FINAL PROJECT REPORT

PROJECT NAME:

BUSINESS INTELLIGENCE SOLUTIONS FOR PURCHASING PROCESS OF ADVENTURE WORKS CYCLE

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Subject: Project Management for Information Systems

Subject code: 212IS4402

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Ho Chi Minh City, May 2021

TASK ASSIGNMENT SHEET

No.	Student Name	Task Name	% Completed
1	Phan Thị Hiền Mai	Team leader. Keep track of various tasks and oversee all activities within a team. Write content 1.2, 6.1, 6.3, chapter 5 in the report.	100%
2	Cao Huỳnh Thị Mỹ Nguyên	Collect information about the project. Design Powerpoint presentation. Write content 1.1, 3.2, 3.3, 6.2 in the report.	100%
3	Nguyễn Thị Duyên	Create project timeline in Microsoft Project. Collect information about the project. Write content 3.1, 3.4, chapter 4 in the report.	100%
4	Hoàng Thị Tân Thanh	Write content 1.3, 1.5, 3.5, 4.1. Synthesize and edit other members' content. Design cover page. Summarizing the report's content.	100%
5	Phạm Văn Nguyện	Design Powerpoint presentation. Collect information about the project. Write content 1.4, chapter 2 in the	100%

		report.	
		Format the report in Word.	

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APPRECIATION

COMMITMENT

We can commit this is the research of the whole group. The research results and conclusions in the project are honest, not duplicated from any source and in any way. During the project implementation, we consulted some relevant documents to confirm the reliability of the topic. The references to sources have been cited and recorded following the regulations.

Ho Chi Minh City, May 2022

Group 4 – Otto - K19406C

LIST OF ACRONYMS

No.	Abbreviation	Explanation
1	AWC	Adventure Works Cycles
2	BI	Business Intelligence
3	SWOT	Strengths – Weaknesses – Opportunities - Threats
4	OLTP	Online Transaction Processing
5	OLAP	Online Analytical Processing
6	ETL	Extracts - Transforms - Load
7	ROI	Return on Investment
8	NPV	Net present value
9	SQL	Structured Query Language
10	SDLC	System Development Life Cycle
11	WBS	Work Breakdown Structure
12	PBS	Production Breakdown Structure
13	PERT	Program Evaluation and Review Technique
14	RACI	Responsible – Accountable – Consult - Inform
15	DW	Data Warehouse
16	QC	Quality Control
17	PM	Project Management
18	BA	Business Analyst

INTRODUCTION

In the 21st century, project management plays a decisive role in the success or failure of the project due to the guarantee of the realization of the project's purpose, also including coordination and allocation of project resources. Because aiming at the goal of the project on schedule, it's required that the project manager will have to apply the knowledge, skills, and tools that are flexibly coordinated to meet the needs of the project and contribute to the implementation of the common goals of the enterprise. In this subject, the project team will implement the solution based on the knowledge provided in the lessons. The course project will be involved managing a project that completes on time, within the approved budget, and achieves the specified requirements in terms of technology and product quality, and service quality through methods. In conclusion, through project management, the team will gain more precious knowledge and experience for the implementation of future projects as well as be aware of their weaknesses and learn valuable lessons through every phase.

CHAPTER 1: PROJECT OVERVIEW

1.1. Company Overview

Adventure Works Cycle is a company that sells bicycles but also provides accessories, clothing, and components. The accessories available such as bottles, bike racks, brakes, etc. The available clothing such as caps, gloves, jerseys, etc. For the components, Adventure Works sells brakes, chains, derailleurs, etc. Many of those things are made by vendors, so Adventure Works stands as a reseller.

Adventure Works serve the customer globally, including Australia, Canada, France, Germany, the United Kingdom, and the United States. There are 2 business models in Adventure Works which are retail stores that sell bikes, and internet sales that serve individual customers. Usually, Adventure Works sells in bulk to retail stores, which acts as resellers for its products.

To run the business activities, Adventure Works has a total of 290 employees that are included in some functions such as sales, production, purchasing, engineering, finance, information services, marketing, shipping and receiving, and R&D. The customers of Adventure Works include over 700 stores and over 19000 individuals worldwide and its vendors are quantified around 100 vendors companies that supply raw materials, accessories, clothing, and components.

In 2000, Adventure Works bought a small manufacturing plant, Import adores Neptuno, located in Mexico. Import adores Neptuno manufactures several critical subcomponents for the Adventure Works Cycles product line. These subcomponents are shipped to the Bothell location for final product assembly. In 2001, Import adores Neptuno, became the sole manufacturer and distributor of the touring bicycle product group.

Coming off a successful fiscal year, Adventure Works Cycles is looking to broaden its market share by targeting its sales to its best customers, extending its

product availability through an external website, and reducing its cost of sales through lower production costs.

1.2. Porter's five forces model analysis of Adventure Works Cycle company

1.2.1. Threat of new entrants

The bicycle industry is a long-standing industry, dominated by prestige and reputable trademarks, with loyal customers. New entrants to the bicycle industry can be deterred because of the economies of scale and learning. Although people are getting used to a green lifestyle by using bicycles, they would prefer a reputable brand more than a new brand. Furthermore, new entrants to the bicycle industry will very likely be met with retaliation from existing firms since the growth rate has slowed for the industry. Another factor discouraging new companies to the industry is the moderate capital investment required to enter.

Throughout the world, 1 billion bicycles are in use. The majority of the world's bikes are made and used in Asia. All these factors lead to the conclusion that it is not very likely that a new firm will attempt to enter this industry.

➔ As a result, the threat of new entrants is considered low.

1.2.2. Bargaining power of buyers

The number of reliable manufacturers is not much. The buyers have low switching costs to other brands of bicycles or substitute products, which helps to give them some leverage over bicycle manufacturers. The demand for bicycles is sensitive because bicycles are not a necessity. They are affected by price changes and phases of the business cycle and market transformation. Currently, besides the price factor, it is necessary to pay attention to customers' interest in the variety of designs and models of products, ... In addition, customers can find all the information about the product through the internet. The level of competition is increasing due to customers being able to compare and choose thus giving customers the right to negotiate. The bigger it gets.

➔ Consequently, the bargaining power of customers is moderate.

1.2.3. Bargaining power of suppliers

The power of suppliers measures the level of power that suppliers have over sellers in an industry. The materials supplied by the suppliers are similar and widely available. Businesses can choose to import or produce their materials. Most bicycle manufacturers purchase supplies for their bikes rather than manufacturing all the parts on their own. A large number of parts are purchased from Asian manufacturers. However, currently, most of the workers in the production process are outsourced.

➔ Suppliers in the bicycle industry have a moderate level of power.

1.2.4. Threat of substitutes

Most bicycles are used for exercise and recreational activities. Besides bicycles, to serve the needs of moving customers can use other means of transportation such as motorcycles, cars, airplanes, ...

Currently, most customers look to bicycles due to their health and environmental concerns to reduce CO_2 emissions. However, walking, participating in outdoor sports activities are also alternatives for customers. Subsequently, there is a low switching cost of consumers to substitute products.

➔ Competitive pressure from substitute products is relatively high.

1.2.5. Degree of rivalry

Rivalry among sellers measures the level of competition between members of the same industry that sells the same product. Buyers have little or no cost to switch from one brand of bicycle to another when they purchase a new bike. Due to being a long-standing industry, besides AWC, there are well-known and reputable businesses. Most businesses try to bring to market attractive new products, advanced so that customers have more space to choose from. The cost of

promotion and marketing in the industry is also high. Winning customer loyalty is never easy.

➔ Subsequently, the competitive rivalry between companies has a moderately high level.

1.3. SWOT analysis of Adventure Works Cycle company

1.3.1. Strengths

a. Database

Adventure Works 2017 database is an Online Transaction Processing (OLTP) database, which is rich in structure, content, and variety. While Adventure Works DW 2017 is a data warehouse, which is targeted for Online Analytical Processing (OLAP) and data mining

b. High market-share company

Adventure Works Cycle is a large, multinational manufacturing company. The customers of Adventure Works include over 700 stores and over 19000 individuals worldwide and its vendors are quantified around 100 vendors companies that supply raw materials, accessories, clothing, and components.

c. Variety in product brands selection

The company has 97 different brands of bikes grouped into three categories: mountain bikes, road bikes, and touring bikes. Moreover, Adventure Works also manufactures some of its components. Several components, accessories, and clothing are purchased from outside vendors.

d. High labor force participation rate

To run the business activities, Adventure Works has a total of 290 employees that are included in some functions such as sales, production, purchasing, engineering, finance, information services, marketing, shipping and receiving, and R&D.

1.3.2. Weaknesses

a. Time-consuming interview for business analysis due to organizational structure

Given the number of senior executives and the size of the organization, you would probably plan on more than 10 but fewer than 20 interviews at Adventure Works Cycles. Depending on availability, expect this to take a minimum of a week, more likely one and a half to two weeks.

b. Slow data accessing (SILO EFFECT)

Brian Welker is head of the sales organization. Brian is particularly frustrated with how difficult it is to get information out of the company's systems. When he asks for a report, it can take days or weeks to get the information.

Jose Hugo, AWC's fiancé manager, says that it is difficult to get information from one department and supply it to others. The department managers want to router more file transactions and data access through the internal

c. Low reorder rate

Beyond this, the data shows that 17 percent of 2002 customers did not reorder in 2003. And to date in 2004, he still has not heard from an additional 17 percent or so. His salespeople could use this information to bring the best of these customers back to the business.

d. Unsynchronized data

The fact that the sales reps are out in the field most of the time makes it difficult for them to keep their price lists current. The price list changes fairly often, but only a few things on the list change. It would be great to get a report to the sales reps that flagged changes and special offers, and maybe even highlighted the relevant customers.

The existing reports are not in a standard because reports are focused primarily on business information in the United States. Users in the non-U.S. subsidiaries are very dissatisfied with this focus and want to be able to view reports in different

currencies and different languages. Suppose they need to get custom information, it's difficult to get it themselves.

e. Centralized environment

Most of AWC's transactions are processed through a single server. This can cause congestion and time-consuming processing of orders.

1.3.3. Opportunities

a. Growing Market Size and Growing Consumer Preferences

As environmental protection and health issues are increasingly concerned, consumers tend to own a bicycle for their own. According to survey data, industry sales of bicycles seem to be stable at around 15 to 20 million bicycle units annually, plus parts, accessories, and service, which historically is a very healthy number for the industry. The Bicycles market in the U.S. is estimated at US$7.9 Billion in the year 2020. The country currently accounts for a 27.04% share in the global market. China, the world's second-largest economy, is forecast to reach an estimated market size of US$6.9 Billion in the year 2027 trailing a CAGR of 4.7% through 2027. This is an excellent opportunity for companies in this industry.

b. The development of technologies

Based on the global connection network through technologies, the company could approach more potential suppliers all over the world that provide great offerings to customers.

Machine Learning and Artificial Intelligence exploding are changing the landscape of technology in which AWC operates. AWC can use these developments to improve efficiency, reduce costs, and transform processes.

1.3.4. Threats

a. Effect of weather

Cyclists as vulnerable road riders are more exposed to weather conditions than car drivers. As a result, their decision of whether to cycle is strongly related to weather conditions. In conclusion, harsh weather will be a reason prevent customers from owning a bicycle.

b. Safety issue

Since the traffic becomes dangerous with the participation of many vehicle models. For instance, most of the means of transport in Europe are cars, and the use of bicycles on the main roads makes cyclists uncomfortable with the smoke and dust from other vehicles. At the same time, traveling by bicycle next to a car or motorbike also poses a problem for the safety of cyclists.

1.4.   Project appraisal

Item Year	Year 1	Year 2	Year 3	Year 4	Year 5
Hardware purchase	150.000	-	-	-	-
Hardware maintenance		22.500	22.500	15.000	15.000
SQL Server	13.748	-	-	-	-
Microsoft Office	6.840	6.840	6.840	6.840	6.840
Microsoft Project Professional	200	-	-	-	-
Software support	-	-	-	-	-
Internal resource reassigned labor	45.633				
Training & other Miscellaneous costs	4.000				
Project Management Cost	24.800				

Total cost per year	245.221	29.340	29.340	21.840	21.840
Cumulative total costs	245.221	274.561	303.901	325.741	347.581
Staff savings per year	82.400	90.640	99.704	109.674	120.642
Cumulative savings	82.400	173.040	272.744	382.418	503.060
Cumulative savings less costs	(162.821)	(101.521)	(31.157)	56.677	155.479
Cash-flow for year	(162.821)	61.300	70.364	87.834	98.802
Discount rate	20%				
Discount Factors	1,00	0,83	0,69	0,58	0,48
Discounted cash flow	(162.821)	51.083	48.864	50.830	47.647
Net present value - NPV	35.603				
Return on Investment – ROI	-66,40%	-36,98%	-10,25%	17,40%	44,73%

Table 1. Investment appraisal

The project has a life cycle of 5 years. The projected cost for the first year is $245,221, with the expectation of generating $82,400 and increasing by 10% per year.

In the 2nd and 3rd years the estimated cost of server maintenance is 15% corresponding to $22500. In the fourth and fifth years, that number drops to 10%, or $15,000.

The cost of renewing the software each year is $6,840.

With a discount rate of 20% per year, the net present value (NPV) after 5 years is $35,603. After the 3rd year, the Return on Investment (ROI) has a positive value (ROI >1)

From the indicators presented in the table above can be seen, that investing in this project is perfectly reasonable.

1.5.   Structure of project

Chapter 1: Project Overview

An introduction to the Adventure Works Cycle company including the analysis of Porter's five forces model and SWOT model as well as the project investment appraisal which contains the crucial cost when implementing the project

Chapter 2: Project Overall Analysis

This chapter includes the business case and business charter which are used for defining the scope of the project based on the business requirements provided by the Adventure Works Cycle company

Chapter 3: Project Planning – System Development Life Cycle and Work Breakdown Structure

Contingent on the business requirements, this chapter introduces the System Development Life Cycle around the definition, the approaching model, and the project life. After defining the people that are involved in the project, the project will build the Work Breakdown Structure also the Production Breakdown Structure.

Chapter 4: Project Planning – Detailed Model Analysis

Based on the WBS, the project will analyze the project in detail with the Gantt model and Pert model. Furthermore, this chapter also mentions about the

RACI matrix of each work phase and the detailed cost related to the implementation of the project.

Chapter 5: Project Quality Control

This chapter will mention some parts to improve the quality of the project among the checkpoint meeting report, the risk register, and the change request form.

Chapter 6: Project Evaluation and Conclusion

The report ends with the evaluation of the charts provided in the Microsoft Project comprising the Resource, Resource Cost, and Earned Value report. In short, the lessons learned are winded up from the project that the project team enlightens after the completion of the project.

CHAPTER 2: PROJECT OVERAL ANALYSIS

2.1. Business case

Project Business Case			
Project Name	Business Intelligence solutions for Purchasing process of Adventure Works Cycle		
Project Sponsor	Head of Sales Brian Walker	**Project Manager**	Phạm Nguyện
Date of project Approval	1/4/2022	**Last Revision Date**	28/05/2022
Contribution to Business Strategy	This business strategy will help contribute: ● Enables organizations to leverage supplier relationships, support decision-making in purchasing, and select the right suppliers in need. ● Allows access to the data, searches for suppliers in detail and quickly. ● Improve productivity and restocking. ● Provide organizations with historical perspectives on business performance and provide predictive analysis of future operations. Thus, organizations can determine the volume of products in need and the real-time for purchasing. ● Boost sales by eliminating stock-out. ● Data is updated in real-time so other departments can		

	see the relevant information they need to improve their processes. • Collaborate better with the other departments and Finance in particular, as well as consolidate its strategic position within the company.
Options Considered	Options considered included: 1. Build a BI/DW system that fits the company's situation 2. Recommend some BI tools which help the company analyze the existing data (could train staff in need)
Benefits	• Improve better sales strategy • Reduce inventory costs. • Increase supplier intimacy
Timescales	According to the initial analysis, the system will take about 2 months to deploy the project.
Costs	Software = $20.778 Hardware = $150.000 Total estimated cost = $245.221

Expected Return on Investment	Year 1 = $82.400 Year 2 = $90.640 Year 3 = $99.704 Year 4 = $109.674 Year 5 = $120.642
Risks	The system cannot meet all the needs of the sales team or the needs of customers There are additional costs incurred The project may be last longer than expected

Table 2. Business Case

2.2. Project scope statement

- *In scope*

− *Stock control to support purchasing strategy*

− *Improving Product quality management*

− *Criteria evaluation for vendors selection*

− *Price list comparison to support monthly report*

− *Ship Method comparison to support decision making*

- *Out scope:*

− *Improving competitive advantage for Adventure Works Cycle*

− *Support other department in information accessing*

2.3. Value and desired outcome of the project

By analyzing the company's situation and interviewing the managers of the Adventure Work Cycle company to take some specific outcomes of the BI solution, here are the list of things about the value and desired outcome of the project

- See reseller customer orders by year by customer territory, regardless of the sales rep assigned to the territory.
- See sales according to the new territory assignments, all the way back through history.
- Updating the higher-level data can drill down to detailed orders for individual reps.
- List of the customers in their territory ranked by orders.
- When any information in the price list changes, the system must update and report to the sales representatives to flag the changes and special offers.
- Advanced customer care systems can track calls by complaint type, product, sales area and customer to know customer satisfaction and product quality.
- Upgraded international support trading system with English translated description below the products.
- The system could analyze the report and provide the sales reps with almost all the information they need in a standard format with just a few keystrokes, providing standard information about the time zone changes of the customer. customers can get direct support from the head office quickly.

    → Easy access to basic sales data for the whole field organization.

    → Flexible reporting and analysis tools.

    → All the data in one place (especially sales and forecast data).

➔ The project implementation is expected to break even on the investment in three years and is expected to reach a profit of about $82.400 for the first year

2.4. Business requirements

Inventory management: is concerned with how much stock you have at any given point in time, and how to keep track of it. The purpose of stock control is to reduce the costs of holding stock while ensuring you can meet the customer's demand and making sure that there's enough material for production. Businesses should always have a 'safety' amount of stock so that they're able to react and cover any unforeseen issues.

Improving Product quality management: Quality control (QC) is a process through which a business seeks to ensure that product quality is maintained or improved. Quality control creates safe measures that can be implemented to make sure deficient or damaged products do not end up with customers. Quality control protocols may help you lower your inspection costs and use your resources in a more cost-effective manner. The defective goods returned not only cost the company money but also affected the company's brand. Therefore, it is necessary to control the rate of return of errors to improve and bring the best product to consumers.

Supplier quality assessment: The vendor selection process is one of the final steps in strategic sourcing. The goal of every procurement organization is to utilize limited resources most efficiently. This makes evaluating suppliers necessary to ensure the best contracts in terms of quality, costs, flexibility, and reliability. The supplier assessment process might be challenging, but the benefits of finding low-risk sources of high-quality goods and services plus mutually beneficial, long-term business relationships outweigh the efforts needed. Supplier evaluation criteria should align with the company's mission, vision, and business goals.

Monthly report: Comparing and reporting monthly prices will help businesses have an overview of supply, demand and market prices. From there,

come up with purchasing strategies (time, quantity,…) to have the cheapest purchase price and sell the most goods.

Ship Method comparison to support decision making: One of the key requirements in the purchasing department is choosing the most efficient and effective shipping method, to ensure the company can have the cost as low as possible. Comparing shipping methods gives businesses the most overview of shipping time, quantity and cost. This helps businesses to prevent risks such as air returning in time, insufficient shipping or transportation costs that make the price too expensive.

2.5. Business charter

Project Charter Example			
Project Name	Business Intelligence solutions for Purchasing process of Adventure Works Cycle		
Project Sponsor	Head of Sales Brian Walker	Project Manager	Phạm Nguyện
Date of Project Approval	1/4/2022	Last Revision Date	28/5/2022
Project Description	To implement a DW/BI solution for AWC company on the purchasing		
Scope	The BI / DW system combined with enhancement EDI (Electronic Data Interchange) solution will be introduced to support the purchasing team to process and transmit critical data and documents such as purchase orders, invoices, payments, product specifications quickly, increase work efficiency, reduce the order processing time of major vendors, provide potential vendors, automate the purchasing process, and provide specific information for strategy purchasing.		

Business Case	Increase productivity		
	More streamlined processes		
	Better purchasing prices		
	Optimize order quantities		
	Transparent supply chain		

Constraints (in priority order)	Time	2 months
	Budget	4 developers
	Scope	The implementation of the BI/DW system will help the purchasing team process smoothly as well as help the business improve business efficiency.
	Quality	Prioritize time and budget

Project Deliverables	The BI/DW system supports the purchasing team, trains the purchasing team to use the features, and supports the first month of system operation.

Benefits (measurable results)	The project implementation is to break even on the investment in three years and is expected to reach a profit of about $68.500 per annum

Steering Committee	CEO	Project Team	Sales Rep
	Finance Director		4 developers
	Sales Director		

Key Stakeholders	Name	Success Criteria

Risks	1. The team may not meet deadlines due to adding unplanned specification features. 2. The team may run out of budget due to extending development or testing time.

Table 3. Business Charter

2.6. Resources

BI Solutions will provide the following resources:

- Project manager (Nguyen Pham)
- Business Analyst (Hien Mai)
- Analyst Data Sciencient (My Nguyen)
- Team ETL: ETL Developer1 (Tan Thanh), ETL Developer2 (Duyen Nguyen)
- Deployment Developer (Duyen Nguyen)
- Dashboard/Report Designer (My Nguyen)

In addition, project sponsors and customers from AWC participate in the exchange for requirements and project development.
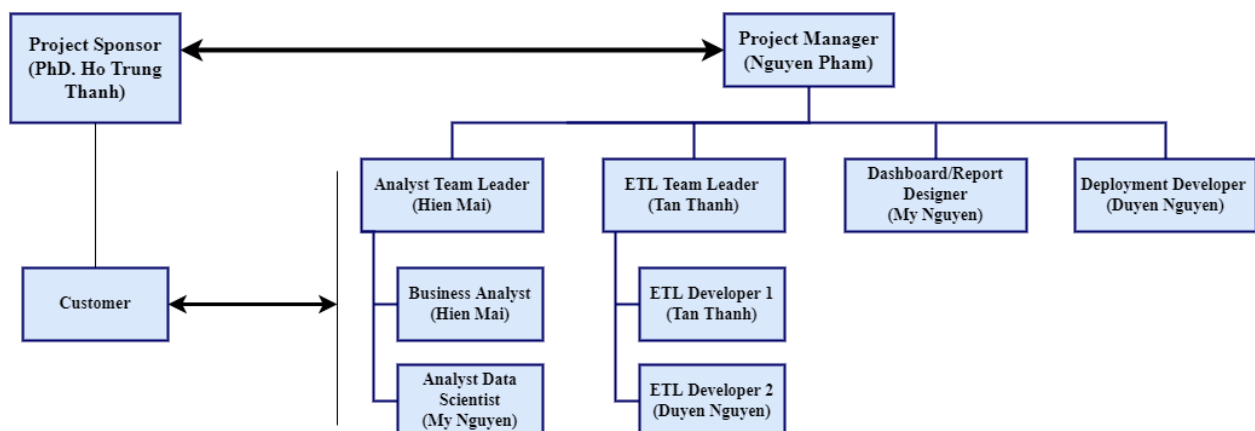
Figure 1. Resources structure

CHAPTER 3: PROJECT PLANNING – SYSTEM DEVELOPMENT LIFE CYCLE AND WORK BREAKDOWN STRUCTURE

3.1. System development life cycle (SDLC)

3.1.1. Project approach model

Currently, there are two popular project management methodologies: Agile-Scrum and the Waterfall methodology. In order to apply the appropriate model for the project, the team will conduct surveys based on the characteristics of each model. Below is a table comparing the two methodologies:

	Agile -Scrum	**Waterfall**
Definition	Agile methodology is a practice that helps continuous iteration of development and testing in the software development process. In this model, development and testing activities are concurrent, unlike the Waterfall model. This process allows more communication between customers, developers, managers, and testers.	Waterfall Model methodology which is also known as Liner Sequential Life Cycle Model. Waterfall Model followed in the sequential order, and so project development team only moves to next phase of development or testing if the previous step completed successfully.
	It separates the project development lifecycle into sprints.	Software development process is divided into distinct phases.
	It follows an incremental approach	Waterfall methodology is a sequential design process.
	Agile methodology is known for its flexibility.	Waterfall is a structured software development methodology so most times it can be quite rigid.
	Agile can be considered as a	Software development will be

	collection of many different projects.	completed as one single project.
Differences	Agile is quite a flexible method which allows changes to be made in the project development requirements even if the initial planning has been completed.	There is no scope of changing the requirements once the project development starts.
	Agile methodology, follow an iterative development approach because of this planning, development, prototyping and other software development phases may appear more than once.	All the project development phases like designing, development, testing, etc. are completed once in the Waterfall model.
	Test plan is reviewed after each sprint	The test plan is rarely discussed during the test phase.
	Agile development is a process in which the requirements are expected to change and evolve.	The method is ideal for projects which have definite requirements and changes not at all expected.
	In Agile methodology, testing is performed concurrently with software development.	In this methodology, the "Testing" phase comes after the "Build" phase
	Agile introduces a product mindset where the software product satisfies needs of its end customers and changes itself as per the customer's demands.	This model shows a project mindset and places its focus completely on accomplishing the project.
	Agile methodology works exceptionally well with Time &	Reduces risk in the firm fixed price contracts by getting risk agreement

	Materials or non-fixed funding. It may increase stress in fixed-price scenarios.	at the beginning of the process.
	Prefers small but dedicated teams with a high degree of coordination and synchronization.	Team coordination/synchronization is very limited.
	Products owner with team prepares requirements just about every day during a project.	Business analysis prepares requirements before the beginning of the project.
	Test team can take part in the requirements change without problems.	It is difficult for the test to initiate any change in requirements.
	Description of project details can be altered anytime during the SDLC process.	Detail description needs to implement waterfall software development approach.
	The Agile Team members are interchangeable, as a result, they work faster. There is also no need for project managers because the projects are managed by the entire team	In the waterfall method, the process is always straightforward so, project manager plays an essential role during every stage of SDLC.

Table 4. Comparision of methodologies

Based on the size of the project, the project team applies the Agile scrum methodology as a project approach model with the following advantages

- *It is a focused client process. So, it makes sure that the client is continuously involved during every stage.*

- *Agile teams are extremely motivated and self-organized so it likely to provide better results from the development projects.*

- *The agile software development method assures that quality of the development is maintained*

- *The process is completely based on incremental progress. Therefore, the client and team know exactly what is complete and what is not. This reduces risk in the development process.*

3.1.2. Scrum

- ***What is Scrum?***

Scrum is an agile development methodology used in the development of Software based on iterative and incremental processes. Scrum is an adaptable, fast, flexible, and effective agile framework that is designed to deliver value to the customer throughout the development of the project. The primary objective of Scrum is to satisfy the customer's needs through an environment of transparency in communication, collective responsibility, and continuous progress.

- ***Scrum overview***

Scrum uses an iterative, incremental approach when delivering products to optimize predictability and control risk, and is built on the theory of empiricism.

Empiricism means that knowledge comes from experience and decisions are made based on information available at the time.

Three pillars support the theory of empiricism:

- *Transparency:* Key aspects of the process must be visible to those responsible for the outcome.
- *Inspection:* Timely and frequent inspections take place to detect unwanted variances.
- *Adaptation:* Unacceptable variances trigger a change in the process to minimize further deviation.

Empiricism and its three pillars are underpinned by five Scrum values: Commitment, Courage, Focus, Openness, Respect

The idea is that working consistently with the courage to learn and adapt helps to foster a culture of continuous improvement and trust.

- **Scrum processes**
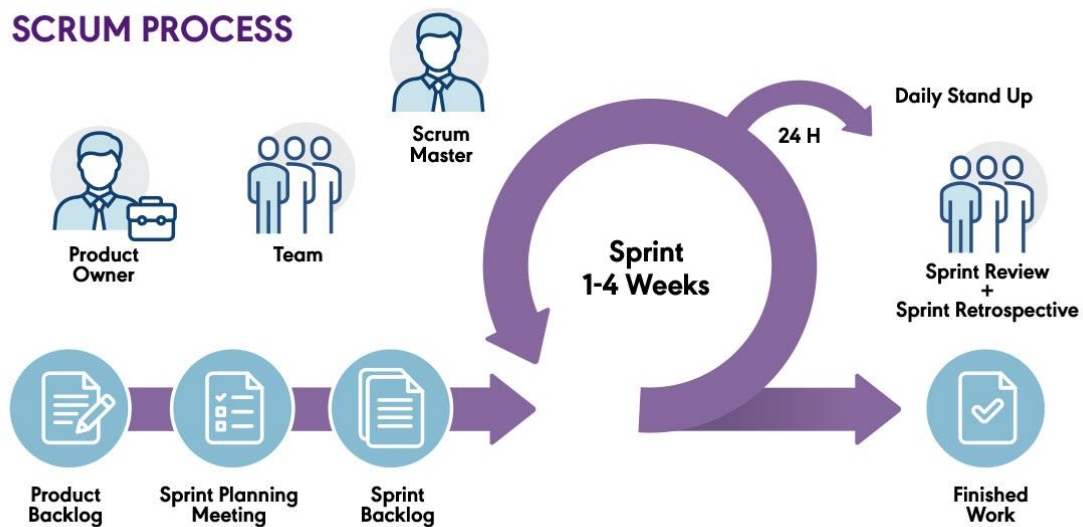
Figure 2. Scrum process

Scrum tools and techniques allow for large tasks to be broken down into manageable chunks that can be completed in a limited period (called a sprint).

The main aim is to deliver value to the customer early and continuously throughout the lifecycle of the project. To this end, those features and product

increments that provide the most value for the customer are ordered so that they are developed and delivered first.

Scrum is executed in temporary blocks that are short and periodic, called Sprints, which usually range from 2 to 4 weeks, which is the term for feedback and reflection. Each Sprint is an entity in itself, that is, it provides a complete result, a variation of the final product that must be able to be delivered to the client with the least possible effort when requested.

The process has as a starting point, a list of objectives/ requirements that make up the project plan. It is the client of the project that prioritizes these objectives considering a balance of the value and the cost thereof, that is how the iterations and consequent deliveries are determined (admin, 23/06/2021, 2021, 2022a, 2022b; Westland, 2/6/2021).

3.1.3. System development life cycle and project life cycles in our project

In this project, the systems development life cycle will run with the following stages:

1. Planning Stage
2. Feasibility study or analysis of requirements and production of requirements specifications
3. Design and Prototyping Stage
4. Software development Stage
5. System integration and testing
6. User training
7. Acceptance test
8. Implementation
9. Operation and maintenance Stage

For stages 1 and 2, all the team members will work together, then from stage 3 to stage 7 will be consecutively repeated for each standalone module in the project

until the module is completed and go through stage 8 and then to stage 9. This lifecycle is illustrated in Figure.
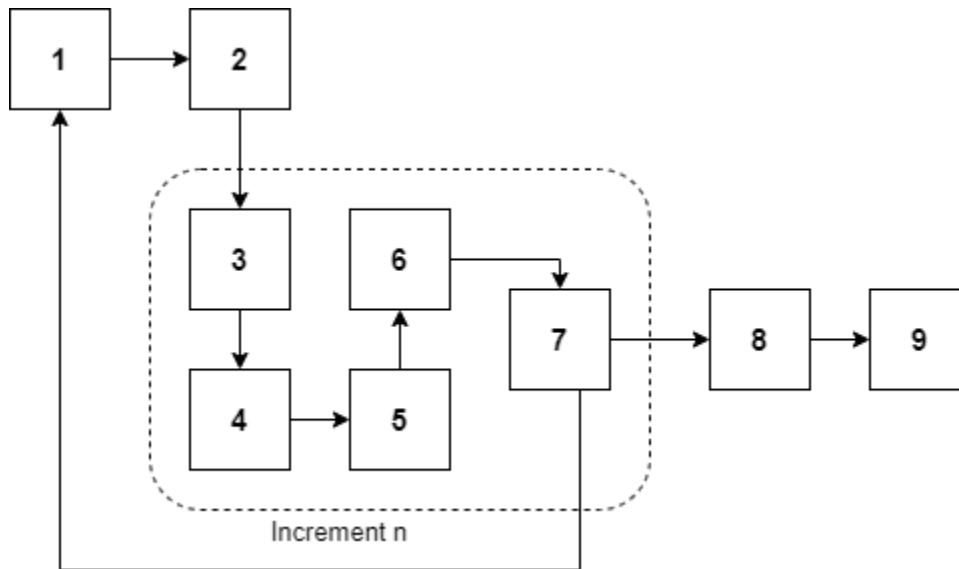
Figure 3. Increment model

3.2. List of stakeholders

Number	Role/Title	Responsibilities
1.	Customer	• Use a service/product • Providing regular communication • Give feedback • Give requirements about the project
2.	Supplier/Vendor	• Supply products • Interact in the procurement and payment processes. • Receive our purchase order • Send quotations. • Confirm purchase order • Solve the risk from the fault of the goods

3.	Competitors	• Give competitive information • Compare information from other competitors • Impact on business strategy
4.	Government	• Promulgating policies and laws on project implementation • Dealing with fraudulent acts
5.	Purchasing team	• Experience and use system BI • Give feedback • Give business requirements • Detect system failure and request repair
6.	Project manager	• Accountable for the project planning • Plan and Develop the Project Idea • Daily management of project team and activities • Monitor Project Progress and Set Deadlines • Managers resources, risks, communications, stakeholders • Build Business case, business chapter, small review presentation and prepare for next phase • Understand and approve the requirements which define the overall scope of the project • Introduction to Adventure Work Company with team • Identify business requirements of Adventure Work Company of purchasing • Identify data requirement • Build a investment appraisal calculation • Monitoring progress and track roadblocks

		• Ensure Stakeholder Satisfaction • Evaluate Project Performance • Managing documentation and reports • Conducting regular meetings • Apply Model Analysis • Define related component to project management • Previewing project results and making lesson learn • Make storytelling
7.	Project sponsor	• Provide necessary guidance and resources to the project team and manger • Defining the project; Securing an executive buy-in on the project • Providing a clear direction for the project and ensuring it links with the organization's strategic objectives • Developing the initial scope and charter • Securing the project resources viz. human capital, project funding, etc. • Ensuring the project is running on time, within budget and within scope • Providing feedback on status reports and making sure they reach key stakeholders via an appropriate communication channel • Taking diverse and often competing stakeholder

		interests and negotiating a common ground that all stakeholders agree on and collaborate to deliver • Delivering maximum possible value to the typical • Define the criteria of the project's success and get stakeholder buy-in • Maintain ongoing communication between the projects manager, team, and stakeholders • Review changes to the project environment (e.g., schedules, tasks, priorities, etc.) and manage risks as they arise.
8.	Business Analyst	• Understanding the project • Gathering the Requirements • Analyze and validate the Requirements • Re-edit base on the project requirements • Understand the Requirement • Feasibility study • Managing the stakeholders and identify the stakeholders. • Track the requirements till delivery. • Write Test Cases (Whenever needed) • Test the Application Functionality and match with the Customer requirement. • Make recommendations • Arrange multiple meetings with internal and external stake holders to understand the requirements (Brainstorming sessions and

		Walkthroughs.)
		• Ensure to deliver the requirements on time with less bugs.
		• Support to client to understand the application functionality.
		• Prepare User Manuals
		• Prepare the Documents
		• Have knowledge about purchasing process
		• Using SWOT and Porter 5 forces model to analyze the company's circumstance
		• Prepare small review presentation
		• Previewing project results and making lesson learn
9.	ETL Developer	• Analyzing the company's data needs
		• Defining the unified format for the data
		• Designing a target database
		• Creating a data flow from original sources to the target database
		• Development of ETL tools (unless ready-made solutions are used)
		• Clean, blend, format and sample data
		• Create fact and dimension table
		• Design data warehouse schema
		• Filter data in Dimension and Fact table
		• Testing and troubleshooting the system
		• Maintaining the ETL process and database

		• Previewing project results and making lesson learn
10.	Deployment Developer	• Choosing the best tools and technologies the team requires to meet the business needs
		• Create dashboard report by Power BI
		• Previewing project results and making lesson learn
		• Monitoring systems for malicious activity.
		• Managing the IT infrastructure.
		• Performing on-call service.
		• Ensuring system availability.
		• Integrating and connecting application elements
		• Test application and infrastructure
		• Translating business requirements into technical one;
		• Report curation and data modeling
		• Documenting contents in a data warehouse and meta-data storage; and creating technical documentation for BI tools.
11.	Dashboard/ Report Designer	• Create dashboard report by Power BI
		• Previewing project results and making lesson learn
		• Complete report
		• Re-edit based on the project requirements
		• Communicate results and make recommendations, make storytelling

		• Determine chart • Build Dashboard
12.	Analyst Data Scientist	• Data mining or extracting usable data from valuable data sources • Gather data from multiple sources • Conduct data research • Identify data requirements • Previewing project results and making lesson learn • Enhance data collection procedures to include all relevant information for developing analytic systems • Analyze large amounts of information to find patterns and solutions • Propose solutions and strategies to tackle business challenges • Present results in a clear manner

Table 5. List of stakeholders and responsibilities

3.3. Stakeholder engagement assessment matrix

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Customer	C		D		
Supplier/Vendor	C		D		
Competitors		C		D	
Government			C D		

Purchasing team				C D	
Project manager					C D
Project sponsor					C D
Business Analyst			C	D	
ETL Dev				C D	
Deployment Dev			C	D	
Dashboard/ Report Designer			C	D	
Analyst Data Scientist			C	D	

Table 6. Stakeholder engagement assessment matrix

Note:

C	**Current engagement**
D	**Desired engagement**

The Stakeholder Engagement Assessment Matrix is a matrix that compares the current and desired stakeholder engagement levels. This matrix can be used to classify project stakeholders into smaller groups based on classification. Stakeholder engagement and interactions will vary from project to project. The classification levels can include 5 levels:

- **Unaware**: Unaware of project and potential impacts.
- **Resistant**: Perception of the project and potential impacts and resist change.
- **Neutral**: Perception of the project; but neither resistance nor support.
- **Supportive**: Awareness of the project and potential impacts; and support change.

- **Leading**: Project awareness and potential impacts; and actively participate in ensuring the project's success.

In the Stakeholder Engagement Assessment Matrix, the level of stakeholder engagement is determined. The current engagement level is indicated by the letter "C" (short for "Current engagement level") and the desired engagement level is indicated by the letter "D" (short for "Desired engagement level") for each interested party.

This matrix analysis will make it possible to identify gaps between the desired level of participation C and actual D for stakeholders. When tracking actual stakeholder engagement, the project manager will add the current observed level of engagement ("C") to each stakeholder During planning, the matrix Shareholder participation is used to document the desired level of involvement of each relevant stakeholder. During monitoring, the actual level of shareholder participation is then compared with the initial desired level of participation. As a result, the project manager can identify and address vulnerabilities.

3.4. Work Breakdown Structure for "BI Solutions for AWC" project

In our project, all the tasks are divided into four main phases including Initiation, Planning, Execution - Monitoring, and Controlling, and the last one is the Close phase. In addition, each phase comprises some sub-tasks which defined the project tasks in detail. All tasks are attached with the duration also start date and end date to easily track performance. To discuss each phase in detail:

Phase 1- Initiation: Perform general analysis of the company's situation based on Porter's five forces model and SWOT model and related documents of Business Case and Business Charter

Phase 2 - Planning: Identify business requirements of AWC of Purchasing and define the approaching model for the project. Specially, we will have a review of the done working task to prepare for the next phase

Phase 3 - Execution - Monitoring & Controlling: there are two sub-tasks in this phase which are technical tasks comprising Designing Data Warehouse and Visualization & Preparation.

Phase 4 - Close: This stage summarizes all that has been done and completed product served for report writing and storytelling
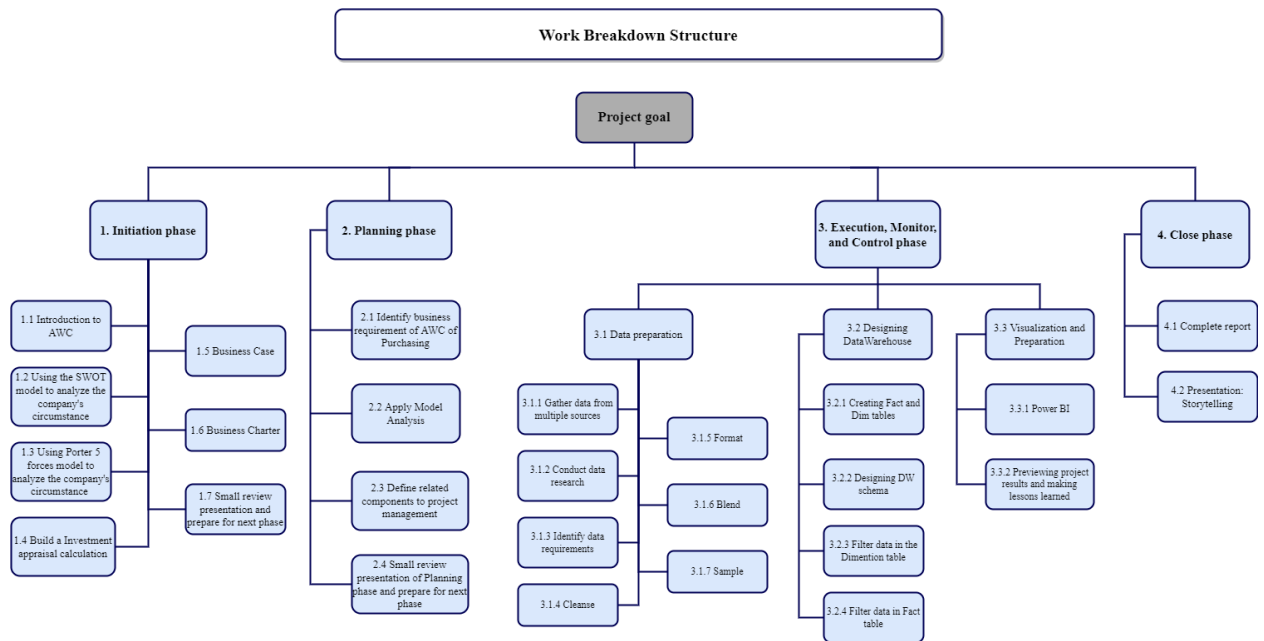
Figure 4. Work breakdown structure

3.5 Product breakdown structure for "BI Solutions for AWC" project

In recent years another approach to project planning has emerged based upon the idea of considering the products that will result from the project. This approach underpins the PRINCE2® project management method. There are several advantages claimed for the product breakdown structure (PBS). A Product Breakdown Structure (PBS) is a hierarchical structure of things that the project will make or outcomes that it will deliver. It can be thought of as the project "shopping list.". It helps ensure the project focus and targets what we need to do when facing struggles. The formal PBS comes in the form of a hierarchy. It begins with the final product at the top of the hierarchy followed by the sub-categorized elements of the product. Here is the PBS of Adventure Works Cycle project:
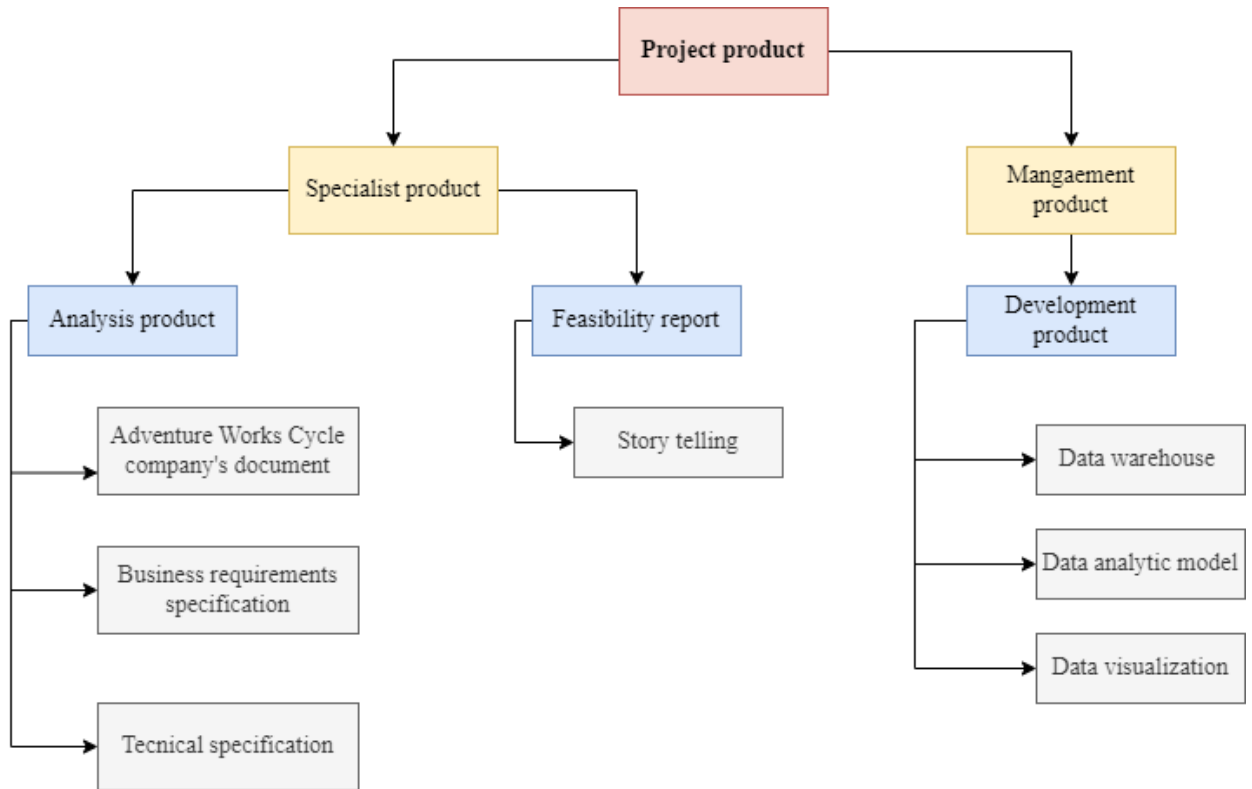
Figure 5. Product breakdown structure

The PBS includes 2 main kinds of products:

- *Management products are those products associated with the planning and control of the project. Management products also include the quality products which are associated with the definition and control of quality and include the product descriptions, quality review reports, and project issue reports.*

- *Specialist products are those things that the project has been set up to create.*

CHAPTER 4: PROJECT PLANNING – DETAILED MODEL ANALYSIS

4.1. PERT analysis

PERT Analysis informs Program Managers and project personnel on the project's tasks and the estimated amount of time required to complete each task. By utilizing this information a Program Manager will be able to estimate the minimum amount of time required to complete the entire project. This helps in the creation of more realistic schedules and cost estimates. Below is the process of the team using pert to analyze the project of smooth
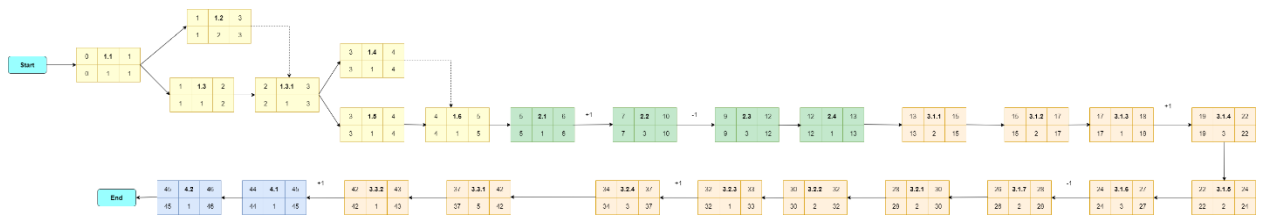
Figure 6. Pert Model

➢ **Step 1: Determine optimistic, pessimistic, and most likely estimates (unit: day)**

Task	Task Name	Optimistic(O)	Most Likely (M)	Pessimistic (P)
1.1	Introduction to Adventure Work Company	1	1	2
1.2	Using the SWOT model to analyze the company's circumstance	1	2	3
1.3	Using Porter 5 forces model to analyze the company's circumstance	1	1	2

1.3.1	Build an investment appraisal calculation	1	1	2
1.4	Business Case	1	1	2
1.5	Business Charter	1	1	2
1.6	Small review presentation and prepare for the next phase	1	1	2
2.1	Identify business requirements of AWC of Purchasing	1	1	2
2.2	Apply Model Analysis	2	3	4
2.3	Define related components to project management	2	3	4
2.4	Small review presentation of Planning phase and prepare for next phase	1	1	2
3.1.1	Gather data from multiple sources	1	2	3
3.1.2	Conduct data research	1	2	3
3.1.3	Identify data requirements	1	1	2
3.1.4	Cleanse	2	3	4
3.1.5	Format	1	2	3
3.1.6	Blend	2	3	4
3.1.7	Sample	1	2	3
3.2.1	Creating Fact and Dimension tables	1	2	3
3.2.2	Designing DW schema	1	2	3
3.2.3	Filter data in the Dimension table	1	1	2

3.2.4	Filter data in the Fact table	2	3	4
3.3.1	Power BI	4	5	6
3.3.2	Previewing project results and making lessons learn	1	1	2
4.1	Complete report	1	1	2
4.2	Presentation: Storytelling	1	1	2
Completion time		**34**	**47**	**73**

Table 7. Pert time

- **Step 2: Calculate PERT Estimate**

After completing Step 1, use the (optimistic, pessimistic, and most likely) estimates in the formula below to calculate the PERT estimate for the project.

Formula: $(P+4M+O)/6 = (34+47*4+73)/6 = 50$ (days)

- **Step 3: Determining the Critical Path**

Definition Critical Path: The longest path of scheduled activities that must be met to execute a project.

Figure 7. Critical Path

As we can see in the Pert model, the critical path is identified as the red arrow line which helps the manager have a better understanding of the realities of their schedules. It takes an experienced program manager to truly utilize the benefits a PERT analysis can provide a project team.

➢ **Conclusion:**

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Particularly, 47-day is the basic time in which we can complete a project. However, the project will take up to 49-50 days to complete the project due to 2 days of project delay

In general, all the tasks listed in the task sheet are the tasks that need to be completed before doing the next task. In order to complete the project on schedule, all tasks must be done on time to ensure there is no delay in the project.

4.2. GANTT analysis

4.2.1. Resource sheet

The Resource Sheet is a view within Project that allows the user to view, create, and edit resources and resource information. Three types of resources are available in Project:

- Work resources are resources or pieces of equipment that perform work to accomplish a task

- Material resources that are project consumables, such as paint

- Cost resources, such as travel expenses

Regarding personnel, our team consists of 4 members, and 1 team leader is divided into project tasks. Due to the relatively small staff, some people will have to take on more than one role. Because the process is rushed, we have to set the Maximum Units column to 100%. For materials, Microsoft Office, Server hardware, SQL Server, and Microsoft Project Professional are the source of the tools needed for a general IT project and a Data Analytics project in the specification. Ordering costs are used for our needs in things like training costs, and extra costs. In particular, software licenses are the most expensive because they are necessary for the legality of use.

Employees will work 8 hours a day, overtime and holiday pay of positions will be 1.5 times higher based on the original salary.

ID	Resource Name	Type	Material Label	Initials	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Base Calendar	Notes
1	Server hardware	Material	each	S		$150,000		$0	Prorated		
2	BA	Work		B	100%	$18/hr	$27/hr	$0	Prorated	Standard	Hien Mai
3	ETL Dev1	Work		E1	100%	$19/hr	$28/hr	$0	Prorated	Standard	Tan Thanh
4	Deployment Dev	Work		D	100%	$20/hr	$30/hr	$0	Prorated	Standard	Duyen Nguyen
5	Microsoft Officer	Material	each	M		$684		$0	Prorated		
6	SQL Server	Material	each	S		$13,748		$0	Prorated		
7	Microsoft Project Professional	Material	each	MP		$20		$0	Prorated		
8	Training costs	Cost		T					Prorated		
9	Extra costs	Cost		Ex					Prorated		
10	Project Manager	Work		P	100%	$65/hr	$93/hr	$0	Prorated	Standard	Nguyen Pham
11	ETL Dev2	Work		E2	100%	$10/hr	$15/hr	$0	Prorated	Standard	Duyen Nguyen
12	Analyst Data Scientist	Work		DA	100%	$28/hr	$32/hr	$0	Prorated	Standard	My Nguyen
13	Dashboard/Report Designer	Work		Des	100%	$16/hr	$24/hr	$0	Prorated	Standard	My Nguyen

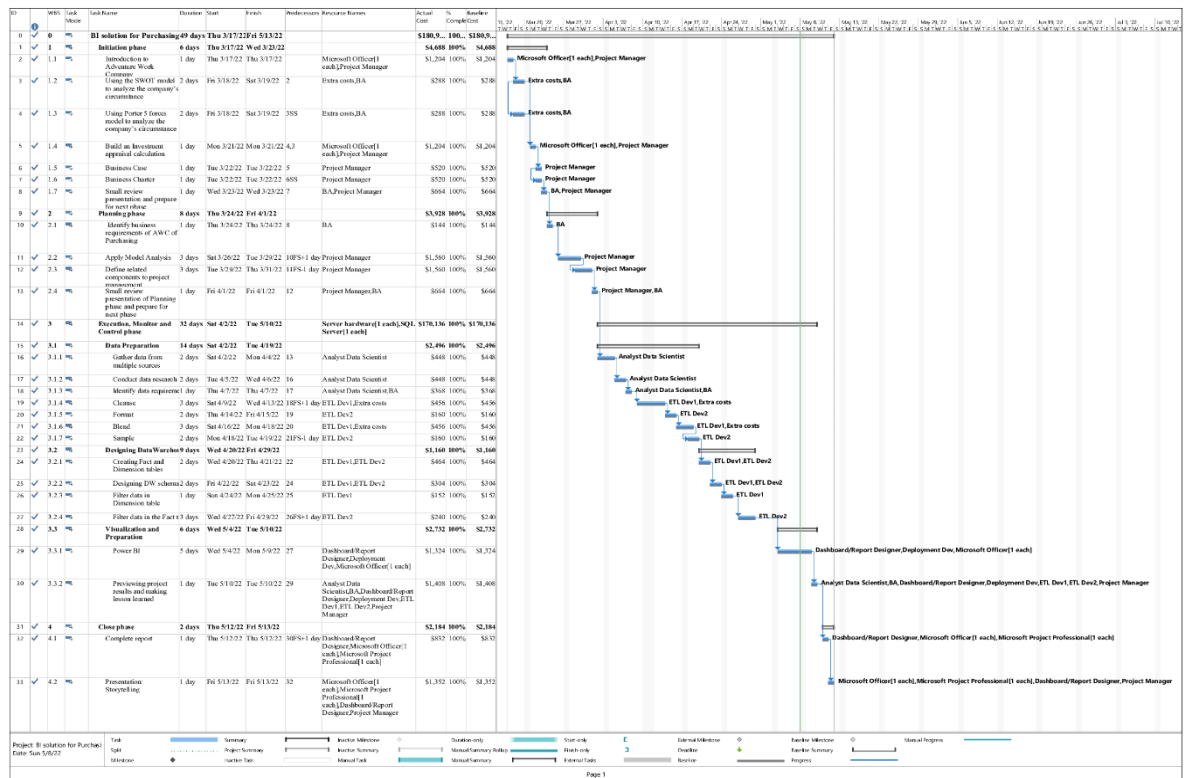Figure 8. Resource sheet

4.2.2. Gannt Chart

Figure 9. Gantt chart

4.3. RACI matrix

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Activity / Deliverable	Project Sponsor	Project Manager	Business Analyst	Analyst Data Scientist	Deployment Developer	ETL Developer	Dashboard/ Report Designer	Customer - Adventure Work Company	Purchasing Team of AWC	Competitors	Government	Supplier/Vendor
	PMO							External Resource				
Project Management												
Appoint PM and support project	A	R										
Project Planning and Kick-Off	C	A/R						C				
Weekly Status Report	I	A/R										
Phase 1: Initiation phase												
Introduction to Adventure Work Company		A/R						C				
Using the SWOT model to analyze the company's circumstance			R	C				C				
Using Porter 5 forces model to analyze the company's circumstance			R	C				C				
Build an Investment appraisal calculation	A	R										
Business Case	A	R										
Business Charter	A	R										
Small review presentation and prepare for the next phase	I	A/R	R	I								
Phase 2: Planning												
Identify business requirements of AWC of Purchasing		A	R									
Apply Model Analysis	C	A/R										
Define related components to project management	C	A/R										
Small review presentation of Planning phase and prepare for next phase	I	R	R	I								
Phase 3: Execution, Monitor, and Control phase												
Data Preparation												
Gather data from multiple sources				R								
Conduct data research				R								
Identify data requirements			R	R								
Cleanse				C		R						
Format				C		R						
Blend				C		R						
Sample				C		R						
Designing DataWarehouse												
Creating Fact and Dimension tables						R						
Designing DW schema						R						
Filter data in the Dimension table						R						
Filter data in the Fact table						R						
Visualization and Preparation												
Power BI					R		R					
Previewing project results and making lessons learned	C	R						C				
Phase 4: Closing												
Complete report							R					
Presentation: Storytelling	I	R	I				R	I				

R - Responsible
A - Accountable
C - Consulted
I - Informed

Figure 10. RACI Matrix

The RACI model provides an organization with insight into employee workload as it helps to see which work is assigned to whom. This way, the organization can see if someone has too much to do or can take on additional tasks.

The RACI model helps reduce miscommunication and increase productivity. In addition, the RACI model also shows who is responsible and ultimately responsible if the incident occurs. And especially, this model saves everyone's time.

Using RACI Matrix helps managers know:

– List of project tasks

– Identify the people involved in the project

– Know who is primarily responsible and responsible for each task, along with team members

– Appoint at least one person responsible for each task (R)

– Have one (and only one) responsible party (A) assigned to each task to enable clear decision-making.

– There can be multiple C and I roles in the matrix, so make sure there is an easy and light way to notify them as meeting after each phase of the project. This ensures that the participants understand their role as well as the work in the project.

– Helps control and avoid the problem that any team member is overloaded with too many responsibilities.

4.3. Cost estimation and analysis

Cost analysis is the process of comparing the actual costs of implementing a project with the initial estimated costs before implementation. This analysis will help the Project Manager better evaluate the profit that the project brings. If the appraisal cost is greater than the project implementation cost, the project is assessed as a profit. And vice versa, if

the estimated cost is less than the project implementation cost, the project is evaluated as a loss

Name	Remaining Cost	Actual Cost	Cost	ACWP	BCWP	BCWS
Initiation phase	$0	$4.688	$4.688	$4.688	$4.688	$4.688
Planning phase	$0	$3.928	$3.928	$3.928	$3.928	$3.928
Execution, Monitor and Control phase	$0	$170.136	$170.136	$4.715	$158.229	$158.229
Close phase	$0	$2.184	$2.184	$0	$0	$0
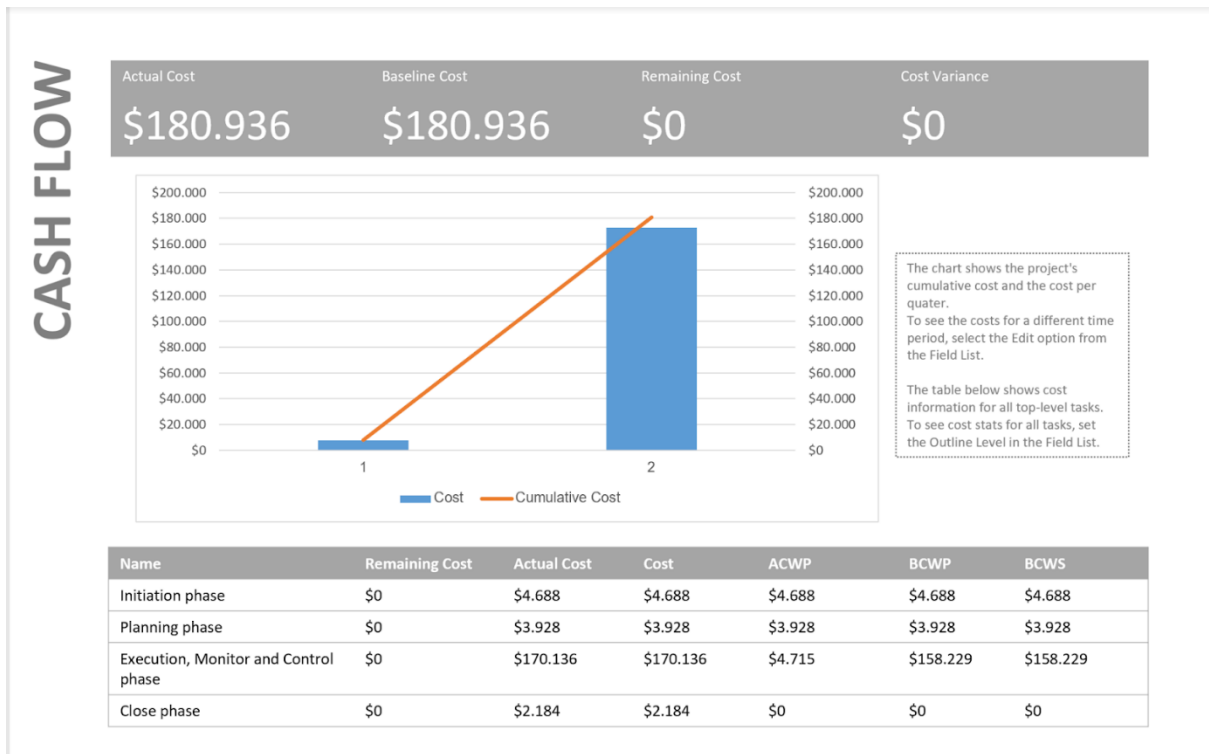
Figure 11. Cash flow chart

The cost of the project was $180,936, much lower than the original estimate of $245,221. It can be clearly seen that the cost in phase 3 is the highest because of the investment in software used. However, hardware and software costs did not differ much from expectations.

Salaries for employees in various positions were much lower than originally expected because they didn't need to spend 2 months full-time dealing with all the work, but only had a few days in it.

This is a good sign that the profit margin will be less because the expenses are less.

CHAPTER 5: PROJECT QUALITY MANAGEMENT

5.1. Quality planning

5.1.1. Risk register

ID	Title	Description	Category	Prob.	Impact	Risk Rank	Effects	Owner	Response
1	The ambiguity of the request	Ineffective communication with customers makes requirements definition unclear.	Requirement	2	3	6	The construction and implementation of the project is not effective	BA	Make some hypothetical cases to give customers reference, then follow the available samples.
2	Resistance to change	Through the implementation process, there will be many points of change that may make them unable to adapt in time or feel like a waste of time.	Planning and resource	2	2	4	Non-cooperative user	PM	Develop and adhere to a comprehensive change management plan. Effective and ongoing communication of the reasons underlying the change and the benefits is critical
3	Scope creep	The internal disagreement of the partner company causes the project	Requirement	2	1	2	Change of cost and time	PM	Monitoring the project's status and baseline scope Determining

#	Risk	Description	Category				Impact	Owner	Mitigation
		requirements to increase and be inconsistent.							the cause and degree of the changes found
									Deciding on change requests whether corrective or preventive action is needed.
4	Budget creep	PM's inexperience in cost planning can cause costs to exceed the project budget.	Commercial	3	1	3	Change of scope and time	PM	Estimate each factor affecting the project.
									Find out the costs that are certain to happen and plan them carefully.
									Regularly check budget and schedule
5	Stretched resources	Team members have the ability to cause delays in a task due to personal reasons such as health (due to the COVID-19 situation), etc. resulting in the delay of related tasks.	Planning and resource	1	2	2	Schedules that take longer than expected can result in additional costs and scope changes	PM	Schedule carefully.
									Track and measure progress

| 6 | Developers lack key skills | Existing developers are not familiar with the tools used to service the project. | Planning and resource | 3 | 2 | 6 | Failure to complete assigned tasks | Project Sponsor | Spend a part of the cost to train personnel right from the start, create a separate training program for the project |

*Table 8. **Risk register***

- *Note:*

#001: The ambiguity of the request occurs when ineffective communication by the project team with the client results in leading to a lack of clarity of requirements. This will affect the structure and direction of the project. However, the likelihood of this risk's impact is not high because they are often detected as soon as the project is deployed. Project managers use an analytical approach to identify projects to reduce ambiguity.

#002: Resistance to change is an unwillingness to adapt to new circumstances. It can happen with individuals, relationships, or within organizations. There are many reasons for resistance, but at its heart, resistance is rooted in fear of the unknown. The project can change the business service at several points. However, this is unlikely to be supported by users because of the anti-change mentality. Users just need to understand the profit of the project, and using BI tools will make their work easier and more productive. The solution is to communicate the benefits of the project and help users develop and adhere to a management plan for effective change. The level of impact of this risk is moderate because besides the interest in changing users are bound by the company's regulations to cooperate with the project team.

#003, #004: Scope creep is what happens when changes are made to the project scope without any control procedure like change requests. And the budget creep is defined to go over budget within the scope of a project. Due to the influence of the project triangle (Cost, scope, time), the change of one element will affect the other two factors. Consequently, the variation of these factors is typical during project implementation. Although popular, it is undeniable that the influence of these factors on the project is huge. Therefore, the proposed solution is to regularly check and determine the change of factors for timely adjustment.

#006: The professional qualifications of the people involved in the project are also a potential risk factor. Existing human resources are likely to be inadequate compared to project requirements, which can lead to tasks not being completed properly or work performance is not high. The proposed solution is to calculate the training costs to ensure the quality of the output work.

The Probability and Impact column from qualitative risk analysis will support the risk rank calculated by multiplying risk impact by risk probability and then rank it based on the numeric to identify the top prioritized risk or the most critical risk needed to be solved. In conclusion, the consideration of the priority of handling risks could help the project run efficiently and achieve better performance.

5.1.1.1 The ambiguity of the request

The ambiguity of the request (ID: 1) occurs when ineffective communication by the project team with the client results in leading to a lack of clarity of requirements. This will affect the structure and direction of the project. However, the likelihood of this risk's impact is not high because they are often detected as soon as the project is deployed. Project managers use an analytical approach to identify projects to reduce ambiguity.

5.1.1.2 Resistance to change

Resistance to change (ID: 2) is an unwillingness to adapt to new circumstances. It can happen with individuals, relationships, or within organizations. There are many reasons for resistance, but at its heart, resistance is rooted in fear of the unknown. The project can change the business service at several points. However, this is unlikely to be supported by users because of the anti-change mentality. Users just need to understand the profit of the project and using BI tools will make their work easier and more productive. The solution is to communicate the benefits of the project and help users develop and adhere to a management plan for effective change. The level of impact of this risk is moderate because besides the interest in changing users are bound by the company's regulations to cooperate with the project team.

5.1.1.3 Scope creep and budget creep

Scope creep (ID: 3) is what happens when changes are made to the project scope without any control procedure like change requests. And the budget creep (ID: 4) is defined to go over budget within the scope of a project. Due to the influence of the project triangle (Cost, scope, time), the change of one element will affect the other two factors. Consequently, the variation of these factors is typical during project implementation. Although popular, it is undeniable that the influence of these factors on the project is huge. Therefore, the proposed solution is to regularly check and determine the change of factors for timely adjustment.

5.1.1.4 Stretched resources

Stretched resources (ID: 5) mean resources that are stretched too thin, too thin to the point that there are almost no more. A project will be carried out by many participants and has a follow-up nature. Therefore, stretched resources of risk are also a common risk when implementing a project. This can be a guide to changing the history, which affects the duration and scope of the project. So, when

determining the Project Manager schedule to consider, expect holdbacks that could affect progress, measure progress, and track progress.

5.1.1.5 Developers lack key skills

The professional qualifications of the people (ID: 6) involved in the project are also a potential risk factor. Existing human resources are likely to be inadequate compared to project requirements, which can lead to tasks not being completed properly or work performance is not high. The proposed solution is to calculate the training costs to ensure the quality of the output work.

→ The Probability and Impact column from qualitative risk analysis will support the risk rank calculated by multiplying risk impact by risk probability and then rank it based on the numeric to identify the top prioritized risk or the most critical risk needed to be solved. In conclusion, the consideration of the priority of handling risks could help the project run efficiently and achieve better performance.

5.2. Project monitor

5.2.1. Project milestone

A project milestone is a management tool that is used to delineate a point in a project schedule. These points can note the start and finish of a project, and mark the completion of a major phase of work. Milestones can be used to symbolize anything that has started or finished, though it's primarily used as a scheduling tool.

If a milestone focuses on major progress points in a project, you can see how it is useful in scheduling. Just as tasks break a larger project into manageable parts, milestones break off project phases to help project managers plan, schedule and execute them.
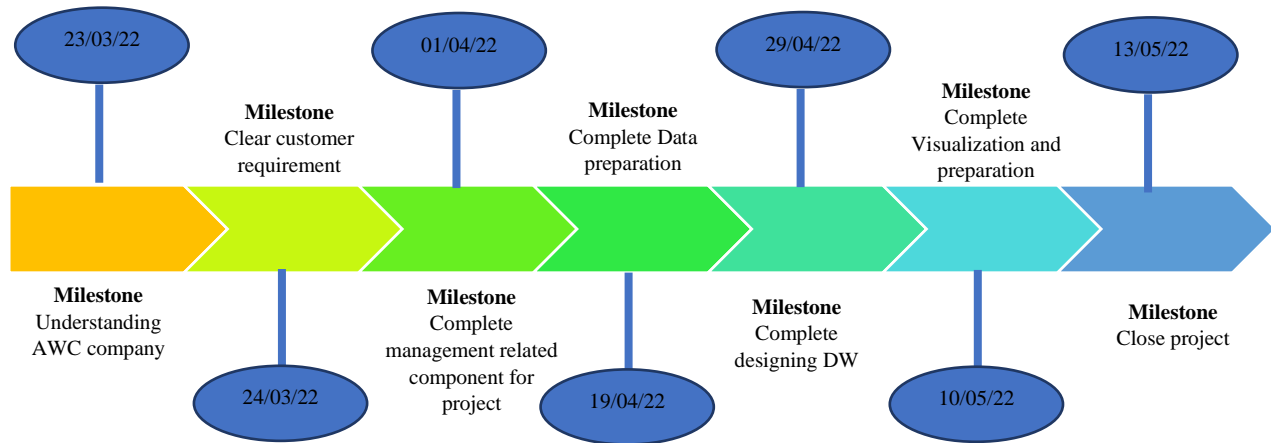
Figure 12. Project milestone

5.2.2 Project diary

ID	Start Date	End Date	Description	Work progress	Arising problem	Plan for next stage
1	17/03/22	23/03/22	In this time, we did some analysis on the company AWC and estimated the cost of the project.	100%	Lack of experience in cost estimation prediction	In addition, to plan the project, we should conduct close to the market price to estimate the project
2	24/03/22	01/04/22	On the first day, we proceed to take the customer's requirements in detail. Then, PM uses the supporting tools to make a detailed	100%	The collected requirements did not meet the needs of the project, the BA had to take more information, so the work delayed	The PM needs to adjust the schedule, deploy, and monitor the work to ensure the quality and time of the

			plan for the project.		for one day. Some points in the schedule are not reasonable.	project.
3	02/04/22	07/04/22	The data collection went smoothly. However, determining the required data is longer than expected.	100%	None	Consider that the data is up to the expected standard.
4	09/04/22	19/04/22	The tasks go on schedule.	100%	None	Make sure the data and DW will meet customer requirements.
5	20/04/22	23/04/22	Designing the Data Warehouse is facilitated by experienced ETL developers.	100%	None	In addition, to pouring data, it is necessary to constantly consider whether the DW meets the requirements set forth.
6	24/04/22	29/04/22	Illogical design of Data warehouse	95%	At step dumping data in the Dimension had some bugs so it had delayed for one day.	Re-transmit the data that needs to be visualized for the members to take on the next task.
7	04/05/22	10/05/22	Project results are given from data visualization to meet customer requirements. The	100%	None	Build scenarios to best communicate project results to stakeholders.

			project team also learned many lessons from the project.						

Table 9. Project Dairy

5.3. Quality Control

5.3.1. Quality control report

ID	Evaluation date	Assessor	Title	Author	Quality issue	Status	Rate	Actions/Planning	Customer feedback
1	22/03/2022	PM	Understanding AWC company	PM, BA	None	Better-than-expected	100%	None	Satisfied
2	24/03/2022	Analyst Team Leader	Requirement analyst	BA	The requirement collected did not meet the needs of the project.	Lower-than-expected	90%	BA proceeds to get more detailed requirements from customers.	Dissatisfied
3	31/03/2022	All team leader	Apply model analysis	PM	The plans laid out appear to have some inconsistencies.	Lower-than-expected	95%	The PM adjusts the plan based on the comments of the project team members.	Not include
4	07/04/2022	Analyst Team Leader	Gather and identify data requirement	Analyst Data Scientist, BA	None	As expected	100%	None	Not include
5	19/04/2022	ETL Team Leader	Cleanse, format, blend, sample data	ETL Dev1, ETL Dev2	ETL dev has a lot of experience, so the task was completed earlier than expected.	Better-than-expected	100%	None	Not include
6	29/04/2022	ETL Team Leader	Design and filter DW	ETL Dev1, ETL Dev2	None	Better-than-expected	100%	None	Not include
7	09/05/2022	PM	Visualization data	Dashboard/Report Designer, Deployment Dev	None	As expected	100%	None	Satisfied
8	10/05/2022	PM	Preview project result	Team project	BA has COVID-19 so	Lower-than-	95%	PM proceeded to replace BA's	Not include

			and make lesson learned		she did not participate in the preview project.	expected		review	
9	12/05/2022	PM	Final report	Dashboard/ Report Designer	None	As expected	100 %	None	Satisfied

Table 10. Quality control report

5.3.2. Change request form

Implementing BI solutions for AWC - [Change Request NN]	
Date:	*31/03/2022*
Change No:	*000001*
Description:	*Staff reduction*
Reason:	*Some of the project team's workforce is cut because of unnecessary.*
Scope Impact:	*The scope of the project is not affected because it is a change due to an omission in the planning phase*
Timelines Impact:	*Timelines are not affected too much because members can take on many roles in the project. However, there is a possibility of delay as the team members' tasks will increase.*
Budget Impact:	*The cost of the project is significantly reduced.*
Other Impact:	*The project team has few members, so the connection between members will be better.*
Change Requested By:	*Project Manager - Nguyen Pham*

Approver:	*Project Sponsor - 01/04/2022*

*Table 11. **Change request form***

CHAPTER 6: PROJECT EVALUATION AND CONCLUSION

6.1. Closing Meeting agenda

6.2. Project evaluation

Quality control involves checking, measuring, and testing to verify that the project output meets the acceptance criteria defined during the quality planning process. It will also focus on preventing issues from being passed on to internal or external customers.

After the implementation of the project, in general, the quality of the project has been evaluated in many different aspects. BI solutions are created as a measure of the company's results so that it is easy to see the aggregated reporting data from the company's activities so that they can be ready to respond and handle the problems in a timely manner. backlog and arising problems as well as making decisions and solutions in a way appropriate to the company's situation. Currently, the BI solution has been meeting the project's output standards.

The quality of deliverables is checked throughout the project management process to correct the deliverables if the set standards are not met.

All team members have participated seriously and responsibly in the work they undertake. All project resources have been optimally utilized during project implementation.

6.2.1 Resource Overview
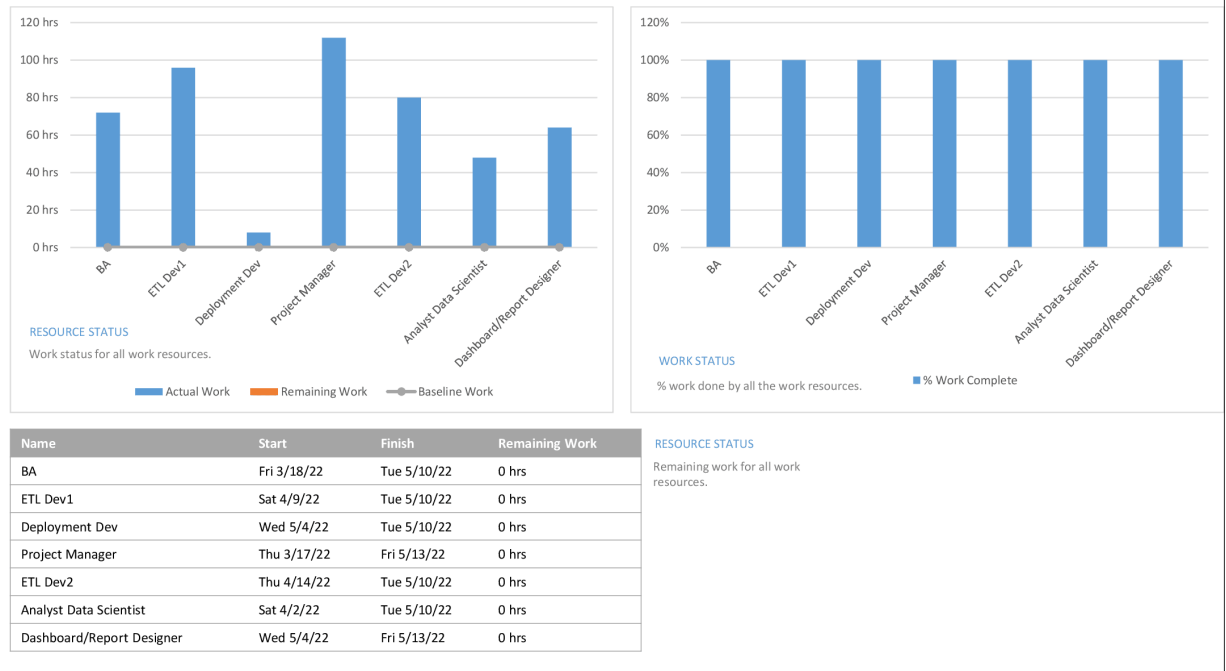
Figure 13. Resource Overview

The chart shows the project's resources, showing the start date, end date as well as the working time of each resource.

Key resources in the project include: Project Manager, Business Analyst, Analyst Data Scientist, Deployment Developer, ETL Developer, Dashboard Report Designer

In the resource overview report, you can view the total work by resource so that the manager can see if the resource meets the requirements from the customer.

In the Resource status chart, the Project Manager position has the highest total working hours due to the massive participation in every phase of the project

In conclusion, up to now, the project team has completed all the initial tasks set out in the project. In the resource overview's work status chart, you can see that all departments in the team are performing well and on schedule.

6.2.2   Resource cost Overview

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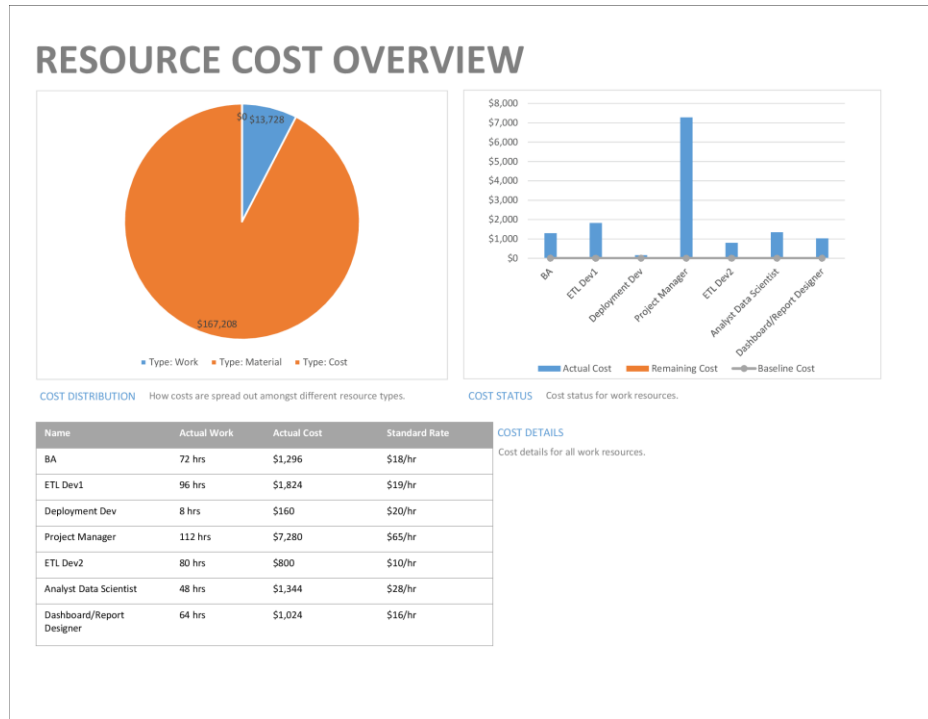
Figure 14. Resource Cost Overview

In the Resource cost overview report, it can be seen that the number of resources of the Work type costs the least, the Work type belongs to human resources, so compared to the total cost of the project, the cost of work accounts for only 1 small portion, accounting for about 13,728 USD. The remaining costs related to software, hardware, BI tools, training costs as well as other incurred costs account for 167,208 USD.

The biggest resource cost is Project Manager, accounting for about a half of the project's resource type of work cost.

6.2.3. Earned value Overview

Figure 15. ***Earned value Overview***

- Actual Cost of Work Performed (ACWP): $13,331

- Budgeted Cost of Work Performed (BCWP): $166,845

- The earned value report shows ACWP is lower than BCWP then it means our project is still not over budget, we are controlling cost well.

- The BCWS line is still the highest line, our project is behind schedule even though the SV line is still negative.

- Deviation between estimated and actual costs of completed work: In the early and middle stages CV is smaller than 0, which means that costs were spent more than planned, however in In the final stage, CV returns to 0 and stays fixed until the end of the project, showing that many problems have arisen but cost control is being done very well in the final stages.

- The ratio of planned funds for completed works to actual costs greater than 2 indicates that the project is not overspended, all sources of costs paid are reasonable and under control. rigid.

- The efficiency ratio of the SPI project cost estimates < 1, indicating that the project was in fact 2 days behind the original schedule. However, the project is still going smoothly and everything is under control.

6.3. Conclusion - Lessons learned

ID	Name	Summary	Description	Impact	Recommendation
1	New technology used	Success	Project teams learn to use new technologies in their projects. Comparing and contrasting existing technologies helps the selected technologies to be really suitable for the	Developer Team	The support of new technologies brings more convenience to the project. However, the developer team needs to be able to adapt quickly. It is necessary to consider the challenges and risks more carefully before deciding to adopt any technology.

			project.		
2	Team member's work spirit	Success	The spirit and attitude of team members are highly appreciated. They have a spirit of cooperation, not afraid to explore and learn. They know how to listen and change but still have their own opinions.	Work environment	Team spirit and attitude have a significant influence on work performance. Therefore, it is necessary to focus on creating an effective working environment to bring good results to the project.
3	Lack of skills	Problem	The experience of some members cannot meet the job requirements. The project is unique, so when exposed and implemented, the existing skills are hard to meet the needs of some tasks.	Task completion level	Learn clearly about the skills of project team members as well as the skills needed to perform the tasks. The lack of skills during project implementation is acceptable. However, early identification of the required skills enables the project team to plan timely and appropriate skill additions.
4	Project cost estimation inaccuracy	Problem	During the implementation of the project, some additional costs are not included in the estimated costs that the project offers.	Cost	The project team needs to more carefully about the costs incurred: which may be due to internal or external factors to devise a cost table closer to the actual cost table.
5	The delay of some tasks	Problem	The team project has a member infected with COVID-19 so the work delayed for one days.	Project Schedule	The epidemic situation is inevitable, so it is important to quickly redesign the schedule, create conditions for members to work from home effectively, without causing too much hindrance to the project.
6	Risk management	Success	Creating a risk log for the project may not help project avoid risks. However, it can help reduce the impact of risks on the project, helping to provide timely and effective solutions.	Project	The risk log has partly predicted the risks arising during the project implementation. However, several other risks have not been considered. Therefore, it can be affirmed that making a detailed and careful risk log will made a positive impact on the

					project.
7	Lack of experience	Problem	Project team members have not had the opportunity to carry out similar projects leading to a lack of experience. Some problems arise due to the bewilderment of the project team.	Project	The manager needs to follow the project team closely to review the work progress, enabling the project team to present the issues that occur throughout. Ensure assigned tasks are completed as expected.
8	Lack of requirement information	Problem	The project team is having trouble getting customer requirements. They want the project to produce results, but the detailed requirements given do not provide enough information to implement the project.	Requirement analysis	The team needs to clearly define the necessary information about the project. Proactive spirit to be able to get full information and conduct detailed analysis instead of waiting for requests from customers

Table 12. Lessons learned

Lessons learned from the project's success help the project team continue to research and promote. Lessons learned from failures help the project team gain more experience to avoid encountering similar problems in the future as well as experience in adapting and solving problems that arise. Through the lessons learned, the group realized the importance of detailed and thorough planning and risk management. At the same time, keeping the spirit and professional working environment is also extremely important

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