Ochils' Ski Company

A Project Management Report

By

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Executive Summary

The Ochil Hills has been recognized as a possible spot for downhill skiing and assisted cross-country skiing across the tops. Most notably, the region is close to several central Scottish cities, making the Ochils' Ski Centre a lucrative economic endeavor due to its convenient location. Two proposals have been put forward by the Ochils' Ski Company (OSC) to determine the best option that will ensure profitability. The company would like to set up Access Roads, Ski lifts, Office/Shop, and Restaurants at different locations. The company is acting on advice from professionals such as the Managing Director, Finance Director, Marketing Manager, Company Solicitor, Architect, Construction Manager, Health & Safety Officer, and Human Resource Director. A sagacious analysis was required for this Ochil Hills project to examine the two OSC project alternatives by researching inter and intra aspects of the evaluation and advise the company on the optimal way to proceed to complement their undertaken studies and this report covers the appraisal of the key results and recommendations. Taking extracts from the reports of the internal key professionals of the Ochils' Ski Company, this report will fixate on **Project Schedule and Financial Analysis** with conclusions, findings, and suggestions narrowing it down for a clear interpretation for the management team. **MS Project and MS Excel tools** have been adopted to construe and edifice the problem, i.e., to formulate a project network and schedule, break down and then concatenate the sub-schedules in a succession pattern, and orchestrate financial complex calculations & analysis, synthesize the verdicts, and cultivate recommendations. Engrossing and harnessing the **Project Network Analysis** concept and deploying its frameworks will capacitate to differentiate between the possible choices while taking into consideration the **Resource Constraints**. Factors like **NPV, IRR, Profit, ROI, Payback Period, and Discounted Cash Flow** would accredit towards accountability and would succor in enduring the pecuniary gauging aspects of the Financial Model. **Sensitivity Analysis and Historical Statistics** would apportion the scheduling of obligatory resources and economic incentives for the execution of this project and would be the prime determiner apropos of activity durations, costs, and Financial Viability of the company. It is germane to divulge and acknowledge preeminent limitations when perorating about a project to choose the best option that benefits OSC, wherefore promising durable project fruition. To mitigate the ambiguities or lack of data, reasonable assumptions have been made. Interpreting the uncertainty in demand, and its aftermaths on the recommendations have been embedded in respective sections of the report and it is bolstered by two MS Project files and an Excel file to oblige an assessment of the syllogism, rationale, and figures.

The timeline for Option 1 has been determined to take approximately **475 days (1 year and 11 months)** from 07 June 2022 to 01 May 2024 costing **£24,012,003.20** generating a profit of **£11,987,996.80**. The Schedule of Option 2 has been determined to take approximately **570 days (2 years and 3 months)** from 07 June 2022 to 11 September 2024 costing **£58,821,001.60** generating a profit of **£25,178,998.40**. Option 2 will take 95 days longer to complete due to the additional ski lifts, access roads, restaurants, and other significant factors. Option 1 is preferable since it provides a better ROI for the same payback time. Appendices containing detailed analysis, tables, graphs, and figures have been provided for reference.

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1. Brief Overview and Assumptions

1.1 Introduction

This Project Management report is intended for Ochils' Ski Company and its top-level executives, and it includes an assessment of the Project Scheduling and Financial Analysis of the feasible preferences to open Ochils' Ski Centre. The purview of this report encapsulates forging a Network Diagram and Gantt Chart in MS Project which entails structuring and postulating the multitudinous activities involved in successive and parallel order, the interconnectivity between them, Resource Sheet, and Cost sheet outlining the latitude of the presented solution in terms of time frame, start and end dates, costs, resources employed, and their efficiency. The Excel File which enwrapped the demonstration of the proposed recommendation covers the analogous Direct, Indirect, Fixed, and Operating costs to accomplish the project and resulting Income, Profits, ROIs, NPV, and IRR to demonstrate the aptness of the proposed project.

Three planning parameters namely **Sales per year, Average income per skier-day,** and **Operating fixed cost per year** were spotted to set up the Financial Model, which can be varied to evaluate output variables that will justify the chosen option with the unfolding of the project plan. The statistics, numerical values, and acumens were congregated from the **Ochils' Sky Centre 2022 Case Study.** This report also engrosses the susceptibility investigation and monetary plausibility that require careful consideration by the company and the paramount restraints associated with this work. A detailed apprehension of the case study has been provided in *Appendix A*.

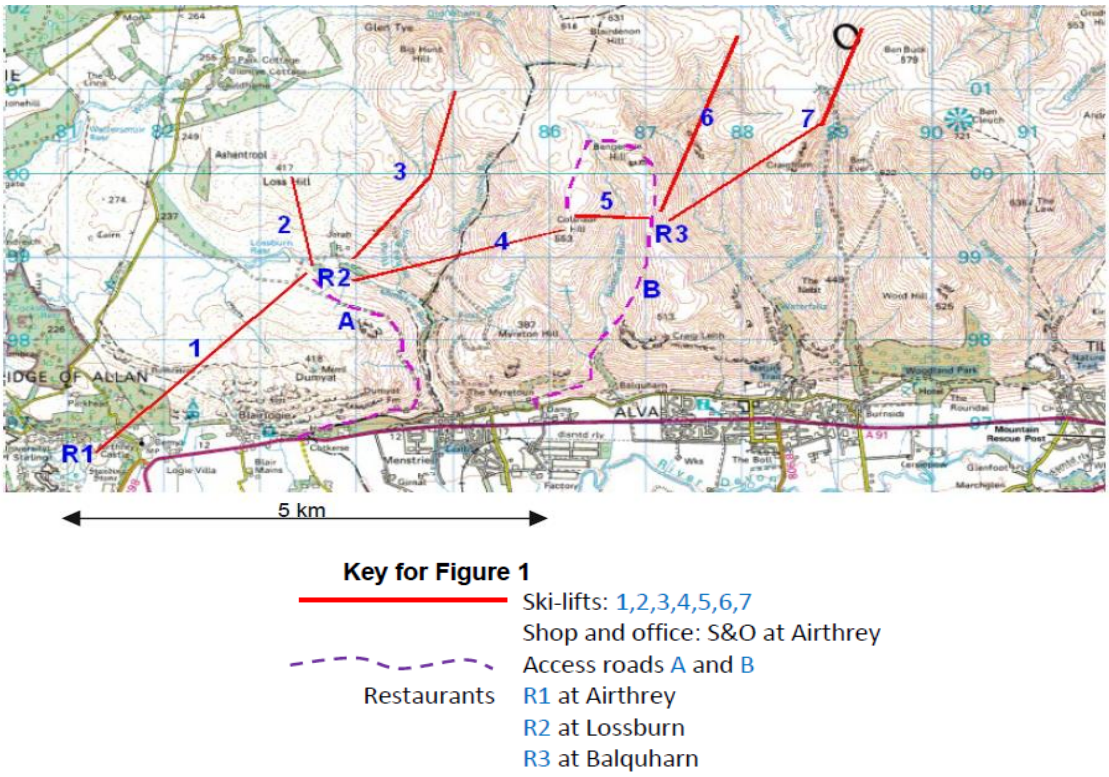

Figure 1: The Proposed OCS Development Plan

(Source: Ochil Ski Centre 2022)

1.2 Key Assumptions

Expectations for the project milestones, deliverables, and expenses, among other things, are formed based on the following assumptions:

(a) Based on the case study and the dataset provided, the scaling is used assuming that 1 square=1km which corresponds to 1.9 cm of the ruler, and the same has been used to measure the length of the Ski lift paths proportionally.
(b) The estimated costs and durations of each building activity as summarized in Table 5 of the case study have been used to calculate the per hour cost of the teams for foundations, structures, and fittings for the Resource Sheet.
(c) The Overheads cost has been calculated from the date of start of construction of Access Roads to the date of finish of the last Restaurant/Office fittings activity.
(d) The working days are assumed from Monday to Friday every week. The non-working days include Saturday and Sunday each week and Christmas holidays (Christmas Holidays 2022: 22 Dec 2022 – 05 Jan 2023 and Christmas Holidays 2023: 22 Dec 2023 – 05 Jan 2024). Working hours are assumed to be 8 hours each working day.
(e) When 2 teams are working simultaneously on the same activity (Foundations, Structures, or Fittings), the efficiency is 200%, changing the amount of work but keeping the duration the same.

2. Schedule Analysis

2.1 Project Network Analysis

Using Network Diagram as a system of planning projects where individual tasks or activities are split down into schedules and placed in a logical order illustrating the jobs to be completed concurrently and the ones to be completed sequentially, this project has been executed in MS Project. A network diagram was created, which visually depicts the relationship between all the actions involved and the associated costs. This analysis has aided in project design, planning, control, and decision-making to complete the project in the shortest period possible with the restricted resources available making the goals of lowering total time, cost, idle resources, interruptions, and conflicts achievable.

The company plans to submit the proposal on 7th June 2022 and start working on the project two months later. There will be 3 Ski lifts in Option 1, an Office/Shop, Airthrey restaurant and Access Road A whereas 7 Ski lifts in Option 2, an Office/Shop, three restaurants (Airthrey, Lossburn and Balquharn) and Access Roads A & B.

In the mountains, ski roads are necessary, and beginning work on ski lifts necessitates a proper access road to transfer materials to the lift top. One of the proposed options is to gain access to Road A, where three ski lifts, an office, and a restaurant will be established, and there are two contractors available whose cost and length differ but who are both capable of constructing this type of terrain. MacAllan can complete road A in 30 weeks for £500000 and road B in 32 weeks for £1000000). uCan, a different company can accomplish the same in less time but at a greater cost for Road A, which cost £800,000 (20 weeks), and road B, which cost £1,300,000, 926) weeks to build.

Marketing managers must determine the number of skier days for both options. For reference, Cairngorm Mountain's skier-days values are used, which averaged 104550 from 2014 to 2019. Option 2 will be enticing since, with an annual total of 80000 skier days, the business can make almost £70 per skier as compared to Option 1 with 40000 skier days (£60 per skier).

2.1.1 Option 1 using MacAllan Constructor

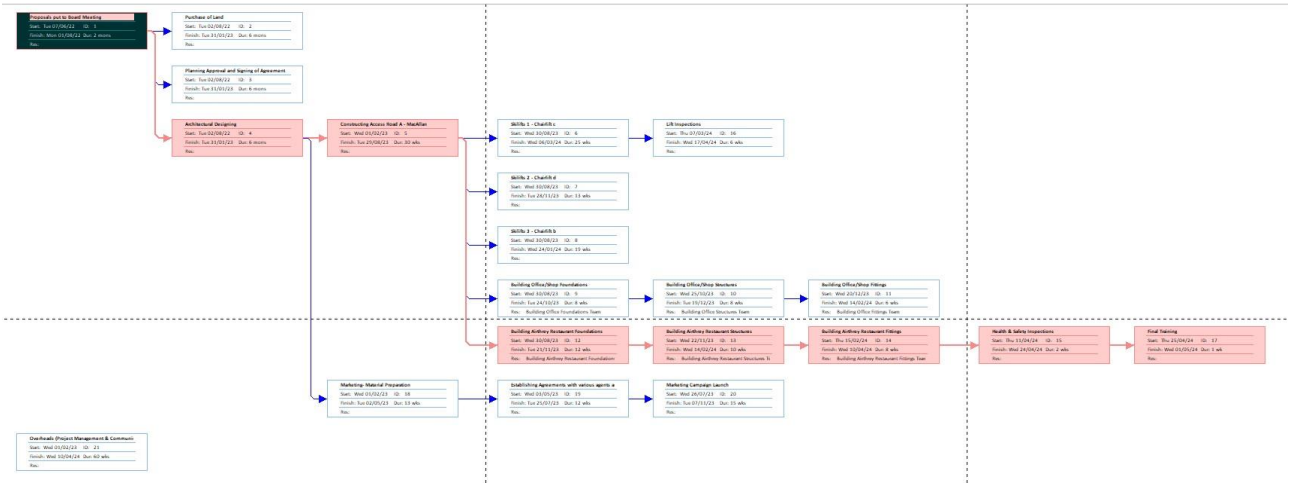

Figure 2: Project Network Diagram-Option 1

(Source: Self-created in MS Project)

The schedule for Option 1 has been determined to take about 475 days (1 year and 11 months) {07 June 2022-01 May 2024} with the Resources (Teams) working for 2960 hours in total for constructing the Office and Airthrey Restaurant. A detailed Network Analysis of Option 1 has been placed at *Appendix B*.

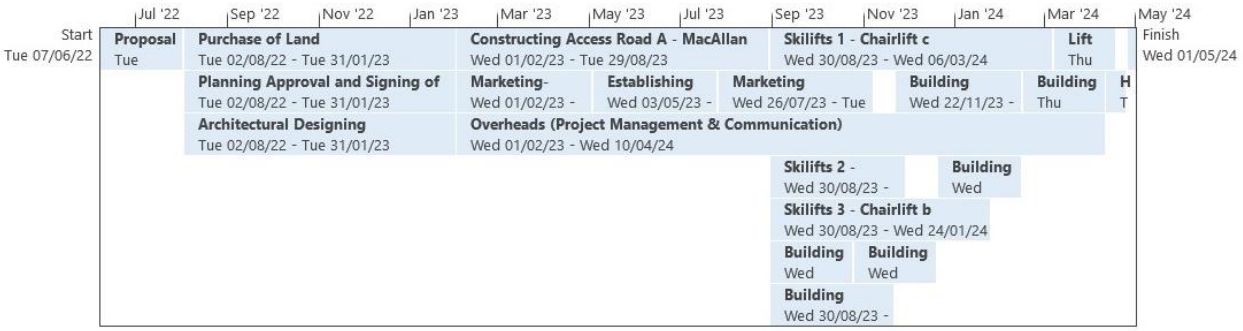

Figure 3: Project Timeline-Option 1

(Source: Self-created in MS Project)

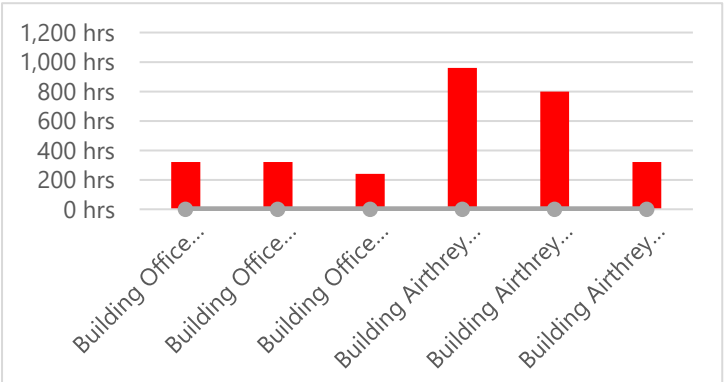

Figure 5: Work in Hours allocated to various Resources

(Source: Self-created in MS Project)

The figure 4 shows the distribution of work to various Resources (Teams) in Option 1 to undertake the construction of Office and Airthrey Restaurant (Foundations, Structures and Fittings). Six teams were used to undertake these activities.

2.1.2 Option 2 using MacAllan Constructor

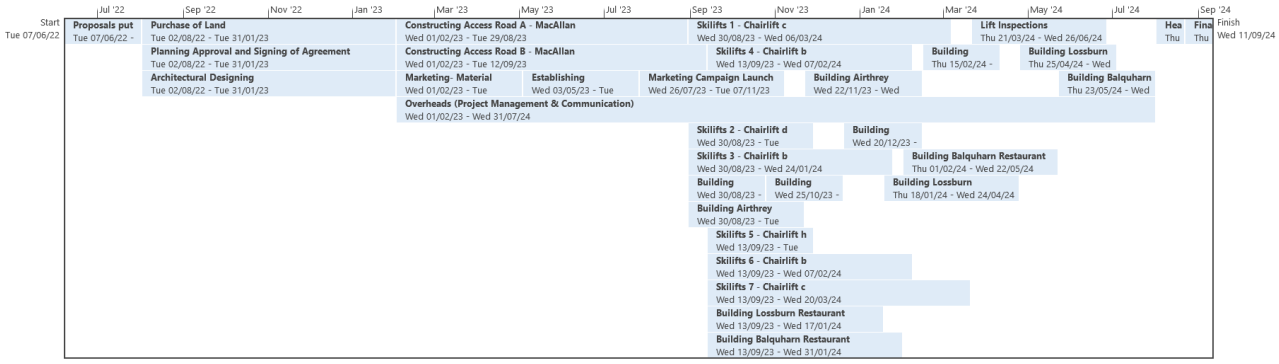

Figure 5: Project Timeline-Option 2

(Source: Self-created in MS Project)

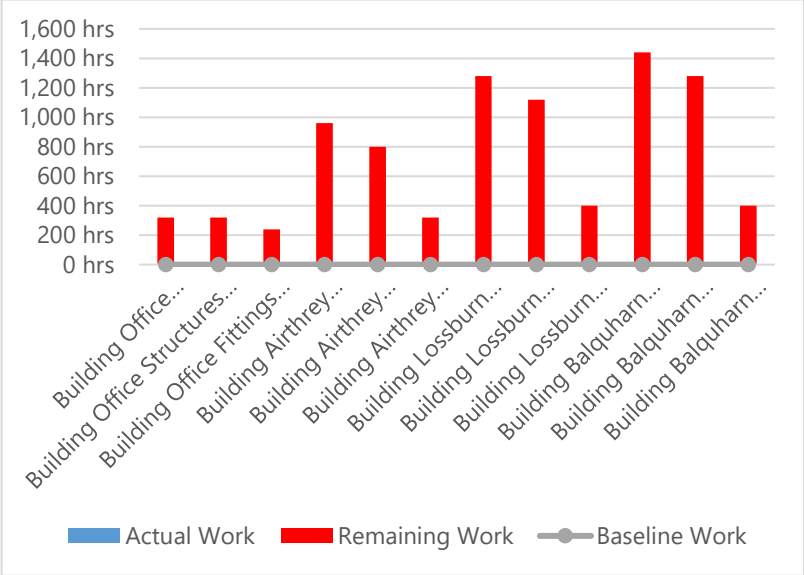

Figure 6: Work in Hours allocated to various Resources of Option 2

(Source: Self-created in MS Project)

The schedule for Option 2 has been determined to take about 570 days (2 years and 3 months) {07 June 2022-11 September 2024} with the teams working for 8880 hours in total for constructing the Office, Airthrey, Lossburn, and Balquharn Restaurants. Option 2 will take 95 days more to execute since it consists of additional Ski lifts, Access Road, Restaurants, and other larger factors. Figure 7 shows the distribution of work to various Resources (Teams) to undertake the construction of Office and 3 Restaurants (Airthrey, Lossburn and Balquharn). 12 teams were used to undertake these activities.

2.2 Resource Constraints

The limitations and/or risks related to project resources that affect the project directly or indirectly are referred to as Resource Constraints. Since “Teams” are the only resource for this project, there may be constraints corresponding to them such as the Resources (Teams) will not be available to work during the Christmas Holidays for the years 2022 (22nd December 2022-5th January 2023) and 2023 (22nd December 2023-5th January 2024) as implemented while creating Project Schedules resulting in a delay of the project for two weeks. Additionally, if other external factors hamper the work, the same can add to more delay. As a result, controlling resource limits in a project is inextricably linked to cost, availability, and access.

3. Financial Appraisal

3.1 Financial Modeling

The prospective advantages of completing the project are weighed against the estimated expenses in a financial analysis of this proposal. The scale of the project and the time duration over which the expenses and benefits will be divided will determine the appraisal. The reasoning is that the return will at the very least be more than the initial investment. To assess the net benefit, this return/payback is examined in a variety of ways.

Payback Analysis considers the cash flow of expenditures and benefits in which the revenue generated with the initial investment is calculated. The **Payback Period** is the exact time it takes for a company/client to see a positive return on their initial investment, as determined by cash flows. However, the analysis only considers costs within the payback period and overlooks a product's complete life-cycle costs.

Discounted Cash Flow is a technique for calculating the 'time value' of a cash flow. Cash flows in this project have been discounted to their present value at future periods in time to establish whether this plan is worth investing in. More specifically, the project cost is compared to the profits derived from the project's exploitation.

$$PV = \frac{FV}{(1+k)^n}$$

PV is the Present Value

FV_t is the Future Value of a cash inflow or outflow in t years hence

k is the discount rate

The **Net Present Value (NPV)** must be greater or equal to zero at a specified discount rate and the time in the future as a minimum condition for investing in a project. NPV analysis is a process where, “the factor of value change of money is nullified with the help of discounted factor”, this analysis process helps to understand, whether a project can earn profit or not from an investment option.

$$NPV = \sum_{t=1}^{n} \left[\frac{FV_t}{(1+k)^t}\right] - II$$

FV_t is the future value of the cash inflows in ‘t’ years hence

k is the discount rate

II is the initial investment

Internal Rate of Return (IRR) determines the time value of money's basic return requirement. To determine the project's internal rate of return the discount rate for which the net present value (NPV) is zero is determined.

3.2 Comparison of Financial Models - Option 1 and Option 2

3.2.1 Option 1 using MacAllan Constructor

While creating the Financial Model for 17 years (2022-2038), **three Planning Parameters** were considered-

(a) Sales per Year (40000)
(b) Average Income per skier-day (£60)
(c) Operating fixed Cost per year (£900000)

Marketing Costs, Company Soliciting Costs, Architectural Design & Construction Costs, Inspection Costs, Training, and Overheads Costs contribute towards the Total Investment. Al these costs have been broken down and presented in an Excel file for calculations.

Total Investment - **£10512003.20**.

Operating Fixed Costs - **£13500000** (**£0.9M per year** since the start of the Ochil Ski Center).

Total Costs - **£24012003.20.**

Income - **£36000000** (**£2400000 per year** since the start of the Ochil Ski Center**)**

Profit - **£11987996.80**

ROI - **1.16%**

At **10.39%** Discount Rate we get **0.00 NPV**.

IRR - **10%**.

Payback Period - **9 years**.

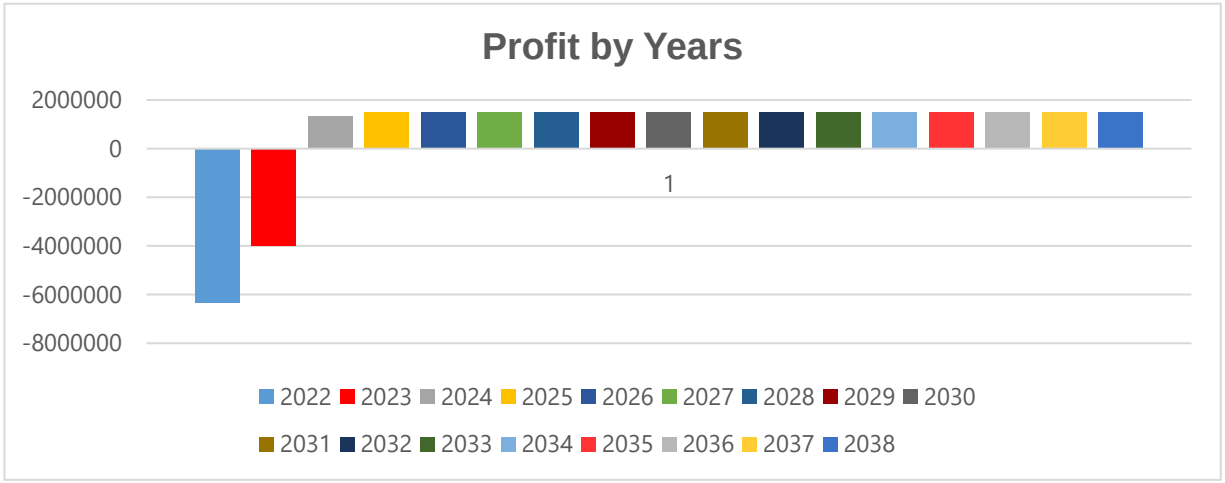

Figure 7: Profit over years-Option 1

(Source: Self-created in MS Excel)

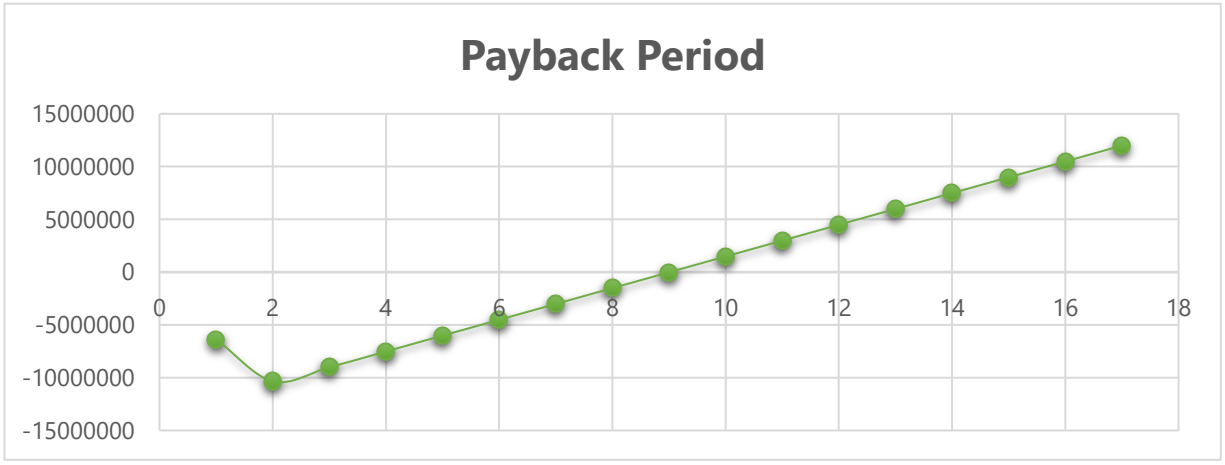

Figure 8: Payback Period (Showing Cumulative Profit)-Option 1

(Source: Self-created in MS Excel)

3.2.2 Option 2 using MacAllan Constructor

While creating the Financial Model for 17 years (2022-2038), three Planning Parameters were considered-

(a) Sales per Year (80000)
(b) Average Income per skier-day (£70)
(c) Operating fixed Cost per year (£2400000)

Marketing Costs, Company Soliciting Costs, Architectural Design & Construction Costs, Inspection Costs, Training, and Overheads Costs contribute towards the Total Investment. Al these costs have been broken down and presented in an Excel file for calculations.

The total Investment - **£22821001.60**.

Operating Fixed Costs - **£36000000** (**£2.4M per year** since the start of the Ochil Ski Center).

Total Costs - **£58821001.60.**

Income - **£84000000** (**£5600000 per year** since the start of the Ochil Ski Center**)**

Profit - **£25178998.40**

ROI - **1.17%**

At **10.241%** Discount Rate**,** we get **0.00 NPV**.

IRR - **10%**.

Payback Period - **9 years**.

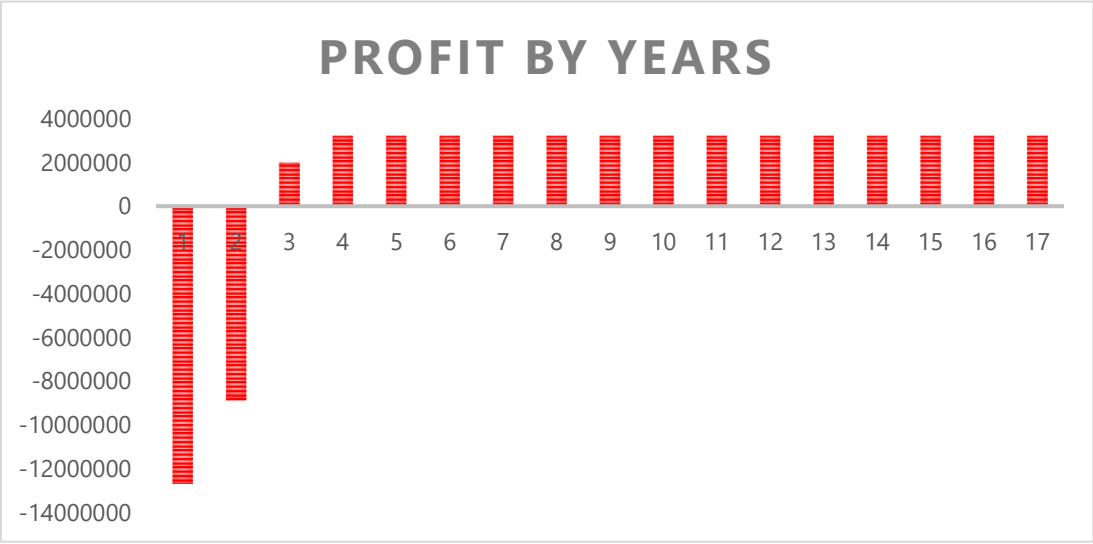

Figure 9: Profit over years-Option 2

(Source: Self-created in MS Excel)

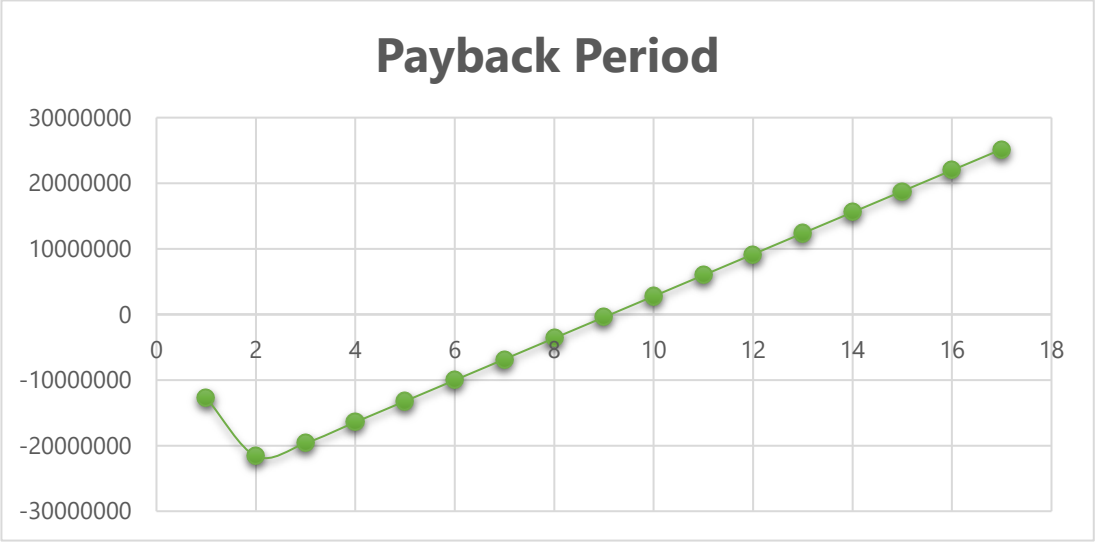

Figure 10: Payback Period (Showing Cumulative Profit)-Option 2

(Source: Self-created in MS Excel)

A comparison of different figures has been conducted. The below table (Table 1) shows the results. The total cost of Option 1 -MacAllan is **£24,012,003.20** while the Total Cost of Option 2-MacAllan is **£58,821,001.60**. This figure is more than double the first option which will be done in less than 2 years. The cumulative profit derived from the second option is seen to double the amount of what is generated from the first option. There are calculations of different years in the Excel file showing estimates of expected skier days with the expected ski-lift tour price to be charged for each person. The estimated profits show an improvement in profits as the first year generates negative profit while the next years have positive budgets. This is mainly attributed to the total cost of the investment being included in the profit calculation.

Table 1: Comparison of Option 1 and Option 2

(Source: Self-created in MS Excel)

	Option 1 - MacAllan	Option 2 - MacAllan	Option 1 - uCan	Option 2 - uCan
Total Costs	£24,012,003.2	£58,821,001.6	£24,212,003.2	£59,331,001.6
Income	£36,000,000	£84,000,000	£36,000,000	£84,000,000
Profit	£11,987,996.8	£25,178,998.4	£11,787,996.8	£24,668,998.4
ROI	1.16%	1.17%	1.12%	1.08%
Payback Time	9 Years	9 Years	9 Years	9 Years

4. Sensitivity Analysis & Use of Historical Data

4.1 Sensitivity Analysis (Option 1 – MacAllan)

Project sensitivity is a holistic assessment of the likelihood of a project's success based on data-driven forecasting. Sensitivity analysis is used as a strategy for modeling risk in the given analysis. The quantitative risk evaluation has been performed to see how changes in each model variable affect the model's output.

The factors that influence the net present value (NPV) or internal rate of return (IRR) of this project are **Sales per Year, Average Income per skier-day, and Operating fixed Cost per year** and these could vary after the project is up and running. The model then determined how the NPV is affected by each of these to see which one makes the most effect. This is a what-if analysis which has been well illustrated by the analysis done in the Excel charts where the cost of operation, as well as the revenue from the Ski Centre for different years, has been calculated.

4.1.1 Varying the Planning Parameter "Sales per Year"

By **Increasing the Sales per Year:-**

(a) Sales per Year (50000)
(b) Average Income per skier-day (£60)
(c) Operating fixed Cost per year (£900000)

Income - **£45000000** (**£3000000 per year** since the start of the Ochil Ski Center**)**

Profit - **£20987996.80**

ROI - **2.03%**

IRR - **16%**.

Payback Period - **7 years**

Figure 11: Payback Period (Showing Cumulative Profit)-Increasing Sales per Year to 50000

(Source: Self-created in MS Excel)

4.1.2 Varying the Planning Parameter "Average Income per skier-day"

By **Increasing the Average Income per skier-day:-**

(a) Sales per Year (40000)
(b) Average Income per skier-day (£70)
(c) Operating fixed Cost per year (£900000)

Income - **£42000000** (**£2800000 per year** since the start of the Ochil Ski Center**)**

Profit - **£17987996.80**

ROI - **1.74%**

IRR - **14%**.

Payback Period - **7 years**.

4.1.3 Varying the Planning Parameter "Operating fixed Cost per year"

By **Increasing the Operating Fixed Cost per Year:-**

(a) Sales per Year (40000)
(b) Average Income per skier-day (£60)
(c) Operating fixed Cost per year (£1000000)

Income - **£36000000** (**£2400000 per year** since the start of the Ochil Ski Center**)**

Profit - **£10487996.80**

ROI - **1.01%**

IRR - **9%**.

Payback Period - **9 years**.

4.1.4 Varying all three Planning Parameters together

(a) Sales per Year (55000)
(b) Average Income per skier-day (£70)
(c) Operating fixed Cost per year (£1000000)

Income - **£57750000** (**£3850000 per year** since the start of the Ochil Ski Center**)**

Profit - **£32237996.80**

ROI - **3.12%**

IRR - **23%**.

Payback Period - **5 years**.

Figure 12: Payback Period (Showing Cumulative Profit)-Varying al 3 Planning Parameters

(Source: Self-created in MS Excel)

The same steps can be repeated for Option 2- MacAllan to see the changes.

4.2 Use of Historical Data

Accuracy estimations have been created using historical data on projects' initial anticipated completion dates and total costs, as well as realized or actual expenditures and durations. These estimations are then used to predict and define targets for Financial Modeling and Scheduling.

The relevant historical data provided in the form of an individual dataset was used as inputs and decision support for planning Ski lift paths and estimating the sales and revenue via a Financial Model. It also provided an elaborate way of comparing both the operating cost, capital investment as well as income and profit margins.

5. Additional Ideas

There were a few major limitations to the study. The first was that the distance of each ski lift was not indicated. Therefore, estimates were used in the calculation of the required chair lifts. The total cost should also have included the wages paid to the workers plus the cost of machinery and materials to be used in the construction. However, this can be assumed that it was included in the initial cost estimation by the construction manager.

The restaurants can be a potential revenue generator and should have been included in the dataset so that it can aid in the calculation of profits and revenue margins. The inclusion of restaurants in the calculations can assist to estimate how much profit the whole center is making so that its revenue does not only rely only on the ski lifts.

Technical constraints are the processes required to complete construction operations, and they are typically dependent on the practicality of building methods and regulations. Before excavating a foundation, for example, the ground must be levelled, and then formwork and reinforcing must be put in place before concrete can be poured. Because each task must be completed before going on to the next, each one acts as a constraint on the next. Building tolerances, sufficient area for builders to work, suitable storage or handling spaces, site access routes, service coordination, and so on are

all examples of technical restrictions. Specific shift patterns, overtime needs, resource distribution between projects, safety regulations, working practices, and environmental and social policies were among the few management restraints.

If additional time and data were available, then a more specific statement about the project's scope could have been possible highlighting a more detailed breakdown of the jobs and resulting in creating an explicit task list for each job bundle. The project's repercussions and total time required for each task could have been determined more accurately and precisely. More diverse resources could have been identified which could have led to an exceptional project management timeline.

6. Conclusions & Recommendations

In a nutshell, the approach acclimated to developing the Project Network/Schedule and Financial Model has the potential to expand the realm of operations of Ochils' Ski Company. All analysis and estimates have highlighted a key issue which shows that even though the second option is costly, it has the potential to generate almost double the revenue generated by the first option. It can only be anticipated that the revenue of both options will continue to rise year after year if the annual average skier days remain the same or are above the average estimated number. Even though the project is costly, more revenue should be set aside to take care of repairs and upgrades to the system in the future. In so doing, the project will continue to attract more tourists rather than decrease the number of teams who visit the area. The issue of workers should also be focused on as they determine when deadlines are met early. The more workers the more efficiency is included. Worker's wages are an important part to consider as it has not been included. The Human Resource Director can include the worker's wages as the total money invested needs to be inclusive of such numbers. More teams need to be added to work on different subprojects to ensure that deadlines are met earlier. It is recommended that the first option is far more achievable. The first option shows a steady increase in revenue generation in the coming years and has the potential to be improved in Option 2. The future improvement will no doubt increase the tourist numbers in the area, therefore, generating income. The second option is not achievable at the moment as it is initially costly to construct and run. It will take more years to earn good steady revenue and profit.

7. Appendices

Appendix A – Apprehension of the Case Study (OSC)

The development plan of the Ochil Hills has two options (Table 2). Option 1 requires three chair lifts, an office, and one restaurant constructed with one access road, while option 2 requires seven chair lifts, an office, and three restaurants at Airthrey, Lossburn, and Balquharn with two access roads. Several important points and assumptions can be derived from the feedback given by different experts.

The proposals are to be put to a board meeting on 7 June 2022 and work could begin two months later if the board approves the plan. This project is expected to provide an IRR of no less than 10%. The Operating Costs for Option 1 and Option 2 are estimated to be £0.9M per annum and £2.4M per annum respectively.

Table 2: The Two Options for the Proposed Project

(Source: Ochils' Ski Center Case Study)

Option	Lifts	Restaurants	Access Roads
1	1, 2, 3	Airthrey	A
2	1, 2, 3, 4, 5, 6, 7	Airthrey, Lossburn, Balquharn	A, B

The average expected income from Option 1 is £60 per skier-day with 40000 skier-days over a skiing season (1 December – 1 April), and from Option 2 is £70 per skier with 80000 skier-days per year, assuming average winter conditions, however, this varies extremely. Data from the Cairngorm Mountain Ski Centre has been used to estimate demand: the average is 104550 skier days (Table 3).

Table 3: Skier Days at Cairngorm Mountain Ski Centre

(Source: Ochils' Ski Center Case Study)

Year	Skier-days
2014/15	145007
2015/16	121420
2016/17	66463
2017/18	112430
2018/19	77430
mean	104550

The time and cost required for material preparation, establishing agreements, and launching a marketing campaign are (13 weeks; £70000), (12 weeks; £20000), and (15 weeks; £200000) respectively. The purchase of land and the planning approval both can be done simultaneously and would each take about 6 months from the start of the project. The planning approval will cost £100000 for Option 1 and £200000 for Option 2. Construction cannot take place until these two activities are done, despite the architectural design can start with the approval of the plan by the board. Land can only be leased until April 2038 costing £6M and £12M for Option 1 and Option 2 respectively. The architect design work should take six months, but Option 2 would require additional personnel costing £500000 as compared to Option 1 costing £250000. Only when the Health and Safety inspections are finished can the final training with the fully operational ski center take place. Option 1 will take one week (cost £20000) while Option 2 will take three weeks (cost £40000). Access roads must be constructed before the office, ski lifts, or restaurant(s).

Table 4: Contractors for Access Road Constructions with costs

(Source: Ochils' Ski Center Case Study)

Work	Contractor	Cost (£'000)	Time (weeks)
Access road A	MacAllan	500	30
Access road B	MacAllan	1000	32
Access road A	uCan	800	20
Access road B	uCan	1300	26

The individual dataset was provided for building ski lifts and pistes and the same has been mentioned in Table 5.

Table 5: Individual Dataset containing Chairlift Data

(Source: Individual Dataset)

Chairlift	lengths (km)	durations (weeks)	costs (£)
chairlift a	1.3	15	630000
chairlift b	2.2	19	708000
chairlift c	3	25	838000
chairlift d	1.2	13	576000
chairlift e	0.5	11	523000
chairlift f	2.4	20	686000
chairlift g	4.2	28	923000
chairlift h	0.8	11	555000

Office/ Ski Shop and restaurants can be constructed in three stages: foundations, erecting the structure, and fitting-out and can be done by different teams (Table 6). For Option 1, two teams will suffice, however, Option 2 requires three teams. Although the total amount of work would be the same, there are fixed costs associated with recruiting and managing each team, so each additional team would cost around £50000.

Table 6: Constructing Office/Shop and Restaurant(s)

(Source: Ochils' Ski Center Case Study)

	Foundations			**Structure**			**Fittings**		
	Duration (weeks)	Teams required	Cost £'000	Duration weeks	Teams required	Cost £'000	Duration weeks	Teams required	Cost £'000
Office/ shop	8	1	50	8	1	100	6	1	30
Airthrey restaurant	12	2	100	10	2	200	8	1	100
Lossburn restaurant	16	2	250	14	2	300	10	1	150
Balquharn restaurant	18	2	300	16	2	350	10	1	180

Overheads costs attributing to project management and communication for Option 1 are £10000 per week and £15000 per week for Option 2. Following the completion of the restaurant(s), a Health and Safety inspection can be scheduled, which will take 2 weeks for Option 1 (cost=£20,000) and 3 weeks for Option 2 (cost=£40,000). Option 1 (cost=£30000) and Option 2 (cost=£70000) require 6 weeks and 14 weeks, respectively, for lift inspections.

Appendix B - Detailed Network Analysis of Option 1 and Option 2 – using MacAllan

Option 1

As per the Analysis, this project should start with putting proposals to the board on 07th June 2022 and it will take 2 months to get approval. Following this, the land purchase, planning approval, and architectural design will take place simultaneously from 02nd August 2022 and take 6 months to get complete. Constructing of Access Road A through MacAllan contractor will start on 1st February 2023 and should take 30 weeks to complete. MacAllan is chosen for the construction of access roads because of the low-price bids provided. Construction of Ski lifts, Office/Shop, and Restaurant can only start once access road A is constructed. The following Ski lifts can be set up synchronously from 30th August 2023:

(a) Ski lift 1 can be built using Chairlift c (3 km) in 25 weeks.
(b) Ski lift 2 can be built using Chairlift d (1.2 km) in 13 weeks.
(c) Ski lift 3 can be built using Chairlift b (2.2 km) in 19 weeks.

The Office/Shop can be built from 30th August 2023 with Foundations, Structures, and Fittings taking place sequentially with a time of 8, 8, and 6 weeks respectively using one team for each. The Airthrey Restaurant can be built from 30th August 2023 with Foundations, Structures, and Fittings taking place sequentially with a time of 12, 10, and 8 weeks respectively using two teams for Foundations and Structures and one team for Fittings. The construction work should start on 1st February 2023 with the construction of access road A and should finish on 10th April 2024 with the Fitting work of Airthrey Restaurant.

Health and Safety Inspections can then be conducted from 11th April 2024 taking 2 weeks. Lift Inspections can be conducted after installation of the last Ski lift from 07th March 2024 taking 6 weeks. Final training of 1 week can take place after completion of Health and Safety Inspections from 25th April 2024. In the interim, Marketing Material preparation, establishing agreements and campaign launch can start sequentially from 01st February 2023 taking 13, 12, and 15 weeks respectively.

Option 1 will take approximately 475 days (1 year and 11 months) from 07 June 2022 to 01 May 2024, with the teams working for a total of 2960 hours to construct the Office and Airthrey Restaurant.

Table 7: Scheduling of Tasks - Option 1

(Source: Self-created in MS Project)

Task Name	Duration	Start	Finish
Proposals put to Board Meeting	2 months	Tue 07/06/22	Mon 01/08/22
Purchase of Land	6 months	Tue 02/08/22	Tue 31/01/23
Planning Approval and Signing of Agreement	6 months	Tue 02/08/22	Tue 31/01/23
Architectural Designing	6 months	Tue 02/08/22	Tue 31/01/23
Constructing Access Road A - MacAllan	30 weeks	Wed 01/02/23	Tue 29/08/23
Ski lift 1 - Chairlift c	25 weeks	Wed 30/08/23	Wed 06/03/24

Ski lift 2 - Chairlift d	13 weeks	Wed 30/08/23	Tue 28/11/23
Ski lift 3 - Chairlift b	19 weeks	Wed 30/08/23	Wed 24/01/24
Building Office/Shop Foundations	8 weeks	Wed 30/08/23	Tue 24/10/23
Building Office/Shop Structures	8 weeks	Wed 25/10/23	Tue 19/12/23
Building Office/Shop Fittings	6 weeks	Wed 20/12/23	Wed 14/02/24
Building Airthrey Restaurant Foundations	12 weeks	Wed 30/08/23	Tue 21/11/23
Building Airthrey Restaurant Structures	10 weeks	Wed 22/11/23	Wed 14/02/24
Building Airthrey Restaurant Fittings	8 weeks	Thu 15/02/24	Wed 10/04/24
Health & Safety Inspections	2 weeks	Thu 11/04/24	Wed 24/04/24
Lift Inspections	6 weeks	Thu 07/03/24	Wed 17/04/24
Final Training	1 week	Thu 25/04/24	Wed 01/05/24
Marketing- Material Preparation	13 weeks	Wed 01/02/23	Tue 02/05/23
Establishing Agreements with various agents around the UK	12 weeks	Wed 03/05/23	Tue 25/07/23
Marketing Campaign Launch	15 weeks	Wed 26/07/23	Tue 07/11/23
Overheads (Project Management & Communication)	60 weeks	Wed 01/02/23	Wed 10/04/24

Option 2

As per the Analysis, the following activities in this project should start and finish on the same dates and should be of the same duration as in Option 1:

(a) Proposal approval by the Board
(b) Land purchase and Planning Approval
(c) Architectural Design

The Construction of Access Roads A and B both will start on 1st February 2023 through MacAllan contractor and should take 30 weeks and 32 weeks respectively to complete. Construction of Ski lifts, Office/Shop, and Restaurants can only start once access roads A and B are constructed. The following Ski lifts can be set up synchronously from 30th August 2023 (since access road A would be finished on 29th August 2023):

(a) Ski lift 1 can be built using Chairlift c (3 km) in 25 weeks.
(b) Ski lift 2 can be built using Chairlift d (1.2 km) in 13 weeks.
(c) Ski lift 3 can be built using Chairlift b (2.2 km) in 19 weeks.

The following Ski lifts can be set up synchronously from 13th September 2023 (since access road B would be finished on 12th September 2023):

(a) Ski lift 4 can be built using Chairlift b (2.2 km) in 19 weeks.
(b) Ski lift 5 can be built using Chairlift h (0.8 km) in 11 weeks.
(c) Ski lift 6 can be built using Chairlift b (2.2 km) in 19 weeks.
(d) Ski lift 7 can be built using Chairlift c (3 km) in 25 weeks.

The Office/Shop can be built from 30th August 2023 with Foundations, Structures, and Fittings taking place sequentially with a time of 8, 8, and 6 weeks respectively using one team for each.

The Airthrey Restaurant can be built from 30th August 2023 with Foundations, Structures, and Fittings taking place sequentially with a time of 12, 10, and 8 weeks respectively using two teams for Foundations and Structures and one team for Fittings. The Lossburn Restaurant can be built from 13th September 2023 with Foundations, Structures, and Fittings taking place sequentially with a time of 16, 14, and 10 weeks respectively using two teams for Foundations and Structures and one team for Fittings. The Balquharn Restaurant can be built from 13th September 2023 with Foundations, Structures, and Fittings taking place sequentially with a time of 18, 16, and 10 weeks respectively using two teams for Foundations and Structures and one team for Fittings.

The construction work should start on 1st February 2023 with the construction of access roads A and B and should finish on 31st July 2024 with the Fitting work of Balquharn Restaurant.

Health and Safety Inspections can then be conducted from 1st August 2024 taking 3 weeks. Lift Inspections can be conducted after the installation of the last Ski lift from 21st March 2024 taking 14 weeks. Final training of 3 weeks can take place after completion of Health and Safety Inspections from 22nd August 2024. In the interim, Marketing Material preparation, establishing agreements and campaign launch can start sequentially from 01st February 2023 taking 13, 12, and 15 weeks respectively.

Table 8: Scheduling of Tasks - Option 2

(Source: Self-created in MS Project)

Task Name	Duration	Start	Finish
Proposals put to Board Meeting	2 months	Tue 07/06/22	Mon 01/08/22
Purchase of Land	6 months	Tue 02/08/22	Tue 31/01/23
Planning Approval and Signing of Agreement	6 months	Tue 02/08/22	Tue 31/01/23
Architectural Designing	6 months	Tue 02/08/22	Tue 31/01/23
Constructing Access Road A - MacAllan	30 weeks	Wed 01/02/23	Tue 29/08/23
Constructing Access Road B - MacAllan	32 weeks	Wed 01/02/23	Tue 12/09/23
Ski lifts 1 - Chairlift c	25 weeks	Wed 30/08/23	Wed 06/03/24
Ski lifts 2 - Chairlift d	13 weeks	Wed 30/08/23	Tue 28/11/23
Ski lifts 3 - Chairlift b	19 weeks	Wed 30/08/23	Wed 24/01/24
Ski lifts 4 - Chairlift b	19 weeks	Wed 13/09/23	Wed 07/02/24
Ski lifts 5 - Chairlift h	11 weeks	Wed 13/09/23	Tue 28/11/23
Ski lifts 6 - Chairlift b	19 weeks	Wed 13/09/23	Wed 07/02/24
Ski lifts 7 - Chairlift c	25 weeks	Wed 13/09/23	Wed 20/03/24
Building Office/Shop Foundations	8 weeks	Wed 30/08/23	Tue 24/10/23
Building Office/Shop Structures	8 weeks	Wed 25/10/23	Tue 19/12/23
Building Office/Shop Fittings	6 weeks	Wed 20/12/23	Wed 14/02/24
Building Airthrey Restaurant Foundations	12 weeks	Wed 30/08/23	Tue 21/11/23
Building Airthrey Restaurant Structures	10 weeks	Wed 22/11/23	Wed 14/02/24
Building Airthrey Restaurant Fittings	8 weeks	Thu 15/02/24	Wed 10/04/24

Building Lossburn Restaurant Foundations	16 weeks	Wed 13/09/23	Wed 17/01/24
Building Lossburn Restaurant Structures	14 weeks	Thu 18/01/24	Wed 24/04/24
Building Lossburn Restaurant Fittings	10 weeks	Thu 25/04/24	Wed 03/07/24
Building Balquharn Restaurant Foundations	18 weeks	Wed 13/09/23	Wed 31/01/24
Building Balquharn Restaurant Structures	16 weeks	Thu 01/02/24	Wed 22/05/24
Building Balquharn Restaurant Fittings	10 weeks	Thu 23/05/24	Wed 31/07/24
Health & Safety Inspections	3 weeks	Thu 01/08/24	Wed 21/08/24
Lift Inspections	14 weeks	Thu 21/03/24	Wed 26/06/24
Final Training	3 weeks	Thu 22/08/24	Wed 11/09/24
Marketing- Material Preparation	13 weeks	Wed 01/02/23	Tue 02/05/23
Establishing Agreements with various agents around the UK	12 weeks	Wed 03/05/23	Tue 25/07/23
Marketing Campaign Launch	15 weeks	Wed 26/07/23	Tue 07/11/23
Overheads (Project Management & Communication)	76 weeks	Wed 01/02/23	Wed 31/07/24

Appendix C - Detailed Financial Analysis of Option 1 and Option 2 – using MacAllan

Option 1

Table 9 shows the individual costs of various activities in the project for Option 1.

Table 9: Costs of Activities - Option 1

(Source: Self-created in MS Project)

Task Name	Total Cost
Proposals put to Board Meeting	£0.00
Purchase of Land	£6,000,000.00
Planning Approval and Signing of Agreement	£100,000.00
Architectural Designing	£250,000.00
Constructing Access Road A - MacAllan	£500,000.00
Skilifts 1 - Chairlift c	£838,000.00
Skilifts 2 - Chairlift d	£576,000.00
Skilifts 3 - Chairlift b	£708,000.00
Building Office/Shop Foundations	£50,000.00
Building Office/Shop Structures	£100,000.00
Building Office/Shop Fittings	£30,000.00
Building Airthrey Restaurant Foundations	£100,003.20
Building Airthrey Restaurant Structures	£200,000.00
Building Airthrey Restaurant Fittings	£100,000.00
Health & Safety Inspections	£20,000.00
Lift Inspections	£30,000.00
Final Training	£20,000.00
Marketing- Material Preparation	£70,000.00
Establishing Agreements with various agents around the UK	£20,000.00
Marketing Campaign Launch	£200,000.00
Overheads (Project Management & Communication)	£600,000.00
Total	**£10,512,003.20**

Figure 13 shows the variance in costs for various tasks of the project for Option 1. The highest cost is for purchasing the land for the Ski Center.

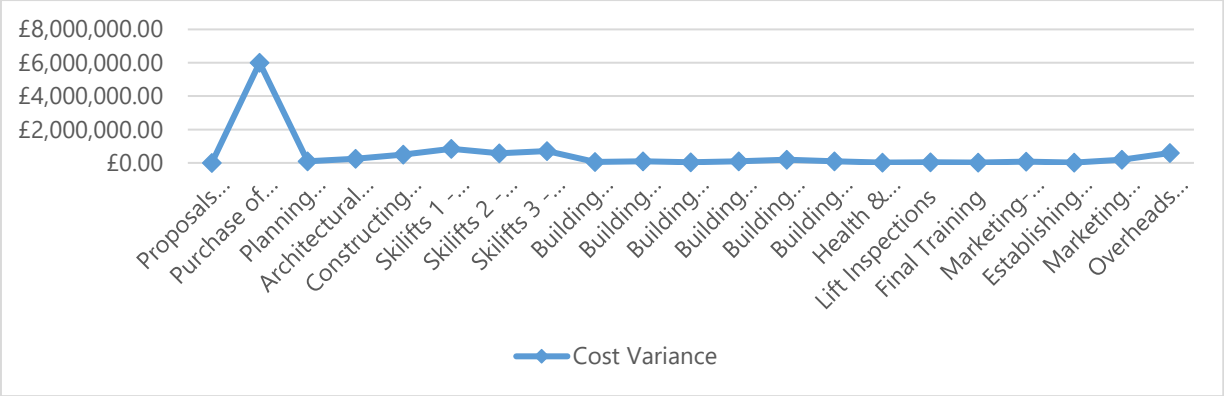

Figure 13: Task Cost Variance-Option 1

(Source: Self-created in MS Project)

Table 10 shows the hourly rates and total cost of each resource (Team) calculated by the data provided in the case study for Option 1.

Table 10: Hourly Rates and Total Cost of Resources-Option 1

(Source: Self-created in MS Project)

Resource Name	No. of Resources	Efficiency	Cost per Hour	Total Cost
Building Office Foundations Team	1	100%	£156.25/hr	£50,000.00
Building Office Structures Team	1	100%	£312.50/hr	£100,000.00
Building Office Fittings Team	1	100%	£125.00/hr	£30,000.00
Building Airthrey Restaurant Foundations Team	2	200%	£104.17/hr	£100,003.20
Building Airthrey Restaurant Structures Team	2	200%	£250.00/hr	£200,000.00
Building Airthrey Restaurant Fittings Team	1	100%	£312.50/hr	£100,000.00
Total				**£580,003.20**

Figure 14 shows the variance in costs for various Resources (Teams) of the project. The highest cost is of the Team building Airthrey Structures.

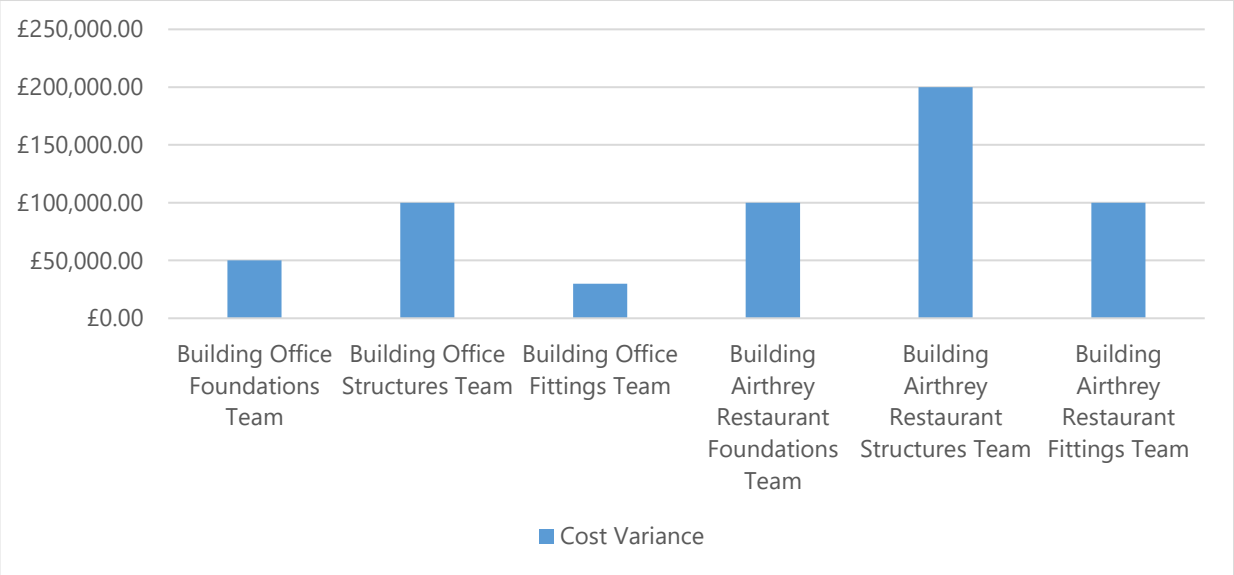

Figure 14: Resource Cost Variance-Option 1

(Source: Self-created in MS Project)

Option 2

Table 11 shows the individual costs of various activities in the project for Option 2.

Table 11:Costs of various activities-Option 2

(Source: Self-created in MS Project)

Task Name	Total Cost
Proposals put to Board Meeting	£0.00
Purchase of Land	£12,000,000.00
Planning Approval and Signing of Agreement	£200,000.00
Architectural Designing	£500,000.00
Constructing Access Road A - MacAllan	£500,000.00
Constructing Access Road B - MacAllan	£1,000,000.00
Skilifts 1 - Chairlift c	£838,000.00
Skilifts 2 - Chairlift d	£576,000.00
Skilifts 3 - Chairlift b	£708,000.00
Skilifts 4 - Chairlift b	£708,000.00
Skilifts 5 - Chairlift h	£555,000.00
Skilifts 6 - Chairlift b	£708,000.00
Skilifts 7 - Chairlift c	£838,000.00
Building Office/Shop Foundations	£50,000.00
Building Office/Shop Structures	£100,000.00
Building Office/Shop Fittings	£30,000.00
Building Airthrey Restaurant Foundations	£100,003.20
Building Airthrey Restaurant Structures	£200,000.00

Building Airthrey Restaurant Fittings	£100,000.00
Building Lossburn Restaurant Foundations	£249,996.80
Building Lossburn Restaurant Structures	£300,003.20
Building Lossburn Restaurant Fittings	£150,000.00
Building Balquharn Restaurant Foundations	£299,995.20
Building Balquharn Restaurant Structures	£350,003.20
Building Balquharn Restaurant Fittings	£180,000.00
Health & Safety Inspections	£40,000.00
Lift Inspections	£70,000.00
Final Training	£40,000.00
Marketing- Material Preparation	£70,000.00
Establishing Agreements with various agents around the UK	£20,000.00
Marketing Campaign Launch	£200,000.00
Overheads (Project Management & Communication)	£1,140,000.00
Total	**£22,821,001.60**

Figure 15 shows the variance in costs for various tasks of the project for Option 2. The highest cost is for purchasing the land for the Ski Center.

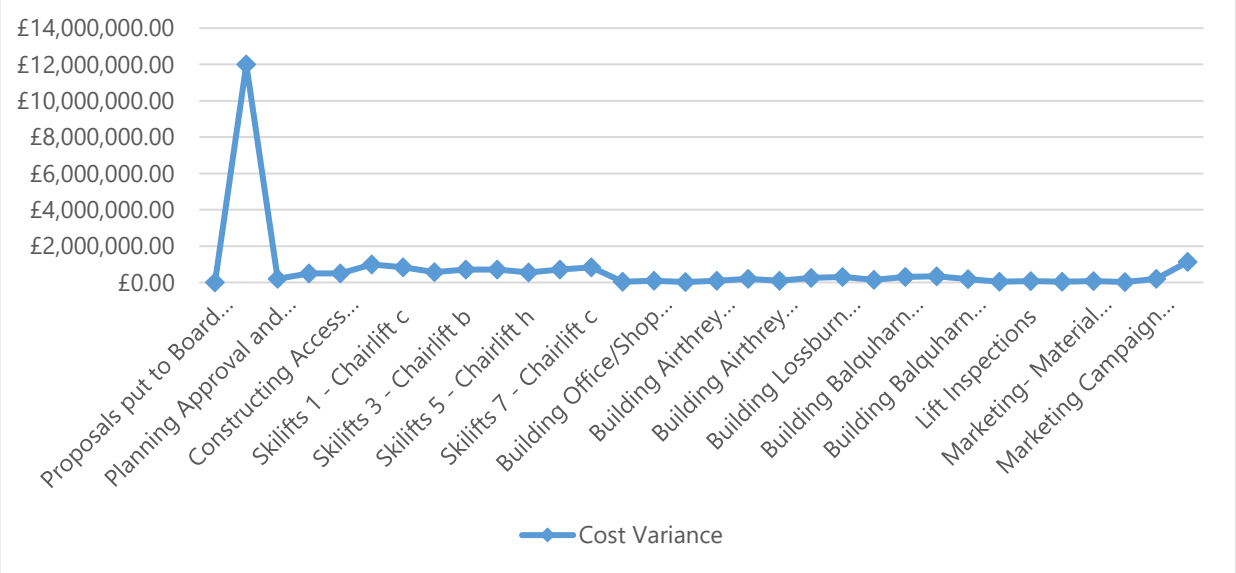

Figure 15: Task Cost Variance-Option 2

(Source: Self-created in MS Project)

Table 12 shows the hourly rates and total cost of each resource (Team) calculated by the data provided in the case study for Option 2.

Table 12: Hourly Rates and Total Cost for Resources-Option 2

(Source: Self-created in MS Project)

Resource Name	No. of Resources	Efficiency	Cost per Hour	Total Cost
Building Office Foundations Team	1	100%	£156.25/hr	£50,000.00

Building Office Structures Team	1	100%	£312.50/hr	£100,000.00
Building Office Fittings Team	1	100%	£125.00/hr	£30,000.00
Building Airthrey Restaurant Foundations Team	2	200%	£104.17/hr	£100,003.20
Building Airthrey Restaurant Structures Team	2	200%	£250.00/hr	£200,000.00
Building Airthrey Restaurant Fittings Team	1	100%	£312.50/hr	£100,000.00
Building Lossburn Restaurant Foundations Team	2	200%	£195.31/hr	£249,996.80
Building Lossburn Restaurant Structures Team	2	200%	£267.86/hr	£300,003.20
Building Lossburn Restaurant Fittings Team	1	100%	£375.00/hr	£150,000.00
Building Balquharn Restaurant Foundations Team	2	200%	£208.33/hr	£299,995.20
Building Balquharn Restaurant Structures Team	2	200%	£273.44/hr	£350,003.20
Building Balquharn Restaurant Fittings Team	1	100%	£450.00/hr	£180,000.00
Total				**£2,110,001.60**

Figure 16 shows the variance in costs for various Resources (Teams) of the project for Option 2. The highest cost is of the Team building Balquharn Structures.

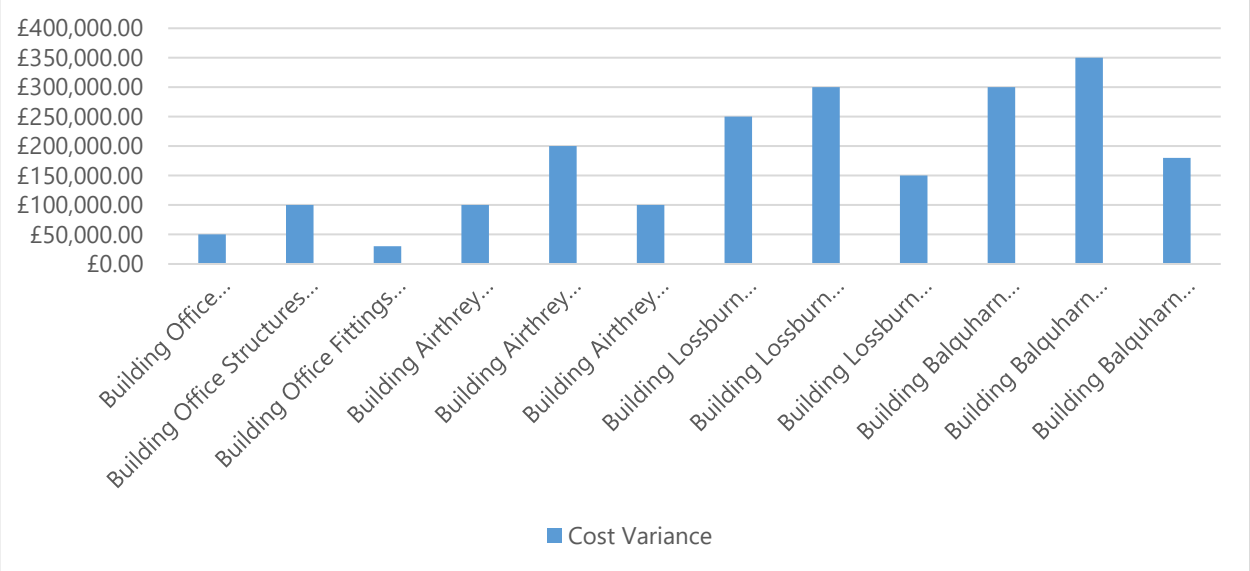

Figure 16: Resource Cost Variance-Option 2

(Source: Self-created in MS Project)