

NATIONAL COLLEGE OF IRELAND
BUSINESS INTELLIGENCE & BUSINESS
ANALYTICS

CONTINUOUS ASSESSMENT - II

IMPLEMENTATION REPORT

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H.V.V.A. 3D Printing Solutions

Contents

1	Balanced Scorecard & Strategies	3
2	Solution Development Process	5
2.1	Generating Data	5
2.1.1	Mockaroo.com	5
2.1.2	Microsoft Excel and Python	6
2.2	Connections between Services	7
2.2.1	Data Migration to Cloud	7
2.2.2	Data loading from cloud to Power BI	7
3	Implementation of the Solution	9
3.1	Dynamics 365 Sales Hub Integration	10
3.2	Dashboards on Power BI	14
3.2.1	Sales Dashboard	14
3.2.2	Trends Dashboard	15
3.2.3	Customer Dashboard	17
4	Benefits of the Solution	19
5	Conclusions	20
6	Further Work	20
7	Appendix: Teamwork	22

List of Figures

1	Balanced Scorecard for the company.	4
2	Strategies for the company.	5
3	Data generation in <i>Mockaroo</i>	6
4	AWS Security Panel in Connectivity and Security tab .	8
5	Legacy Data transfer to pgAdmin	9
6	A full pictorial representation of the solution that was implemented.	10
7	Step-1 (Sales Hub)	11
8	Step-2 (Sales Hub)	11
9	Step-3 (Sales Hub)	12
10	Step-4 (Sales Hub)	12
11	Step-5 (Sales Hub)	13
12	Step-6 (Sales Hub)	13
13	Step-7 (Sales Hub)	14
14	All dashboards implemented in this project are interactive.	15
15	Sales Dashboard	16
16	Trends Dashboard	17
17	Customer Dashboard	18

1 Balanced Scorecard & Strategies

Balanced Scorecard is a business-performance scorecard which is used to create strategic priorities, initiatives and Key Performance Indicators (KPIs) [1, 2]. It is a unique, and arguably a more coherent way to create strategic priorities that align with what the company is doing in its business [3, 4]. A Balanced Scorecard can not only help track the financial progress of the company, but also assist in doing much more than just generating money in the business [5]. For example, if a company is customer-oriented, a well-constructed Balanced Scorecard can help the company to grow, build its customer base, improve its manufacturing in order to serve more customers and make more profit.

A Balanced Scorecard is divided into four features: Financial, Customer, Internal Business Process, and Learn & Growth. All these features work in an ecosystem. Each of these features can have their own requirements:

- **Objective:** Making strategies to achieve the Targets of the company.
- **Measures:** Making use of KPIs to track the progress using different parametric.
- **Targets:** Short-term, Medium-term, & Long-term goals of the company.
- **Initiatives:** Dividing the strategies into achievable tasks.

For H.V.V.A 3D Printing Solutions, a Balanced Scorecard was curated along with the Strategies that would help the company excel in its niche, but emerging, market segment.



Figure 1: Balanced Scorecard for the company.

Strategy				
	Objectives	Measures	Targets	Initiatives
Financial	Increase Revenue	Increase in Euros' Profit	30% Revenue	28K
Customer	Increase in new Customers	Larger Percentage	Increased by 25%	100
Internal	Fast decisions	Easy workflow	7 days	10 days
Learning & Growth	Improve training program	Enhanced skills	200 employees	100

Figure 2: Strategies for the company.

2 Solution Development Process

2.1 Generating Data

The initial process in data preparation is to create fitting data with relevant entry fields. A random data generator (*Mockaroo*) and *Microsoft's Excel* spreadsheets were used in tandem with *Python's Pandas* library to create, clean and prepare the data.

2.1.1 Mockaroo.com

Relevant datasets were created on *Mockaroo.com* after doing comprehensive background checks and information gathering about a few 3D printer providers and manufacturers. For Example: A list of customers was created on *Mockaroo* with entry fields such as fake Company Name, Email ID, Contact No., Full Name, and Various unique IDs for each data collection step in the process flow. This data was piped into *Dynamic 365 Sales Hub* as *Leads*(prospective customers).

After fully implementing the solution for this current (2019-2020) data, the patterns and data supplemented in each step in the *Sales*

Schema	Last Modified
Accounts 18-19 Lead_ID Opp_ID Account_ID Organisation Phone City Full Name Email ID	about 8 hours ago
Accounts ID Account Name Main Phone Address 1: City Primary Contact Email (Primary Contact) Contact Status Account ID	3 days ago
Invoice 18-19 Lead_ID Opp_ID Account_ID Order_ID Quote_ID Product Name Product_ID Organisation Email ID Revenue	about 7 hours ago
Leads 17-18 Leads_ID Full Name First Name Last Name Product Name Owner Status Created On	about 23 hours ago
Leads 18-19 Leads_ID Full Name First Name Last Name Product Name Owner Created On	about 8 hours ago
Opportunities 17-18 Opp_ID Lead_ID Product Name Organisation Email ID Created On Close Date Revenue	about 23 hours ago
Opportunities 18-19 Opp_ID Lead_ID Product Name Organisation Email ID Created On Close Date Revenue	about 8 hours ago
Opportunities ID Lead_ID Product_ID Product Name Organisation Email Address	3 days ago
Order 17-18 Lead_ID Opp_ID Account_ID Order_ID Email ID Revenue Organi	about 10 hours ago
Order 18-19 Lead_ID Opp_ID Account_ID Order_ID Email ID Organisation Revenue	about 8 hours ago
Quote 17-18 Lead_ID Opp_ID Account_ID Order_ID Quote_ID Product Name Product_ID Revenue Organisation Email ID Created On	about 9 hours ago
Quote 18-19 Lead_ID Opp_ID Account_ID Order_ID Quote_ID Product Name Product_ID Revenue Organisation Email ID Created On	about 8 hours ago

Figure 3: Data was created in *Mockaroo* for the years 2017-2018 and 2018-2019.

Hub data chain were observed, and then similar datasets with similar attributes and fields were created to show background history (legacy data) of the company. As shown in figure 3, data for each step in the chain was created in *Mockaroo* for the years 2017-2018 and 2018-2019.

2.1.2 Microsoft Excel and Python

Microsoft Excel spreadsheets & *Python*'s *Pandas* library were used clean and manipulate the data. For example: the 'IF' function in Excel was used to give Product ID to each product in the Leads table. Also, the 'date' function was used to create Closing Date columns for the legacy data as it was present in another format. The Actual Revenue, Estimated Revenue in the legacy data was added in Python using several conditions that were observed in the current data from *Sales Hub*.

In Excel, unique IDs of each column were linked to each other and a relationship was created between the datasets. For example: Leads 17-18 & Opportunities 17-18 were linked with 'Lead ID' column, Order 17-18 & Invoice 17-18 were linked with 'Order ID' column. In few of the datasets extra rows were also removed.

In the end, a total of fifteen datasets are created on *Mockaroo* which are manipulated and cleaned with *Microsoft Excel & Python's Pandas* library.

2.2 Connections between Services

As any small-scale industry begins to expand its business, it becomes more expensive and harder for it to deal with on-premise database system, which ultimately leads to more traffic and loss in agility. The proposed solution was to migrate the company database to the cloud. This has benefits like Data Storage Flexibility, Improved Disaster Recovery and Security, Increased Operation Efficiency, Lower Power and Labour Costs. Along with migrating the current Customer Relationship Data, it is advantageous to consider the legacy data in order to analyse trends for planning and measuring performance.

A large number of organisations provide cloud storage, more prominently tech giants like Amazon, Google and Microsoft. Being widely used and free for one year, Amazon AWS RDS PostgreSQL is for the scope of this project, but alternatively, any other service can also be used. Data is migrated to cloud in two parts as shown in section 2.2.1, and then loaded for visualisations to Power BI as shown in section 2.2.2.

2.2.1 Data Migration to Cloud

1. Legacy data was migrated using Open Source administration and development platform PGAdmin. A connection was established as shown in first four steps of section 2.2.2.
2. Dynamics 365 and PostgreSQL were integrated to migrate current and future data.

2.2.2 Data loading from cloud to Power BI

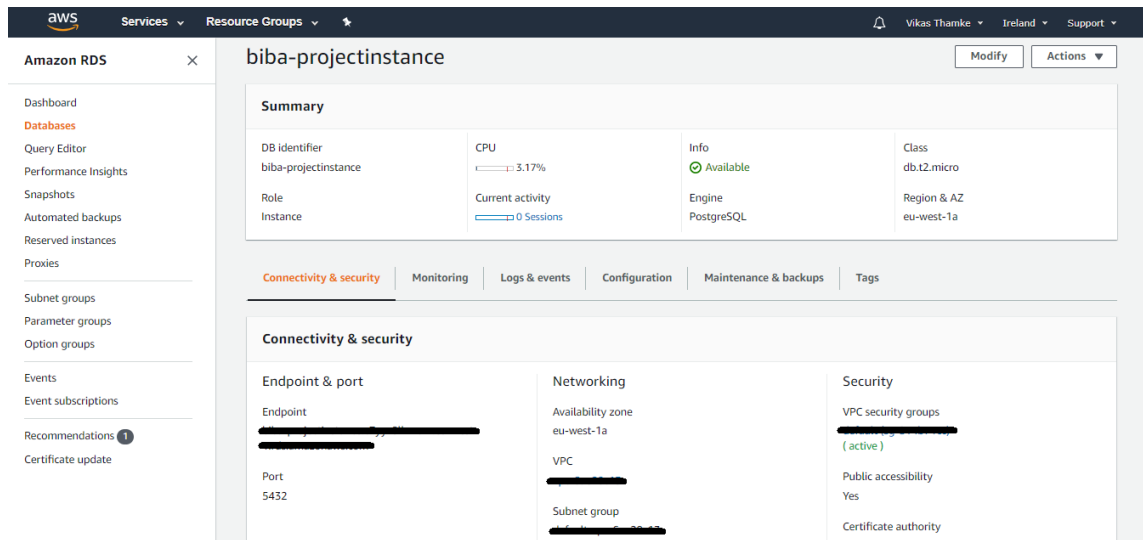


Figure 4: Link for the inbound and outbound page as available under Security Panel in Connectivity and Security tab

1. Log-in ID was created on [Amazon AWS](#), and RDS PostgreSQL was created as shown on [Amazon Tutorials](#).
2. To allow pgAdmin and Power BI connection request, Inbound and Outbound rules were edited to allow access from specific IP addresses (figure 4).
3. pgAdmin was installed from [pgAdmin](#).
4. With the help of EndPoint, Port, and credentials, connection was established. Tables were created and legacy data inserted to the tables (figure 5).
5. The connection between Power BI and PostgreSQL required downloading AWS public key, converting it to PKCS#7/P7B certificate, and importing the converted certificate to trusted root certificates.
6. AWS public key was available at [S3 Amazon AWS](#), which was converted to certificate using the link [SSLShopper](#).

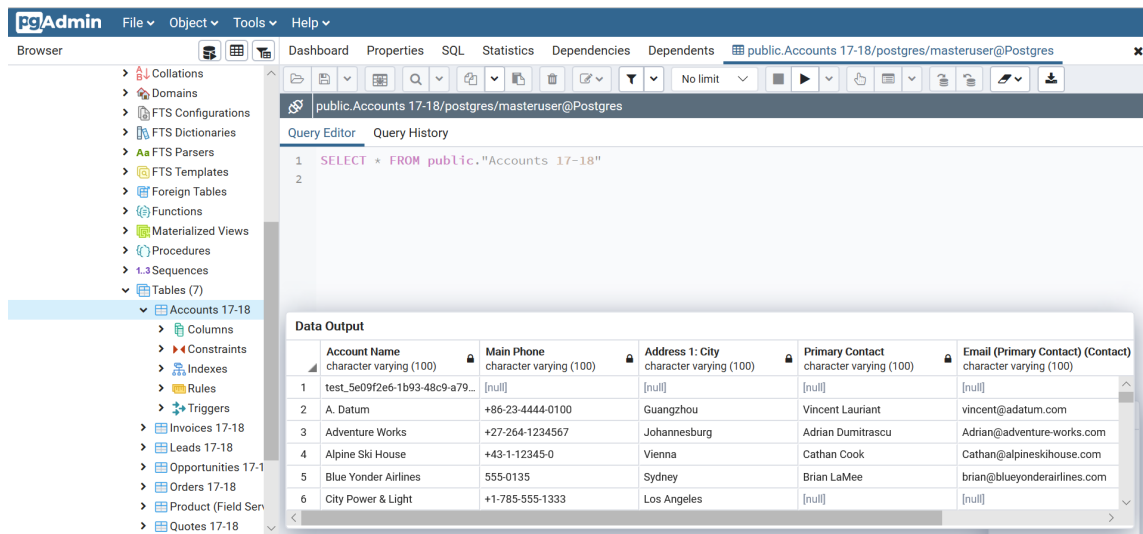


Figure 5: Tables were created and legacy data inserted to the tables in pgAdmin

7. Certificate was imported to the trusted root as shown on [SSL Support Desk](#).
8. *Get Data* option was selected, *PostgreSQL database* was selected, Server was entered. Database, credentials, and the connection were successfully established.

3 Implementation of the Solution

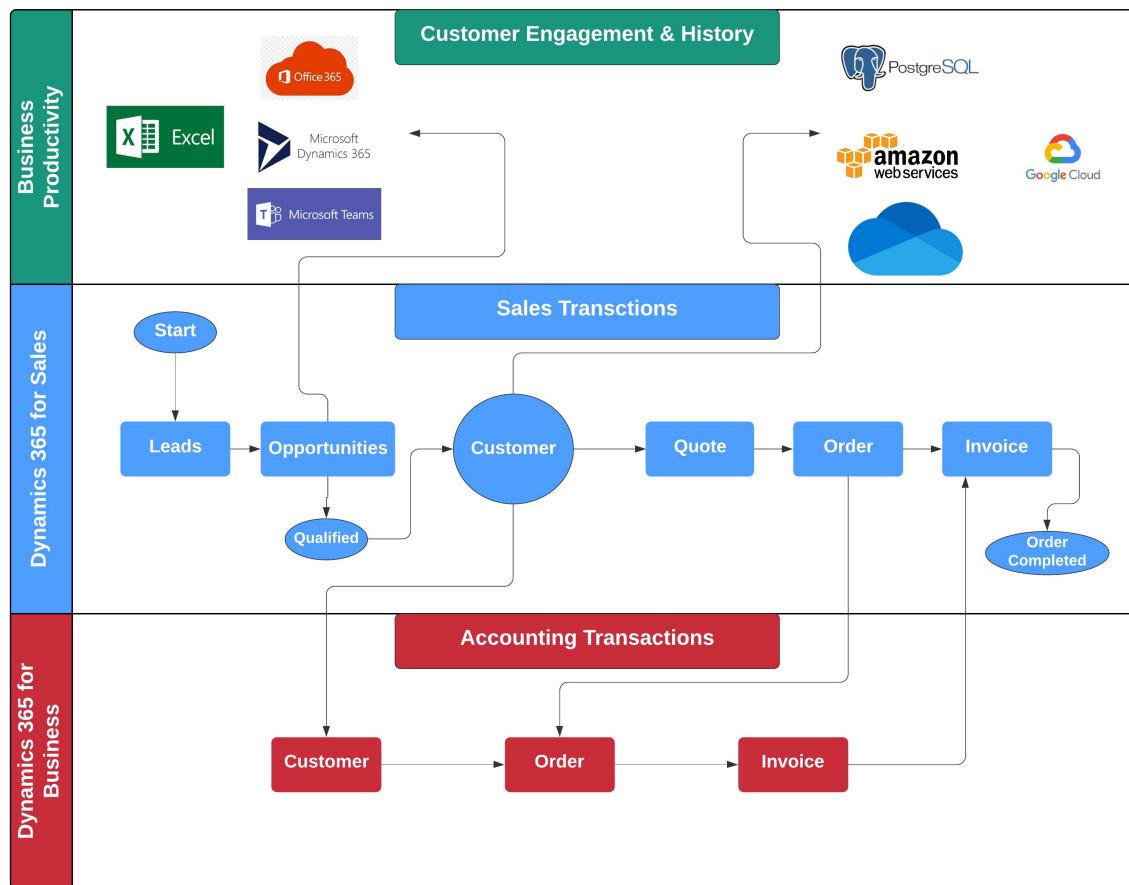


Figure 6: A full pictorial representation of the solution that was implemented.

3.1 Dynamics 365 Sales Hub Integration

Dynamics 365 is Microsoft's solution for a Customer Relationship Management (CRM) System. In this project, the Sales Hub feature of Dynamics 365 was utilised to transform the chain of data collection and transfer within the company to an efficient system without redundancies. Each step of data collection is shown through screenshots:

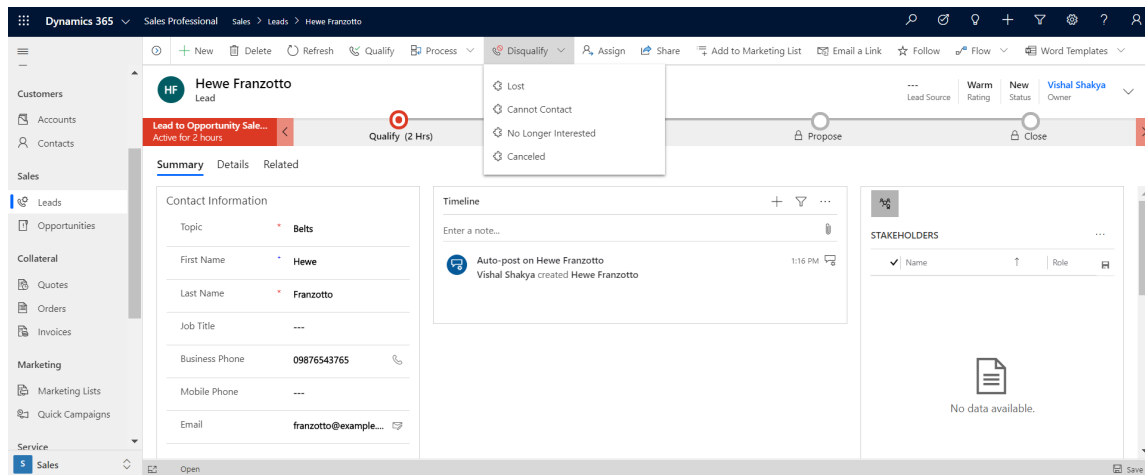


Figure 7: Step-1: A lead is created by filling in the prospective customer's details, then it is marked *qualified* by an agent to move further in the chain. It can also be marked *disqualified* on the basis of four parameters as shown in the given image.

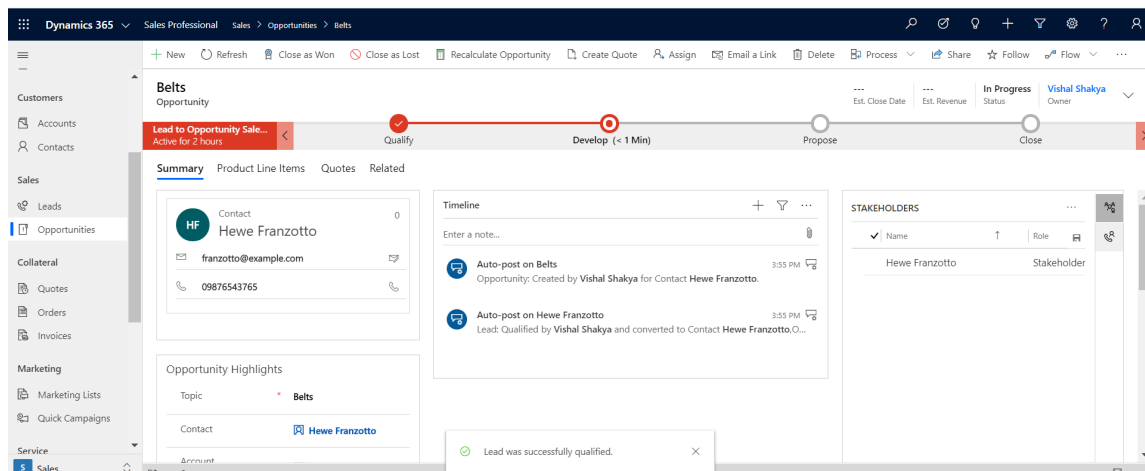


Figure 8: Step-2: Next step is to convert the lead into an opportunity. At the bottom of the image: *Lead has successfully qualified*, which means that an opportunity has been generated and that the customer is engaged.

Dynamics 365 Sales Professional Sales > Opportunities > Mark-5

Mark-5 Opportunity In Progress Status Owner: Vishal Shakyas

Lead to Opportunity Sale... Active for 3 hours

Summary **Product Line Items** Quotes Related

Price List **Mark-5**

Revenue **System Calculated**

Product Name	Price Per Unit	Quantity	Manual Discount Amount	Extended Amount
mark-5	€165.00	1.00000	---	€175.00

Total Amount (Base) \$190,217

Total Discount Amount (Base) \$0.000

Figure 9: Step-3: The price list for the preferred product is added in *Product Line Items* on the opportunity step. The system generated revenue is selected to get the estimated revenue and the currency is checked. Filling up all the required details will give the estimated revenue of the product. A quote can be generated now.

Dynamics 365 Sales Professional Sales > Quotes > Mark-5

Mark-5 Quote Draft Status

Summary Details Related

Quote ID QUO-01016-JSC1H0

Revision ID 0

Owner Vishal Shakyas

Name Mark-5

Currency euro

Price List Mark-5

SHIPPING INFORMATION

Products

Product	Price	Quantity	Extended
mark-5	€165.00	1.00000	€175.00

Detail Amount €165.00

(-) Discount (%) ---

(-) Discount ---

Pre-Freight Amount €165.00

SALES INFORMATION

Opportunity Mark-5

Potential Customer Gerhardine Nutty

DESCRIPTION

You've drafted a new quote. To finish, click Activate in the top menu

Figure 10: Step-4: Details of the customer are rechecked before *activating* the quote. An option to create a PDF of the quote to share it with the customer is also present. Next step is to create an invoice.

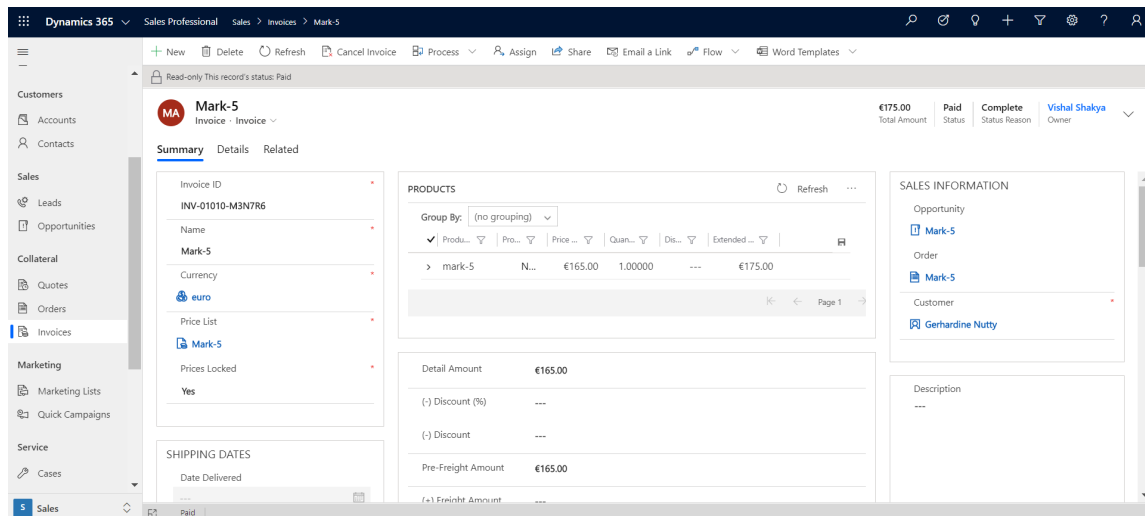


Figure 11: Step-5: After creation, the invoice is *activated*. The *Invoice Paid* option is checked to verify the amount paid by the customer and then it is marked *Paid*. Invoice is the last step in this flow.

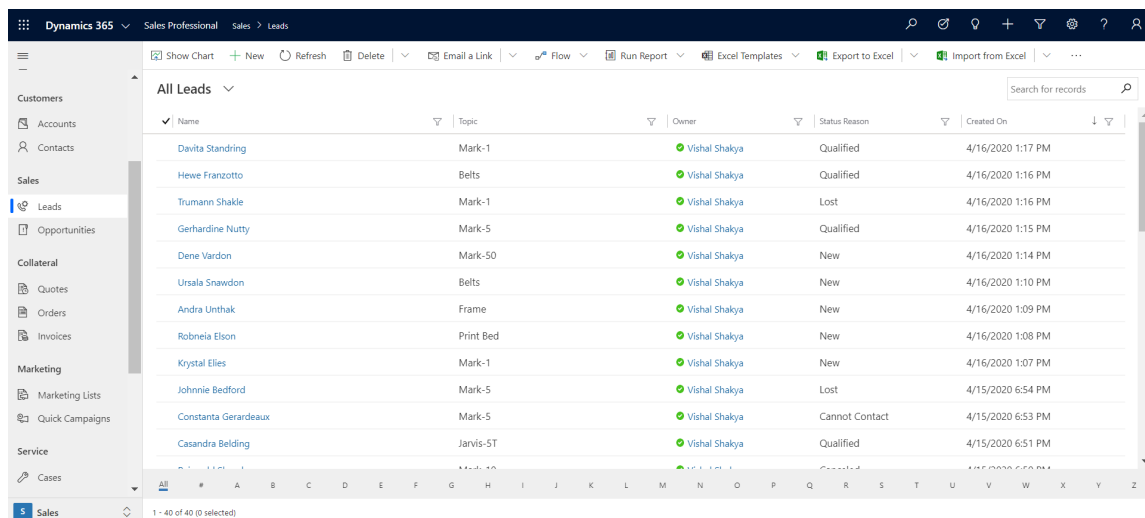


Figure 12: Step-6: All details can be exported into an Excel sheet. This screenshot shows the leads which can be exported into excel.

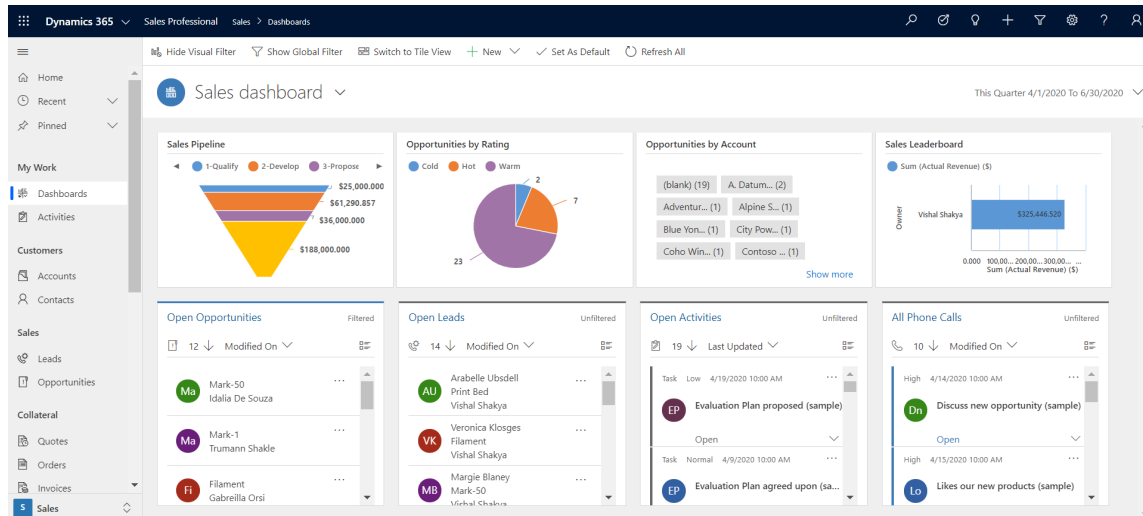


Figure 13: Step-7: The visualisations for all the steps and aspects of the Sales chain is shown on the *Sales Dashboard* automatically generated by Sales Hub. All the links to pages for leads, opportunities, quotes, invoices, orders, etc. are given in the sidebar.

3.2 Dashboards on Power BI

As shown in figure 14, all dashboards were designed to be distinctly colourful and interactive to allow for faster and efficient transfer of information to the onlooker/audience.

3.2.1 Sales Dashboard

The Sales Dashboard (figure 15) shows the overview of the products sold and the revenue generated in the current year, i.e., for the year in which the solution was implemented.

- The Total Revenue card shows the total revenue generated through sales in the time period selected in the above time-slider. Currently it is showing the revenue for the year 2019-2020.
- Revenue by Close Date time series plot shows the revenue generated at various times of the year. The Close Date is the date when the invoice was generated and marked *complete*. This plot is also linked with all the custom sliders present in the top row.

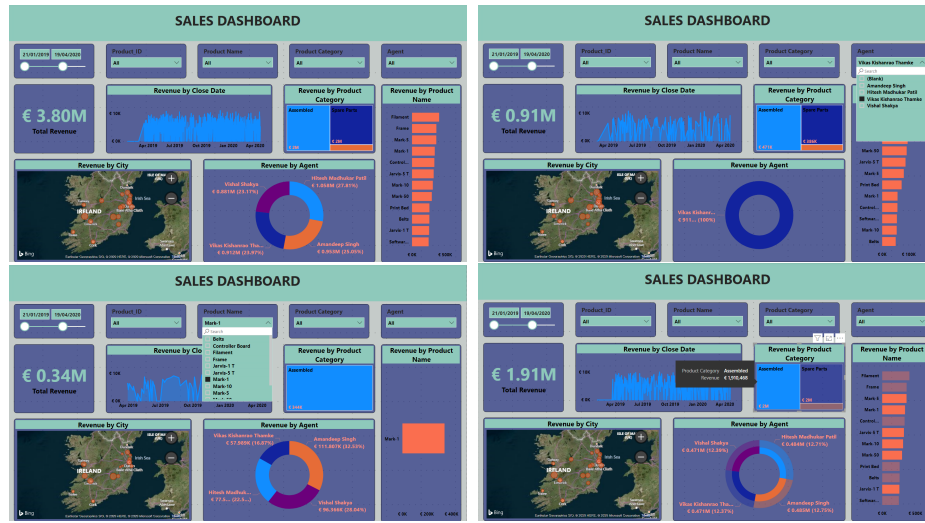


Figure 14: All dashboards implemented in this project are interactive.

- Revenue by Product Category tile plot shows the distribution of revenue by the category of products and services offered by the company.
- Revenue by Product Name horizontal-bar graph shows the distribution of revenue by the names of products and services offered by the company.
- Revenue by City shows the distribution of revenue by the cities on a satellite map. These are the cities where customers purchased the products offered by the company.
- Revenue by Agent doughnut plot shows the distribution of revenue generated by the names of employees who qualified the leads.

3.2.2 Trends Dashboard

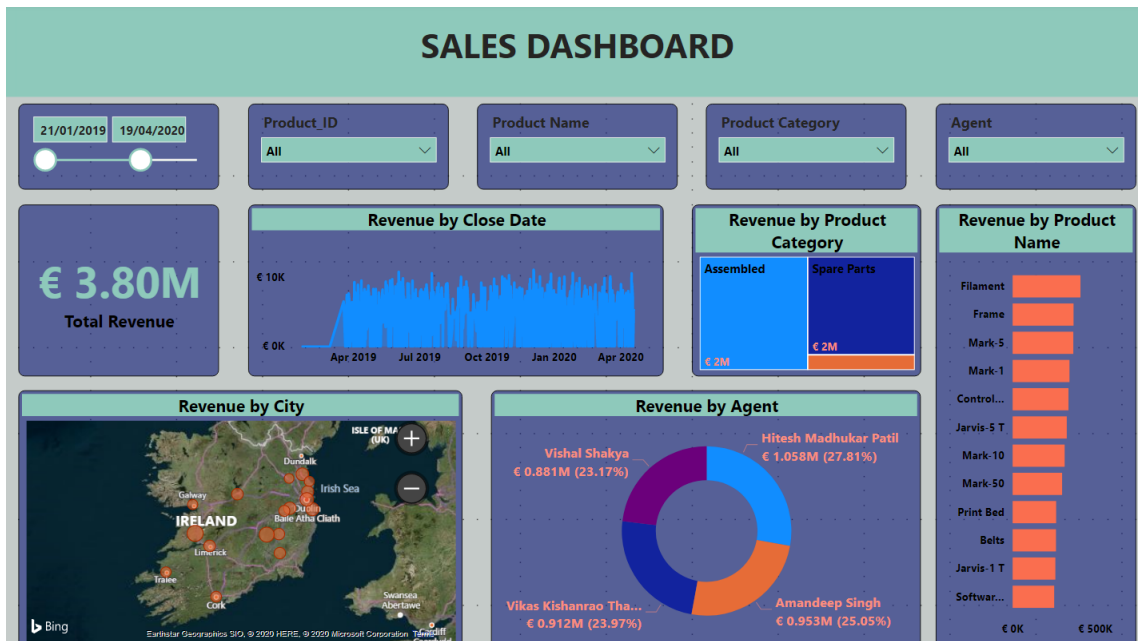


Figure 15: Sales Dashboard

The Trends Dashboard helps to visualise the patterns in the sales revenue generated for the current year and then compare it with legacy data of previous years.

- The Product distribution by Revenue bar graph shows the revenue generated by different products for all years (2017-18, 2018-19, & 2019-20)
- The Product Category distribution by Revenue bar graph shows the revenue generated by different product categories for all years (2017-18, 2018-19, & 2019-20)
- The three Top-3 Products by Revenue horizontal-bar plots show the top-3 selling products of the years 2017-18, 2018-19, & 2019-20 respectively.
- The Total Revenue by Year bar graph depicts the revenue generated by the company for the years 2017-18, 2018-19, & 2019-20 respectively.

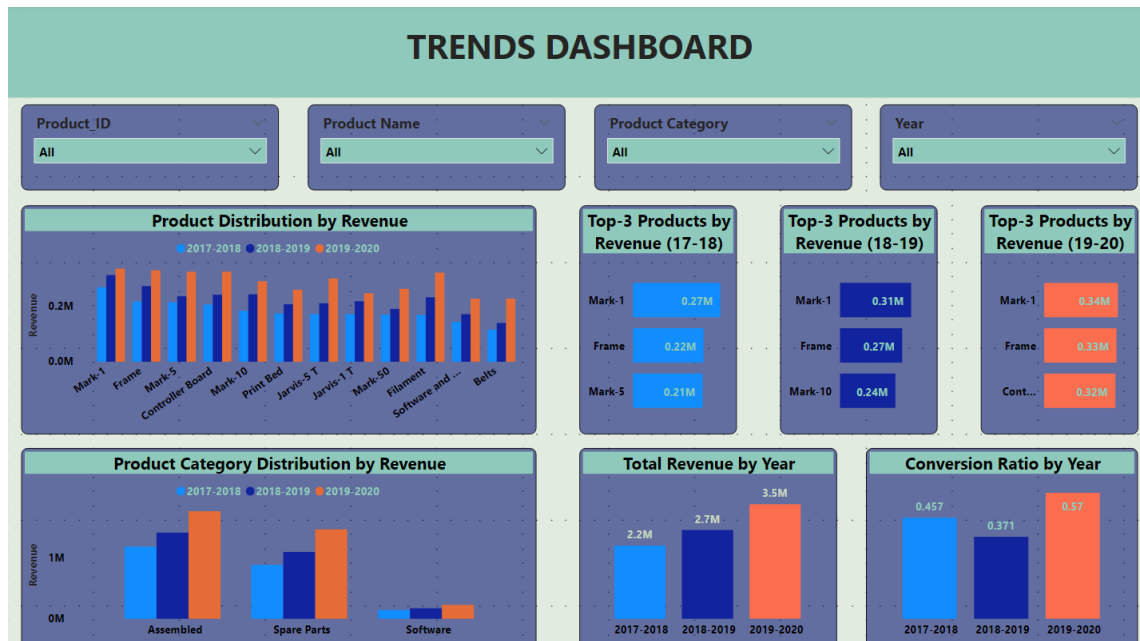


Figure 16: Trends Dashboard

- The Conversion Ratio by Year bar graph depicts the ratio of the number of leads generated to the number of invoices completed for the years 2017-18, 2018-19, & 2019-20 respectively.

3.2.3 Customer Dashboard

The Customer Dashboard helps to depict the actual number of customers based on different customer preferences to aid in visualising the customer base of the company.

- The Total number of Customers by Year tile plot shows the number of customers for the years 2017-18, 2018-19, & 2019-20 respectively.
- The Customer Distribution by City map shows the locations of customers for the years 2019-20 based on the number of purchasers.

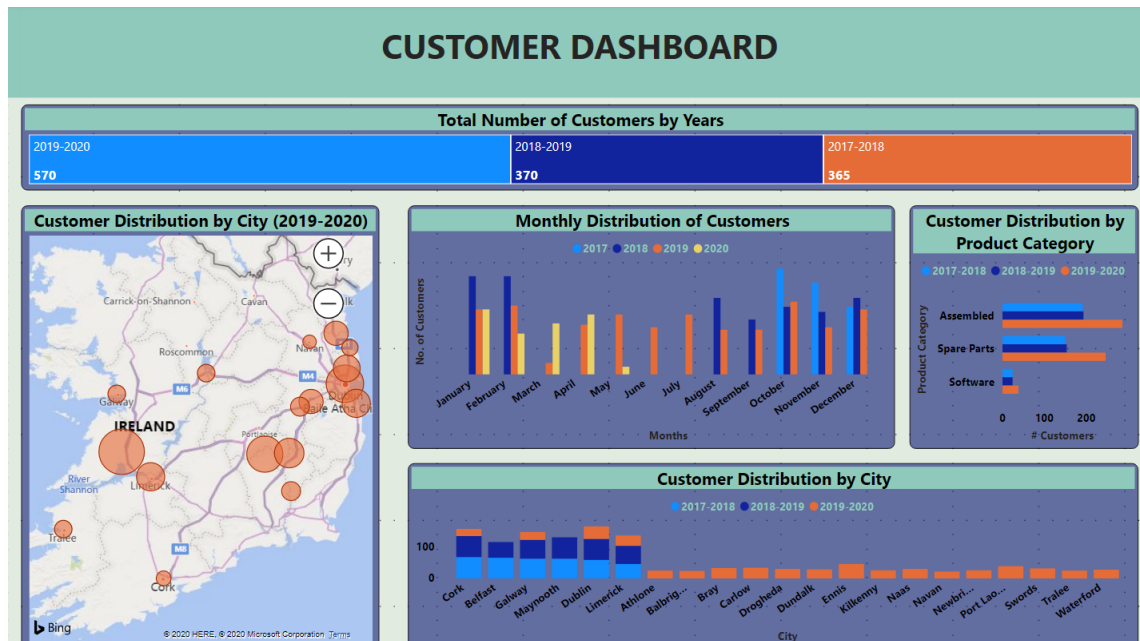


Figure 17: Customer Dashboard

- The Monthly Distribution of Customers bar graph shows the number of customers for all the months of the years 2017-18, 2018-19, & 2019-20 respectively.
- The Customer Distribution by Product Category horizontal-bar graph plots the number of purchasers for each product category offered by the company.
- The Customer Distribution by City stacked-bar graph visualises the number of customers for the years 2017-18, 2018-19, & 2019-20 respectively, for each city where the company has sold its products.

4 Benefits of the Solution

1. As described by the Total Revenue by Year and Conversion Ratio by Year charts in the Trends Dashboard (figure 16), by implementing the solution the total sales and leads to invoices ratios follow an upward trend. This means that due to the implementation of this solution, more prospective customers are getting engaged in the products and services offered by the company and reaching the payment stage of the process flow. Relative to previous years, the upward trend in revenue generated by the company is almost doubled. This is the biggest benefit of the solution because it is making the sales chain more efficient without the need for any drastic changes/measures.
2. As shown by the Customer Dashboard (figure 17), the customer base of the company has expanded by almost 1.5 times relative to previous years. This means that the revenue being generated is also coming from new customers rather than existing customers purchasing more. This is a clear benefit of the solution because it shows that the popularity of the company is increasing and the customer base is widening by just making the sales chain more efficient.
3. The Customer Dashboard (figure 17) also shows that the company has managed to connect to customers present in more cities than before. This is a side benefit to the solution because this proves that the company is inching closer to its goal of expanding in various cities in Ireland. If the revenue and popularity growth follows a similar upward trend in the coming years, the company can even think about opening physical stores in locations with maximum customer base.
4. One basic but very important benefit of this solution is that all the services used to implement this infrastructure were cloud-based, meaning that the company does not need to invest in high-end on-premise computer systems. Rather a similar amount

can be paid to the cloud service provider that will take care of the security, maintenance and backups of the company's data infrastructure. This will also be beneficial if the company decided to expand its operations. The new operation-base can be up-and-functional as soon as the company desires, this makes the solution future-proof also.

5 Conclusions

Based on the statistics presented by the dashboards, the solution implemented in this project was a complete success. Revenue generated grew, customer base widened, company popularity increased across various cities, and seasonality disappeared from the sales. All in all, the benefits of this solution substantially outweighed the initial costs and the efforts to train the employees for this system.

6 Further Work

1. The organisation considered for this project was fictional. It was created just as a means to depict the workings on different stages and to present the solution implemented by the group. For a future project, an authentic organisation may be considered to better emulate the real-life conditions of a marketplace.
2. The cloud service used in this project was Amazon's AWS, only because first year use of AWS was being offered to students for free. In a future project the costs associated with such a service may also be considered. The environments of Microsoft's Excel, Dynamics 365 and Power BI may also go well with the cloud services offered by Microsoft Azure.

3. This project only aimed at implementing the sales aspect of the organisation using Sales Hub. For a future project, the Customer Hub feature may also be implemented to show to the customer dealing side of the business.

References

- [1] E. Tarver, “Use a balanced scorecard to detect and prevent firm weaknesses,” 2019.
- [2] R. S. Kaplan and D. P. Norton, “The balanced scorecard—measures that drive performance,” 08 2014.
- [3] “Using strategy map with balanced scoreboard.”
- [4] S. Strategies, “What is a strategy map? a short and simple guide for 2019.,” 2019.
- [5] “Balanced scorecard basics — balanced scorecard institute,” 2015.

7 Appendix: Teamwork

- The key behind timely submission of the project was the methodology used for the project implementation. As learned in the Business Intelligence and Business Analytics class, we thought Agile Scrum Methodology would be suitable to assign and track tasks.
- In the current situation of the ongoing COVID-19 pandemic, Microsoft Teams played an important role in bringing us together.
- On doing research for couple of hours, we found Microsoft Planner, where it is very easy to create sprints, create tasks and manage tasks.
- A time slot of one hour was dedicated every day and each team member ensured his availability for the Daily Scrum Call, in spite of being in different countries.

- The whole project is divided in six sprints with each sprint having a duration of 2 days.
- The first sprint was about Specifications, next three were dedicated for Implementation and last two were used for Project Report and Presentation.
- Looking at the strengths of members, work was divided in various tasks in each sprint. Some tasks required more time than the assumed two days, such tasks were moved to the subsequent sprint.
- It would not be fair to calculate percentage of work of each member as all the members put efforts sincerely in each sprint, and it was ensured that the work is divided equally between members in each sprint.
- Lastly, the name for the fictitious company was selected as H.V.V.A. 3D Printing Solutions because *H-V-V-A* are the initials of the names of all the members involved in this project.