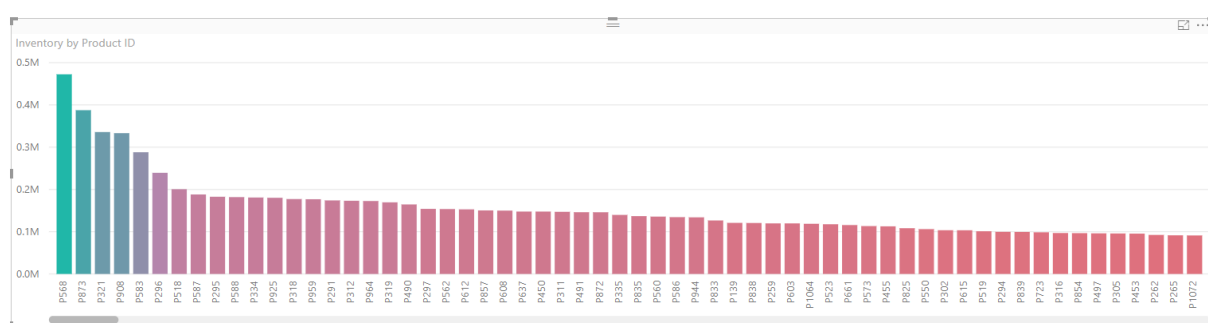


Figure 5 9 Product ID with the biggest sum of inventory (Power BI)

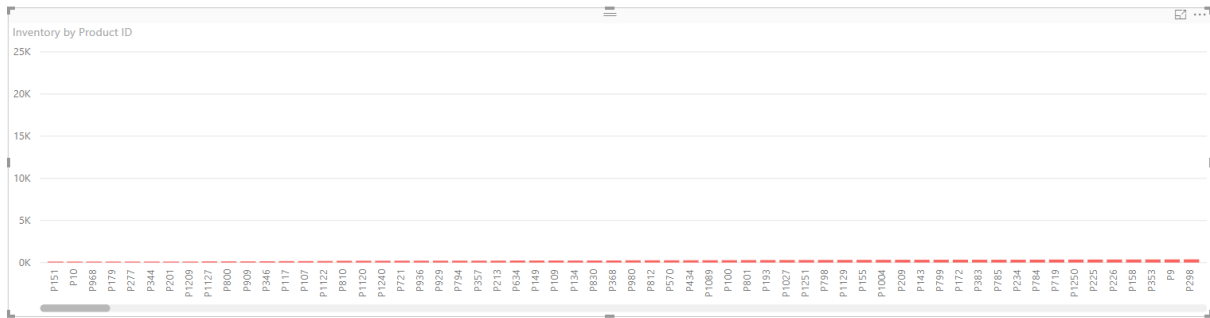


Figure 5 10 Product ID with the lowest sum of inventory (Power BI)

The next graph (Figure 5.12) is a pie chart which shows us the 10 IDs with the highest inventory. The sum of the product IDs is 1264. As we already know product P568 which is 'Global Troy™ Executive Leather', has the biggest share and it is 16.8%. Next is product P873 with a share of 13.8%.

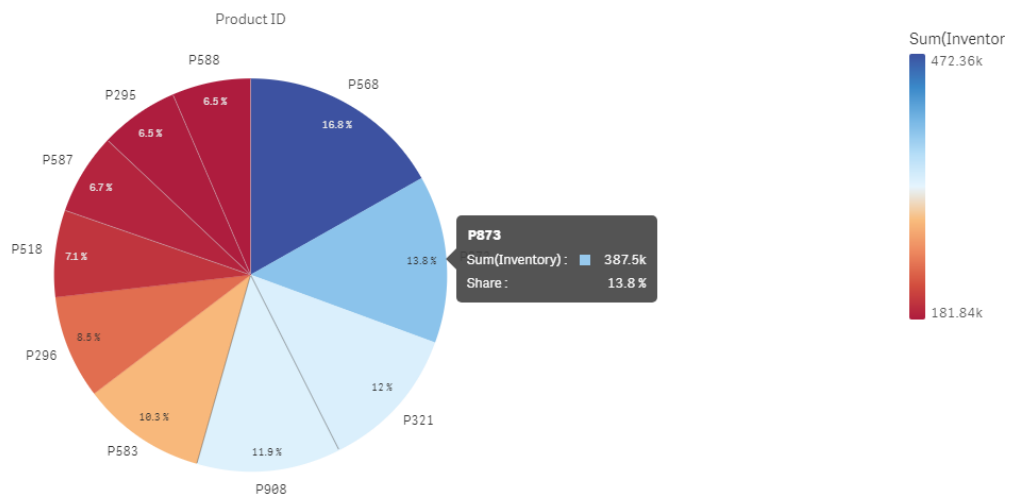


Figure 5 11: Pie chart with the 10 highest inventories.

5.1.2 The user asks “which is the store with the highest and which is the store with the lowest inventory”

In this chart (Figure 5.13) we analyze the inventory from every store. The store with the highest inventory is *Cement* with an inventory of 420.37k. (Figure 5.14) The store with the lowest inventory is *Bell* with an inventory of 738.57. (Figure 5.15). The same results are extracted from Power BI (Figure 5.16 & 5.17).

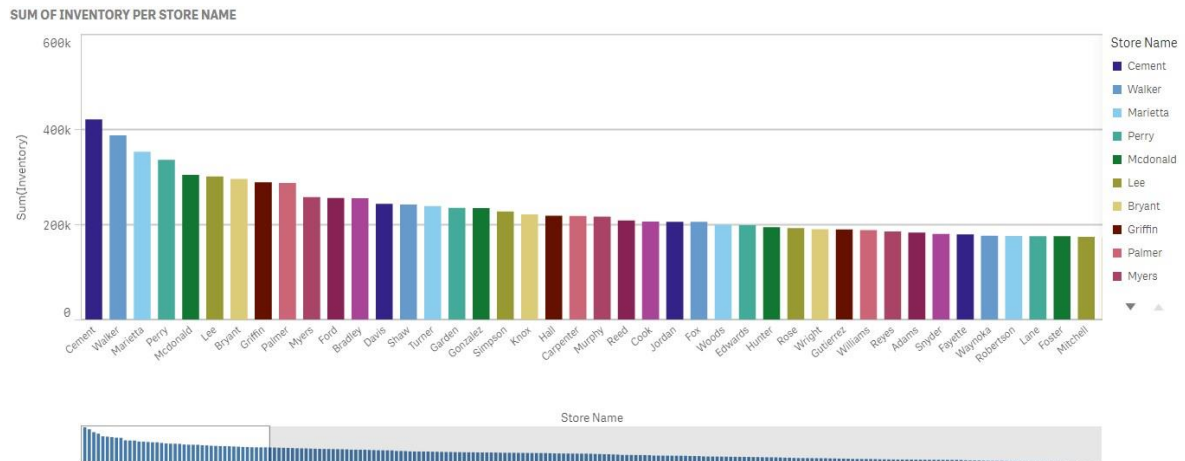


Figure 5 12: Sum of Inventory per Store Name.

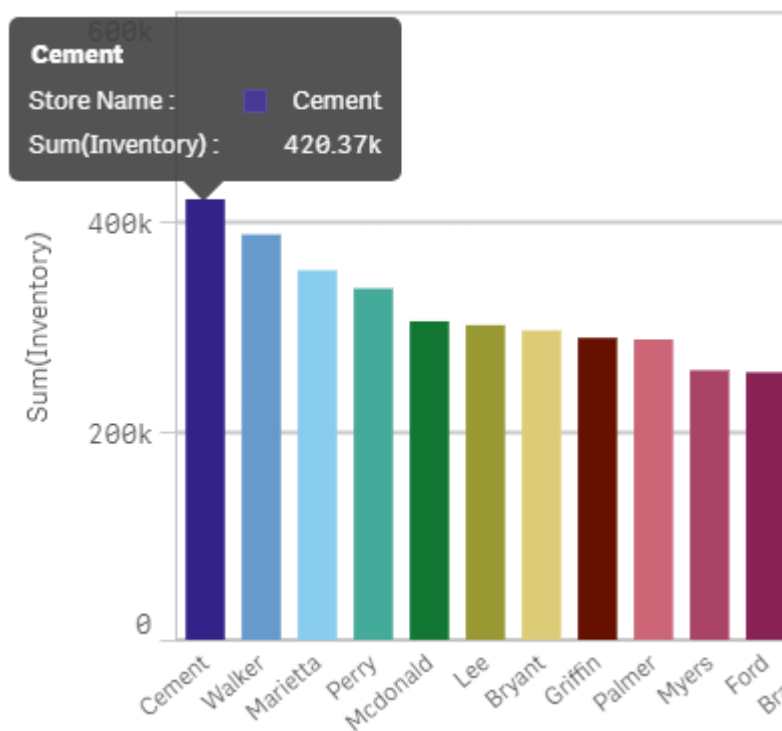


Figure 5 13: The store with the biggest inventory.

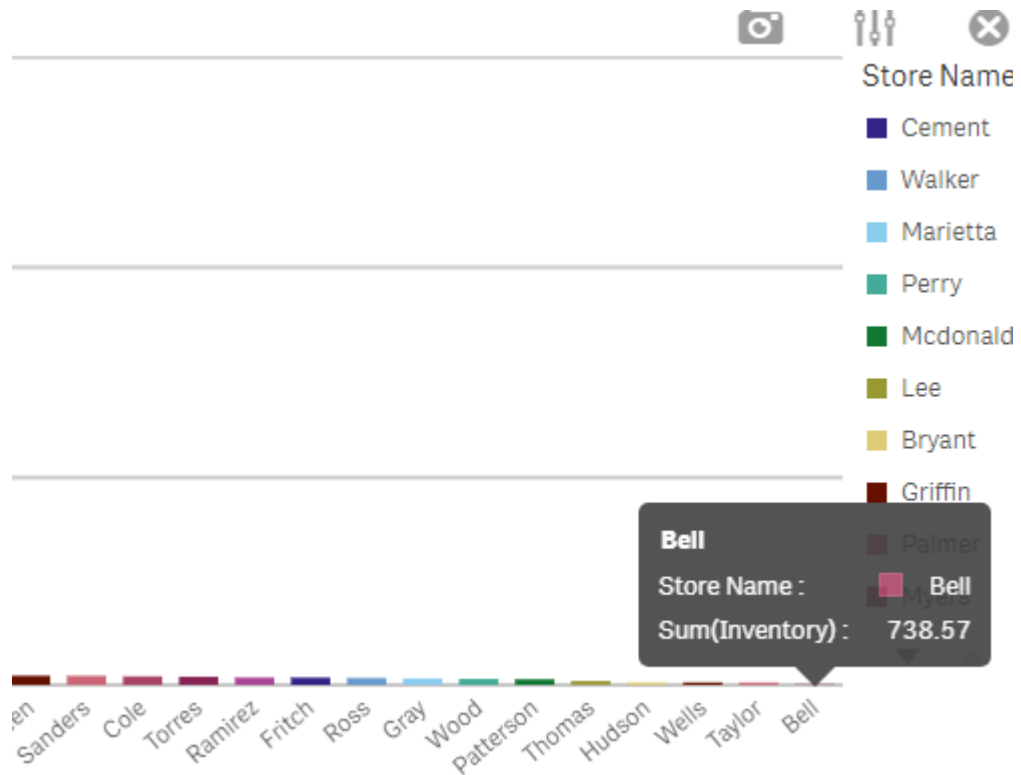


Figure 5 14: The store with the lowest inventory.

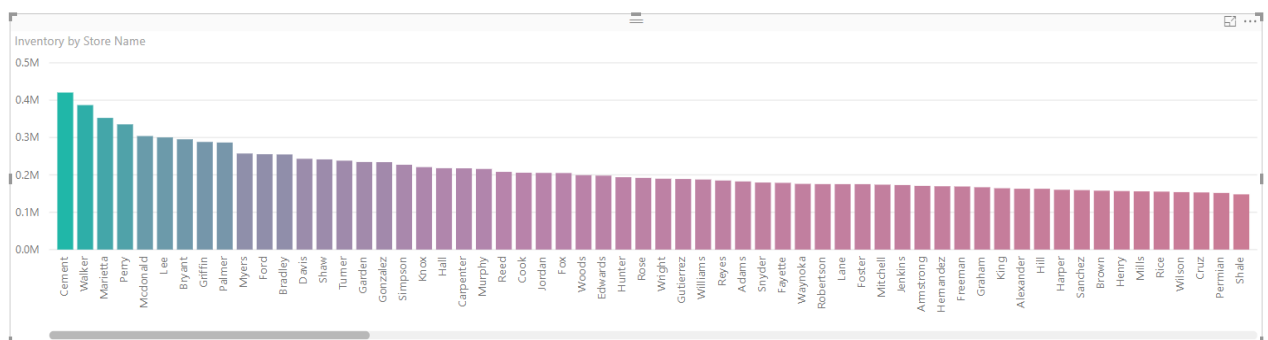


Figure 5 15 The store with the highest inventory. (Power BI)

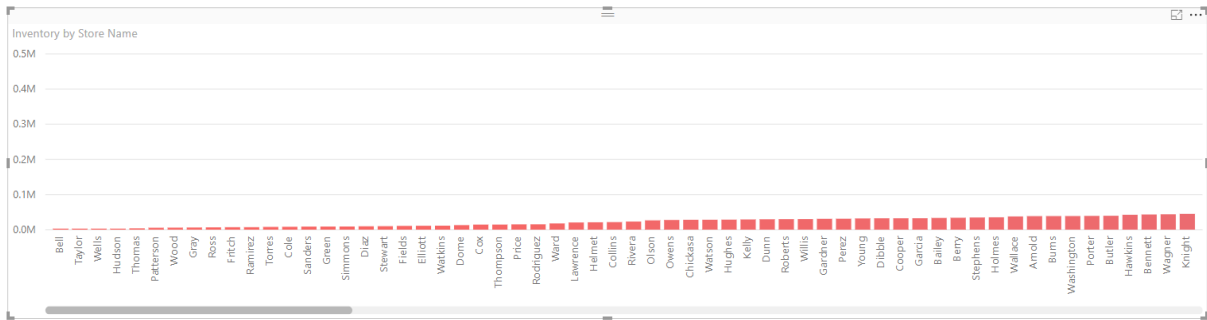


Figure 5 16 The store with the lowest inventory (Power BI)

There are 226 stores with inventory of this company. Next picture portrays the stores with the biggest sum of inventory and their shares in a pie chart. (Figure 5.17) These are *Cement*, *Walker*, *Mariett*, *Perry*, *Mcdonald*, *Lee*, *Bryant*, *Griffin*, *Palmer* and *Myers*.

Sum of Inventory per Store Name

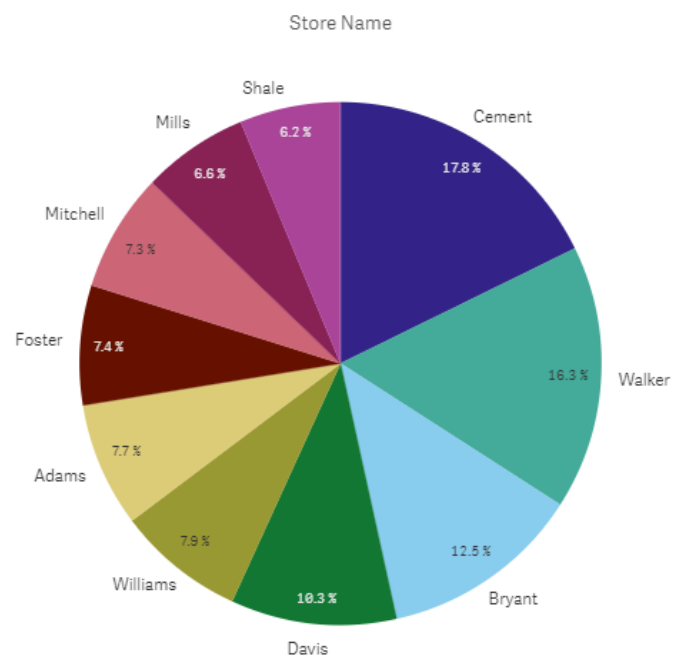


Figure 5 17: Stores with the highest inventory.

5.2 CUSTOMER

In this section the user can ask for information by analyzing the data that concern the customers.

5.2.1 The user asks “who is the customer with the highest life time revenue, and who is the customer with the lowest life time revenue”.

In this chart (Figure 5.18) we examine the life-time revenue from every customer. After the process of the data, through Qlik Sense programme we conclude that the customer with the highest life-time revenue is *Emily Phan* with 15.17k revenue, and the customer with the lowest revenue is *Jeremy Farry* with 10.79 revenue.

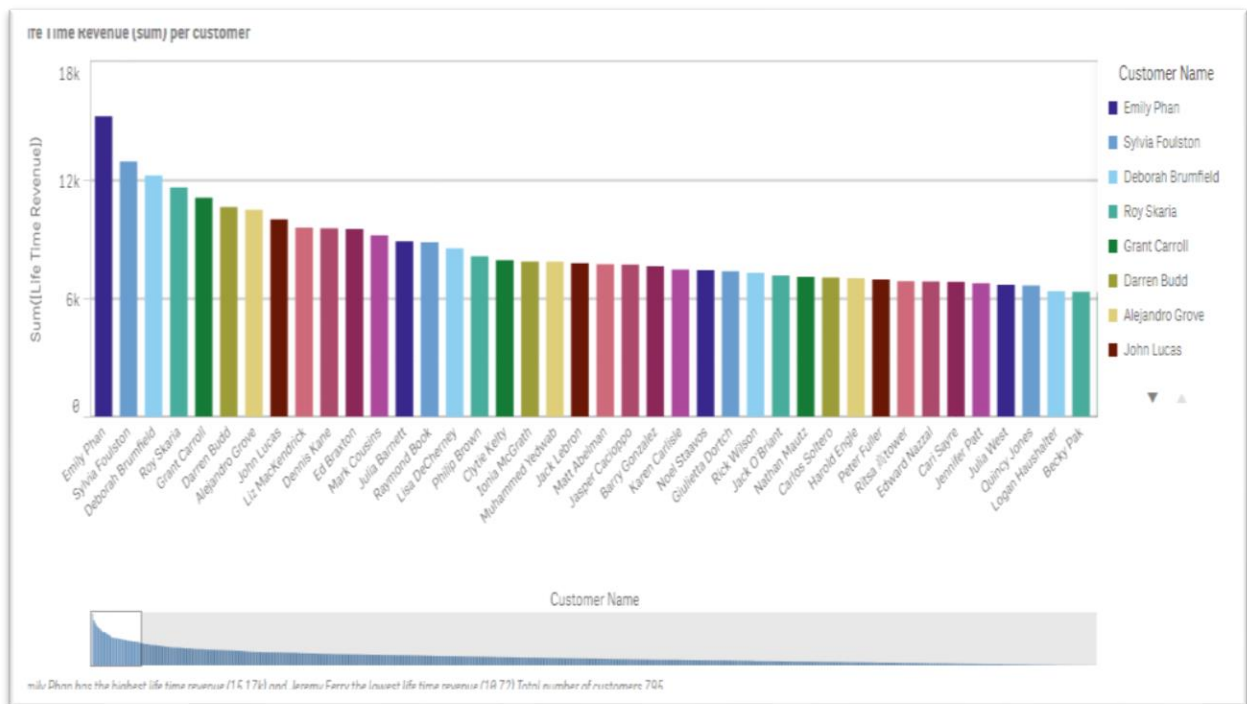


Figure 5.18: Life Time Revenue per Customer

My new sheet

Emily Phan

Life Time Revenue (sum) per customer

Customer Name : ■ Emily Phan

Sum([Life Time Revenue]) : 15.17k

Sum([Life Time Revenue]) : 15166.1127499999...

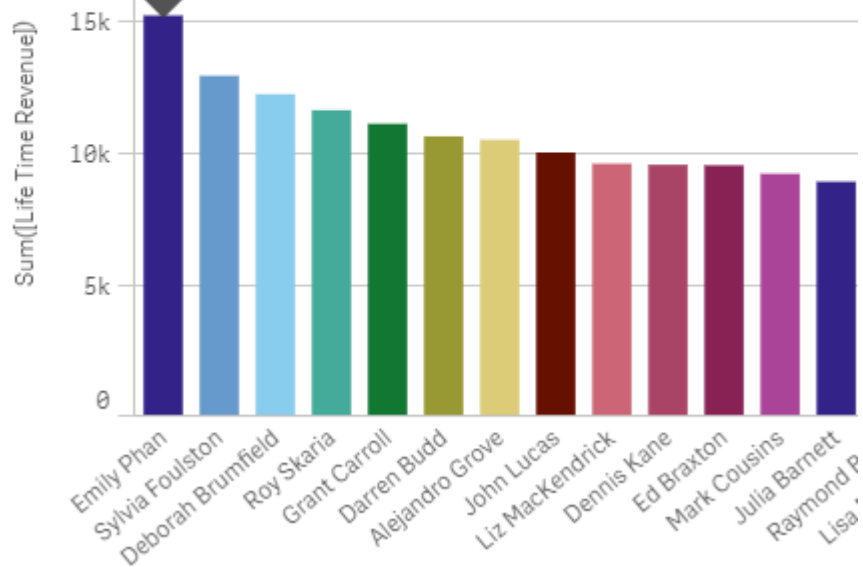


Figure 5 19 The customer with the highest Life Time Revenue.

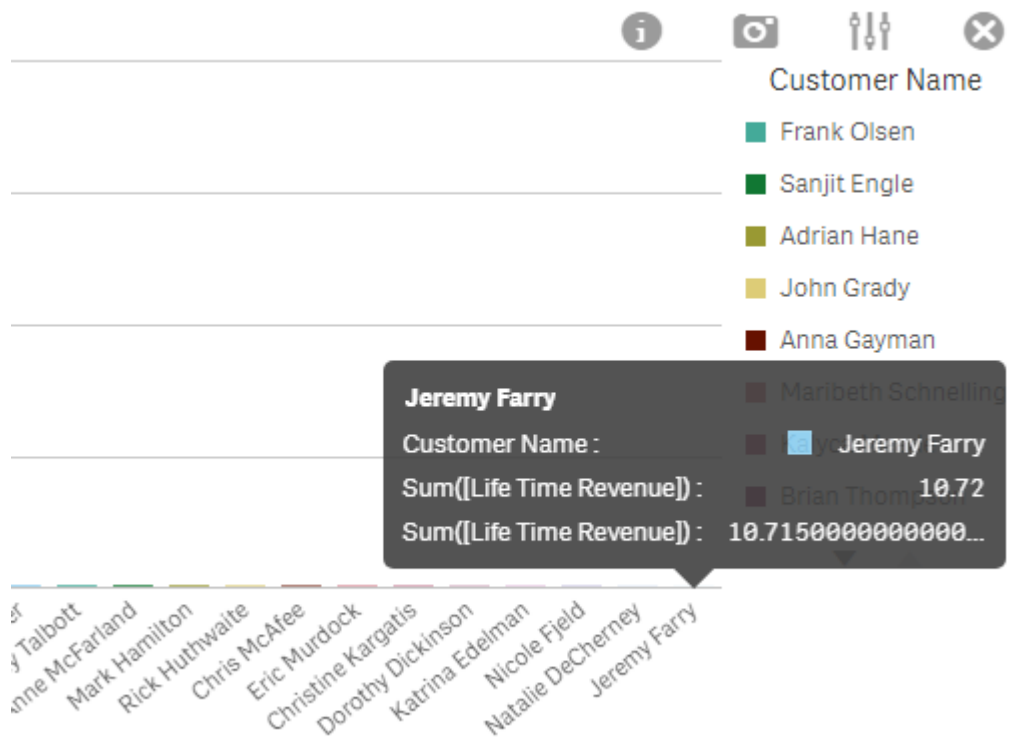


Figure 5 20: The customer with the lowest Life Time Revenue.

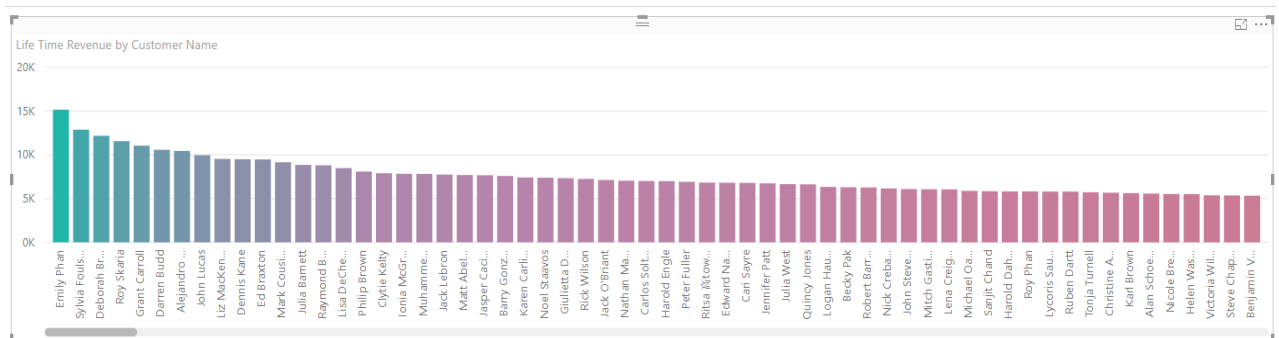


Figure 5 21 The customer with the highest Life Time Revenue. (Power BI)

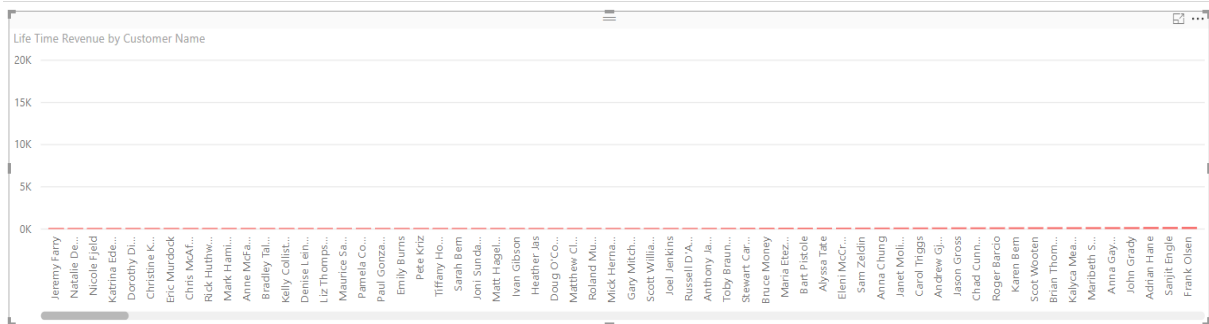


Figure 522 The customer with the lowest Life Time Revenue.

5.2.2 The user asks “which age group has the biggest and lowest life-time revenue”.

To examine the life-time revenue we have separated the population in five age groups. These five groups are the 20s, 30s, 40s, 50s and 60s. We can see from the graph in Figure 5.17 that the group of 40s has the highest life-time revenue and it is 458.88k. The group of 30s has the lowest life-time revenue and it is 341.86k.

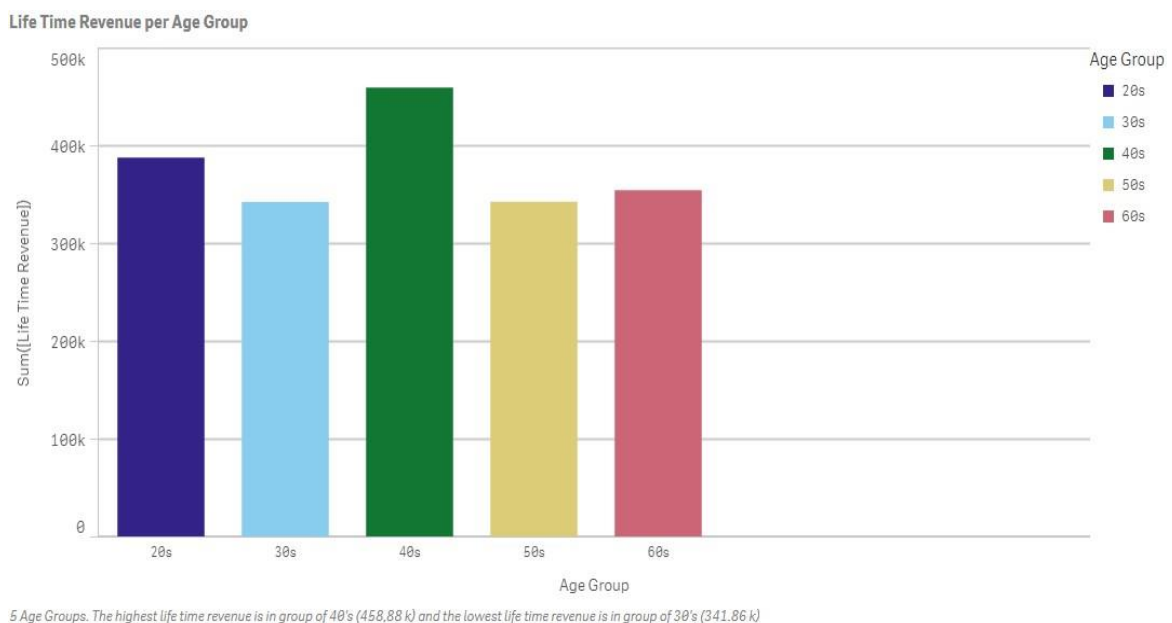


Figure 5 23: Life-Time Revenue per Age Group.

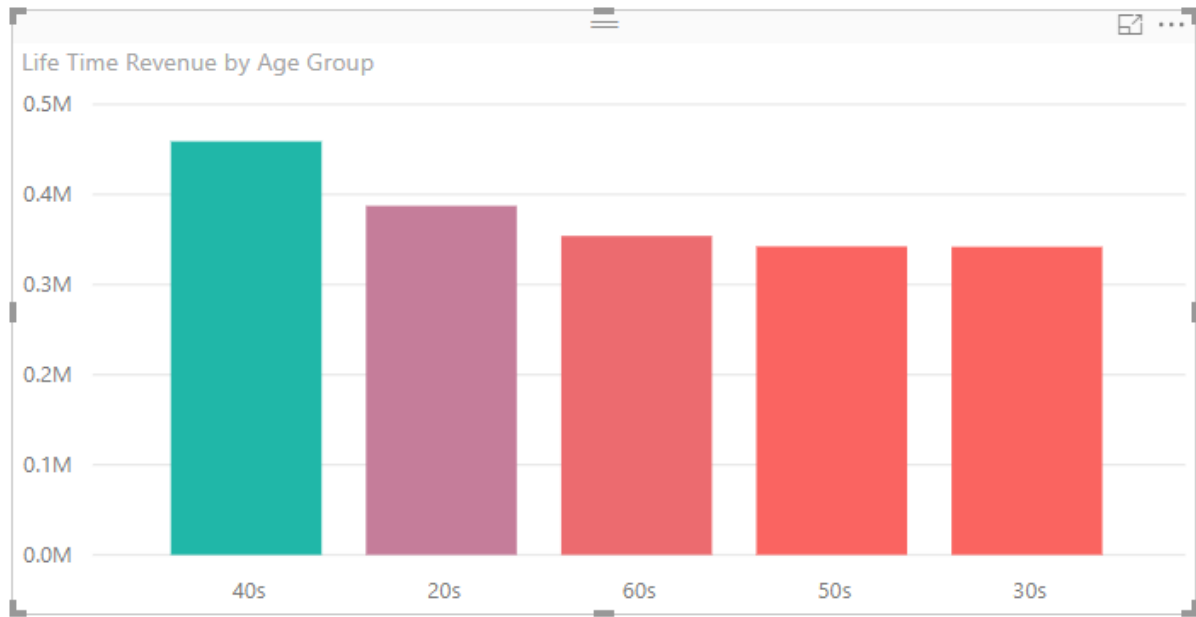


Figure 5.24 Life-Time Revenue per Age Group.

5.3 ORDERS

5.3.1 The user asks “which order has the highest and lowest quantity”

In this chart (Figure 5.25) we can see the results that concern the quantity of orders in every product. The product with the largest quantity is the product with the ID 57253 and the order quantity is 194. This ID corresponds in three products, the first one is a technology product with the name *Xerox 227* and the supplier is Ningbo. The second is in the category of office supplies and has the name *Acco Pressboard Covers with Storage Hooks*. This product also has Ningbo as a supplier. The third one belongs in the same category as the second, is *Assorted Color push pins*, and the supplier of this product is Merxin.

The product with the ID 59911 has the lowest quantity and it is 1. This ID corresponds in two products. Both are office supplies. The first one is *Xerox 1908* from the supplier Compu Point, and the second is *Black Print Carbonless Snap-Off Rapid Letter* from the supplier Merxin.

QUANTITY PER ORDER ID

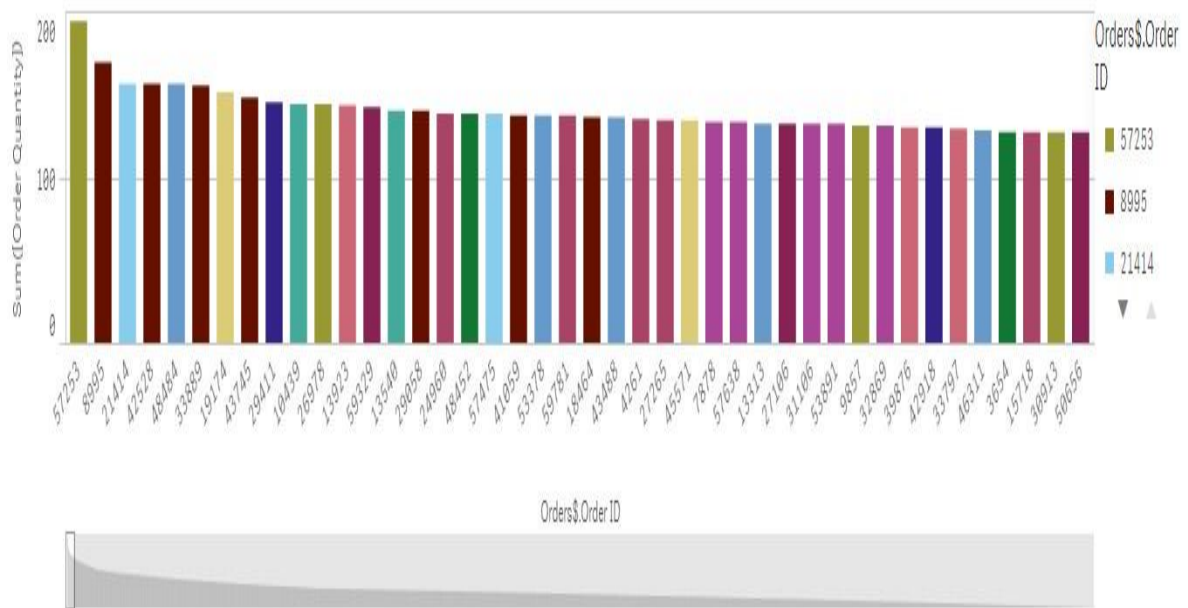


Figure 5 25: Order Quantity per ID

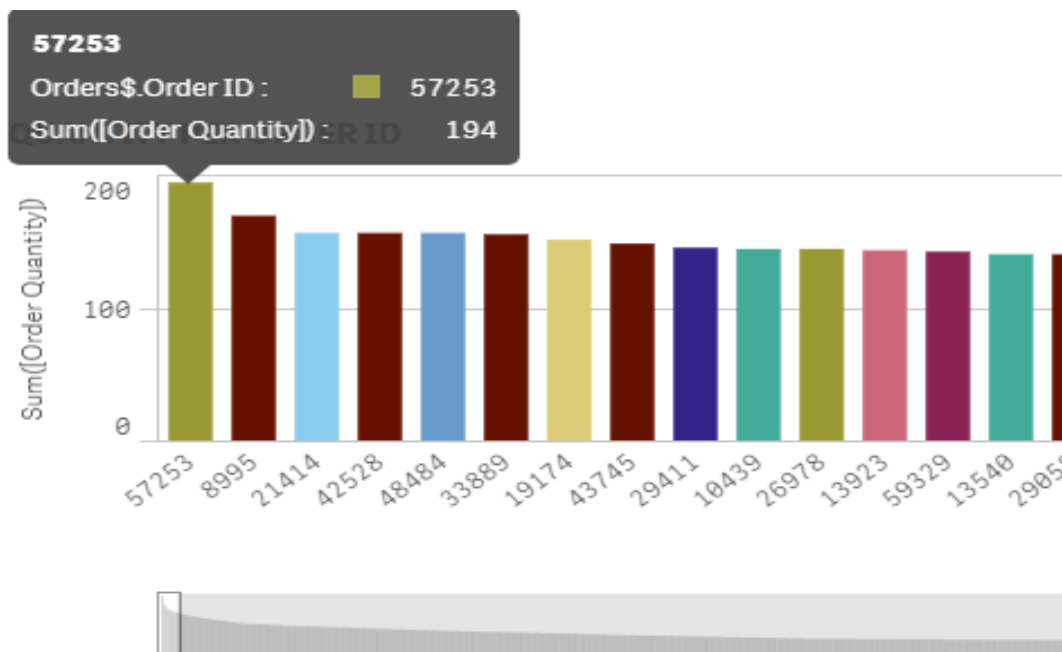


Figure 5 26: The biggest order quantity

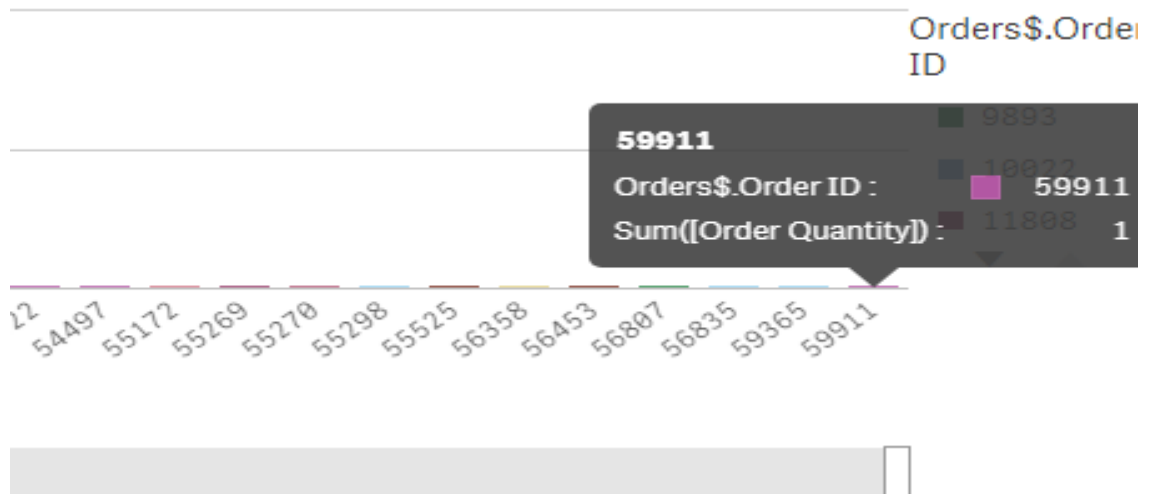


Figure 5 27: The lowest order quantity

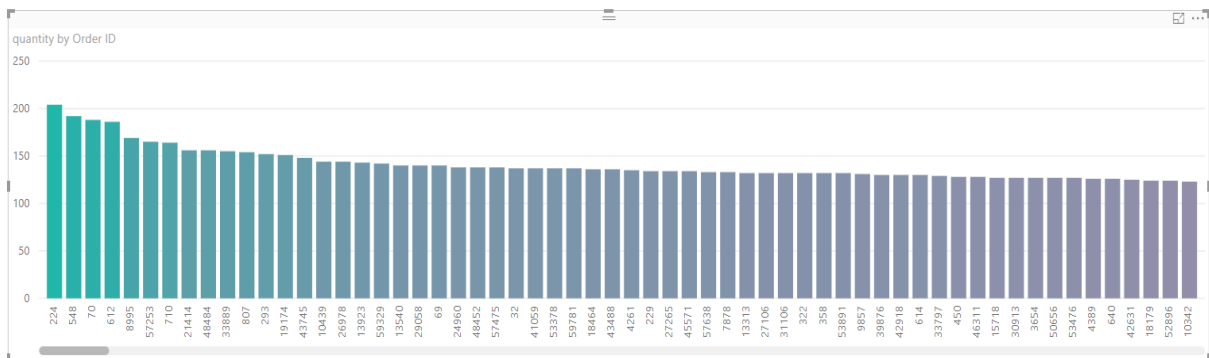


Figure 5 28 The highest order quantity

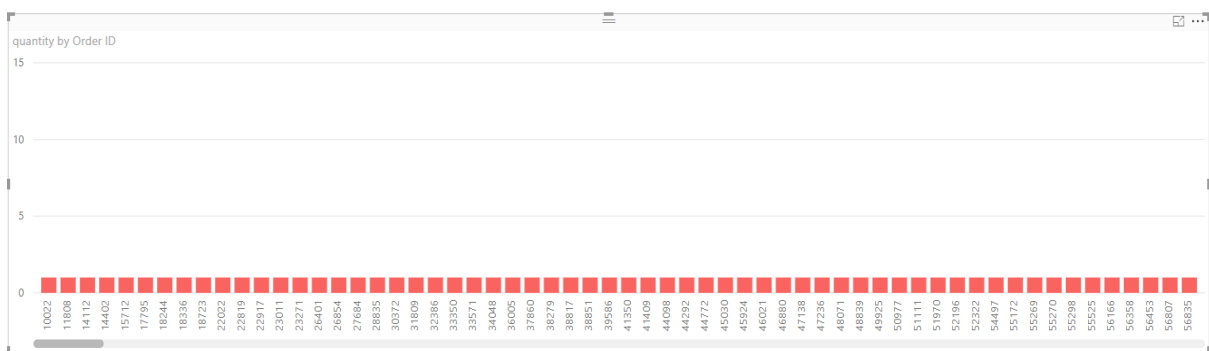


Figure 5 29 The lowest order quantity

We can also see the results that concern the quantity of orders in every product in a pie chart. We have 5496 orders and we also can isolate the orders with the highest quantity.

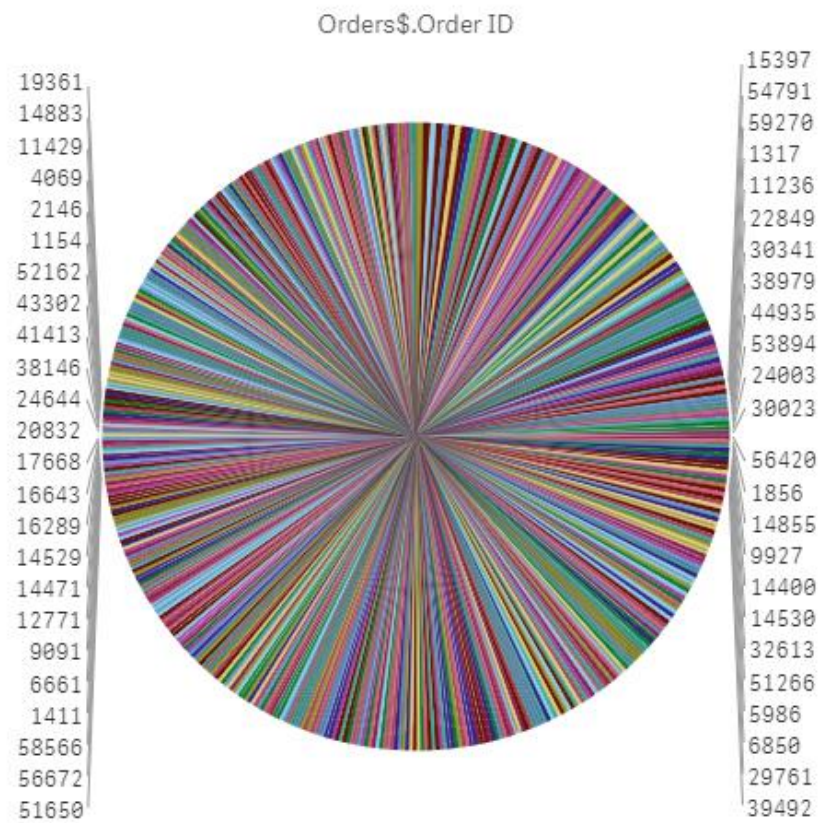


Figure 5 30: All the orders (5496 orders)

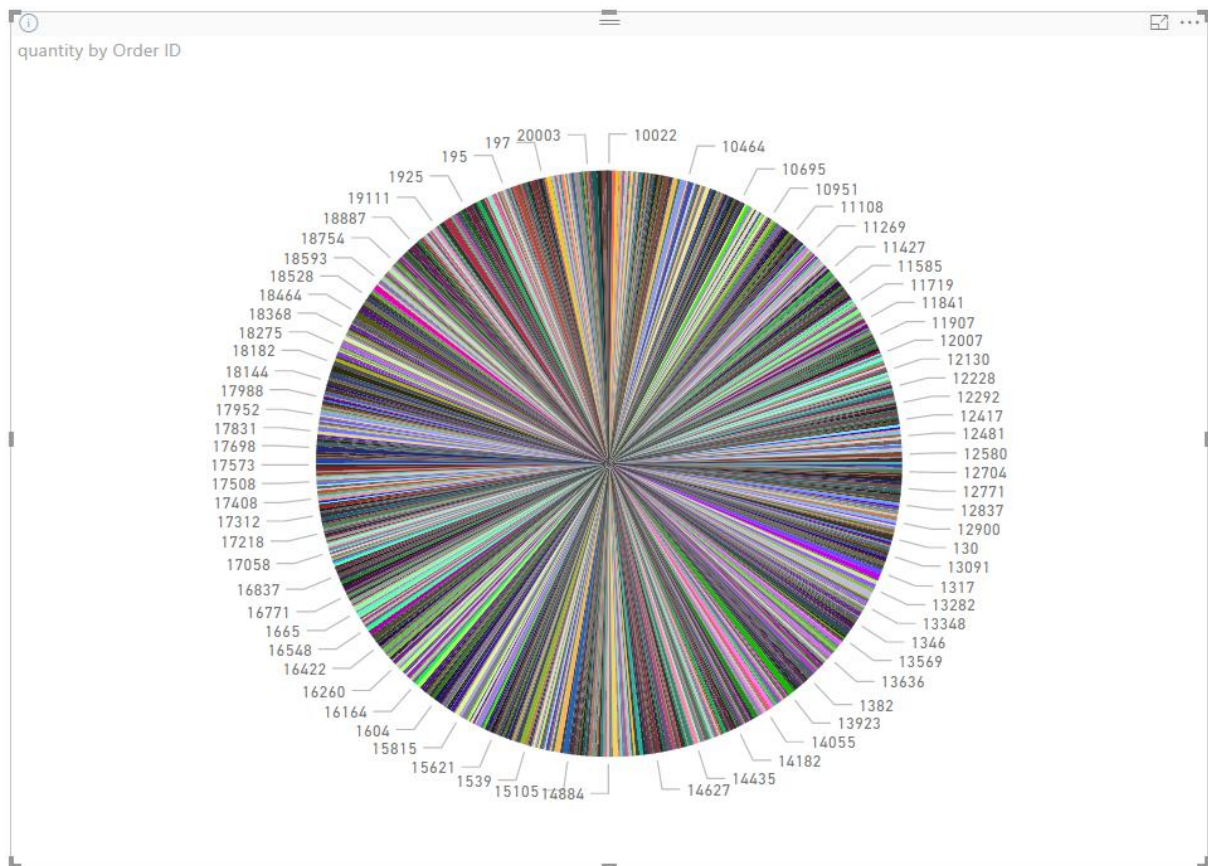


Figure 5 31 All the orders (5496 orders) (Power BI)

The first 10 products with the largest quantity.

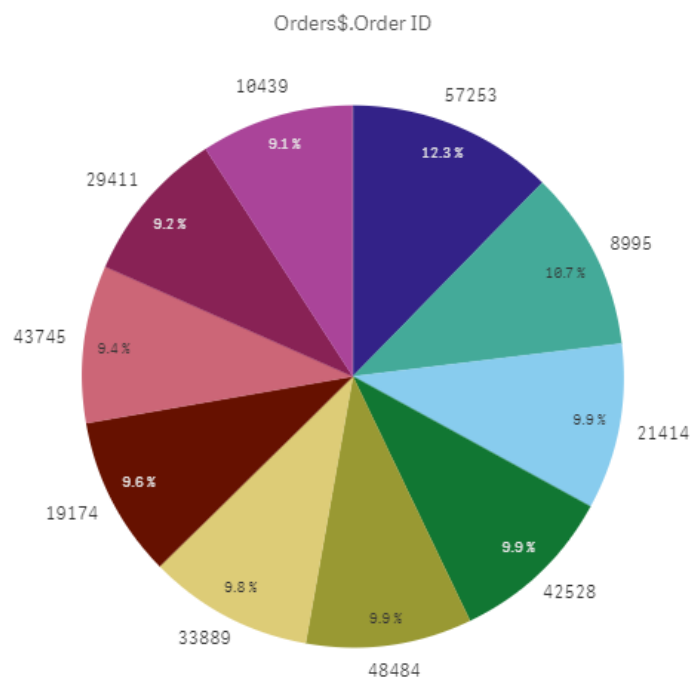


Figure 5 32: The ten highest orders

5.4 ORDER PRIORITY

5.4.1 The user asks “how many orders have high priority? And how many orders have low, medium, critical or not specified priority?”

This graph (Figure 5.33) depicts the orders and the priority they have. We can see that the amount of orders with high priority is 54 million, orders with low priority are 50.6 million. And then we have orders with Medium priority (50.11M) with Critical priority (47.89M) and with Not Specified priority (49.08M).

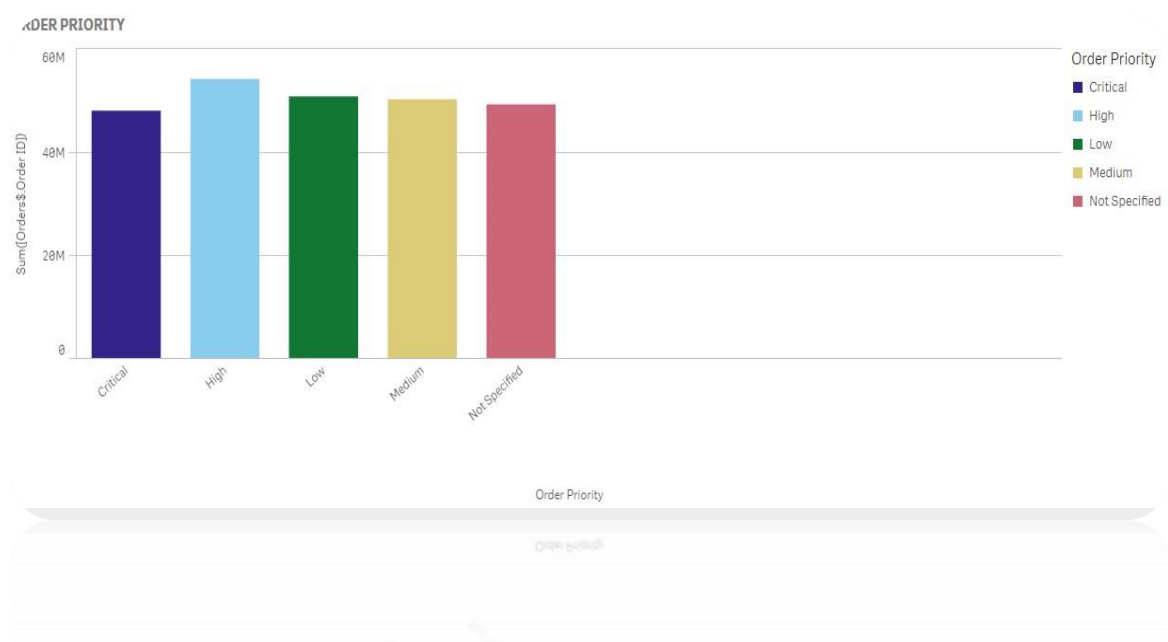


Figure 5 33: Orders Priority

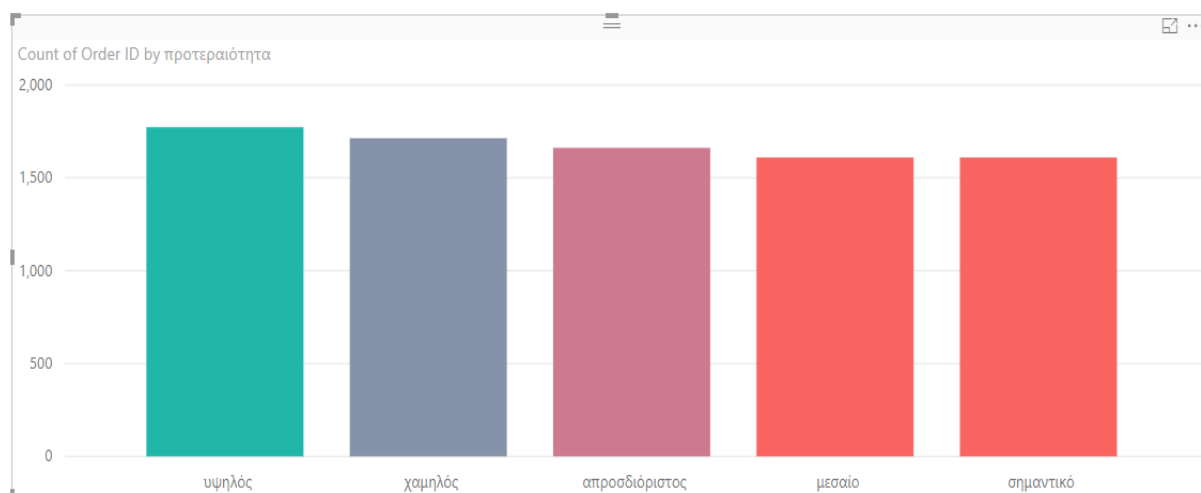


Figure 5 34 Orders Priority (Power BI)

5.4.2 The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”.

In this chart (Figure 5.35) we examine how much is the shipping cost for every product. From the results we have the conclusion that the biggest shipping cost is 210.5 and corresponds to the ID 35364, and the lowest shipping cost is 0.49 which corresponds to ID 53762. The biggest shipping cost can be found in four products. One product is *Xerox 199*, it is an office supply product which comes from northeast and is shipped with normal flights. An other product is the *Racetrack Conference Table*, it is a furniture which comes from the region of Kanto by track. The third one is the product *Bretford Rectangular Conference Table Tops* it is furniture product from Kyushu and is shipped by track. And the last one product with the biggest shipping cost is *T28 WORLD* a technology product from Koshu that is shipped by normal flights. The product with the lowest shipping cost is the *Avery White Multi-Purpose* an office supplies product, which comes from Kyushu by normal flights.

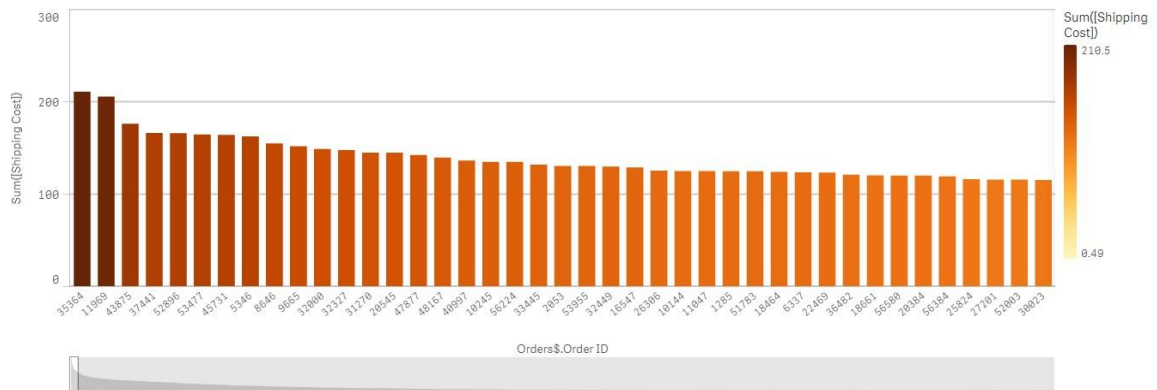


Figure 5 35: Shipping Cost per Product ID.

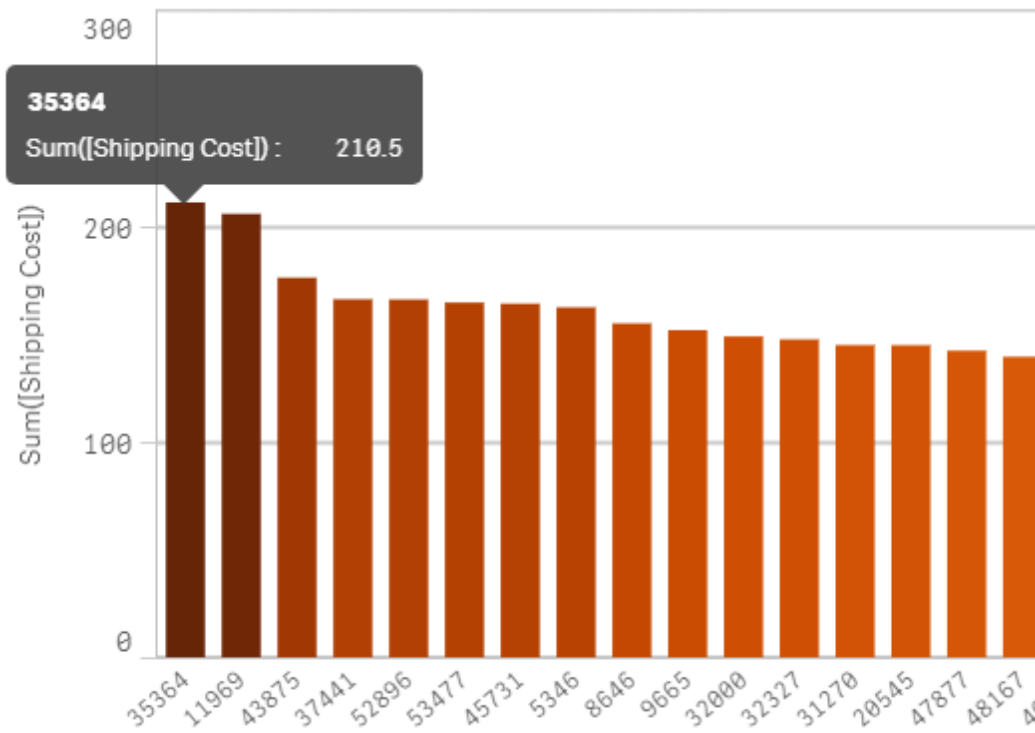


Figure 5 36: Product with the highest shipping cost

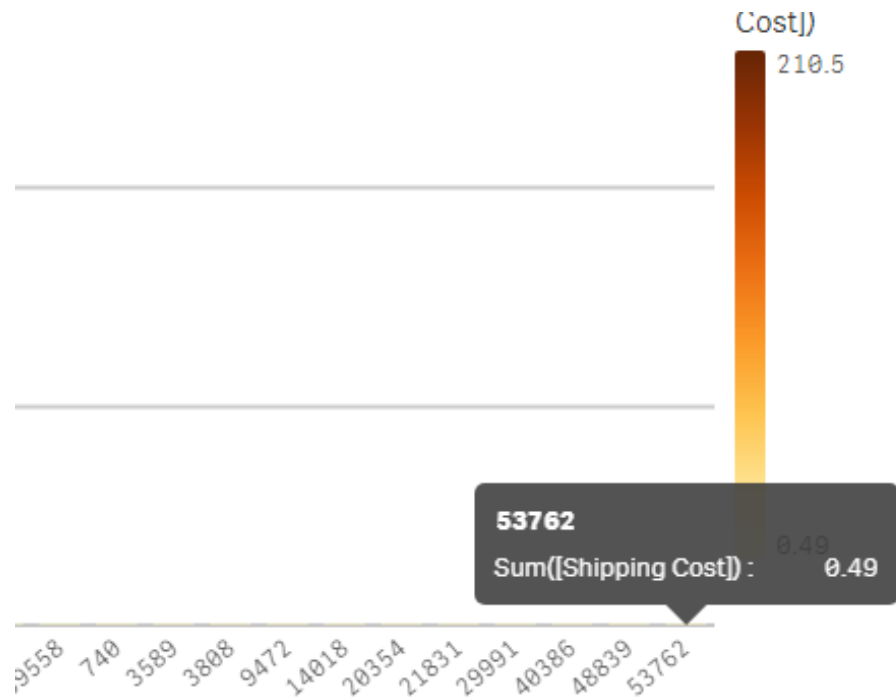


Figure 5 37: Product with the lowest shipping cost.

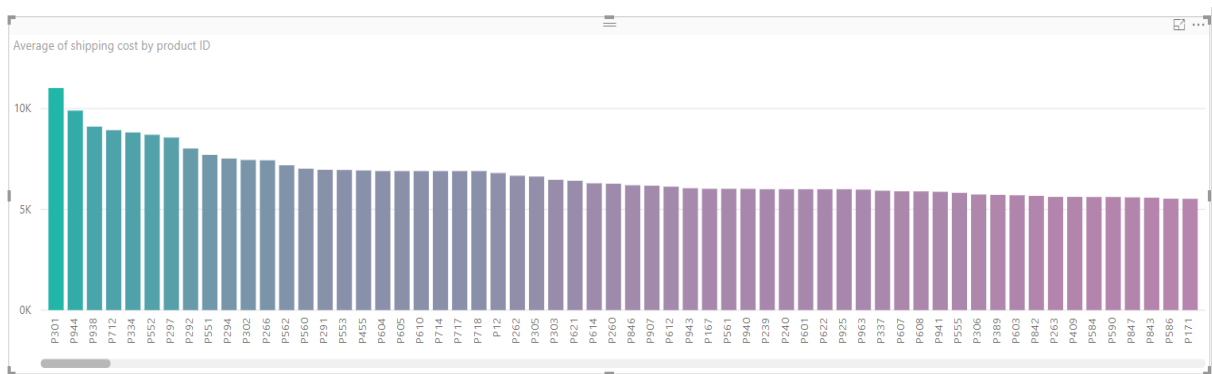


Figure 5 38 Product with the highest shipping cost.

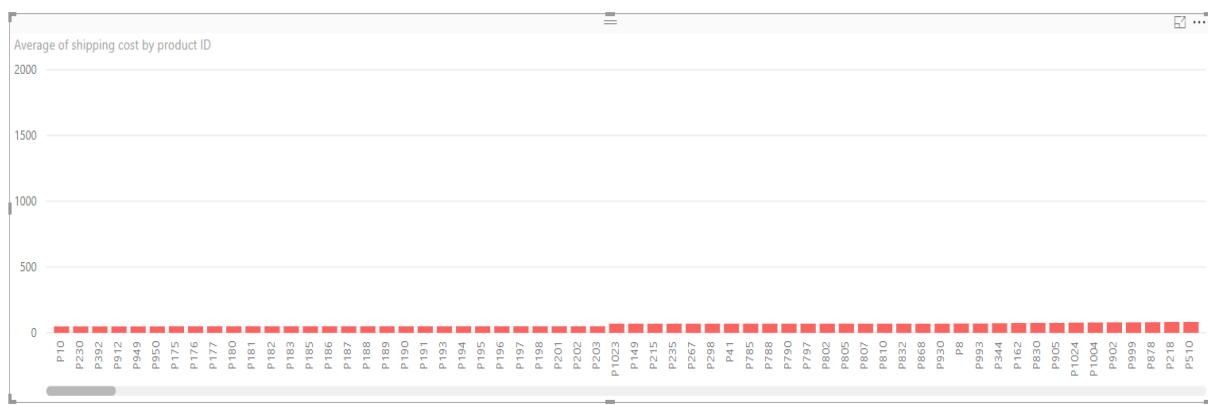


Figure 5 39 Product with the lowest shipping cost.

Below we can see the shipping cost of the products as a trend in a line chart. The line chart is in two different types. (Figure 5.40) (Figure 5.41)

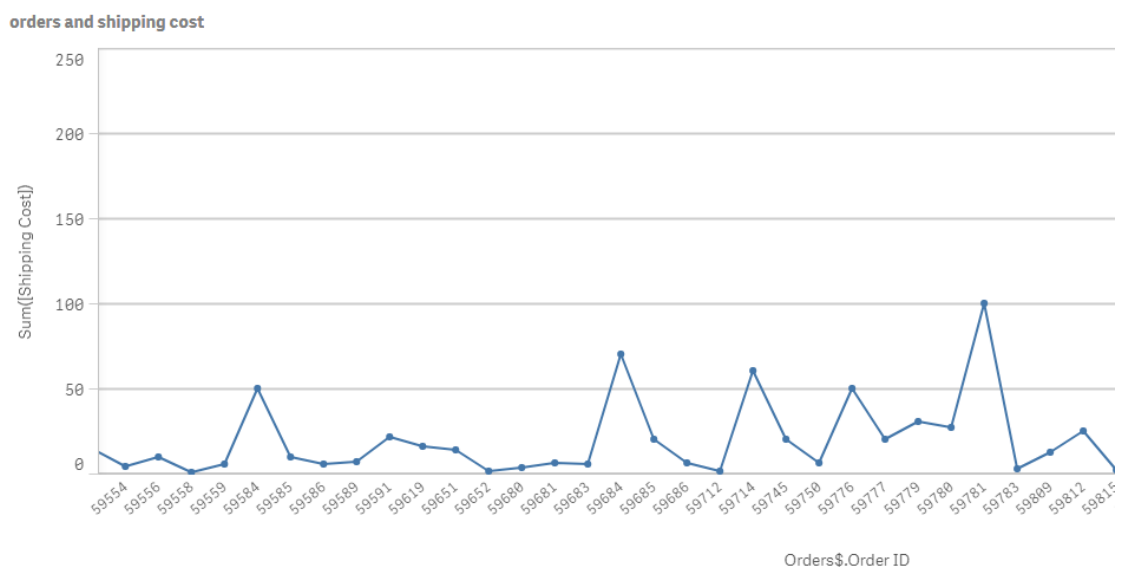


Figure 5 40: Shipping cost

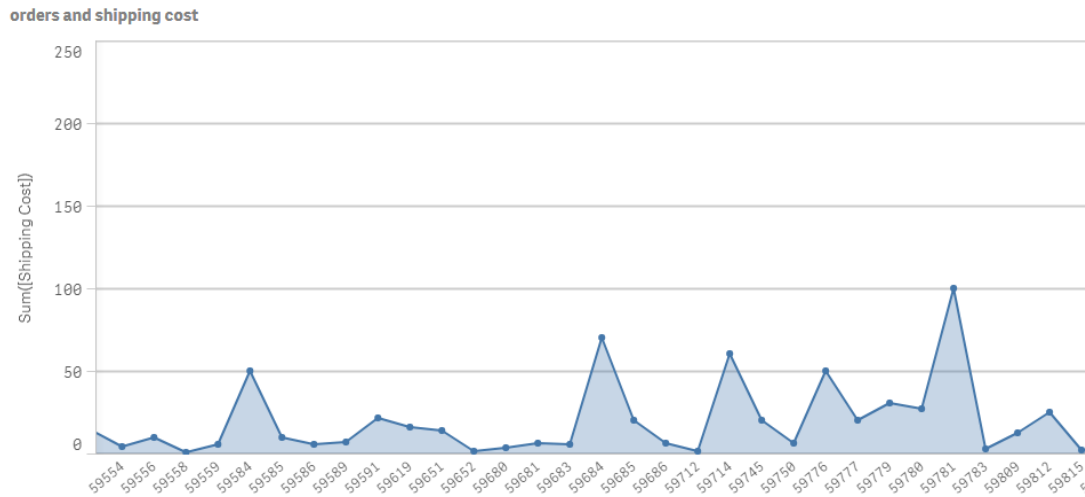


Figure 5 41: Shipping cost

5.4.3 The user asks “Which product has the biggest margin and which product has the smallest margin”.

In this chart Figure 5.42 we can see the margin that the products have. As we notice from the results the ID with the biggest margin is 43745. This ID belongs in six products. These are *Belkin 5 Outlet SurgeMaster*, *Microsoft Natural Multimedia Keyboard*, *Acco Clips to Go™ Binder Clips*, *Xerox 1968*, *3M Office Air Cleaner*, *T61*. The lowest margin is zero, and we can observe it in twenty-two IDs.



Figure 4 42 Margin per Product ID:

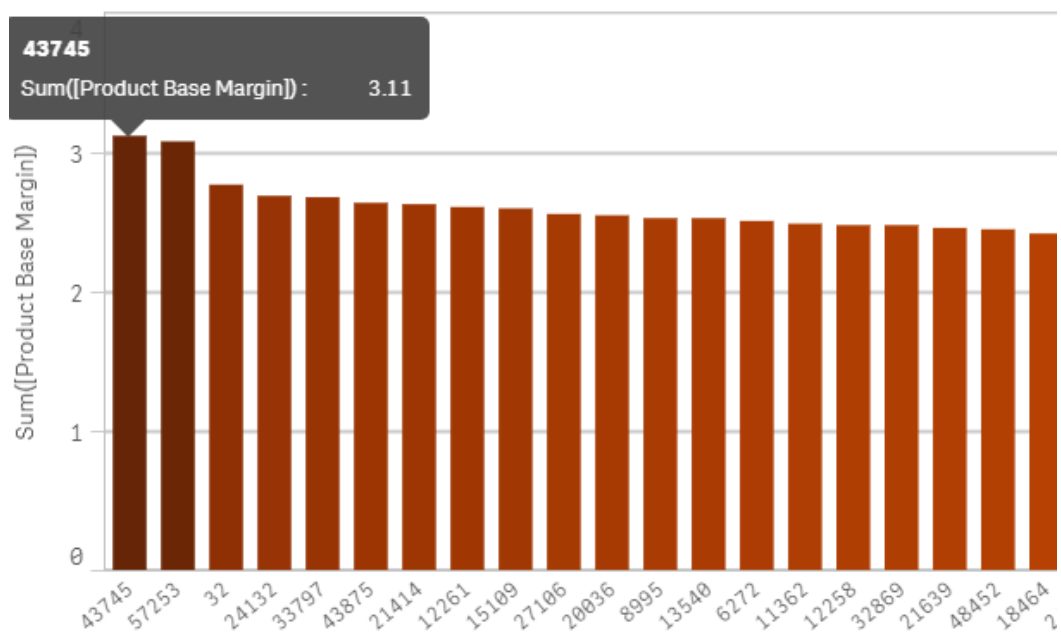


Figure 5 43: The product with the biggest margin.

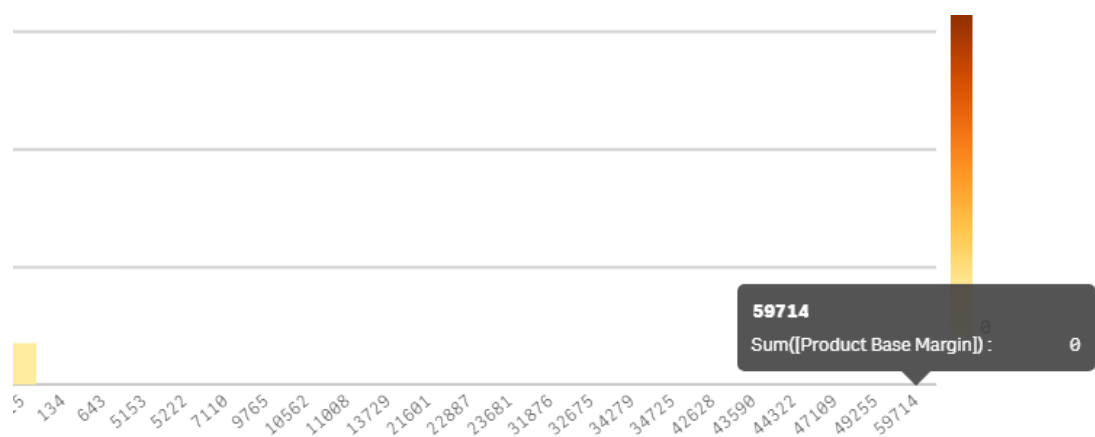


Figure 5 44: The product with the lowest margin

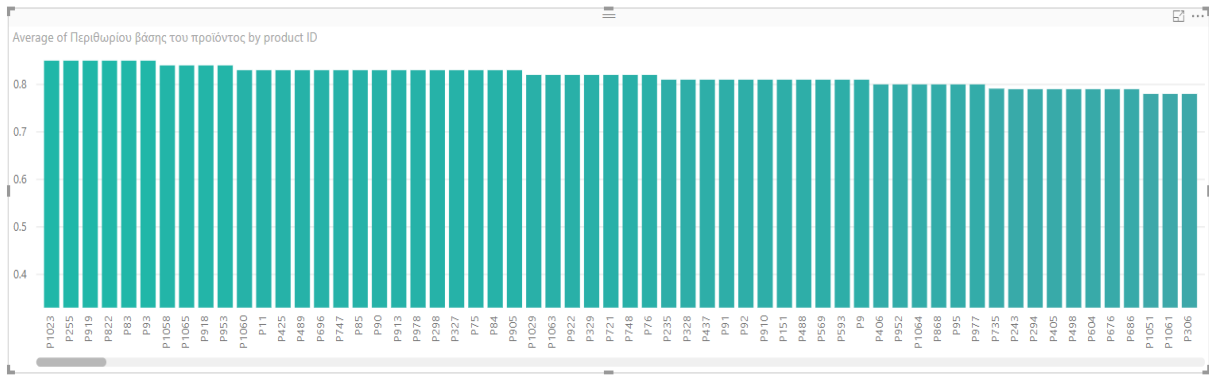


Figure 5 45 The product with the highest margin

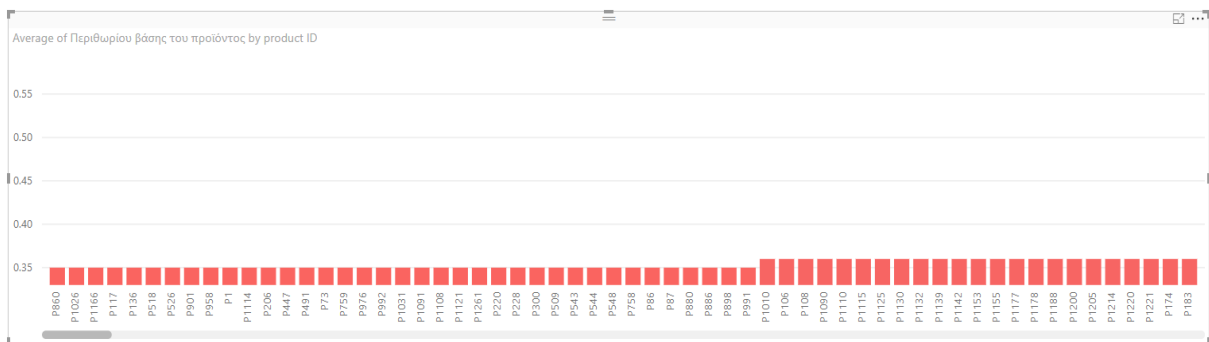


Figure 5 46 The product with the lowest margin

5.4.4 The user asks “Which product has the highest advertising cost and which product has the lowest advertising cost”.

This chart (Figure 5.47) is the portraiture of the advertising costs for every product. As we see the ID with the highest advertising cost is 224 with the cost of 2.18M. This ID belongs in the product *SC-3160*, a technology product for telephones and communication. The ID with the lowest advertising cost is 58978 and has the cost of 100.12K. This product is *Xerox 193*, and is paper for office supplies.

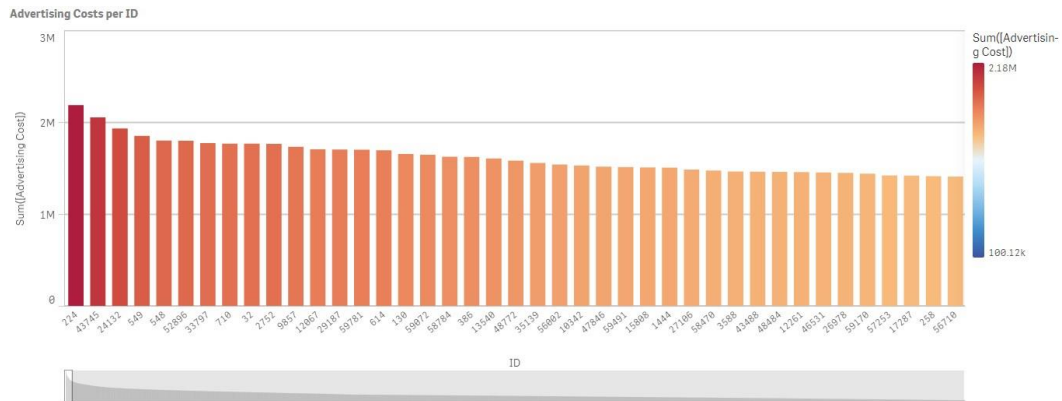


Figure 5 47: Advertising Cost per ID

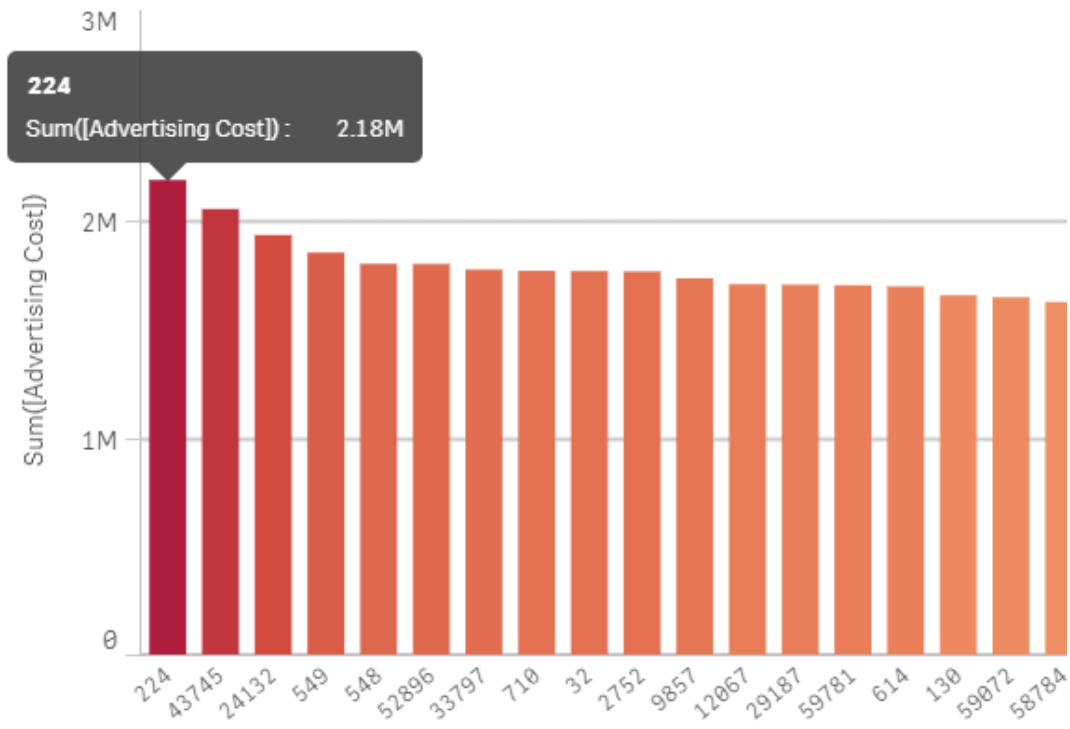


Figure 5 48: The product with the highest advertising cost

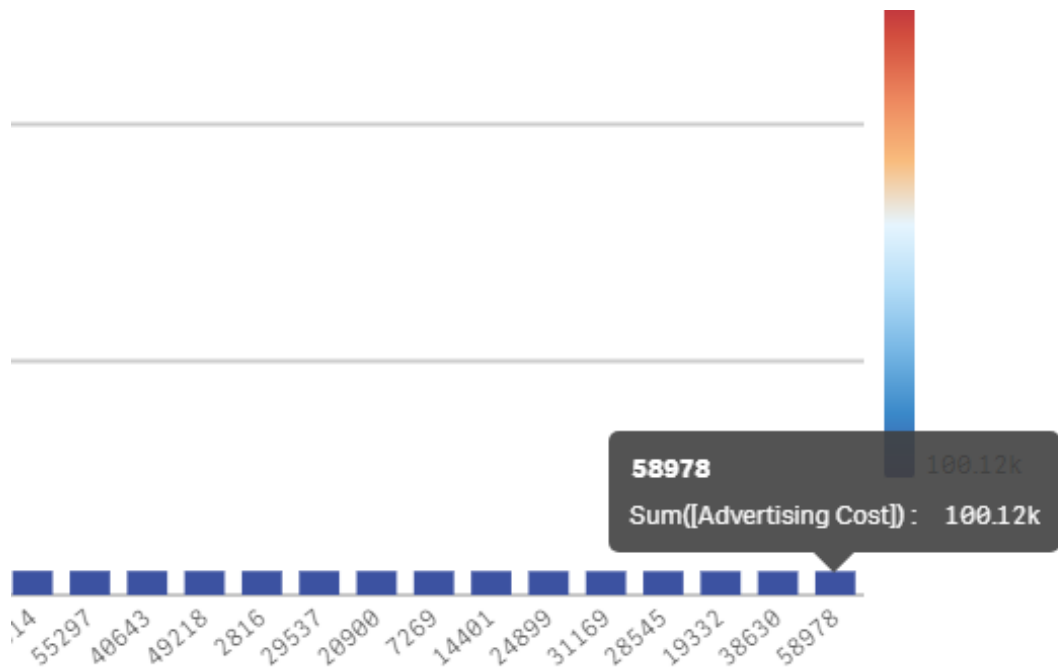


Figure 5 49: The product with the lowest advertising cost.

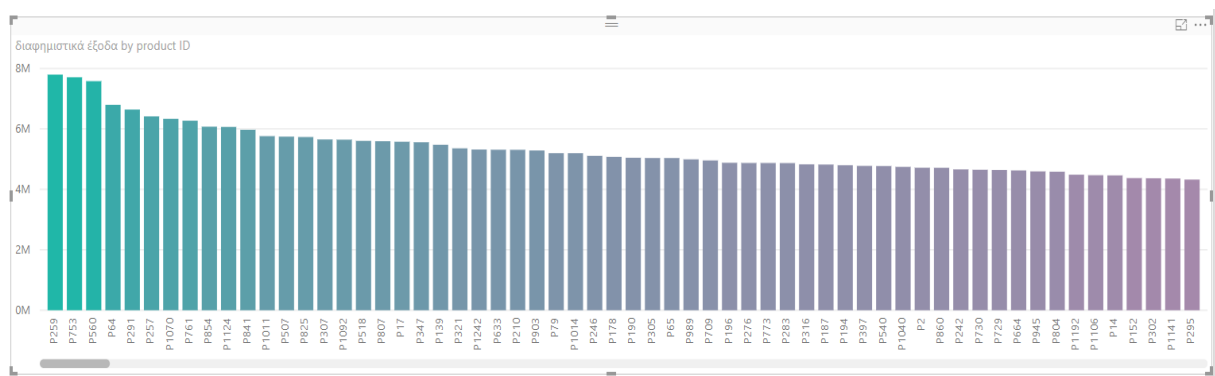


Figure 5 50 The product with the highest advertising cost.

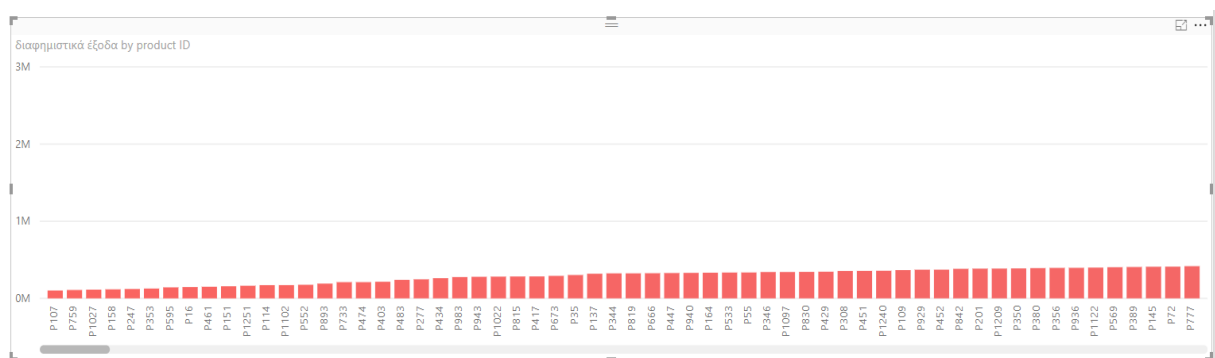


Figure 5 51 The product with the lowest advertising cost.

5.4.5 The user asks “Which product has the highest unit price and which product has the lowest unit price”.

In this chart (Figure 5.52) we examine the unit price per ID. The ID with the biggest price is 3073. This ID has the price of 748.5K. There are four products with this ID. First one is *Avery Reinforcements for Hole-Punch Pages*, an office supply product with unit price 1.98. The second product is *Canon PC1060 Personal Laser Copier*, a product for copiers and fax with unit price 699.99. The third product is *Polycom ViewStation™ ISDN*, a technology product with unit price 6783.02. Last product is *Xerox 1922*, a product for office supplies with unit price 5.98.

The ID with the lowest unit price is 59680 with the price of 99. The product with this price is *Sony IBM Color Diskettes* a technology product for Computer Peripherals.

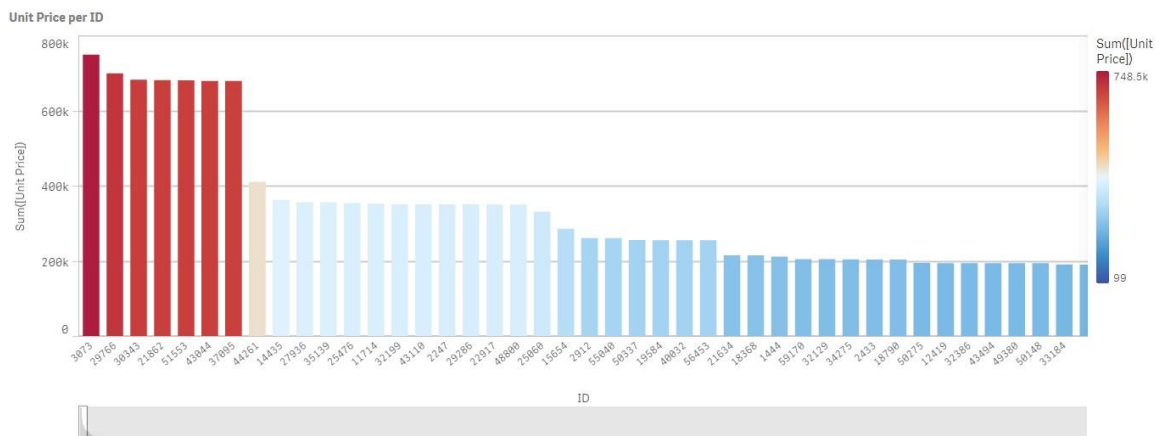


Figure 5 52: Unit Price per ID.

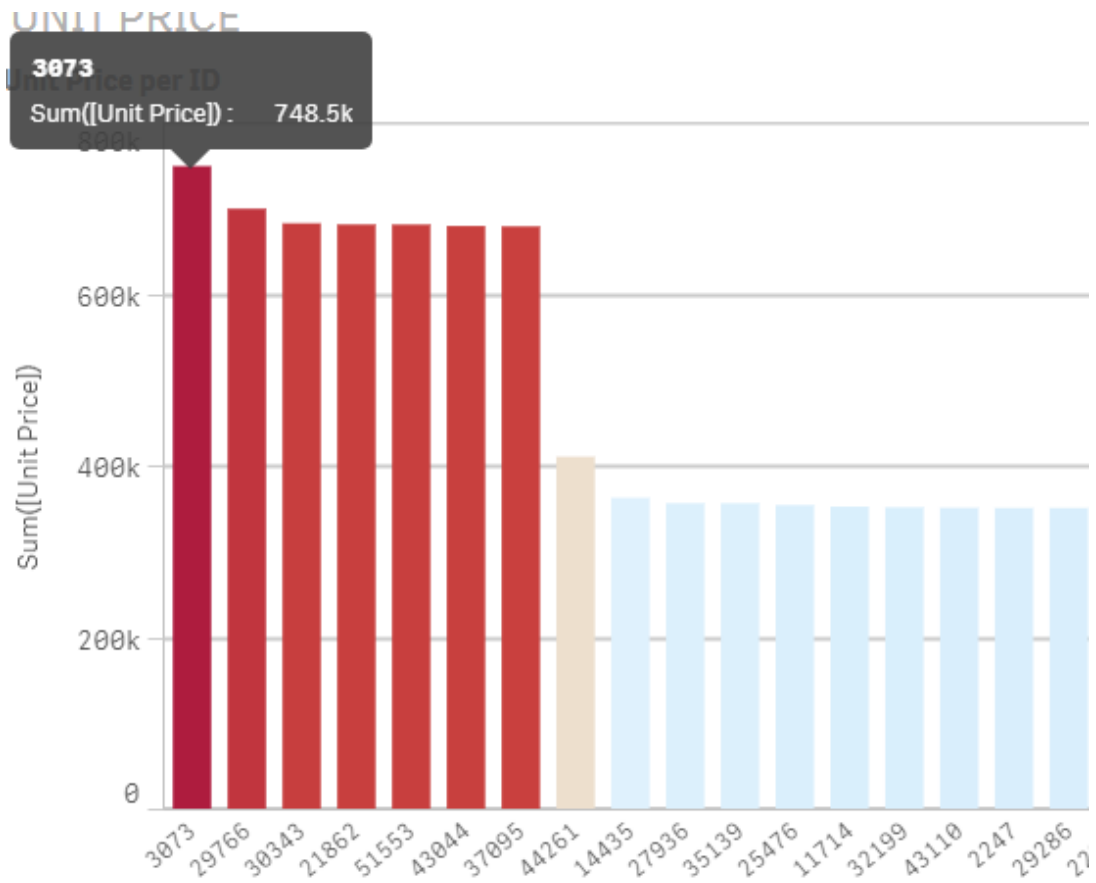


Figure 5 53: The product with the biggest unit price.

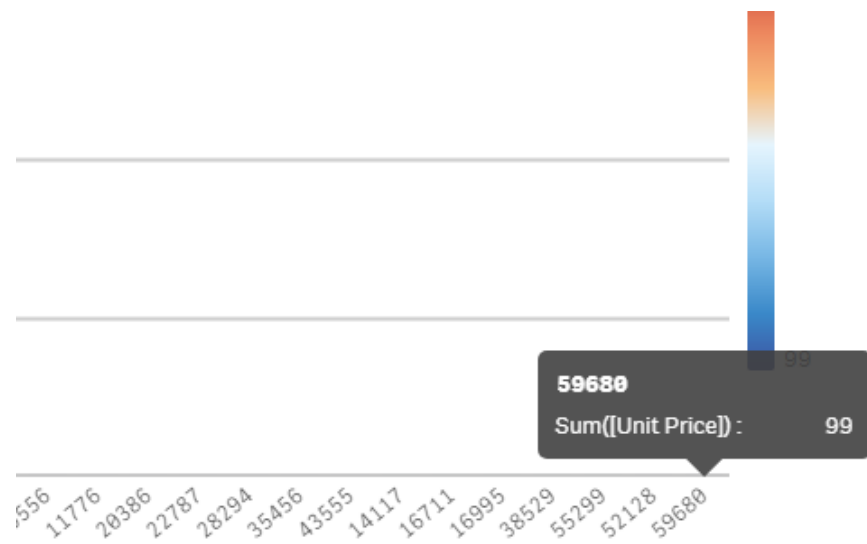


Figure 5 54: The product with the lowest unit price.

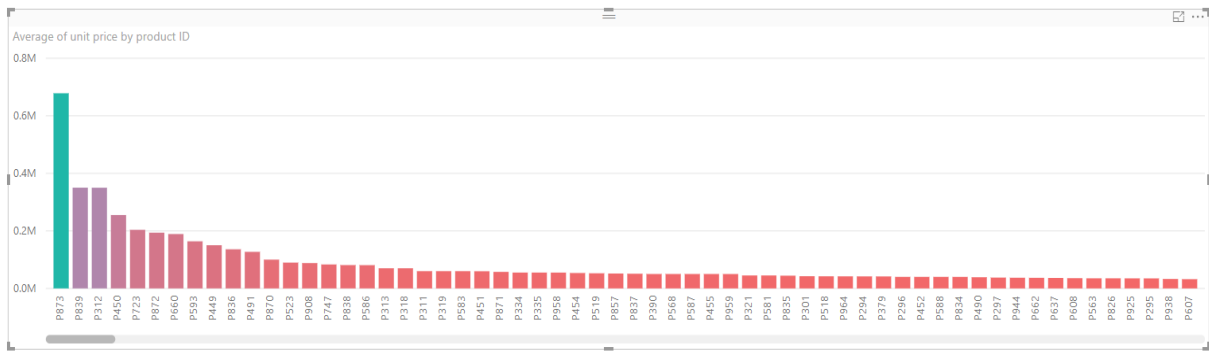


Figure 5 55 : The product with the biggest unit price.

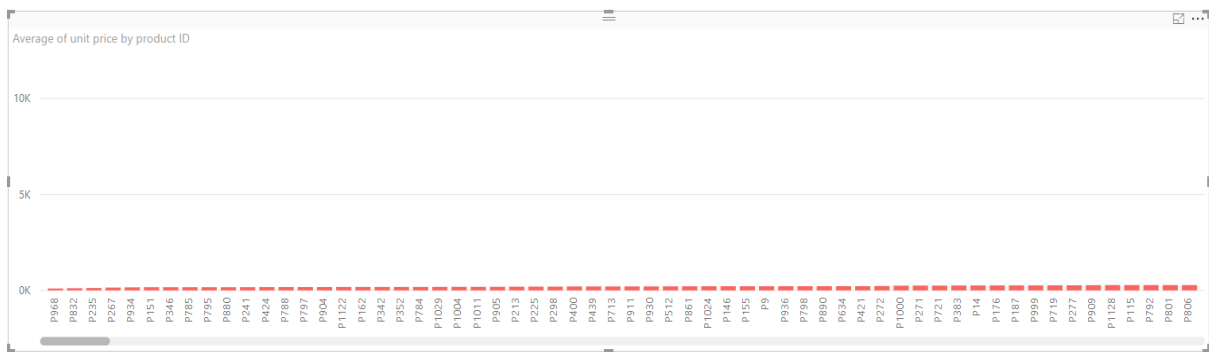


Figure 5 56: The product with the biggest unit price.

The below chart (Figure 5.57) is a form of pie chart called doughnut where we can see the first ten products with the highest unit price. The product 3073 has the highest unit price and it is 7.48 K. this product is '*Polycom ViewStation™ ISDN Videoconferencing Unit* , and has a share of 9.7% . The total amount of orders is 5496.

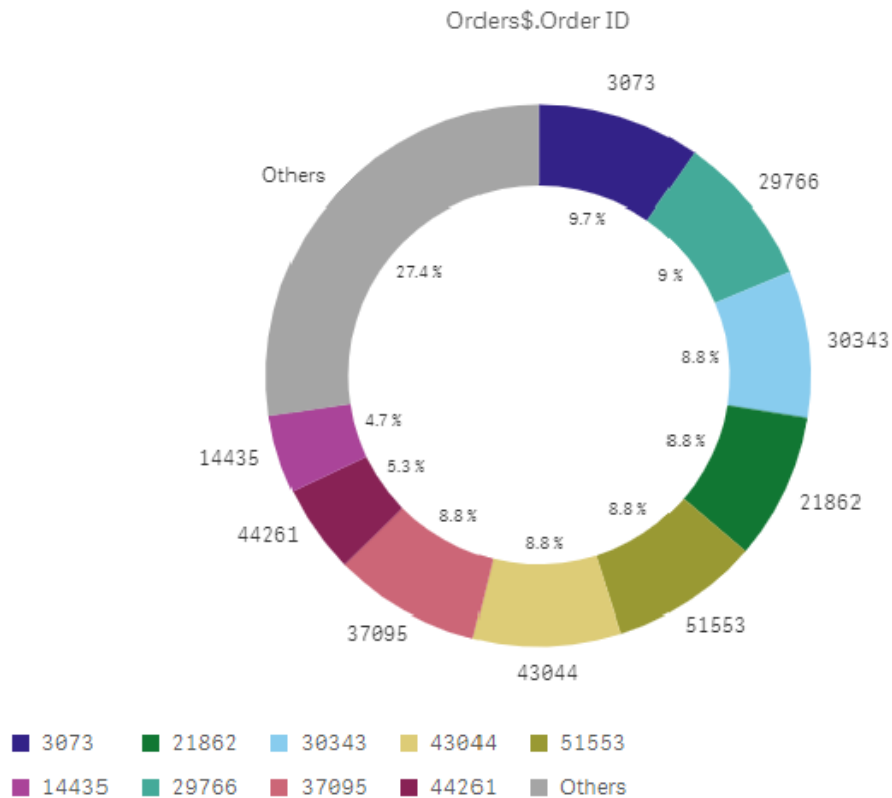


Figure 5 57 Ten products with the highest Unit Price.

5.4.6 The user asks “Which product has the biggest sum of quantity and which product has the smallest sum of quantity”.

In this graph (Figure 5.58) we observe the sum of orders quantity in every ID. The ID with the biggest quantity is 224, and the quantity is 204. This product is *SC-3160*, which is used for telephones and communication. The ID with the smallest quantity is 59911 and has quantity 1. This product is *Black Print Carbonless Snap-Off® Rapid Letter*, which is paper for office supplies.

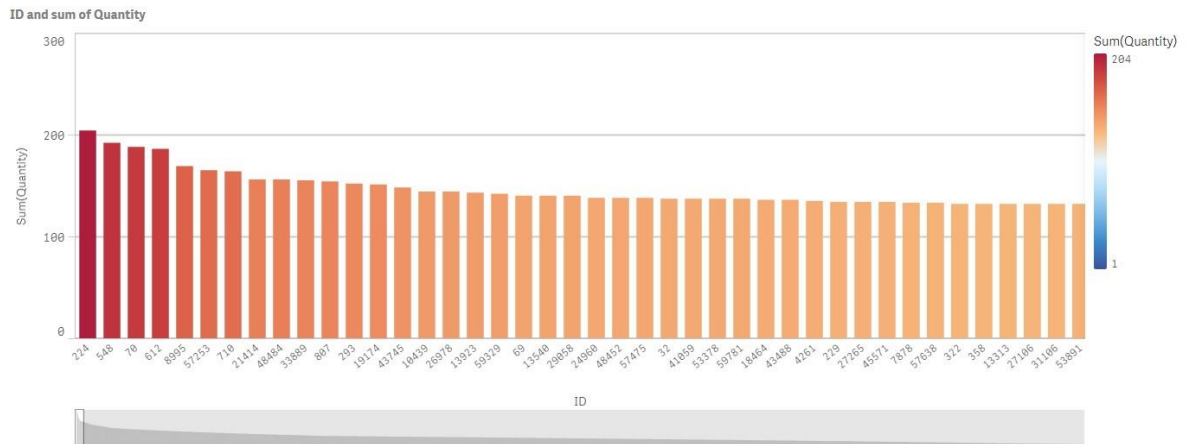


Figure 5 58: ID and sum of Quantity.

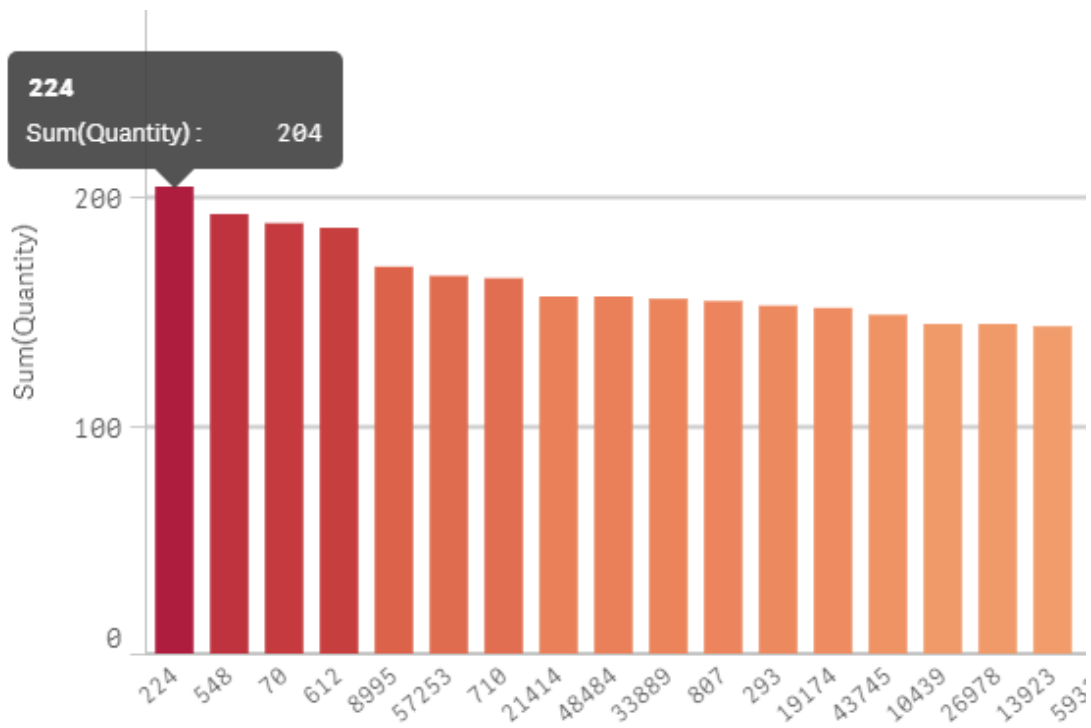


Figure 5 59: The product with the biggest quantity.

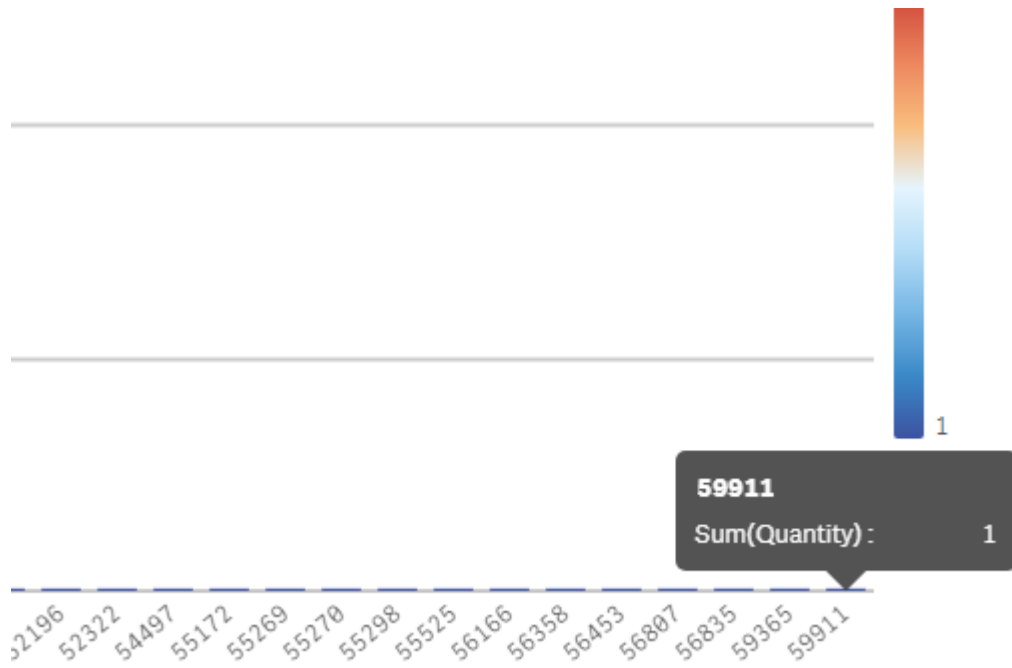


Figure 5 60: The product with the lowest quantity.

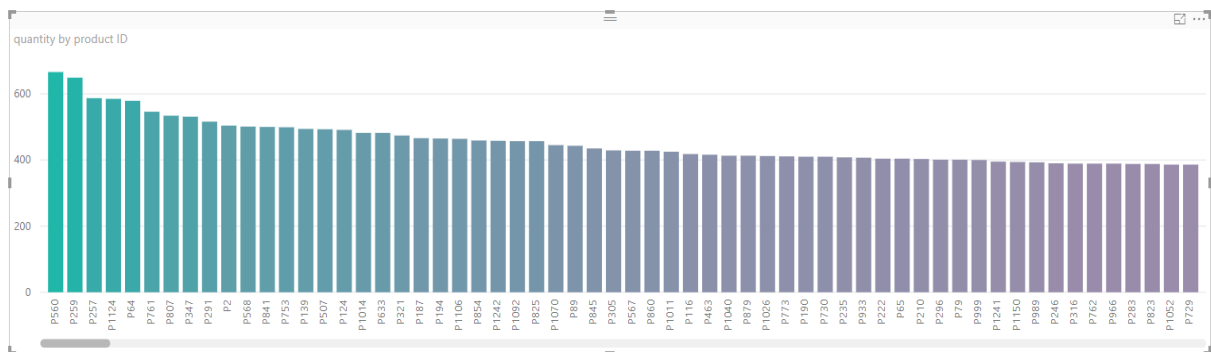


Figure 5 61: The product with the highest quantity. (BI)

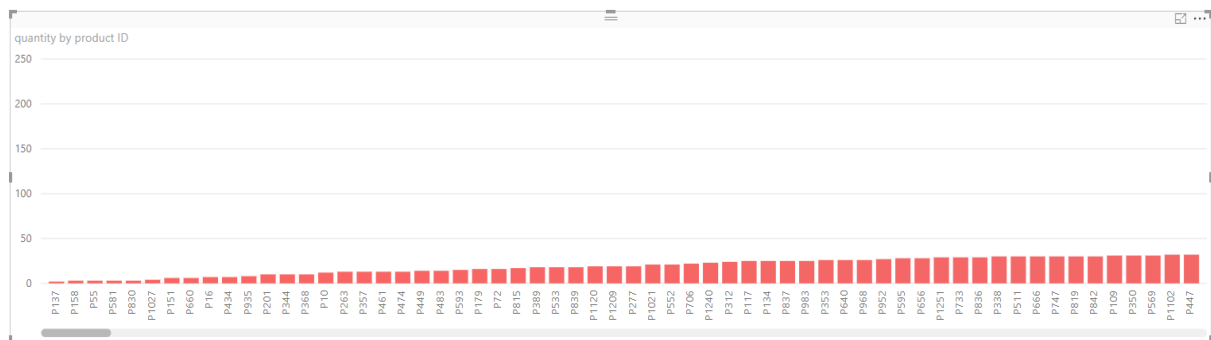


Figure 5 62: The product with the lowest quantity. (BI)

5.4.7 The user asks “Which product has the highest profits and which product has the lowest profit”.

This graph (Figure 5.63) portrays the profits of every ID. As we see the ID with the biggest profit is 29766 and has a profit of 11.96M. This ID corresponds to two products. The first one is *Polycom ViewStation™ ISDN Videoconferencing Unit*, a technology product with profit 27220.69. The other product is *TimeportP7382*, a technology product too with profit 1623,699.

The ID with the smallest profit is 49925 and has a profit of 426. This product is the *Newell 346* , a product used for office supplies with profit -1.78.

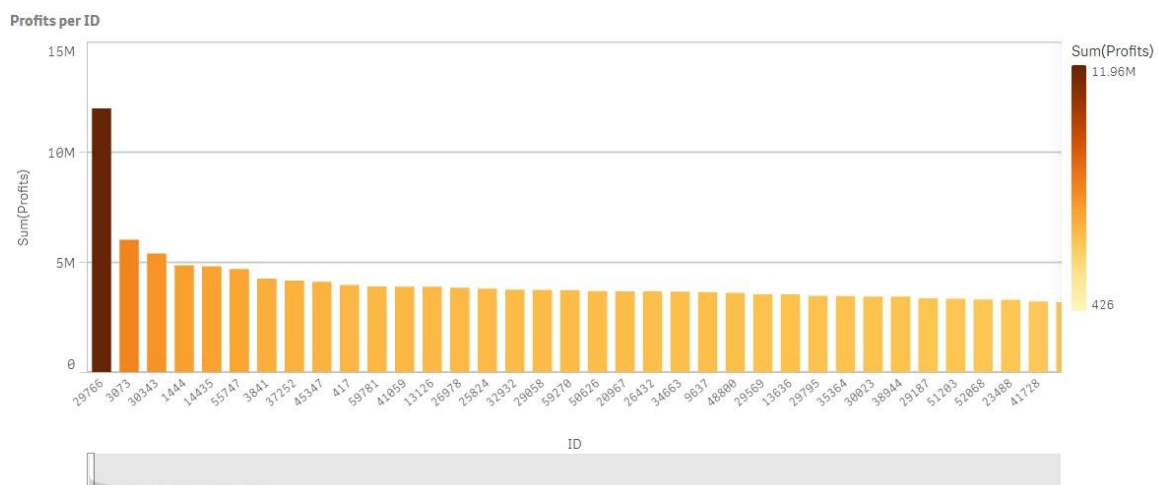


Figure 5 63: Profits per ID.

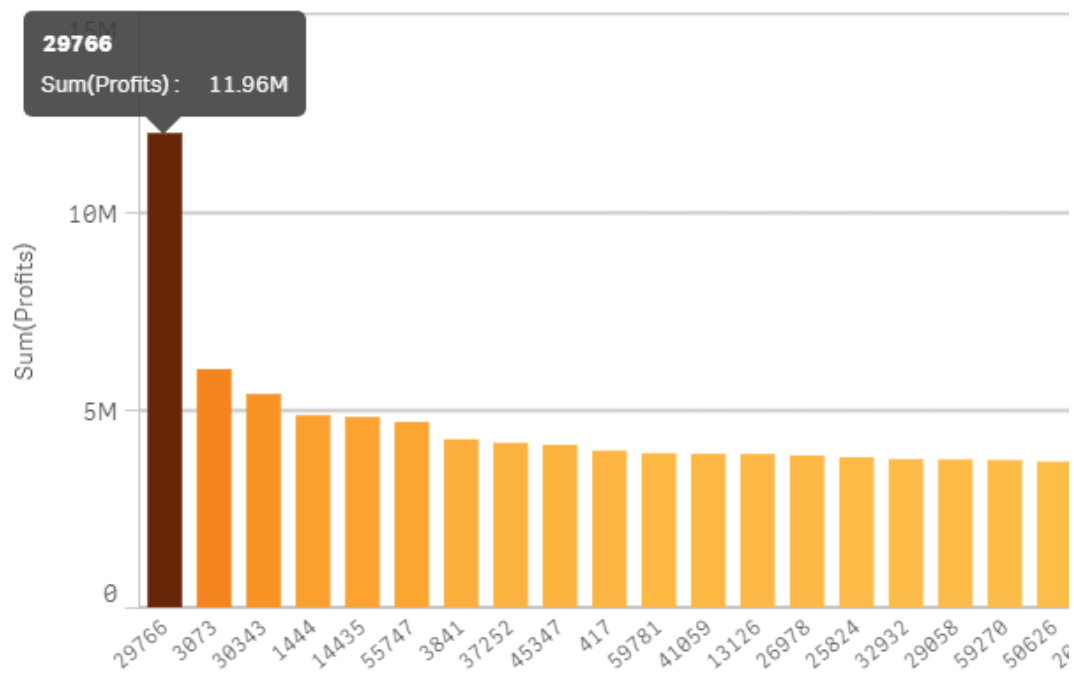


Figure 5 64: ID with the highest profit.

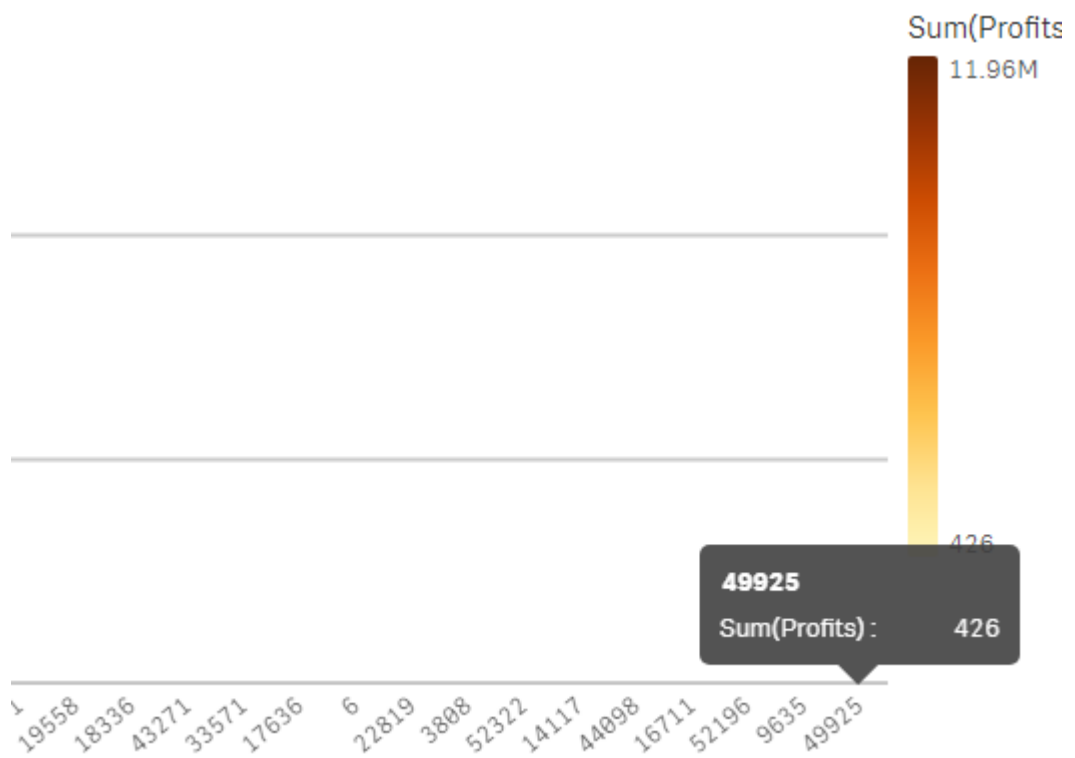


Figure 5 65: ID with the lowest profit.

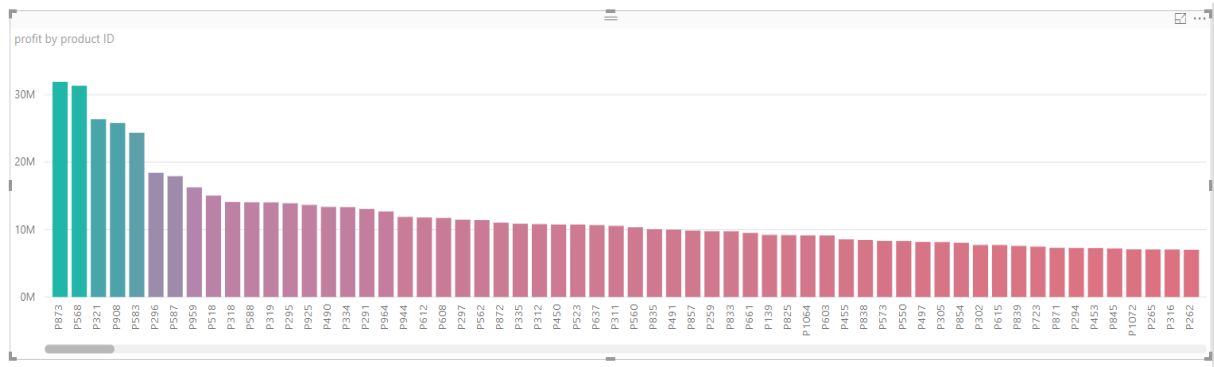


Figure 5 66 ID with the highest profit.(BI)

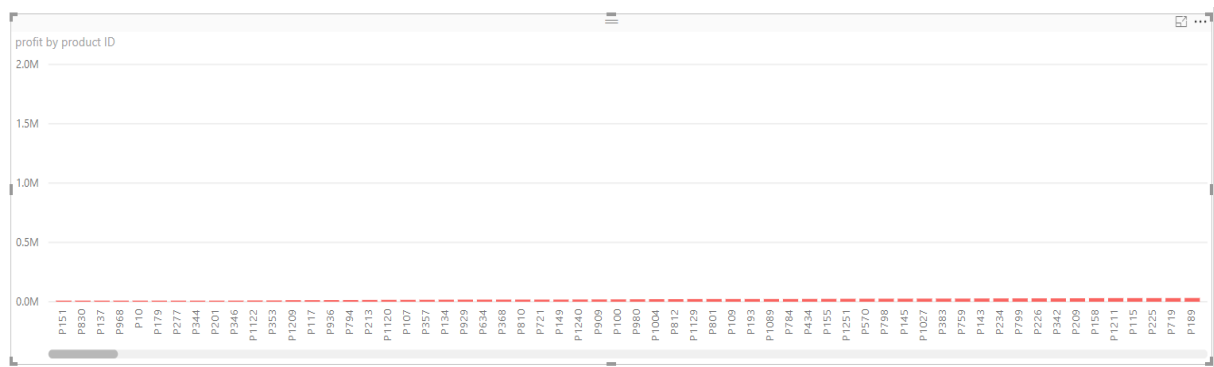


Figure 5 67 ID with the lowest profit. (BI)

5.4.8 The user asks “Which product has the highest shipping cost and which product has the lowest shipping cost”.

In this chart (Figure 5.68) we examine the shipping cost of every ID. From the results we can see that the ID with the highest shipping cost is 35364 and has the cost of 21.05K. This ID corresponds in four products. These are *Xerox 199*, a product contained in a small box with shipping cost 5.68 and is shipped by air transfer, *Bretford Rectangular Conference Table Tops*, a product contained in a jumbo box with shipping cost 85.63, *Bush Advantage Collection® Racetrack Conference Table* a product contained in a jumbo box with shipping cost 110.2, and the last one is *T28 WORLD* a product contained in small box with shipping cost 8.99. The lowest shipping cost is 49 and we observe it in 10 different IDs.

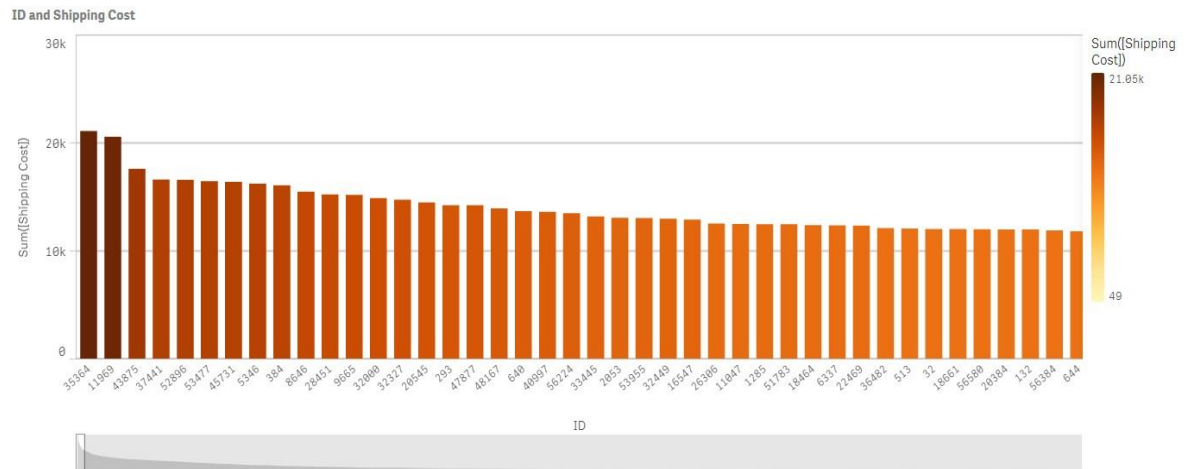


Figure 5 68: Shipping Cost per ID.

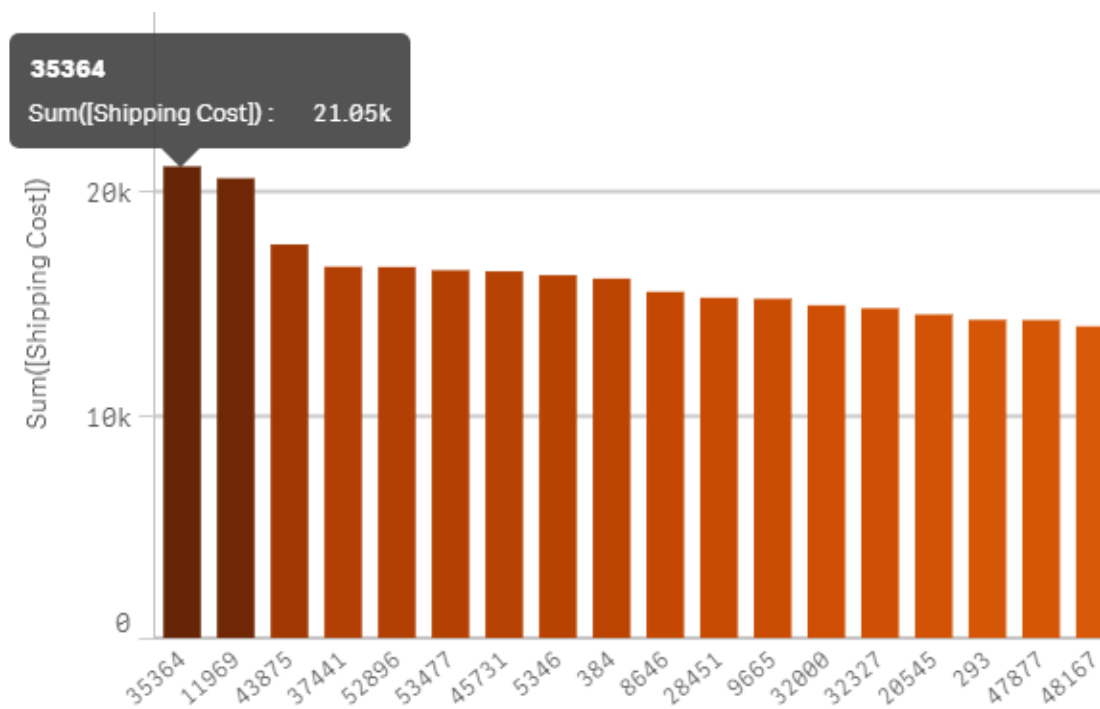


Figure 5 69: ID with the biggest shipping cost.

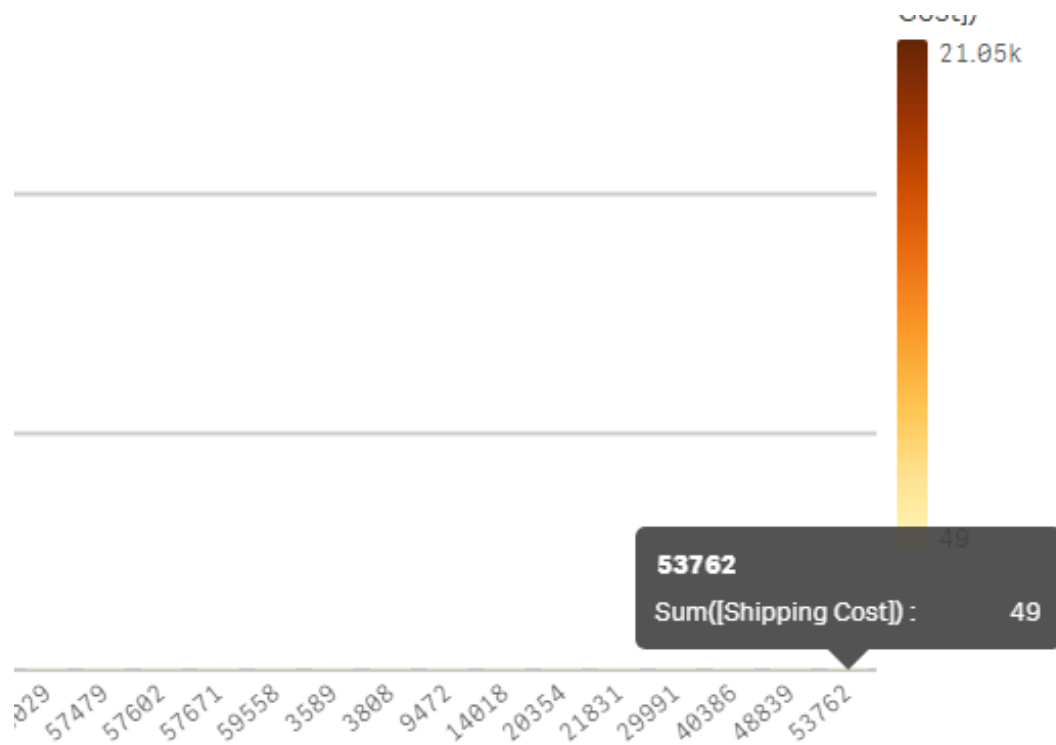


Figure 5 70: ID with the lowest shipping cost.

There are 47 regions in Japan where we can find products of the company. We can see these cities in the map below where the program portrays them as dots in a map chart. (Figure 5.71)

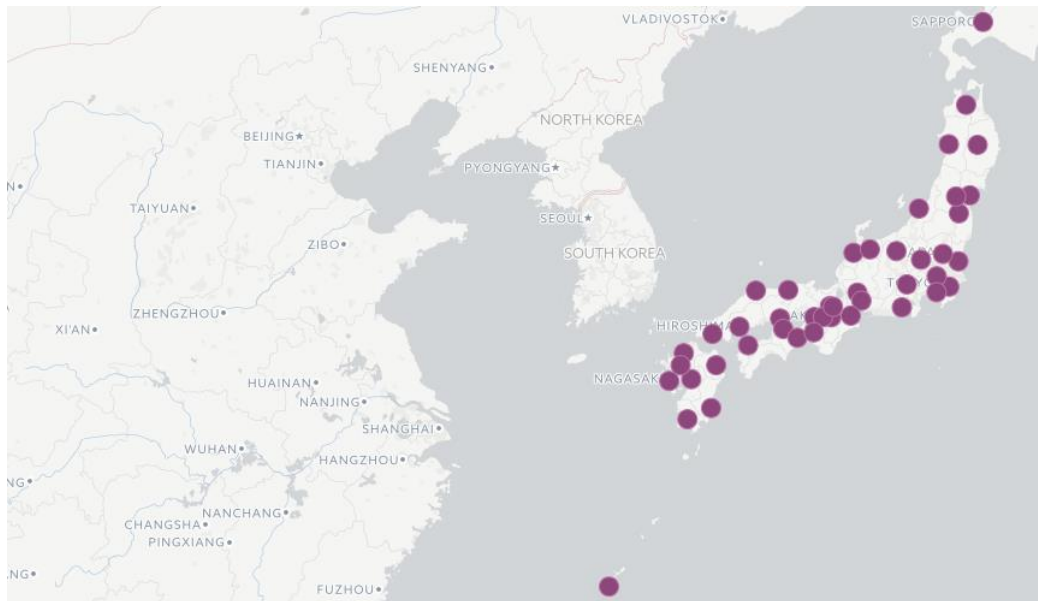


Figure 5 71: Map chart with the 47 regions.

Below we see 3 random selected cities of the total 47. These are Aomori, Chiba and Fukushima (Figure 5.72).



Figure 5 72: Map chart with three selected regions.

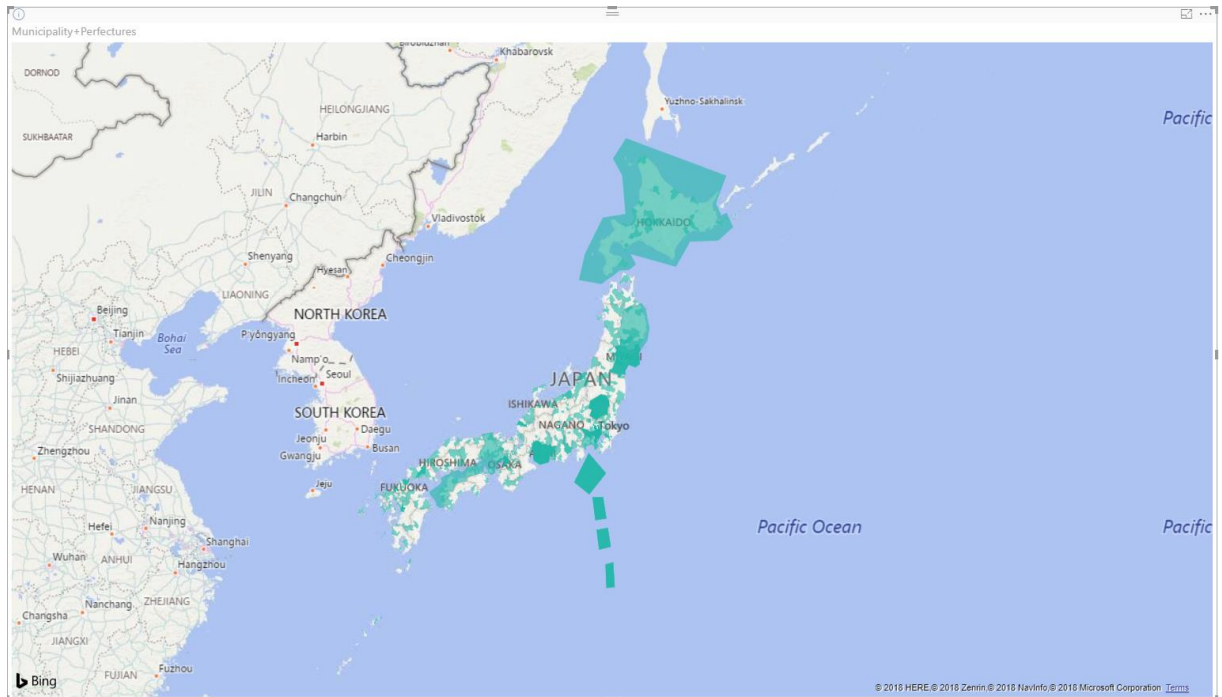


Figure 5 73 Map (BI)

5.5 Comparison between Qlik View Program and Microsoft Power BI .

In the world of business intelligence, putting the right tools in the hands of the right people is critical to success. Two of the most popular tools in the industry today are Microsoft Power BI and QlikView. Both provide modeling capabilities and allow the user to generate visualizations and dashboards, but there are key differences between the two products.

Although both solutions offer extensive opportunities for data assessment and generation of screenshots and dashboards, a closer look shows that there are significant differences.

Simple and intuitive versus versatile and complex.

Moreover, QlikView videos in particular offers advanced BI users (especially those with programming skills) all kinds of options with regard to scripting and data modeling, which Power BI does not. With the use of Qlik products, the user also benefits from a far larger

variety of view and presentation options. But increased options also lead to an increased complexity of QlikView. While using the tool, users with little experience in working with business intelligence tools could sometimes be stretched to their limits with the creation of multi-layered analyses and assessments, despite the intuitive user interface and the high performance thanks to the inmemory technology. In contrast, Qlik Sense is a data analysis solution that is so intuitive that all employees of a company can create personalized reports and dynamic dashboards very easily. In the process, the user's own screenshots can be generated conveniently via drag & drop and data can be analyzed up to a high level of detail.

Easy integration into the Microsoft environment.

One of Power BI's biggest strengths is its easy integration with other Microsoft products such as Dynamics NAV, Office 365 or SQL Server. If a company already works in a Microsoft environment, the necessary data sources (e.g. Excel tables or NAV data) can be connected particularly quickly and easily. In case of QlikView or Qlik Sense, integration with a source system such as Dynamics NAV is just as simple. The products also seamlessly into the Microsoft product portfolio.

Benefits of Power BI and QlikView

Power BI Benefits

As tends to be the case with the majority of Microsoft products, the greatest strength of Power BI is its level of integrati with other Microsoft products. If we are already using Office 365 and SQL Server, we have a good chunk of the most common data sources for using Power BI already in place. It is a fairly quick jump from entering data into an excel spreadsheet to producing a visualization in Power BI.

Microsoft's current commitment to cloud-based computing extends a lot of the advantages of Power B further. For example the power BI mobile app can be fully connected to the rest software stack.

QlikView Benefits

Qlikview is widely regarded as the more mature and robust of the two BI solutions. It is built especially well for analytic purposes, and anyone who comes from a programming or data science background is likely to find it less limiting. Qlikview allows the user to get into the scripting system and tinker around with any models he creates, and that can be very beneficial if we need low-level access. We can also produce a wider range of visualizations and presentations using QlikView.

One area where Qlikview really excels is in raw speed. By keeping its analytics capabilities in memory, it allows anyone with sufficient processing resources to crunch a ton of data and develop insights fast. The ability to use Qlikview on locally based computers is also important to managed organizations that have strict requirements regarding the availability and storage of sensitive information

Qlik View offers a lot to businesses as the application displays data in organized views, and helps users to understand it. It uses an out-of-the-box approach towards data analytics and relies on accurate visualizations and quick connections. Also, the system offers handy file sharing tools and a load of collaborative features.

The problem with most BI vendors is that they rely on query-based analysis that restricts people to linear exploration within a partial view of their data. Qlik's Associative engine lets us any number of data sources so we can freely explore across all the data and instantly pivot our thinking based on what we see. The result: Powerful insights you miss with other tools.

5.5.1 Why to choose Qlik?

SQL was not designed for modern analytics, yet all other “modern” BI tools use a query-based approach to analysis. This limits us to predefined, linear exploration within subsets of data. Only Qlik's Associative engine brings together all our data so we can explore without limit. This is the Associative Difference™. It is the most powerful competitive advantage in a data-driven world. (<https://www.qlik.com/us/products/why-qlik-isdifferent>)

Qlik's pros

- Explore without boundaries.

Search and explore across all the data in any direction with no pre-aggregated data or predefined queries to hold you back. Quickly probe for insight with interactive selections and global search, and instantly pivot your thinking based on what you see. Take away the limits from your analytics.

- All the data seriously.

Easily combine all data sources, no matter how many, how large, or how imperfect. Qlik's Associative engine indexes all data relationships with no data left behind and no need to fully clean and model data in advance. It is all available and ready to be explored.

- Insights as fast as you can think.

Powerful, on-the-fly calculation and aggregation instantly updates all analytics with each click. Critical thinking is no longer derailed by slow queries or ongoing data preparation needs. This lets analysis move at the speed of thought, even with massive numbers of users and complex data sets.

5.5.2 Company overview.

Qlik delivers intuitive platform solutions for self-service data visualization, guided analytics applications, embedded analytics and reporting to approximately 45,000 customers worldwide. Companies of all sizes, across all industries and geographies, use Qlik solutions to visualize and explore information, generate insight and make better decisions. Qlik, optimizes Business Intelligence (BI) by harnessing the collective intelligence of people across an organization and focus on empowering people—by enabling everyone in an organization to see the whole story that lives within their data.

5.5.3 Qlik products.

- Qlik Sense

With Qlik Sense, everyone can make smarter, more informed decisions, together. No matter how small or large is a team, easily can share insights and work collaboratively

in powerful ways. Stay connected with a unified hub, collaborate securely and share data driven stories.

- **Qlik View**

QlikView is a proven, market-leading data discovery product that offers rapidly developed, highly interactive guided analytics applications and dashboards, purpose built for business challenges. QlikView allows users to rapidly build and deploy analytic apps without the need for professional development skills, driving faster response to changing business requirements, shorter time to value, and more insight across the organization. QlikView takes interactive data discovery to a whole new level by enabling unrestricted exploration and search for users, offering collaboration and mobility for groups and teams, and supporting large deployments with enterprise-class scalability and management tools

- **Qlik NPrinting**

An advanced reporting and distribution solution. Fast and easy report creation, reports delivered the way we need them, collaborative analytics for the organization.

- **Qlik Analytics Platform**

Develop, extend, and embed visual analytics in apps, portals, anywhere - all done within a common governance and security framework. Accelerate and broaden the analytics, one platform for embedding analytics, flexible platform.

6 CONCLUSIONS AND FUTURE RESEARCH

QlikView, and Power BI are all solid business intelligence tools. Which one is the best fit for a company depends on the analysis needs. If we are connecting to existing internal databases, data warehouses and other data sources are critical to our operations, we must individually analyze these solutions against those requirements and configurations.

QlikView is highly adaptable and provides wide-ranging deep analytics. It also provides integration with Deltek products, so if we use Deltek for time and expense or earned value

management (EVM) reporting, QlikView is a natural choice. Overall, QlikView also continues to have one of the industry's highest customer satisfaction ratings.

Microsoft's Power BI is inexpensive and plugs-in seamlessly with MS Office. It is a solid option if we need quick access to specific analytics or intensive reporting (and have personnel who are skilled in MS-based data queries). In the long run, it may challenge QlikView or Power BI in their respective specialties. Microsoft Power BI is the only one of these two data visualization and analytics apps that have extensive R and big data-related integrations, ensuring this specific apps' scalability for larger projects.

In the current competitive environment, there is a large burst of data of various types and sizes every day, the so-called "Big Data". Businesses need to find and install synchronous data analysis software.

Through these software, businesses will be able to collect and process more efficiently and within a short time this huge amount of information they collect in their data warehouses.

This timely and in-depth analysis of daily business data provided through this software plays a vital role today for existing businesses and new entrants to the market. The competitive edge gained by businesses is that executives have instantly comprehensive information about company performance and can focus on actions that are more important and take better business decisions.

With quick access to a wider variety of data that would be difficult to access using traditional systems, the capabilities of executives are greatly enriched. Managers can quickly identify business opportunities, market trends and solutions to any problems in order to ensure the smooth and orderly operation of the company.

Furthermore, a better understanding of consumer needs and the provision of a high level of service to them are key factors for the future course of companies and the enhancement of their image in the market.

By investing in modern data analysis tools, businesses have more information about consumer needs and can create personalized products or services that best fit their preferences.

7 BIBLIOGRAPHY

1. **Abraham, A., Hassanien, A. E., Snâaésel, V. 2010**, Computational social network analysis: trends, tools and research advances, Springer.
2. **Airinei, D. & Homocianu, D., 2009**. DSS vs. Business Intelligence.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2381821
3. **Beyer M. A. and Laney D., 2012**, The importance of big data: A definition. Stamford, CT: Gartner.
4. **Bishop M. Christopher, 2006**, Pattern Recognition and Machine Learning, Springer.
5. **Brinch, M.** Big data and supply chain management: A content-based literature review. The 23rd EurOMA conference, EurOMA, Trondheim, 2016.
6. **Chen Min, Mao Shiwen, Liu Yunhao, 2014**, Big Data: A Survey, Springer Science + Business Media, New York.
7. **Cheng Lu & Zhang Qi, 2014**, Data-intensive applications, challenges, techniques and technologies: A survey on Big Data, Department of Computer and Information Science, Faculty of Science and Technology, University of Macau, Macau, China
8. **Crowd G2, 2015**, “Rankings of the best Business Intelligence Platforms”
<https://www.g2crowd.com/>

9. **Cody, W.F., Kreulen, J.T., Krishna, V. & Spangler, W.S., 2002.** The integration of business intelligence and knowledge management. *IBM Systems Journal*, Vol 41(No 4), pp.697-713.
10. **Cui, Z., Damiani, E. & Leida, M., 2007.** Benefits of Ontologies in Real Time Data Access. In *Digital Ecosystems and Technologies Conference*. Cairns, 2007.
11. **Davenport T., Harris J. G. and Morison R., 2010,** *Analytics at Work: Smarter Decisions, Better Results* (Harvard Business Press).
12. **Davenport, T.H., Barth, P., and Bean, R.** How 'big data' is different. *MIT Sloan Management Review* 54(1), 2012, pp. 22–24
13. **Davenport, T.H. and Kirby, J.** Just how smart are smart machines? *MIT Sloan Management Review* 57(3) ,2016, pp. 20–25.
14. **Douglas L., 2001,** 3d data management: Controlling data volume, velocity and variety, Gartner
15. **Dijcks J. P., 2012,** Oracle: Big data for the enterprise, *Oracle White Paper*
16. **Duan, L. and Xiong, Y.** Big data analytics and business analytics. *Journal of Management Analytics* 2(1), 2015, pp. 1–21
17. **Erl Thomas, Khattak Wajid , Buhler Paul, 2015,** *Big Data Fundamentals: Concepts, Drivers & Techniques*, Prentice Hall.
18. **Evelson, B., 2008.** Topic Overview: Business Intelligence. <https://www.forrester.com/Topic+Overview+Business+Intelligence/-/ERES39218?objectid=RES39218>
19. **Fosso Wamba, S., Akter, S., Edwards, A., Chopin, G., and Gnanzou, D.** How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics* 165, 2015, pp. 234–246.
20. **Gangadharan, G.R. & Swami, S.N., 2004.** *Business Intelligence Systems: Design and Implementation Strategies*. In *26th International Conference on Information Technology Interfaces*. Cavtat, 2004.

21. **Gantz, J.F. et al., 2007.** The Expanding Digital Universe.
<https://www.emc.com/collateral/analyst-reports/expandingdigital-idc-white-paper.pdf>
22. **George, G., Haas, M.R., and Pentland, A.** Big Data and Management.
 Academy of Management Journal 57(2),2014, pp. 321–326.
23. **Golfarelli, M., Rizzi, S. & Cella, I., 2004.** Beyond Data Warehousing:
 What's Next in Business Intelligence? In 7th ACM international workshop on
 Data warehousing and OLAP. New York, 2004
24. **Hameurlain, A., Küng, J., Wagner, R., Sakr, S., Wang, L., Zomaya, A.,
 2015,** Transactions on Large-Scale Data- and Knowledge-Centered Systems
 XX, Special Issue on Advanced Techniques for Big Data Management,
 Springer-Verlag Berlin Heidelberg
25. **Hurwitz, J., Nugent, A., Halper, F. & Kaufman, M., 2013.** Big Data For
 Dummies. Hoboken, New Jersey: John Wiley & Sons.
26. **Hwang, M.I. & Xu, H., 2007.** The Effect of Implementation Factors on Data
 Warehousing Success: An Exploratory Study. Journal of Information,
 Information Technology, and Organizations , Volume 2, pp.1-14.
27. **IDC report, 2014,** The digital universe of opportunities, Available at:
<http://www.emc.com/collateral/analyst-reports/idc-digital-universe-2014.pdf>
28. **IBM What is big data?, 2013,** - Bringing big data to the enterprise.
<http://www-01.ibm.com/software/data/bigdata/>.
29. **Intel IT Center, 2012,** Intel Peer Research on Big Data Analysis, Available
 at: [http://www.intel.com/content/dam/www/public/us/en/documents/reports/
 data-insightspeer-research-report.pdf](http://www.intel.com/content/dam/www/public/us/en/documents/reports/data-insightspeer-research-report.pdf)
30. **Laney, D. 2001,** 3D Data Management: Controlling Data Volume, Velocity,
 and Variety, META Group. Available at: [http://blogs.gartner.com/doug-
 laney/files/ 2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-
 Velocity-and-Variety.pdf](http://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf)

31. **Li, J., Tao, F., Cheng, Y., and Zhao, L.** Big Data in product lifecycle management. *The International Journal of Advanced Manufacturing Technology* 81, 2015, pp. 667–684.
32. **Loshin, D., 2013,** Big data analytics: from strategic planning to enterprise integration with tools, techniques, NoSQL, and graph, Morgan Kaufmann.
33. **March, S.T. & Hevner, A.R., 2005.** Integrated decision support systems: A data warehousing perspective. *Decision Support Systems*, 43, pp.1031– 1043.
34. **Marr, B., 2015.** Big Data: Using SMART Big Data, Analytics and Metrics To Make Better Decisions and Improve Performance. United Kingdom: John Wiley & Sons Ltd.
35. Mantzanaris Nikolaos : Big Data and Business Intelligence Software for the Supply Chain ,January 2016
36. **Mayer-Schönberger V, Cukier K., 2013,** Big Data: A Revolution That Will Transform How We Live, Work, and Think. Boston, MA: Houghton Mifflin Harcourt.
37. **McKinsey Global Institute, 2011,** Big data: The next frontier for innovation, competition, and productivity, McKinsey & Company. Available at: <http://www.mckinsey.com/business-functions/business-technology/our-insights/big-datathe-next-frontier-for-innovation>
38. **Microsoft UK Enterprise, 2013,** The Big Bang: How the Big Data Explosion Is Changing the World, Insights Blog - Site Home - MSDN Blogs, Available at: <http://blogs.msdn.com/b/microsoftenterpriseinsight/archive/2013/04/15/the-big-bang-how-thebig-data-explosion-is-changing-the-world.aspx>
39. **Olszak, C.M. & Ziemba, E., 2003.** Business Intelligence as a Key to Management of an Enterprise. *Informing Science*, pp.855-63.
40. **Olszak, C.M. & Ziemba, E., 2006.** Business Intelligence Systems in the Holistic Infrastructure Development Supporting Decision-Making in

- Organizations. *Interdisciplinary Journal of Information, Knowledge, and Management*, Volume 1, pp.47-58.
41. **Olszak, C.M. & Ziemba, E., 2007.** Approach to Building and Implementing Business Intelligence Systems. *Interdisciplinary Journal of Information, Knowledge, and Management*, Volume 2, pp.135-48.
 42. **Pechenizkiy, M., 2006.** Introduction to Business Intelligence, University of Jyväskylä,
<http://www.win.tue.nl/~mpechen/courses/TIES443/handouts/lecture02.pdf>
 43. **Philip Chen, C.L. and Zhang, C.-Y.** Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. *Information Sciences* 275, 2014, pp. 314–347.
 44. **Pries, K.H. & Dunnigan, R., 2015.** Big Data Analytics: A Practical Guide for Managers. New York: Auerbach Publications.
 45. **Pries, K.H. & Dunnigan, R., 2015.** Big Data Analytics: A Practical Guide for Managers. New York: Auerbach Publications.
 46. **Ranjan, J., 2009.** Business Intelligence: Concepts, components, techniques and benefits. *Journal of Applied and Theoretical Information Technology*, Vol 9(No 1), pp.60-70.
 47. **Ranjan, J., 2009.** Role of Business Intelligence in Supply Chain Management. *Global Journal of e-Business & Knowledge Management*, Vol. 5(No 1), pp.1- 7.
 48. **Russom, P., 2011.** Big Data Analytics, TDWI Research, ftp://ftp.software.ibm.com/software/tw/Defining_Big_Data_through_3V_v.pdf
 49. **Sanders, N.R., 2014.** Big Data Driven Supply Chain Management: A Framework for Implementing Analytics and Turning Information Into Intelligence. New Jersey: Pearson Education Inc.
 50. **Sanders, N.R.** How to use big data to drive your supply chain. *California Management Review* 58(3), 2016, pp. 26–48.

51. **Sanders, N.R., 2014.** Big Data Driven Supply Chain Management: A Framework for Implementing Analytics and Turning Information Into Intelligence. New Jersey: Pearson Education Inc.
52. **Savvas, A., 2011.** IBM: Businesses unable to analyze 90 percent of their data. <http://www.computerworlduk.com/news/itbusiness/3313304/ibm-businesses-unable-to-analyse-90-percent-of-their-data/>
53. **Sengupta, K., Heiser, D., and Cook, L.** Manufacturing and service supply chain performance: A comparative analysis. *Journal of Supply Chain Management* 42(4), 2006, pp. 4–15.
54. **Schoenherr, T. and Speier-Pero, C.** Data science, predictive analytics, and big data in supply chain management: Current state and future potential. *Journal of Business Logistics* 36(1), 2015, pp. 120–132.
55. **Souza, G.C.** Supply chain analytics. *Business Horizons* 57, 2014, pp. 595–605
56. **Stackowiak, R., Rayman, J. & Greenwald, R., 2007.** Oracle Data Warehousing and Business Intelligence Solutions. Indianapolis: Wiley Publishing Inc.
57. **Stock, J.R. and Boyer, S.L.** Developing a consensus definition of supply chain management: a qualitative study. *International Journal of Physical Distribution & Logistics Management* 39(8), 2009, pp. 690–711.
58. **Schink, H., 2009.** Current state and future challenges of real-time ETL. In *Student Conference on Software Engineering and Database Systems*. University of Magdeburg , 2009.
59. **Stock, J.R. and Boyer, S.L.** Developing a consensus definition of supply chain management: a qualitative study. *International Journal of Physical Distribution & Logistics Management* 39(8), 2009, pp. 690–711.
60. **Schoenherr, T. and Speier-Pero, C.** Data science, predictive analytics, and big data in supply chain management: Current state and future potential. *Journal of Business Logistics* 36(1), 2015, pp. 120–132.

61. **Sengupta, K., Heiser, D., and Cook, L.** Manufacturing and service supply chain performance: A comparative analysis. *Journal of Supply Chain Management* 42(4), 2006, pp. 4–15
62. **Tvrdikova, M., 2007.** Support of Decision Making by Business Intelligence Tools. In 6th International Conference on Computer Information Systems and Industrial Management Applications. Minneapolis, 2007.
63. **Vanauer, M., Bohle, C., and Hellingrath, B.** Guiding the introduction of big data in organizations: A methodology with business- and data-driven ideation and enterprise architecture management-based implementation. *Proceedings of the 48th Hawaii International Conference on System Sciences, IEEE*, 2015, pp. 908–917.
64. **Villars, R.L., Eastwood, M. & Olofson, C.W., 2011.** Big Data: What It Is and Why You Should Care.
http://www.adminmagazine.com/HPC/content/download/5604/49345/file/ID_C_Big%20Data_whatpaper_final.pdf
65. **Waller, M.A. and Fawcett, S.E.** Data science , predictive analytics , and big data: A revolution that will transform supply chain design and management. *Journal of Business Logistics* 34(2), 2013, pp. 77–84.
66. **Wang, G., Gunasekaran, A., Ngai, E.W.T., and Papadopoulos, T.** Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *International Journal of Production Economics* 176, 2016, pp. 98–110.
67. **Zailani, S.H., Subaramaniam, K.S., Iranmanesh, M., and Shaharudin, M.R.** A global exploration of big data in the supply chain. *International Journal of Physical Distribution & Logistics Management* 46(8), 2016, pp. 710–739.

Electronic Bibliography

- 1 www.emathzone.com– Big Data
- 2 www.itu.int– Big Data
- 3 [http://www.gartner.com/newsroom/id/2723717-](http://www.gartner.com/newsroom/id/2723717) Worldwide Business Intelligence and Analytics Software Market
- 4 <http://www.qlik.com/>
- 5 <http://prod.qlik.com/us/>
- 6 <https://eu.qlikcloud.com/hub/user/53a32091f663e776169bdb5c> Qlik desktop
- 7 <https://community.qlik.com/servlet/JiveServlet/previewBody/12259-102-1-16199/Qlik%20Sense%20Cloud%20Quick%20Guide.pdf> Qlik desktop help
- 8 <http://help.qlik.com/en-US/qlikview/12.1/Content/Guides.htm> Qlik desktop help
- 9 <https://demos.qlik.com/qliksense>
- 10 <http://www.witside.com/el/>
- 11 https://www.sas.com/el_gr/home.html
- 12 <https://docs.microsoft.com/en-us/power-bi/service-basic-concepts>