

NATIONAL COLLEGE OF IRELAND
BUSINESS INTELLIGENCE & BUSINESS
ANALYTICS

CONTINUOUS ASSESSMENT - II

SPECIFICATION REPORT

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

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1 Abstract

At the time of writing of this report, the world is struggling with a pandemic that is affecting every single human being on this planet. There is an acute shortage of life-saving equipment because all the factories and workplaces responsible for manufacturing them are closed indefinitely. Healthcare workers are on the front-lines, but without these equipment they will die. Strangely, but thankfully, innovative people from various walks of life who own a 3D printer – a system that uses heat to liquefy thin PVA plastic tubing and construct various 3D objects based on the blueprints supplied to it via a computer – have come forward to *print* these essential equipment.

This ingenious idea to *print* whatever is needed in one's own home inspired the authors of this report to dig deeper and investigate the extent, popularity, feasibility and costs associated with this niche industry. Broadly based on real-life organisations that manufacture and sell 3D printing systems, a fictitious company was created – *H.V.V.A. 3D Printing Solution*. Mock customer, sales, and purchase data was generated and then fed into a cloud service that piped the datasets into a Customer Relationship Management (CRM) software. The whole chain of the Sales section of the company was emulated, and the resulting statistics were visualised. The benefits and conclusions from these visualisations were studied and reported.

2 Background

2.1 Organisation Background & History

HVVA 3D Printing Solutions is a fictitious company created for the scope of this project. But this company is loosely based on the emerging companies in the 3D printing industry [1, 2].

The company was set-up in Ireland in 2017 following the rise in popularity of 3D printers. After a relatively good first year, 2018 saw the sales of the company take a hit. The founders of the company, all from engineering and technical backgrounds, wanted to solely focus their attention on innovating. So they hired a team of sales executives to probe, analyse and implement a solution to improve the sales and outreach of the company.

Customers of HVVA 3D Printing Solutions can purchase from a variety of fully assembled 3D printers, spare parts for already existing printers, or the software to set-up the printers with a computer system. The company has six already-assembled modular-3D printer models, five fully-replaceable spare-parts, and the software/drivers to help with synchronisation with a computer.

2.2 Marketplace Participation

HVVA 3D Printing Solutions was founded as a physical retail shop that later expanded to E-commerce to sell 3D printers and accessories in Ireland. Since this sector is still emerging, competition is fierce. Maintaining the quality of products & services is essential to survive. HVVA 3D Printing Solutions has made a name for itself in this niche sector by focusing on design & build quality. The company has innovated and introduced a relatively large variety of products that span a wide price range. This helps the company to connect with consumers from various market segments and expand further by introducing updated versions periodically. Although sales took a slight dip in 2018, a strong start in 2017 suggests that the company is in it for the long haul.

2.3 Vision

Aims to be the top 3D printer and services provider with an active presence in major cities of Ireland.

2.4 Objectives

- To increase sales and public outreach but not compromise with the quality of products.
- To make the sales chain efficient without any drastic overhauls.
- To expand into other cities of Ireland by E-commerce.

3 System Design

3.1 Process Flow Diagram

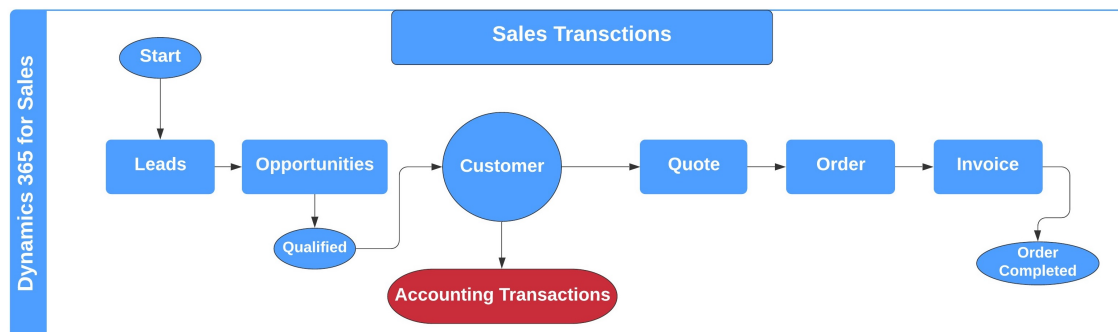


Figure 1: The Process Flow diagram depicting each stage of the data collection process – from a prospective customer to the final invoice generation.

3.2 Data Capture Points

DATA CAPTURE POINTS	
Capture Point	Data
Lead	Details of customer interested in buying the products (pospective customer)
Opportunity	Details of engaged customer - certified by an agent (engaged customer)
Quote	Details of product preferences & price offered to the customer
Order	Details of product preferences & price agreed upon by the customer
Invoice	Customer purchase details & order confirmation

Figure 2: Data capture points and the description of the data collected in the process.

3.3 Analytical Requirements

The database for HVVA 3D Printing Solutions incorporates details for each customer from the starting of the Lead generating process to the end of the Invoice completion. Each step in the data-chain has it's own importance and helps the company to track its progress efficiently. This step-wise implementation helps when any troubleshooting is required and prevent the breakdown of the whole chain.

Creating visualisations from this database is necessary to look at the progress of the company and decide on its future strategies and investments. The analytical requirements for the solution would be:

- To identify the revenue generated by the company across preferred services, products and cities.
- To analyse the customer distribution across cities, preferred types of services and years.
- To break down the trends in the products and services over periods of time.
- To investigate the pattern in Leads to Invoice ratio compared to previous years.

3.4 SWOT Analysis

SWOT analysis is a key part of any business and strategic plan. SWOT stands for: Strengths, Weaknesses, Opportunities and Threats – where strengths and weaknesses are internal factors and opportunities and threats are external factors [3, 4]. A SWOT diagram analyses a project or a business by focusing on each of these factors by pictorially representing them in four separate quadrants [5].

SWOT diagrams can be especially useful when trying to decide whether or not to embark on a certain venture or strategy by clearly visualising and outlining the pros and cons of a project [4]. SWOT analysis makes it easier to decide the strategy to move forward – first step is to figure out how to build on the strengths of the organisation. A SWOT analysis will help in identifying the parts of the business that are doing well – these will be the critical successes, factors, aspects of the business that are strong and give the organisation a competitive advantage [5]. Recognising these assets will help to continue the journey on an upward trend by finding ways to leverage and build upon these strengths to grow the business.

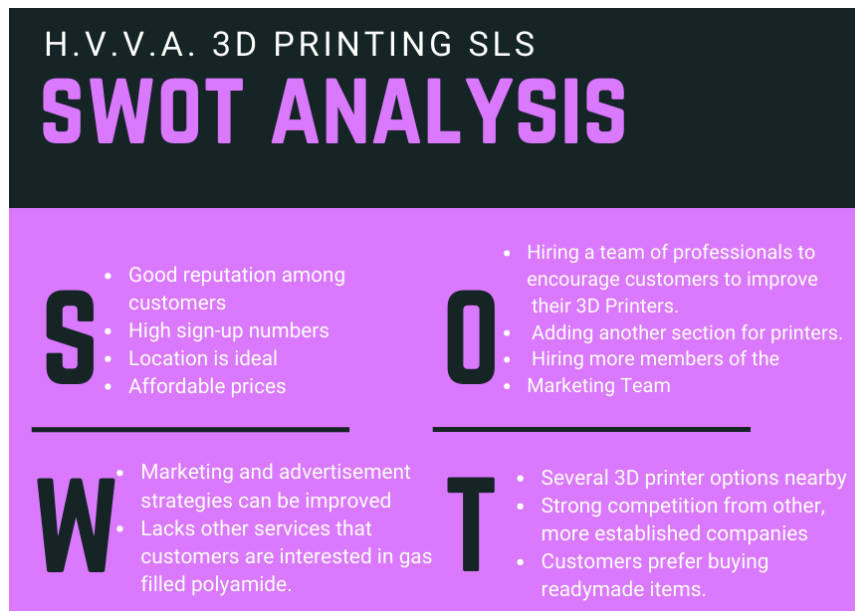


Figure 3: SWOT Analysis of the company.

4 Database Design

4.1 Entity Relationship Diagram

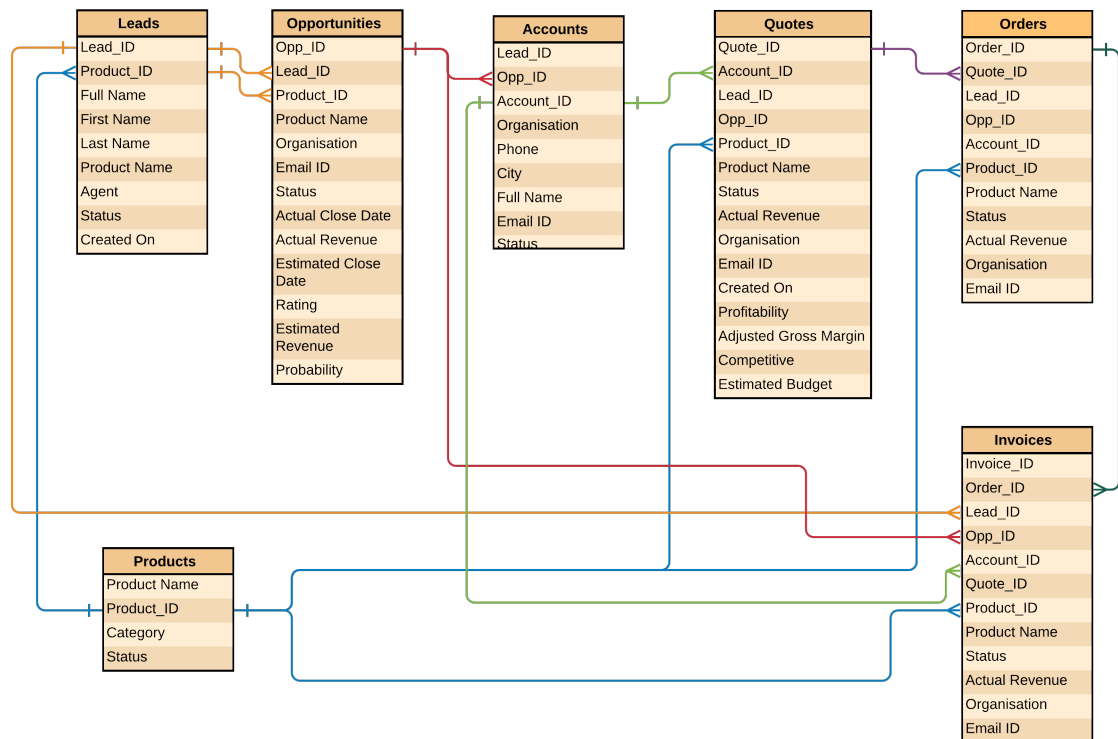


Figure 4: The Entity-Relationship diagram representing the relationship and overview of data collected during each stage of the process (colour coded for ease in following the relationships).

An Entity Relationship Diagram (ERD) assists in visualising each step in the data collection and transfer chain in a business or organisation [6]. Each individual entry in a table is an entity. Different tables may have similar entities which are related through a cardinality or

rule. An ERD breaks these rules into lines with symbols to aid pin-pointing a bottleneck in the data flow. The ERD for this company is shown in figure 4.

4.2 Data Dictionary

LEADS		
Attribute Name	Datatype	Description
Lead_ID	string/integer	Unique ID for prospective customer
Full Name	string	Full Name of prospective customer
First Name	string	First Name of prospective customer
Last Name	string	Last Name of prospective customer
Product Name	string	Name of product which is of interest
Product ID	string/integer	Unique ID for product being offered
Agent	string	Full Name of prospective customer
Status	string	Status of Lead (New, Existing)
Created On	Date	Date when the lead was generated

Figure 5: Data dictionary for Leads generated (prospective customers).

OPPORTUNITIES		
Attribute Name	Datatype	Description
Lead_ID	string/integer	Unique ID for prospective customer
Opp_ID	string/integer	Unique ID for engaged customer
Product ID	string/integer	Unique ID for product being offered
Product Name	string	Name of product which is of interest
Organisation	string	Name of customer organisation
Email ID	string/integer	Email ID of customer/customer organisation
Created On	Date	Date when the opportunity was generated
Estimated Close Date	Date	Expected date of customer qualification
Actual Close Date	Date	Actual date of customer qualification
Estimated Revenue	decimal	Estimated revenue that will be generated
Actual Revenue	decimal	Actual revenue that is generated
Status	string	Status of Customer Engagement (Won, Open, Lost)
Rating	string	Rating of Customer Engagement (Hot, Warm, Cold)
Probability	integer	Estimated probability of customer qualification

Figure 6: Data dictionary for Opportunities (engaged customers).

ACCOUNTS		
Attribute Name	Datatype	Description
Lead_ID	string/integer	Unique ID for prospective customer
Opp_ID	string/integer	Unique ID for engaged customer
Account_ID	string/integer	Unique ID for customer account
Full Name	string	Full Name of prospective customer
City	string	City (Location) of customer
Organisation	string	Name of customer organisation
Phone	integer	Contact number of customer
Email ID	string/integer	Email ID of customer/customer organisation
Status	string	Status of Customer Account (Active, Dormant)

Figure 7: Data dictionary for Accounts (account details of engaged customers).

QUOTES		
Attribute Name	Datatype	Description
Lead_ID	string/integer	Unique ID for prospective customer
Opp_ID	string/integer	Unique ID for engaged customer
Account_ID	string/integer	Unique ID for customer account
Quote_ID	string/integer	Unique ID for customer quote
Product ID	string/integer	Unique ID for product being offered
Product Name	string	Name of product which is of interest
Actual Revenue	decimal	Actual revenue that is generated
Organisation	string	Name of customer organisation
Email ID	string/integer	Email ID of customer/customer organisation
Profitability	string	Estimation of quote provided (Profitable, Not-Profitable)
Status	string	Status of Customer Engagement (Won, Active, Closed)

Figure 8: Data dictionary for Quotes offered to the customer.

ORDERS		
Attribute Name	Datatype	Description
Lead_ID	string/integer	Unique ID for prospective customer
Opp_ID	string/integer	Unique ID for engaged customer
Account_ID	string/integer	Unique ID for customer account
Quote_ID	string/integer	Unique ID for customer quote
Order_ID	string/integer	Unique ID for customer order
Product ID	string/integer	Unique ID for product being offered
Product Name	string	Name of product which is of interest
Actual Revenue	decimal	Actual revenue that is generated
Organisation	string	Name of customer organisation
Email ID	string/integer	Email ID of customer/customer organisation
Status	string	Status of Customer Order (In-progress, Closed)

Figure 9: Data dictionary for Orders (product preferences & price agreed upon by the customer).

INVOICES		
Attribute Name	Datatype	Description
Lead_ID	string/integer	Unique ID for prospective customer
Opp_ID	string/integer	Unique ID for engaged customer
Account_ID	string/integer	Unique ID for customer account
Quote_ID	string/integer	Unique ID for customer quote
Order_ID	string/integer	Unique ID for customer order
Invoice_ID	string/integer	Unique ID for customer invoice
Product ID	string/integer	Unique ID for product being offered
Product Name	string	Name of product which is of interest
Actual Revenue	decimal	Actual revenue that is generated
Organisation	string	Name of customer organisation
Email ID	string/integer	Email ID of customer/customer organisation
Status	string	Status of Customer Invoice (Open, Closed)

Figure 10: Data dictionary for Invoices (customer purchase details & order confirmation).

PRODUCTS		
Attribute Name	Datatype	Description
Product ID	string/integer	Unique ID for product in inventory
Product Name	string	Name of product in inventory
Price	decimal	Price of product in inventory
Category	string	Category of product (Assembled, Spare Parts, Software)
Status	string	Status of product availability (Active, Not Active)

Figure 11: Data dictionary for Products being offered.

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