INDIVIDUAL ASSIGNMENT

TECHNOLOGY PARK MALAYSIA

CT122-3-2-BIS

Business Intelligence System

HAND OUT DATE: 24 FEBRUARY 2020

HAND IN DATE: 18 MAY 2020

WEIGHTAGE: 40%

STUDENT NAME:

STUDENT TP:

LECTURER:

INSTRUCTIONS TO CANDIDATES:

1 **Submit your assignment at the administrative counter**

2 **Students are advised to underpin their answers with the use of references (cited using the Harvard Name System of Referencing)**

3 **Late submission will be awarded zero (0) unless Extenuating Circumstances (EC) are upheld**

4 **Cases of plagiarism will be penalized**

5 **The assignment should be bound in an appropriate style (comb bound or stapled).**

6 **Where the assignment should be submitted in softcopy for both written assignment (documentation) and source code (where appropriate) through Moodle.**

7 **You must obtain 50% overall to pass this module.**

Contents

1.0 Introduction

History of Business Intelligence (1950's – 2010's)

Origins (1958)

As stated above, it was Hans Peter Luhn aka "Father of Business Intelligence"; an IBM computer scientist who first gave a definition to BI in the article "A Business Intelligence System" . He also used Websters Dictionary to provide a definition for intelligence. This allowed for a clear definition of BI to be presented for as a very efficient and quick way to comprehend large amount of data to make better business decisions. With regards to Luhn's work IBM was able to create "touchstone analytical systems." (Heinze, Reedy, Pardo-Bunte and Ly, 2014)

Expansion (late 1980's and 1990's)

In 1956 IBM invented the hard disk which completely changed the game for data storage. This inspired the formation of the first DBMS referred to as decision support system (DSS).

Throughout the 70's BI vendors started creating tools that made analysing and cleaning the data. However, since it was fairly new it was hard to use.

In 1988, the Multiway Data Analysis consortium in Rome was the milestone in making BI analysis effortless. This gave a pathway for the modernization of BI. Howard Dresner made the phrase "business intelligence "popular by making it an umbrella term for data storage and analysis, DSS and executive information system (EIS). (Heinze, Reedy, Ly and Pardo-Bunte, 2014)

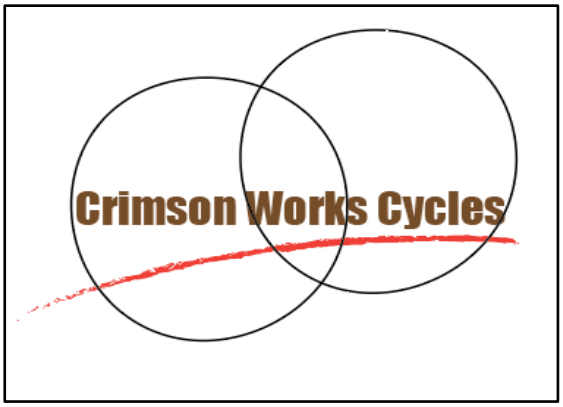
BI also led to advances in data warehouse which enhanced the data flow as it transferred from operational system to decision supports and reduced the time taken to access data as all the data was stored in one place. Moreover, this advancement came with extract, transform and load (ETL) tools and online analytical processing (OLAP) software that is now a vital part of BI. This phase today is known as **Business Intelligence 1.0.** (Heinze, Reedy, Ly and Pardo-Bunte, 2014)

BI became very common in the late 90's and early 00's; at first its only two functions was generating data and statements while displaying and managing it in a tidy way however it was held back due to difficulty and time. BI could not be used by anyone other than experts and

needed vast analytical training to obtain insight. BI did develop for the non-technical users but at a very slow pace. (Heinze, Reedy, Ly and Pardo-Bunte, 2014)

Now comes **Business Intelligence 2.0** gives place to characteristics and capabilities that are different from the usual data querying ways of BI as it incorporates Web 2.0 hence bringing about a more web and browser-based method to obtaining information. An example of BI 2.0 is it has real time processing which integrates information from incidents as they occur into the data warehouses which allows organizations to make better decisions based on latest data accessible. (techopedia.com, 2019) (Heinze, Reedy, Ly and Pardo-Bunte, 2014) BI soon was turning out to be a necessity for companies to stay ahead of their competitors.

1.1 Company Profile



Crimson Works Cycles Logo

Crimson Works Cycles is a massive global outdoor sporting equipment producer with the equipment of bicycles being their focal point. They are also an OEM (Original Equipment Manufacturer) that means that they provide goods to other companies that use it in their products and sell the finished product to its consumers. Crimson Works Cycles headquarters is in Bothell, Washington, USA with over 300 employees with 29 of them being the sales representatives. Crimson's products are sold through resellers over the world in Australia, Canada, France, Germany, United Kingdom, and the United States. Crimson Works Cycles also promotes to corporate customers worldwide through their website.

1.2 Problem Statement

Crimson Works Cycles contains a lot of data in their database ranging from 2017 to 2019. Crimson needs to manage this data to help them extract valuable data and find hidden patterns within it. If this data is managed properly then it will allow Crimson to make better and more informed decisions in the future which will help them improve their performance.

Crimson Works Cycles has seen drops in company sales and customer performance in the end of 2019 and beginning of 2020. There can be many reasons for this and though the company has taken several measures to try and improve there has not been any significant changes in the company and customer performance. Hence it was realized that utilizing BIS approach will

provide the company a step-stool to explore the data they have and find any hidden patterns which they can take out and help them exceed in terms of performance in all aspects even the areas that they have been lacking throughout the years.

1.3 Aims

The aim is to use Business intelligence to allow for Crimson Works Cycles to make better and quick business decisions to ensure their success as it will ensure they remain ahead of their competitors. To take the data they have in their databases through the years 2017,2018 and 2019 and provide Crimson Works Cycles with visualization about their business process so they can use it to make accurate decisions. Business Intelligence is a context free expression so for example two people may view the data differently, this will Crimson Works Cycles work more efficiently as one person may see something the other might have missed. Furthermore, BI uses real-time data analysis so in case of any type of issues that may arise, Crimson Works Cycles can take swift action to make proper changes.

1.4 Objectives

- Allow Crimson Works Cycles to understand their customer sales performance
- Clean the data and observe it
- They will be able develop their performance by improving business development.
- Extract data and find hidden patterns
- Improve customer and sales performance
- Improve decision making
- Improve in other area that they might lack
- Provide visualization of data through Power BI
- Use CRISP-DM as methodology,
- Use data provided to assist the organization in making better decision
- Use Visual Studios to extract tables and create cube

2.0 Methodology (CRISP-DM)

Methodology are very important in researching and analysing our data which allows us to gather accurate and important results.

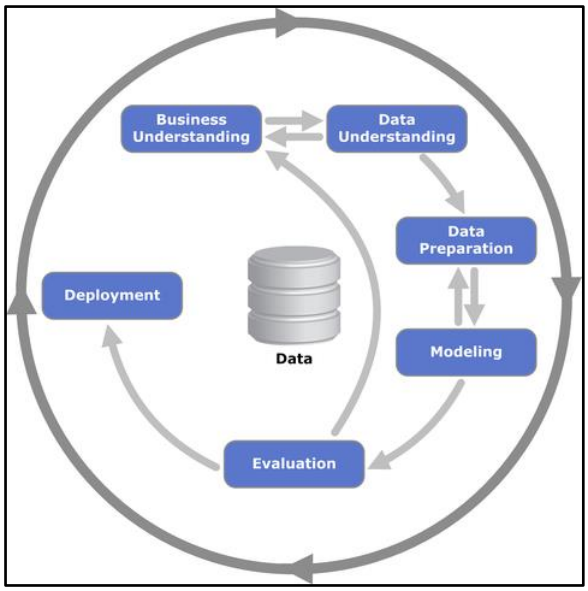


Figure 1 - (Vorhies, 2019)

Cross industry process for data mining more commonly known as CRISP-DM is one of these methodologies. It was introduced in late 1999 & presents an organized approach to devising a data mining task. (sv-europe.com, n.d.) A vital part of data science management is to make sure the data quality is of the highest quality. (Zavgorodniy, 2018) This methodology allows us to go back to some tasks and possibly fix our mistakes. However, it only goes back to certain phases, not all of them. There are 6 phases in CRISP-DM.

- Business Understanding

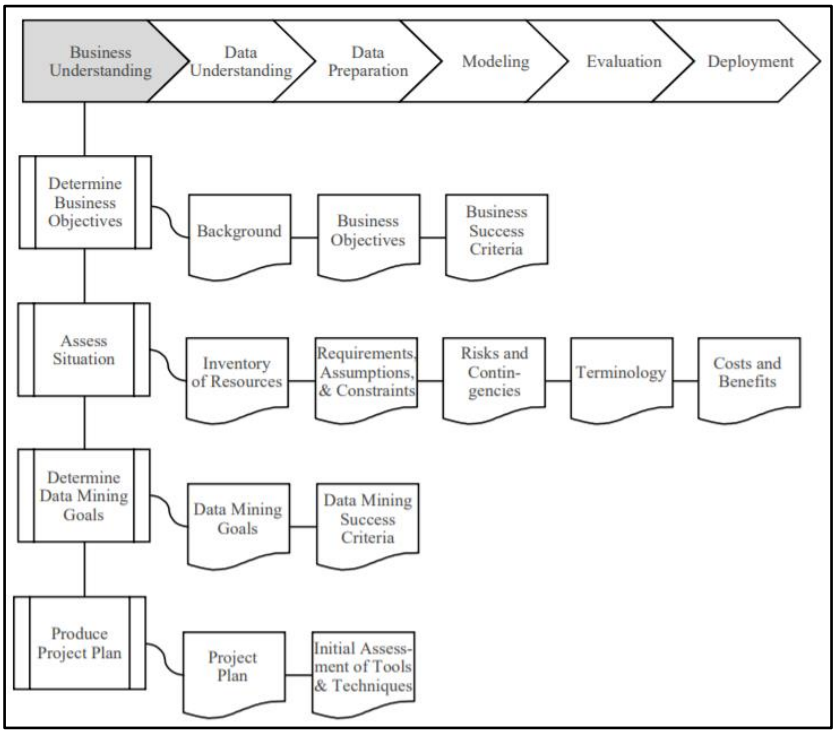


Figure 2 – (Chapman et al., 1999)

This is the initial stage of CRISP DM and as the name suggests, it is to understand what you want to gain from your business. This phases mainly concentrates on identifying the projects aims and requirements from the point of view of the company (Vorhies, 2019) after which the

knowledge earned is transformed into a “data mining problem definition” and a plan is created to attain the objectives. (Vorhies, 2019) (Chapman et al., 1999)

a. Assessing situation

i. Inventory of resources
ii. Requirements, assumptions, and constraints
iii. Risks and Possibilities – Issues that may arise during the project and alternative solutions.
iv. Terminology – a list containing proper business terms and data mining terminology. (sv-europe.com, n.d.)
v. Costs and benefits

b. Determining your goals

This includes criteria for business success where goal output is stated for attaining those objectives. (proglobalbusinesssolutions, n.d.)

c. Developing the project plan

While advancing with this plan, you will also need to keep your data mining goals at the forefront. The steps that will take place in the later stages will need to be detailed here which includes all the CRISP-DM phases and their execution techniques and tools.

i. Project Plan –consists of the specifics such as duration ,input , output ,resources, dependencies (between certain risks and time).
ii. Initial assessment of techniques and tools – When the first phase ends, you need to evaluate the techniques and tools used as these are important in the later phases. (proglobalbusinesssolutions, n.d.)

- Data Understanding

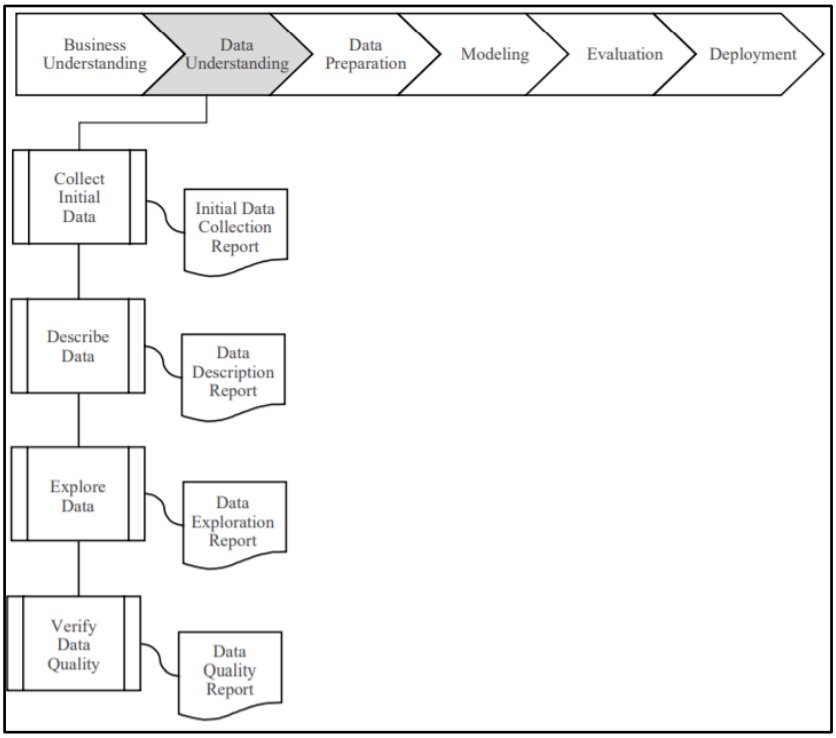


Figure 3 - (Chapman et al., 1999)

In this phase it allows us to recognize what we can accomplish with the data given and where should our expectations be. Data quality is assessed in terms of completeness, value, and governance compliance. This is a very important step of the plan as it informs us how reliable is the final outcome. Brainstorming takes place to find the best possible way to extract the pieces of information. (Rodrigues, 2020) This phase detects any interesting subsets that may be hidden, evaluate the data to find patterns and so on. (Vorhies, 2019)

a. **Collection of the initial data –** data sources, methods to acquire them, issues gathering data
b. **Data description reports –** data formats, quantity, identities of field, evaluation of data if satisfies requirements
c. **Exploration and verification of data quality reports –** relationships between attributes, statistical analysis, data exploration report, is data complete or missing?

- Data Preparation

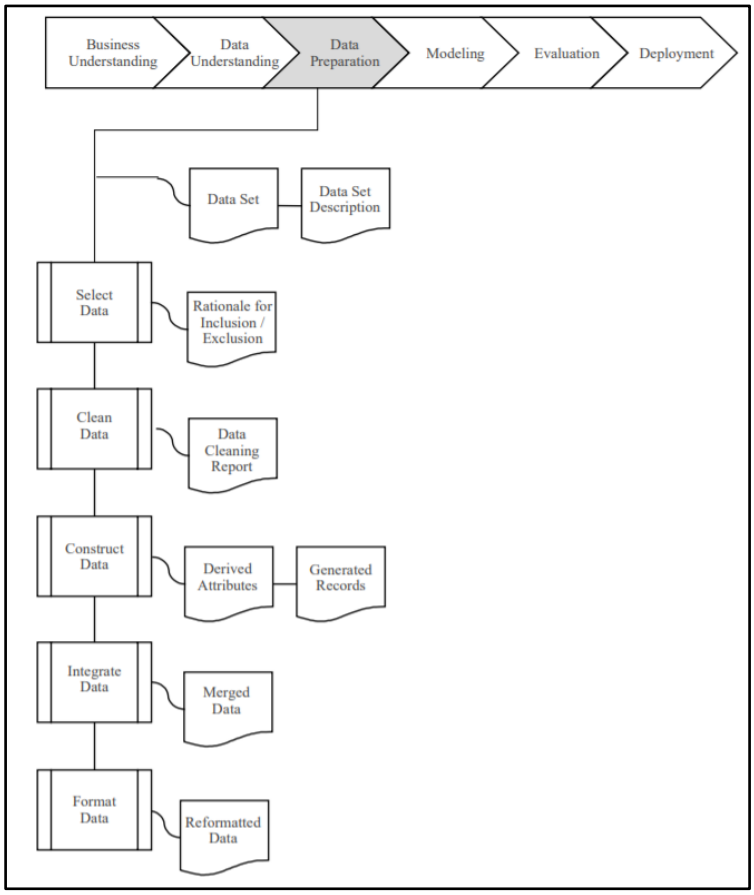


Figure 4 - (Chapman et al., 1999)

This phase involves ETLS that changes a portion of information into something valuable by using certain methods and algorithms. Data engineers standardize the data in case data governance policies are not set in the company and is obligatory to give an accurate meaning to the information. There may be some algorithms that work well with specific parameters while some are unable to process any type of discrepancy in the values. All of this is the duty of the development team to normalize the information. (Rodrigues, 2020). It is noted that majority of the time spent in a project is on this specific step as it is very time-consuming and may also end up becoming complex when dealing with copious amount of data.

a. **Selection of Data**
b. **Cleaning of Data**
c. **Construction of Data**
d. **Integration of Data**
e. **Formatting of Data**

(Chapman et al., 1999)

- Modelling

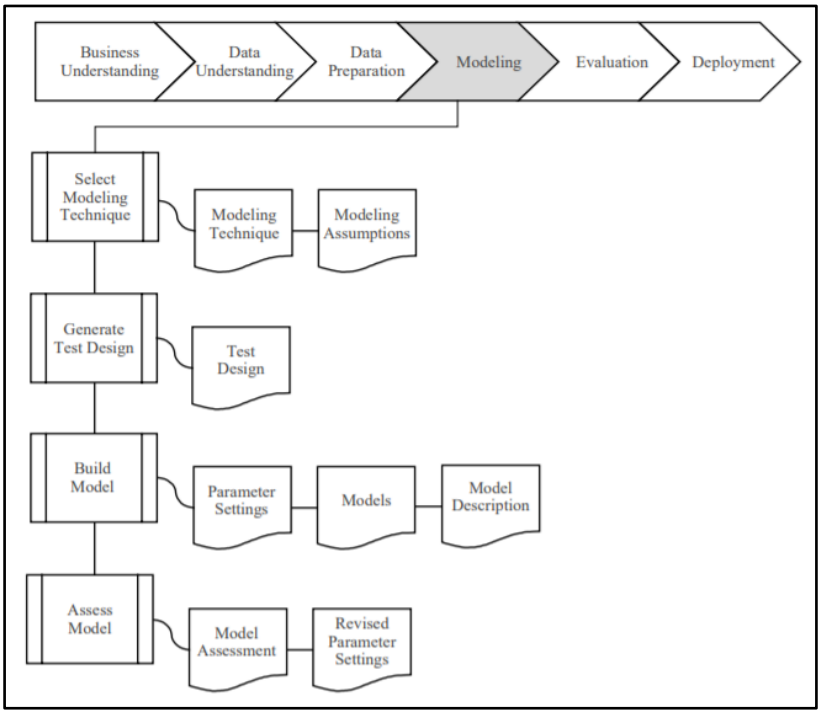


Figure 5 - (Chapman et al., 1999)

This is an extremely important core step that will be accountable for the outcomes that should be satisfactory to the project aims. It takes the least amount of time from the project if previous phases have been carried out efficiently and are sufficient. Due to any reasons such as result is not satisfactory or can be additionally improved then we can go back to data preparation and enhance the available information. K-means, clustering, time series, linear regression and k-nearest neighbour are the algorithms used. (Rodrigues, 2020).

a. **Select Modelling Technique –** documentation of technique to be used.
    i. **Modelling Assumptions**
b. **Generate Test Designs –** description of plan to be used for training, testing, and evaluating prototypes.
c. **Build Model**
    i. **Set Parameters**
    ii. **Models** – real models created by modelling tool.
    iii. **Model Descriptions –** details about created models.

d. **Assess Model**
    i. **Revised Parameter Settings** (Chapman et al., 1999)

- Evaluation

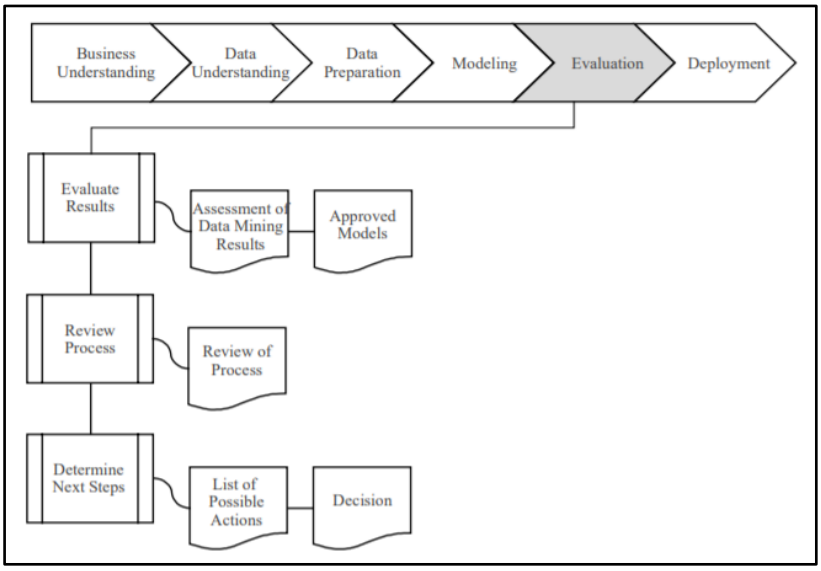


Figure 6 - (Chapman et al., 1999)

The second last step is the evaluation phase where all the results are verified and validated. In case our results are unsatisfactory, we can go back to the previous phases and find the mistakes which caused such results. Typically, the data engineers separate the data into test and training data. In this step, the test data is used figure out the model is accurate. (Rodrigues, 2020). In regard to time and resources, real applications may be used to evaluate the model. Furthermore, this phase deals with evaluating unique data mining results that may have been created which can help aid us with extra information or tips. (proglobalbusinesssolutions, n.d.)

a. **Evaluate Results**
    i. **Assessment of DM results –** summarized according to business success requirements along with details about if project meets original corporate goals.
    ii. **Approved Results**
b. **Review Process**
c. **Determine Next Steps**

(Chapman et al., 1999)

- Deployment

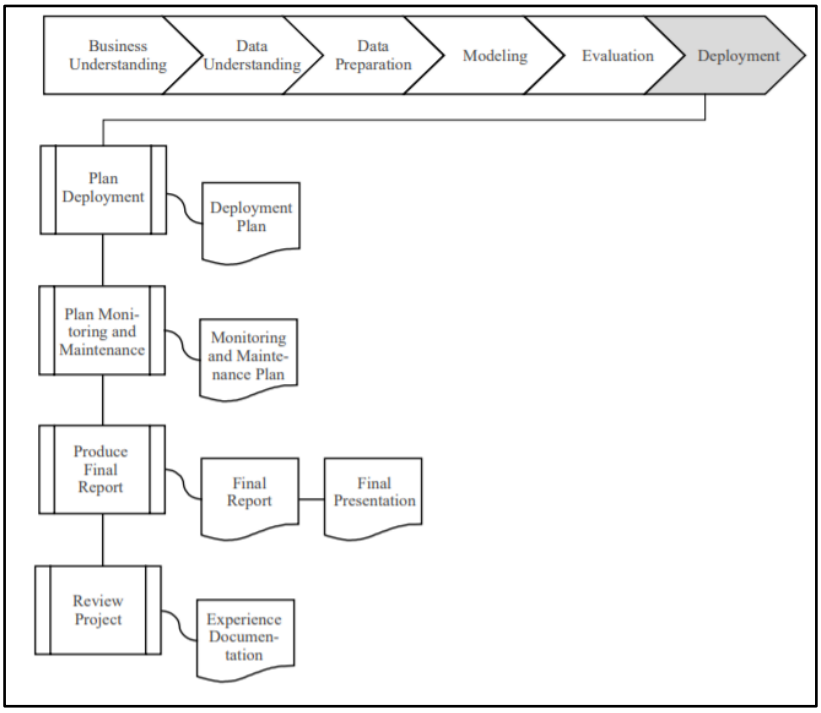


Figure 7 - (Chapman et al., 1999)

Deployment means deploying a code interpretation of the prototype into an operating system to classify the latest data as it develops and to establish a system for the utilization of that new information in the solution of the initial business challenge. (Vorhies, 2019) The code must consist of the data preparation steps leading up to the modelling phases, so the model be capable of handling new unrefined data in the similar approach as while in the model development. (Vorhies, 2019)

a. **Plan Deployment**

b. **Plan Monitoring and Maintenance**

c. **Produce Final Report –** includes prior deliverables, condensing and managing the outcomes.

   i. **Final Presentation –** meeting takes place at end of project where result shown to consumer.

d. **Review Project**

   i. **Experience Documentation**

(Chapman et al., 1999) (sv-europe.com, n.d.)

3.0 Business Intelligence System

Business Intelligence takes advantages of programs and services to change data into appliable observations that improve an organizations decision making skills. (Pratt and Fruhlinger, 2019). Through using BI tools, datasets can be investigated and observed to produce conclusions in the forms of graphs, summaries, charts etcetera to give users with comprehensive data regarding the state of current business functions. Business intelligence has a major influence of the company's decisions as it supports decisions based on true facts and figures.(Guru99.com, n.d.)

Hans Peter Luhn was an IBM researcher and is the one who came up with the term "Business Intelligence" in 1958. It was defined as the ability to capture the correlations of the given facts and figures to use them to act towards a certain goal. (KlipFolio, n.d.)

Forrester also put in his two cents and gave a more detailed description by stating that BI uses a set of techniques , principles, operations, composition and technology to change raw data into important information which allows for a more efficient, vital and operational insights and decision making. (KlipFolio, n.d.)

Companies such as Starbucks, Amex and Amazon also use Business Intelligence Technology. Starbucks uses BI tech in their loyalty card program where they can gather purchase information of their customers. They then use this data to analyse and predict what type of offers each individual customer may be inclined towards hence then offer their customer certain offers that they think the customers will want to benefit from via their gadgets. Amex uses BI to establish new payment benefits and market deals to their clients. It also helps them discover frauds and protect their consumers that might have their data compromised. Amazon uses BI in a similar way as Starbucks to provide product suggestions based on consumer's history however it is also used for logistical business choices which allows their massive supply chain to operate cleanly. BI can be used to see the most optimal shipping routes, allocate inventory and more proving that BI tools establish each phase of Amazon's supply process.(ccstechnologygroup.com, 2018)

Types of Business Intelligence/Analytic Tools used:

Tableau vs Power BI

- *Tableau and Power BI are visualization tools.*

Tableau is described as a popular visualization tools used in BI and simplifies the information we have into a more user-friendly and comprehensible way. Moreover, it is a fast tool for analysing data in the forms of dashboards which can help identify the data presented to anyone at any position in a company. Power BI is also described in a similar format. It transforms raw data gathered from a variety of databases into reports and dashboards. Power BI also allows connections to other software's and services. (Guru99.com, n.d.)

Tableau has been noted more for the "data visualization functionality" aspect in contrast to Power BI. Power BI compared to Tableau is better suited to complete beginners while Tableau is for experts. Hence, for this project, Power BI is more suited due to its easier interface to understand as compared to Tableau. Furthermore, we have to present reports and models but not necessarily store the data hence Power BI again is the suitable choice. (Guru99.com, n.d.)

Microsoft Visual Studio/Data Tools

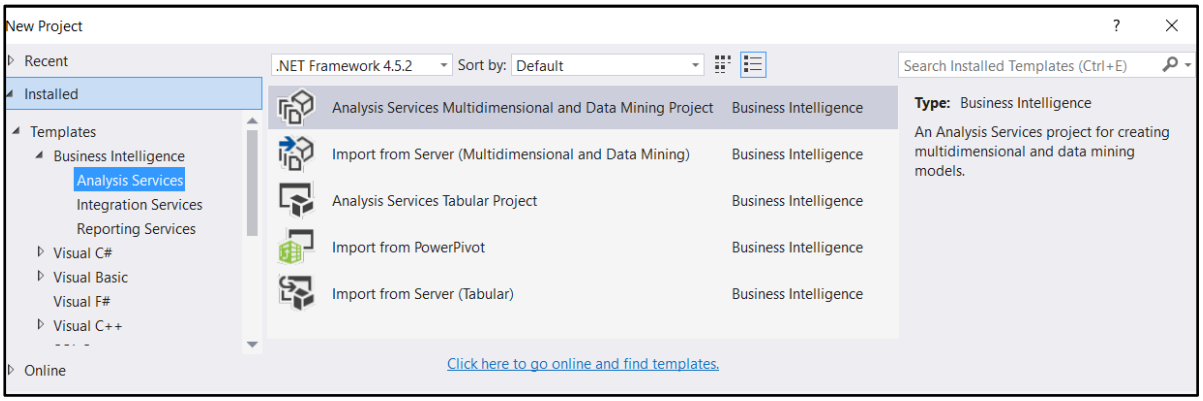


Figure 8 - Data tool

Microsoft Visual studio is defined as a "integrated development environment for Microsoft Windows" (computerhope.com, 2019) It allows us to write programs, create website or web applications/services. MVS comprises a code-editor, debugger, graphical user interface design tool and a database schema designer. For this project we are using a business intelligence tool – ***Analysis Services Multidimensional and Data mining project*** which allows us as the name itself suggests, create Data mining models. (computerhope.com, 2019)

SQL Server Management Studio (SSMS)

This software will allow us to generate and operate our very own database, in this case, Crimson Manufacturing and also give us rights to oversee our SQL Server configuration.

Here are some of the tasks that can be performed using SSMS –

- Making a query for our database,
- Manage or altering the database
- Import or export data from/to another database
- Duplicating said databases.

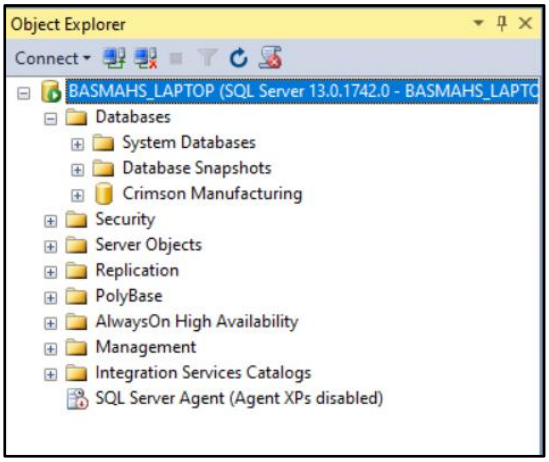


Figure 9 - Object Explorer

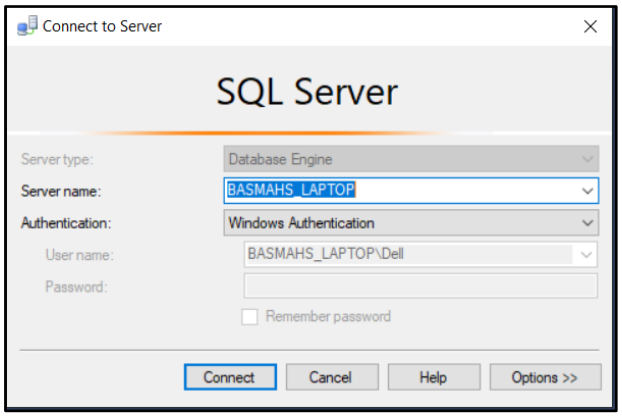


Figure 10 - Connection to Server

SSMS has an object explorer that allows us to move through our databases and more. When SQL first starts up, we are started off with the option to connect to the SQL Server. Normally, there may be many occurrences on the network we are so we can choose whichever one we want to connect to. All these networks show up under the object explorer so moving between the databases which may be on our own laptop or in a whole different country becomes easy. We can transfer data between the databases, run queries etc. (Database.Guide, 2016)

Benefits of Business Intelligence system implementation

The most important is that they will be able to make **accurate and quick decision based on the facts**. They were lacking in their performance so the company can analyse various aspects of their business such as customer, financial and production information which may help make decision which will benefit their company in the long run, this will allow them to see which products should be more focused on in terms of which product was most popular and among what demographic.

It was noted that Crimson Works Cycles had a clustered database ranging from 2017 to 2019 so they can also improve their **operational efficiency** as BI system will allow for data from multiple sources to be kept in one place so the employees can quickly produce statistics and reports which they can use to concentrate on their long and short term goals.

Better data quality is also one benefit they may receive as the software has a visualization tool that will allow for data that might go undetected in a text report to be converted into a chart or graph that can allow for tracking of various patterns and trends.

They can **reduce the extra costs** they may be losing. The BI system developed will help them understand their investments and expenses; they will be able to see what areas require more expenses, which areas can help save costs by cutting back and so forth. They can explore what products are not doing well and either find a way to make the product better or completely take it off their shelves.

They will also become a **strong competition** in the market by being able to see what the current trends and needs are and apply it to their own business. Crimson Works Cycles can track their competitors' performances and find a suitable way to make their own products more attractive.

They can monitor their **customers satisfaction** by asking them for feedback for the products they buy and figure out the purchasing patterns. This will help them establish a loyal customer base and further attract new customers hence increasing their profits and revenues.

4.0 Business Intelligence Solution (BI Solution)

Data Source

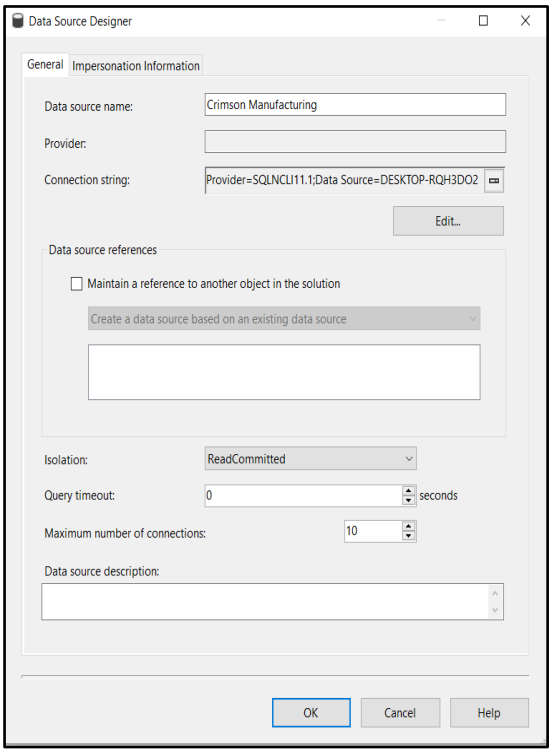


Figure 11 - Data Source in Visual Studio

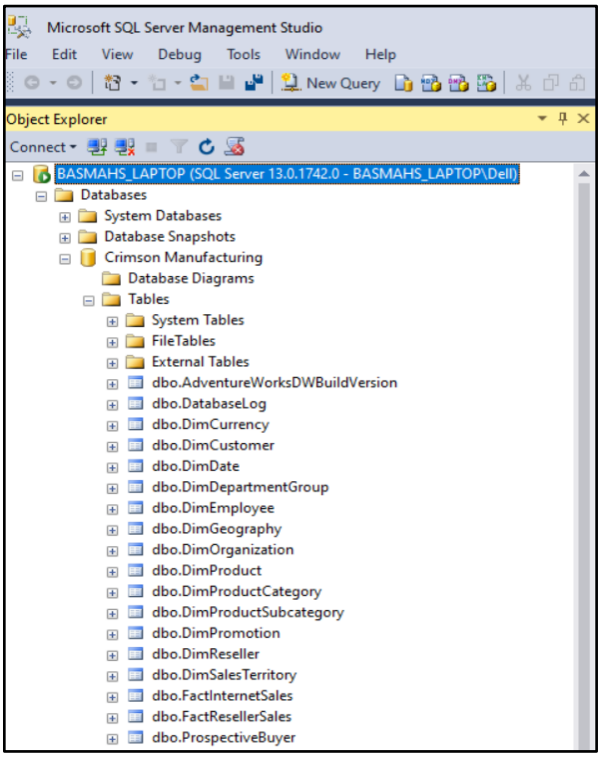


Figure 12 - Data Source in Visual Studio

Crimson Works Cycle's database consists of data ranging from 2017 to 2019. It contains historical data of the company. Historical data contains much of the data produced either manually or automatically inside the organization. Crimson Works Cycles database is very cluttered and consists of manually entered data. (Wigmore, n.d.) Crimson Works Cycles database consists of sixteen tables as shown above and SQL Server 2016 Management Studio was utilized to explore the data.

Data Source View

The view of the data source is a single, coherent view of the metadata from the defined tables and views that data source identifies in the original project. Storing the metadata in the view of the data source helps you to operate with the metadata throughout production without a transparent link to the underlying data source. (Microsoft, 2019)

This is done in Visual Studios; we right click on Data source view and the dialog box below pops up and specific tables that we need for our solution are selected. Out of sixteen tables, only ten were selected which are shown below.

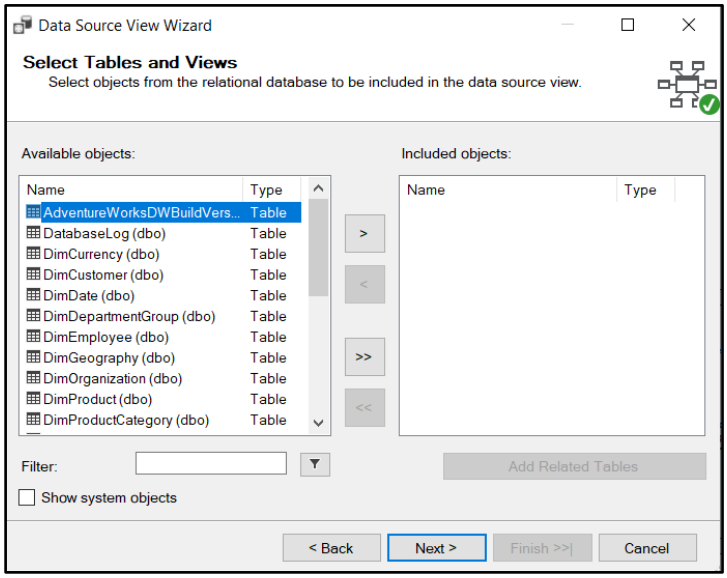


Figure 13 - Data Source View

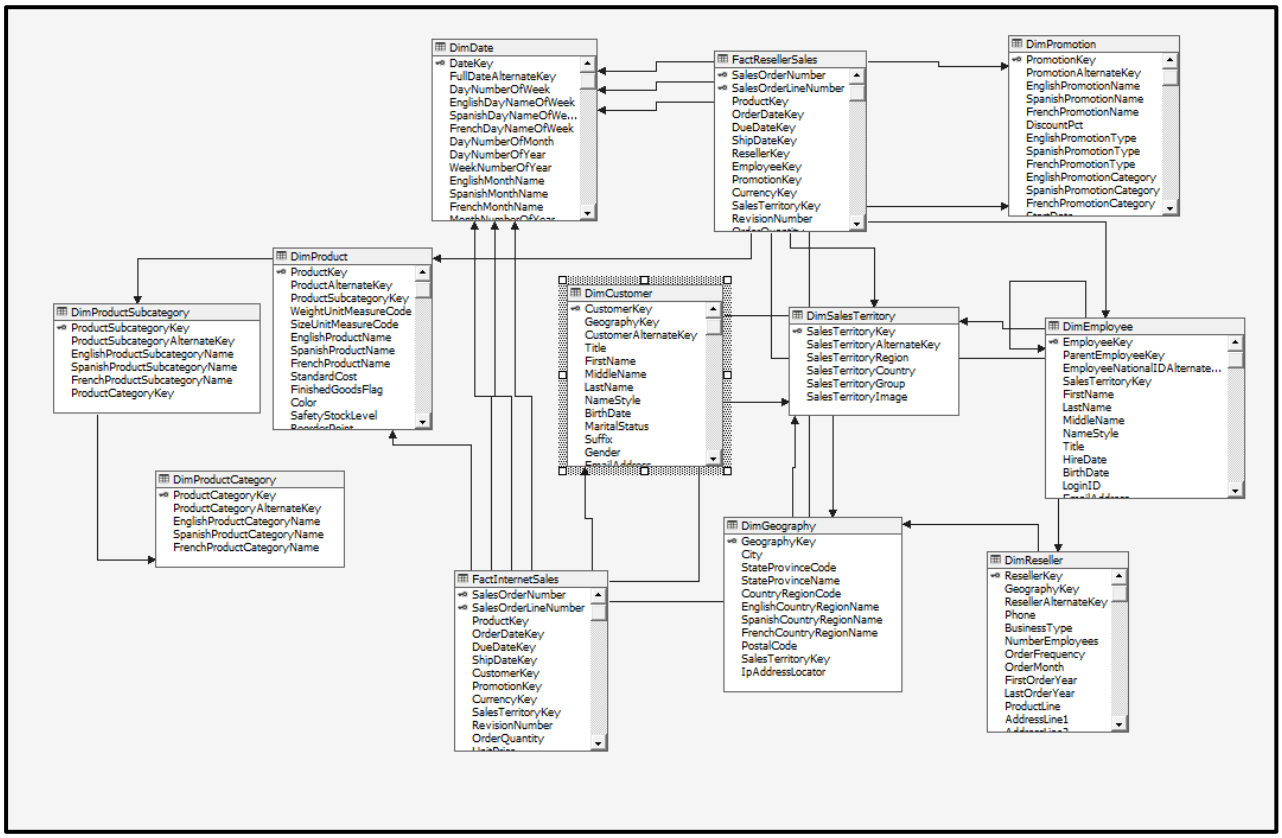


Figure 14 - Selected Tables

Cube Structure

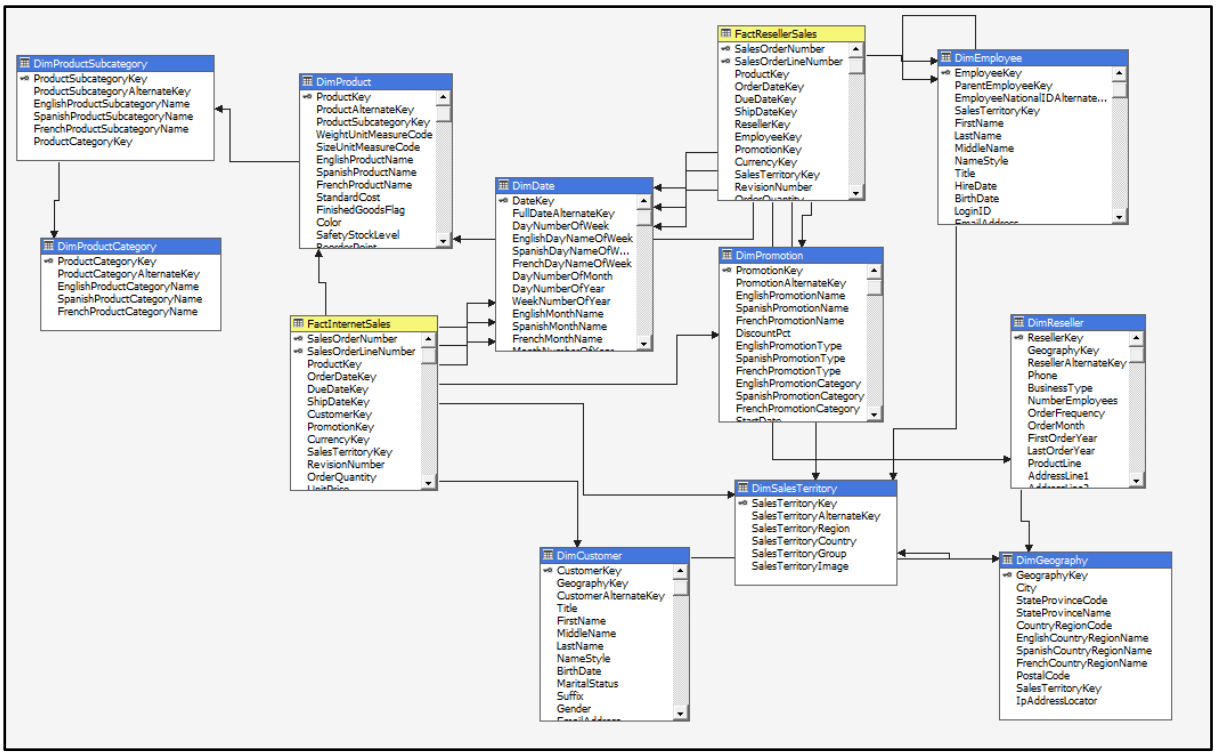


Figure 15 - Cube Structure

A cube is a multidimensional framework that includes information for analytical purposes; the key components of a cube are values and measurements. SQL Server Data Tools are used to build and change sets and proportions, incorporate cube dimensions, and show items contained in the cube from the corresponding data source view. (Microsoft, 2017) This figure shows the cube structure of Crimson Works Cycles.

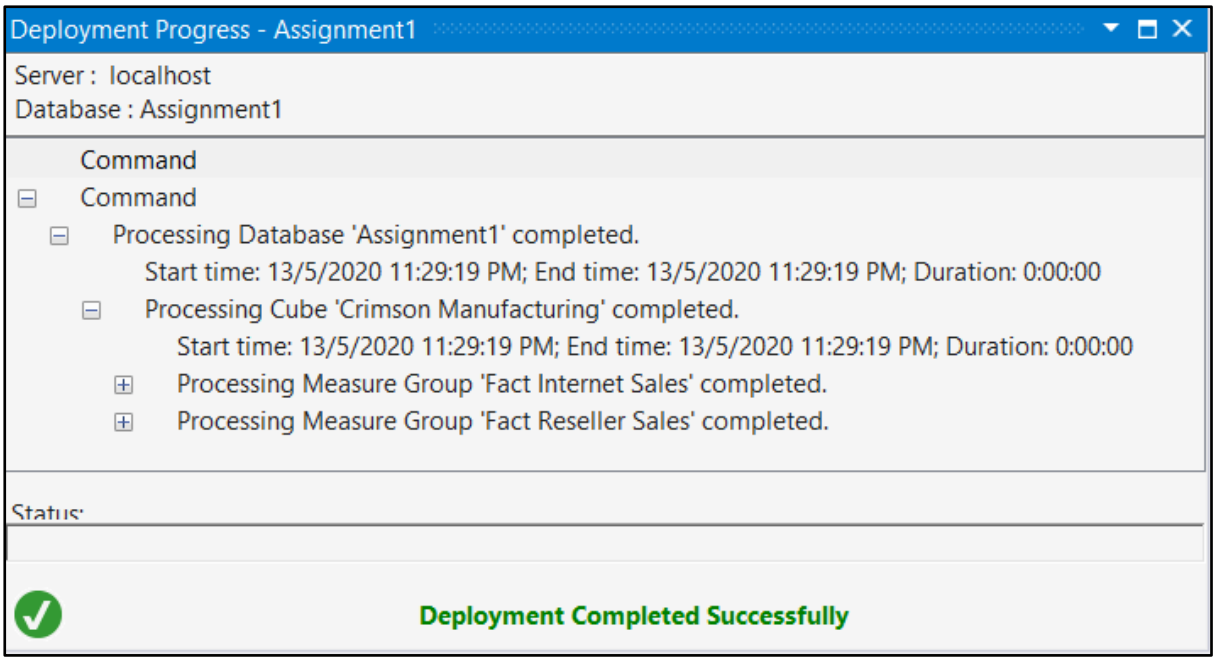


Figure 16 – Successful Deployment

There are two types of tables shown above. Dimension tables and Measure tables. The difference between both is that dimension tables consists of tables that do not have any calculations while measure tables have quantity that can be calculated or measured. Dimension tables here are DimDate, DimSalesTerritory, DimProduct, DimGeography, DimCustomer, DimReseller, DimProductSubcategory, DimEmployee, DimPromotion and DimProductCategory while the Measure tables are FactInternetSales and FactResellerSales.

Usage of Dimensions

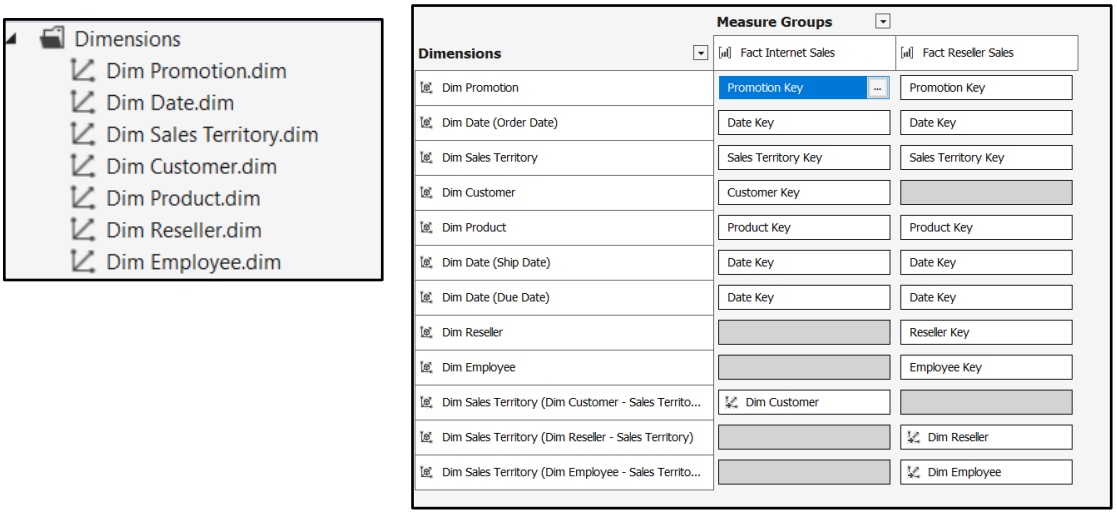


Figure 17 & 18 - Dimensions

"Dimension usage describes the relationships between a cube dimension and the measure groups in a cube." (Microsoft,2018). The database dimension is a list of similar items, called attributes, which may be utilized to give data regarding specific data in one or more cubes. Some attributes such as product subcategory name, product category and product size can be attached to more than one column in more than one table in a data source view. These attributes are perceptible as a hierarchy and can be used to grasp the data in a cube. Attributes could also be structured into a user-defined hierarchy according to the users need. (Microsoft,2017). IBM defined hierarchy as many-to-one relationship between the elements contained in a table or other tables. It has various degrees, each parallel to a dimension attribute. Examples of hierarchy are shown in the tables Date and Customer. (IBM, n.d.)

Customer

In the customer table above, it demonstrates the hierarchy and attributes defined; sixteen attributes are selected to contribute to the final solution, one hierarchy is defined for the customers location. For the hierarchy, English country region name -> state province name -> city were used.

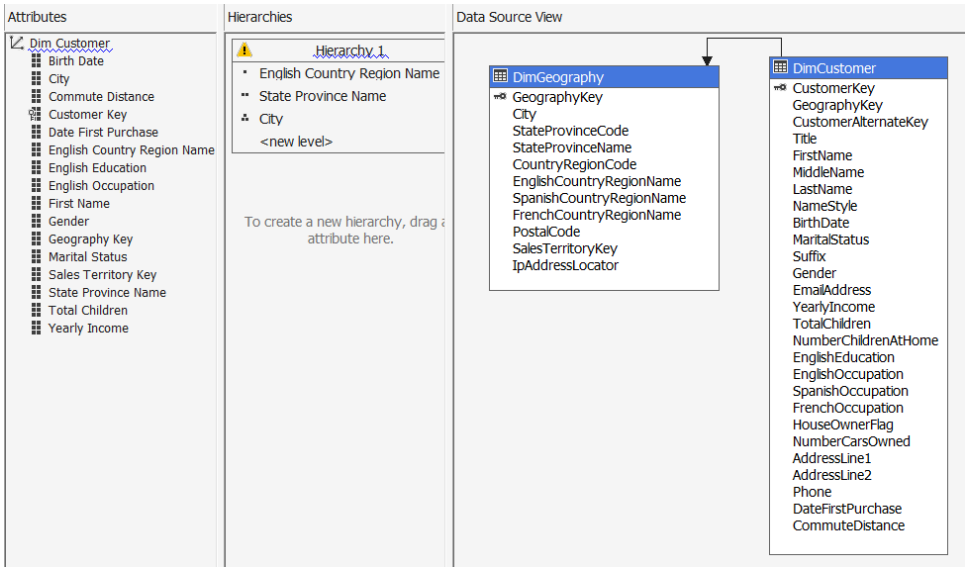


Figure 19 - Customer table

Date

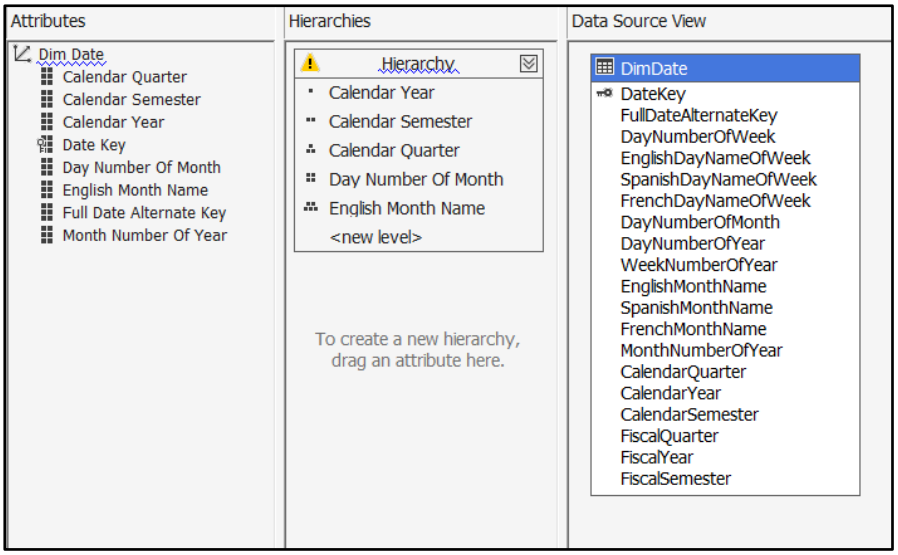


Figure 20- Date table

For the date table above, eight attributes were selected from the data source view with one hierarchy defined which allow information to be defined according to the dates.

Calendar Year->Semester->Quarter->Day Number of Month-> English Month Name.

Employee

For the employee table, 17 attributes were selected with no hierarchy defined.

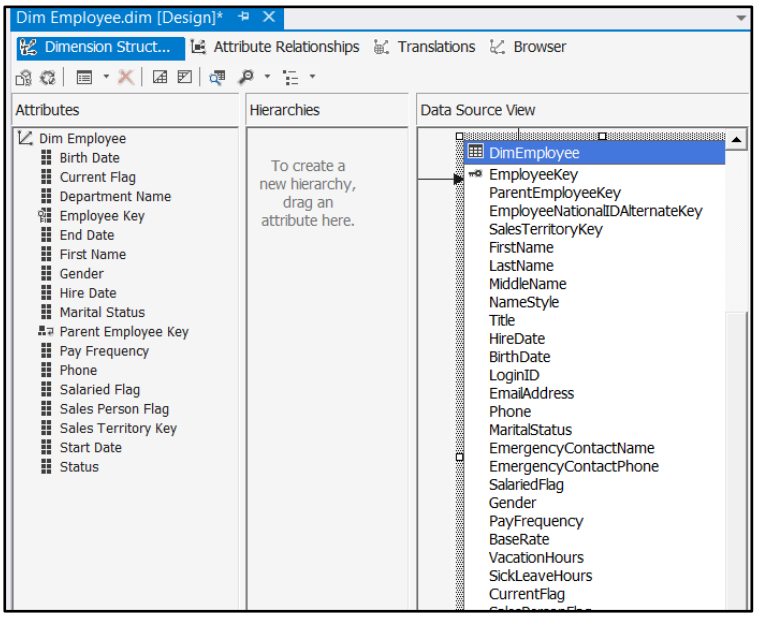


Figure 21 - Employee table

Product

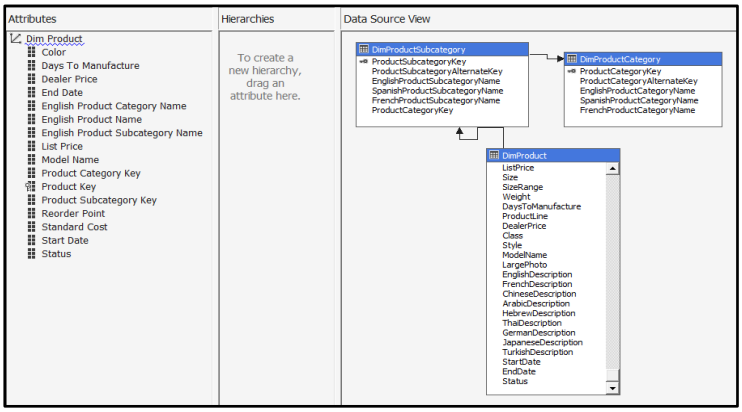


Figure 22 - Product table

The product table is a very important component for our solution as it contains all data regarding Crimson Works Cycles products. sixteen attributes were selected from the data source view with no hierarchies defined.

Promotion

The promotion table shows various types of attributes and eight attributes have been selected to aid in the visualization.

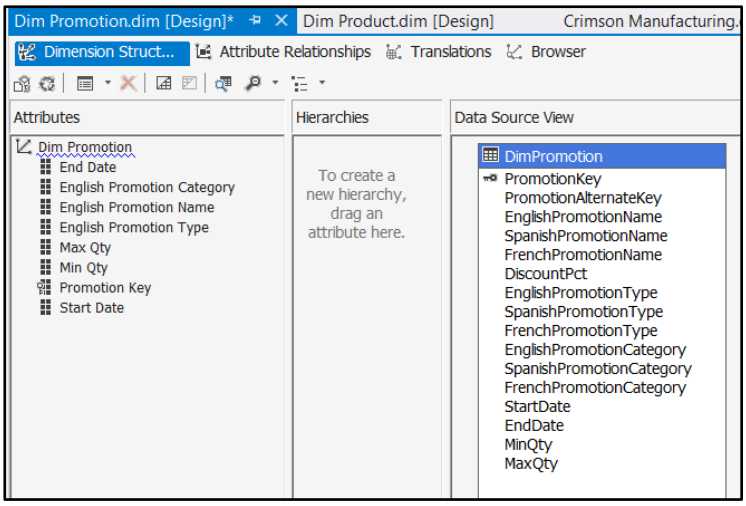


Figure 23 - Promotion table

Reseller

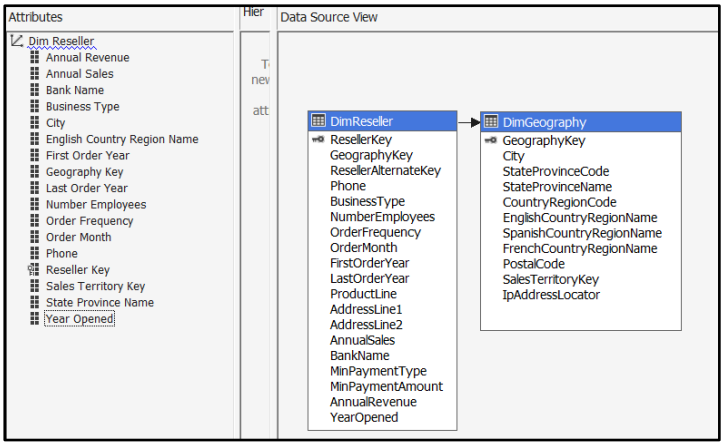


Figure 24 - Reseller table

In the reseller table, seventeen attributes were selected from data source view with no hierarchies defined.

Sales Territory

In the sales territory table, three attributes were defined with no hierarchies set.

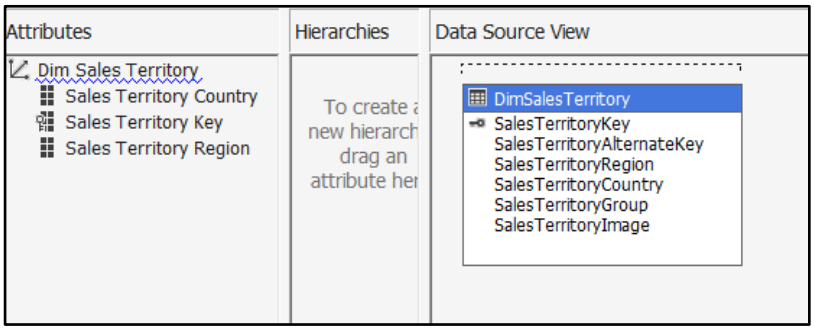


Figure 25 – Sales Territory table

5.0 Business Intelligence Report

Sales Performance

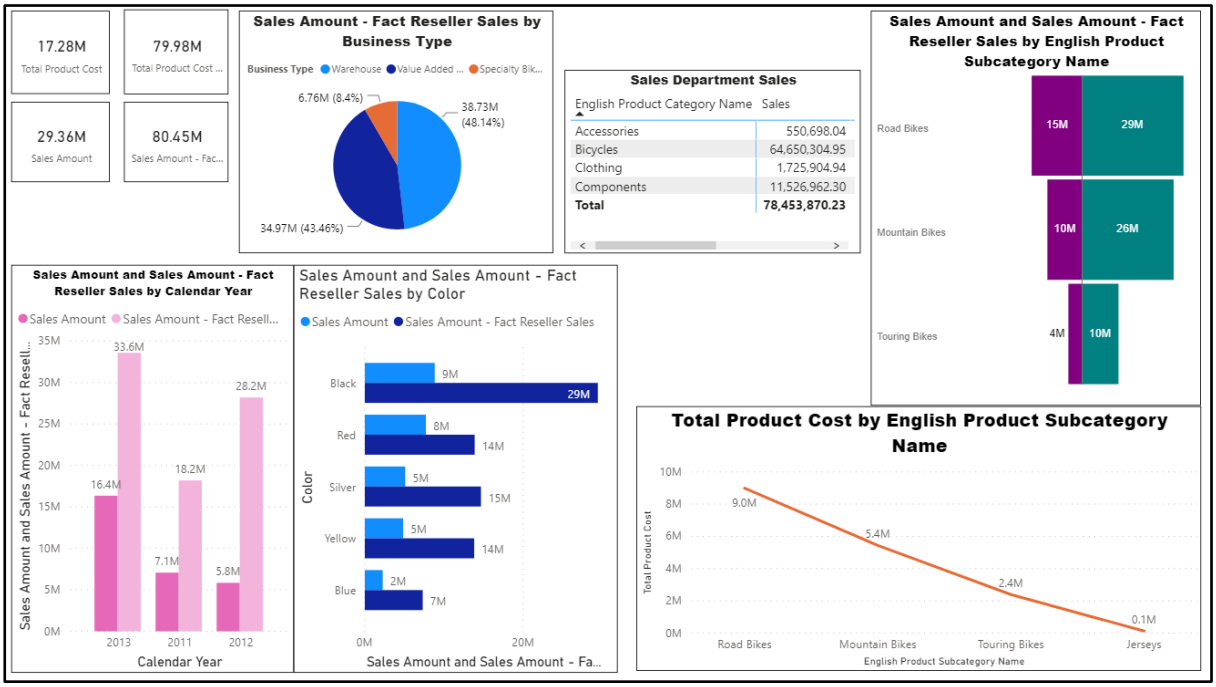


Figure 26 - Sales Performance Dashboard #1

The graph on the right shows top 3 products (Road Bikes, Touring Bikes and Mountain bikes) sales amount for both reseller and internet sales. Internet sales are in purple while Reseller are in green. Road bikes are dominant for both reseller and internet sales. Road bikes contribute to 51.7% of total sales for Internet Sales and 44.6% for Reseller Sales. We can assume that Road Bikes are the most popular among their customers and perhaps customers use it as their main mode of transportation. Road bikes are used for longer distances and are listed as one of the best commuter bikes hence this reflects in the graph. (Luke, 2020)

The graph on the bottom left is comparing the sales amount for reseller and internet sales . It compares the sales amount between 2011, 2012 and 2013. Internet sales had 9m higher sales amount in 2013 compared to 2011 while Reseller had a staggering 16m difference between 2013 and 2011. The difference of sales between the two may be because Resellers may already have an established customer base and with that could possibly have greater experience with Sales and Marketing as compared to Crimson Works Cycles. Reseller may have ads that could be promoting the product better than the latter hence greater sales performance. (Ervin, 2017)

Sales Amount for Internet and Reseller by colour shows products which are black are most popular amongst products sold as compared to other colours.

Sales Department Sales for Product category further confirms that Accessories and Clothing are amongst the least sold. The assumption and more information regarding this is shared in the next dashboard.

A sales summary also further confirms the assumption above , it consists of sales amount and total product cost for FactResellerSales and FactInternetSales. It shows Internet sales have a low sales amount as compared to the reseller sales. However, it can be noted that although Internet sales have low sales amount, they have bigger profit as the difference between their total product cost and sales amount 12.08m while Reseller sales have low profit as the difference for them is only 0.47m.

The graph in the middle showing Reseller Sales Amount by Business type shows that Warehouse resellers are contributing to almost 1/3 of the sales amount with 48.14% followed by value added resellers at 43.46% and lastly speciality bike shops with lowest reseller sales at 8.4%. Warehouse resellers can be assumed to be the highest contributors to sales amount since they can bulk store a lot of product, so they have already bought the products and then sell them faster since they already have them in stock, so this may attract more customers to them and make it easier for them to sell the products.

The last graph shows the top 4 products with the highest total product cost. Road bikes contribute 9m to the total 17m which is more than half of the total product cost. It proves to be a good investment on the company's part as Road Bikes have the highest sales amount compared to other products.

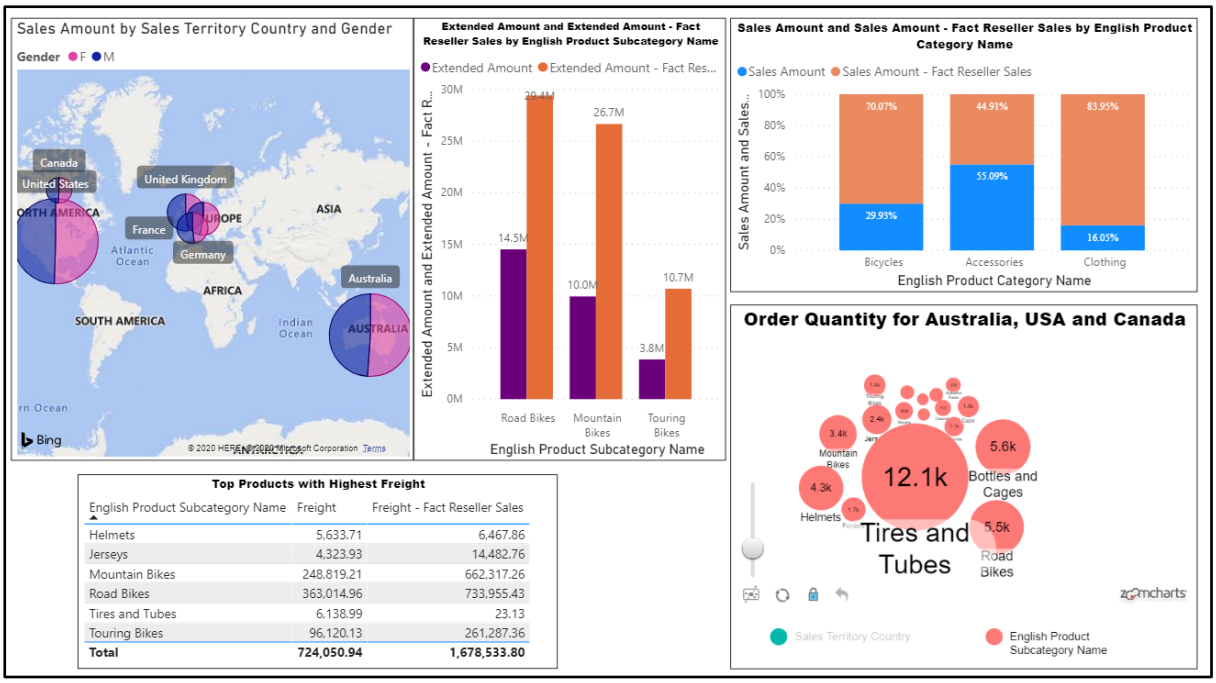


Figure 27 - Sales Performance Dashboard #2

A map shows sales amount according to gender in different countries. Canada seems to have the lowest sales as compared to other countries. Cycling is still a relatively new sport and there are initiatives to increase transportation through cycling in Canada in the recent years so Crimson Works Cycles can join in with these initiatives and promote their products to increase their Sales Revenue in Canada. (Verlinden et al., 2019) United States is shown to be the country providing them with majority of their sales revenue, this is also because their headquarters is located in the US so it is apparent that most sales will occur there. According to Statista.com, in 2016, 12.4% Americans were cycling on the regular basis with numbers increasing from 43m to 47.5 m in 2017. (Gough, 2018) It will be a good move for Crimson Works Cycles to keep catering to their United States audience meanwhile also focus on making more sales in Canada.

A table showing top products with highest freight is shown at the bottom left and Jerseys have high freight compared to other top products but are one of the lowest in demand products, The higher the freight, the higher the costs for the corporation. Freight can be defined as the goods transported by either water, land, or air by pay.

The graph in the middle shows Extended Amount for the road, touring and mountain bikes for Reseller and Internet Sales. Extended amount has been defined as estimating the money paid for more than a single component of a product bought at the same cost. (Sprouse, 2017) Extended amount can be used to prevent loss.

Crimson Works Cycles should re-evaluate which products they should focus on to prevent loss. They can throughout the year keep an eye on the extended cost and can adjust accordingly when required. (wiseGEEK, n.d.)

The graph displaying product categories sales amount for both internet and reseller sales. The sales amount for internet sales for the three categories Bicycles, Accessories and Clothing are comparatively lower than the reseller sales with the exception of Accessories which are 55.09% as compared to Resellers 44.91%.

The graph on the bottom right displays the products with highest order quantity for US, Australia, and Canada. Tires and Tubes seem to the most popular amongst all three countries with 12.1 k orders followed by Road and Cages,5.6k and Road Bikes,5.5k. This also shows that accessories and clothing are not high in demand as they have the lowest order quantities.

Customer Performance

Understanding a customer need is essential for Crimson Works Cycles as it will help them become more popular in the market and stay ahead of the trends, furthermore it will build a good consumer relationship and earn new business by good word-of-mouth referral.. (Jones, 2020)

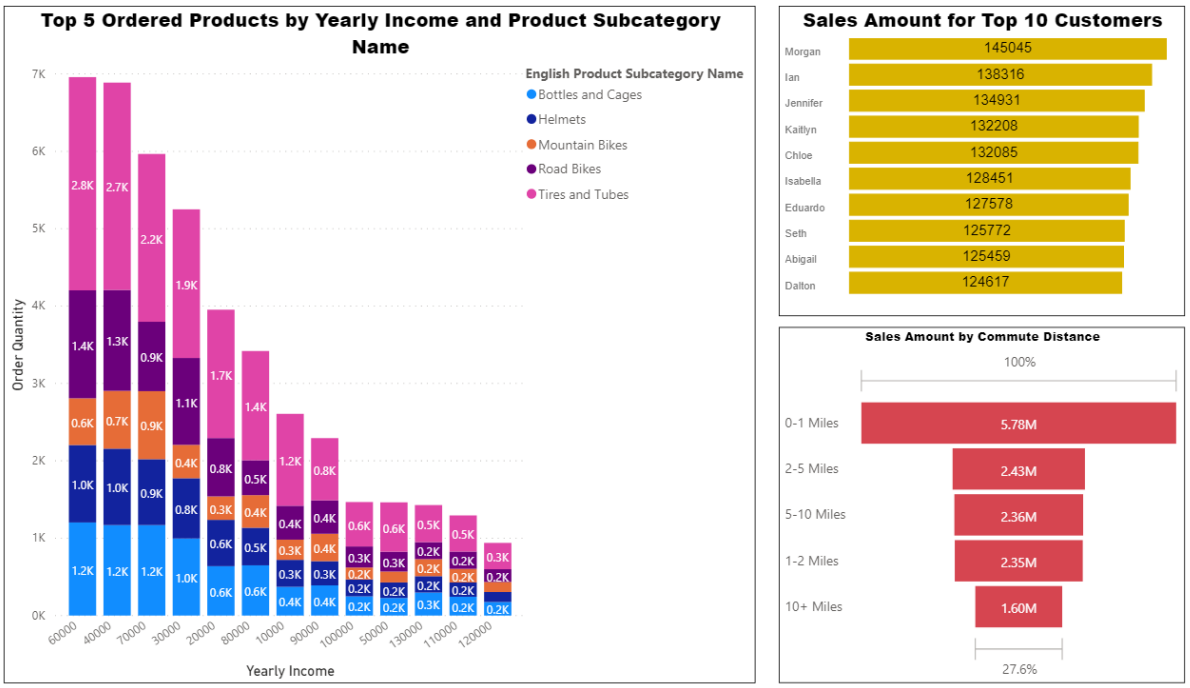


Figure 28 - Customer Performance Dashboard #1

The first graph shows the top 5 products bought according to a customer's income. Customers with a yearly income of 60,000 have contributed to most of the product sales while Customers with 120,000 income have contributed the lowest. Tires and Tubes were the most popular product amongst all the customers. It is also noted that the lower incomes purchased more than the ones with a higher income. Higher income consumers usually shop around to find the best product for themselves as compared to low income who try to find a go-to-vender and stay with them and become loyal customers. (Gudat, 2019) The company should find a method to attract customers with higher income through events, advertisements, commercials etc.

Sales amount by top 10 customers lists customer by their name. These customers have contributed to majority of the sales made by Crimson Works Cycles. We can assume these may also be resellers other than their own resellers since resellers are known to bulk buy products and market them to their own customers. (Kokemuller, n.d.) These may also be corporate customers since corporate customers buys on behalf of their companies.

Lastly, as Crimson Works Cycles is a predominantly bicycle catered company, they can also view Sales Amount by commute distances. Customers commuting 0-1 miles are dominant purchasers while the customers who commute 1-10 miles are the secondary purchasers and customers commuting 10+ miles being the last. This may account to people finding more ways to become healthy. Cycling has been noted to be great for mental and physical health, it is more convenient and efficient than cars and lastly provides more economic benefits such as being cheaper to buy and maintain as well as save the money that may have been used on transportation costs. (Qld.gov.au,2020).

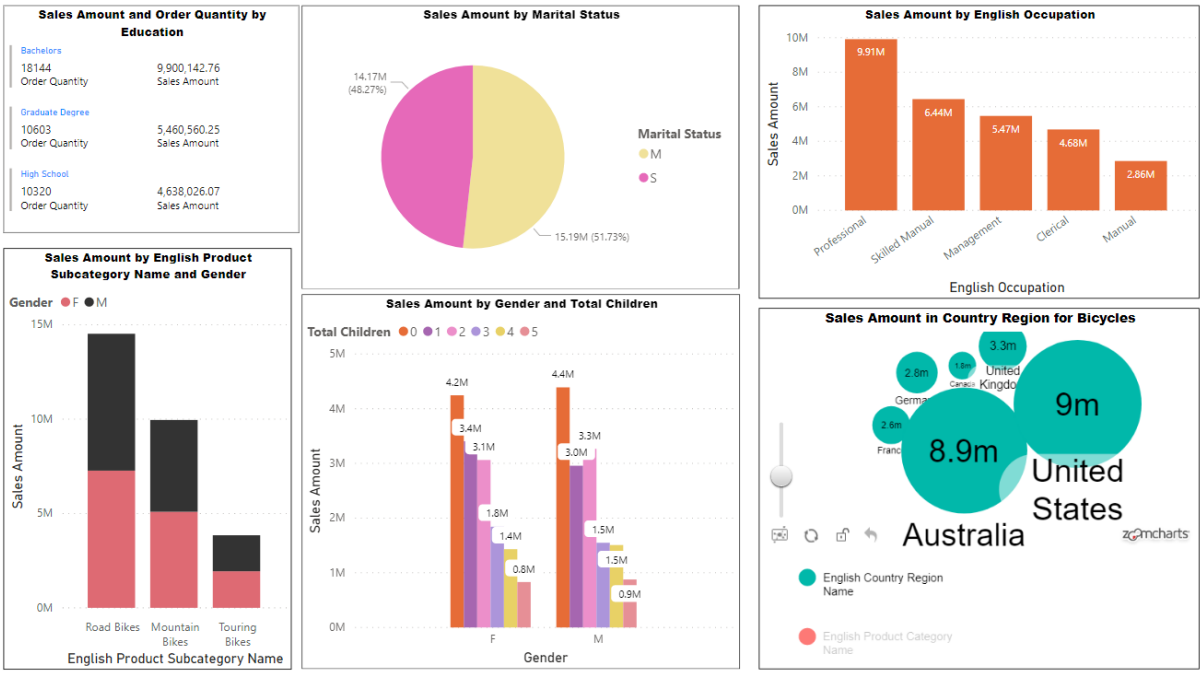


Figure 29 - Customer Performance Dashboard #2

The first dashboard shows sales amount according to educational level with people with high school degree being the lowest consumers and this is probably due to the fact that they may still be underage and unable to purchase some items themselves. Bachelors students have a higher order quantity and sales amount(9.9m) than master's students (5.4m). The second graph consists of data about marital status of customers and how it relates to sales amount. Although the difference between both types of customers is not large, married people contribute just a little more than single people. Married Customers contribute to 51.73% of the sales amount as compared to the Single Customers. This possibly may be due the fact that if a customer is married they may have picked up on cycling as a hobby to do together, they may also be able to purchase more products together as they may have greater net worth than single people.(Livingston, n.d.)

A graph showing Sales Amount according to Occupations. A professional contributes to 9.1m of their total sales while Manual only contribute 2.86m. Manual people may have lower income as they can be considered to be low-wage workers (Bateman and Bateman, 2019) than the Professional so that could be a reason for them being the lowest consumers. Crimson Works Cycles can cater to these types of workers by bringing about more affordable products that can be bought within their budget. A chart displaying Sales Amount of the Bikes according to Gender. Road bikes are the most popular bike and the former and touring bikes are equally bought by both genders. The mountain bike has higher number of females buying it than males

with 5.1m vs 4.9m respectively. Sales amount was also seen according to gender and total children. Obviously, people with no children are able to spend more than people with children and as the number of children increase , the sales amount decreases. Childcare does inherently affect how a person spends their money so instead of buying products they may simply save their money. (Livingston, n.d.) Crimson Works Cycles can market their product for their customers with children or provide them special benefits which may help them increase their sales.

The last graph displays Sales Amount by Country Region for bicycles. United States occupies 9m of the total sales with Australia being a close second at 8.9m and United Kingdom following them at number 3. This chart shows Canada has the lowest sales amount for bicycles with the sales being at 1.8m. As discussed in the previous dashboard, Crimson Works Cycles can focus on making Canada their new target market to boost their sales.

6.0 Conclusion

To implement a business intelligence system in Crimson Works Cycle, we would need to distinguish their business needs such as improving organizations overall performance; with the use of an appropriate visualization software such as Power BI, data analysis can be carried out to determine their most popular products, sales each year compared to resellers, customers sales depending on various aspects such as marital status and children, etcetera and suggest possible reasons for each information analysed. The conclusions and analysis can be used to identify patterns they may have missed before and use it to improve their sales and customer performance by setting certain targets and goals to reach within a specific time frame to improve their performance, such as they can improve their customer performance by reviewing which products are doing well and which are not and cutting costs on said products to prevent loss as well as viewing which country is producing more sales and finding ways to increase sales in countries which have low sales. Furthermore, they can provide their 29 sales representatives with suitable information regarding the most popular products. They can also provide great customer service to ensure they keep their faithful customers. With the implementation of business intelligence, they can now make better and more informed business decisions and improve business performance. Any problems they might have faced in regard to sales and customer, they can now review and mend those problems.

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