# Decision Analysis- The Conroy Manufacturing Company

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## Executive summary

The Conroy Manufacturing is a company which operates in different industries in Australia. And the purpose of this report is to analysis project of lunching new gardening tools and equipment. In this project, there need to be taken different critical decisions mainly about continuity of the project and suitable location for the production. Decision analysis techniques such as decision tree, Net present value, Expected value and probabilities has been used to this study to make more accurate decisions. Further SMART technique which mainly consider qualitative aspect of the scenario is used as alternative option to discuss this situation. And also strength and limitation of these technique and recommended course of actions have been discussed in this study. This report recommend to continue the project according to current situation and suitable location is depended according to different scenarios. Detail results of the study and recommendations have been discussed comprehensively in the body of the report.

## Introduction

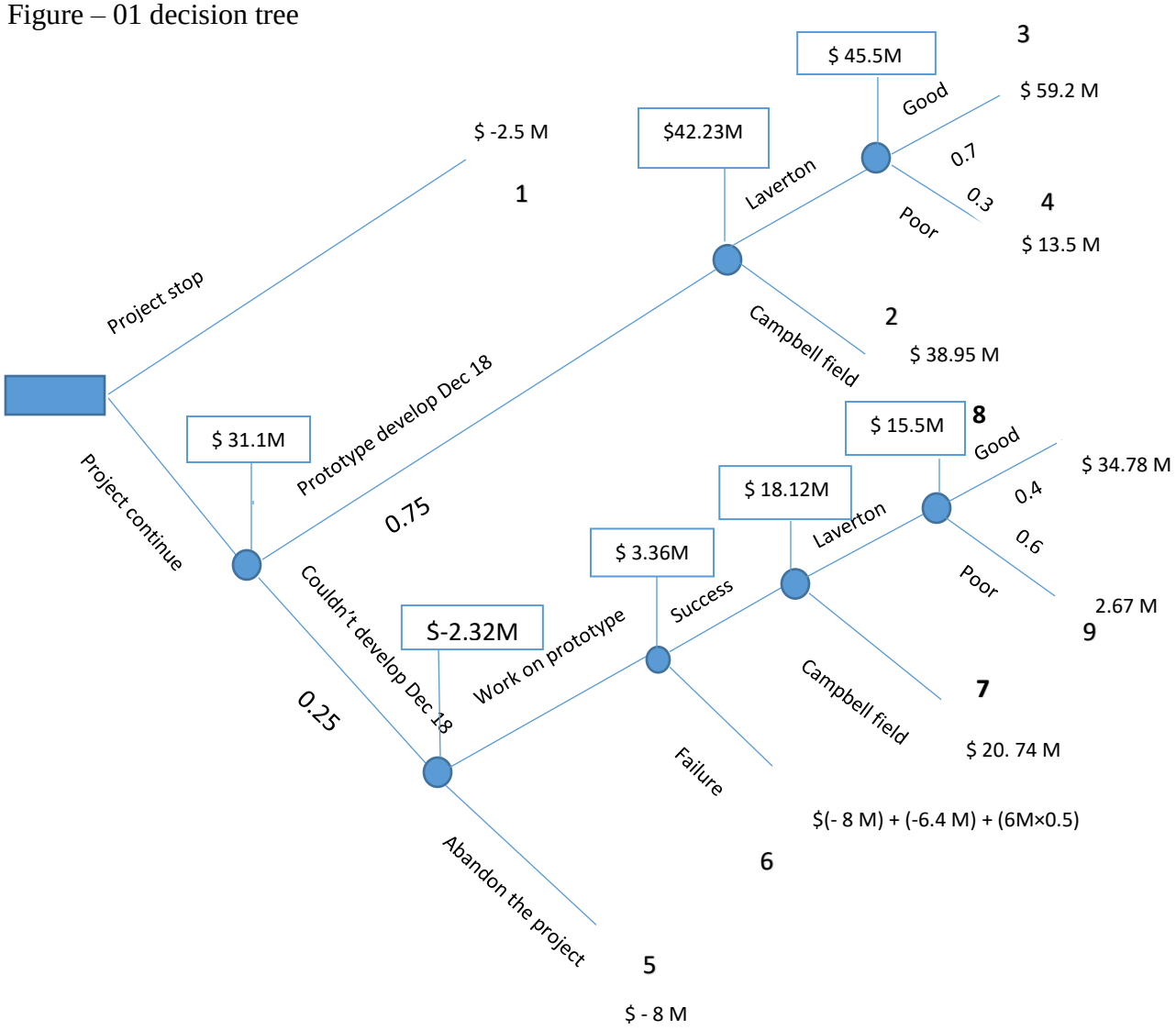
The Conroy Manufacturing Company currently operates in industries such as industrial machinery, paints, building materials and consumer goods. When consider the sales level of those sectors, company couldn't achieve a considerable level of sales improvement in last five years. Further Conroy manufacturing company's market share is relatively small compare to other competitors in the industry. That is the main reason which company consider to develop gardening tools and equipment.

According to the scenario, company has to make few main decisions regarding the new project. Initially company need to decide whether project continue or stop. If the project continues and also prototype could be developed in December 2018, company need to choose a location for production of LM18. If the prototype couldn't be developed in December 2018, then company need to decide whether modify the prototype by taking another year or abandon the project. If modification of the prototype would success, then company need to choose a location for production.

Decision tree is the decision analysis technique which is used for this kind of complex scenarios. Further technique such as Net Present Value and Expected value has been used for this scenario.

**Applying Decision analysis techniques to Conroy manufacturing**

Figure – 01 decision tree




Management need to calculate Net present Value (NPV) of different scenarios to identify the best possible option. NPV need to calculate in each scenarios in both main conditions which are prototype successfully complete in Dec 2018 and couldn't compete prototype in Dec 2018 and then modify the prototype within the year.

**NPV calculation**

If prototype can develop December 2018

Table 01- NPV if Campbell field is selected as location.

| ($) | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Net cash flow | | | 16M | 16M | 16M | 16M |
| Market research | (8M) | | | | | |
| Building value and installation cost | | (6M+ 4M) | | | | 16M |
| | (8M) | (10M) | 16M | 16M | 16M | 32M |
| Cost of capital (10%) | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| Present value | (8M) | (9.09) | 13.216 M | 12.016 M | 10.928 M | 19.872 |

NPV = $ 38.95 M

Table 02 – NPV if Laverton is selected as location and market condition is good.

| ($) | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Net cash flow | | | 24M | 24M | 24M | 24M |
| Market research | (8M) | | | | | |
| Building value and installation cost | | (24M) | | | | 32M |
| | (8M) | (24M) | 24M | 24M | 24M | 56 M |
| Cost of capital (10%) | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| Present value | (8M) | (21.816M) | 19.824 M | 18.024 M | 16.392 M | 34.776 M |

NPV = $ 59.2 M

Table 03 – NPV if Laverton is selected as location and market condition is poor.

| ($) | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Net cash flow | | | 8M | 8M | 8M | 8M |
| Market research | (8M) | | | | | |
| Building value and installation cost | | (24M) | | | | 32M |
| | (8M) | (24M) | 8M | 8M | 8M | 40M |
| Cost of capital (10%) | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Present value | (8M) | (21.816 M) | 6.608M | 6.008M | 5.464M | 24.84 M |

NPV = $ 13.5 M

If prototype couldn't develop December 2018

Table 04- NPV if Campbell field is selected as location.

| ($) | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Net cash flow | | | | 16M | 16M | 16M |
| Market research | (8M) | | | | | |
| Building value and installation cost | | | (6M+ 4M) | | | 16M |
| Further develop prototype | | (6.4 M) | | | | |
| | (8M) | (6.4 M) | (10 M) | 16M | 16M | 32M |
| Cost of capital (10%) | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| Present value | (8M) | (5.82 M) | (8.26 M) | 12.016 M | 10.928 M | 19.872M |

NPV = $ 20.74 M

Table 05- NPV if Laverton is selected as location and market condition is good.

| ($) | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Net cash flow | | | | 24M | 24M | 24M |
| Market research | (8M) | | | | | |
| Building value and installation cost | | | (24M) | | | 32M |
| Further develop prototype | | (6.4 M) | | | | |
| | (8M) | (6.4 M) | (24M) | 24M | 24M | 56 M |
| Cost of capital (10%) | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| Present value | (8M) | (5.82M) | 19.824 M | 18.024M | 16.392M | 34.776 M |

NPV = $ 34.78 M

Table 06 - NPV if Laverton is selected as location and market condition is poor.

| ($) | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Net cash flow | | | | 8M | 8M | 8M |
| Market research | (8M) | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Building value and installation cost | | | (24M) | | | 32M |
| Further develop prototype | | (6.4 M) | | | | |
| | (8M) | (6.4 M) | (24M) | 8M | 8M | 40 M |
| Cost of capital (10%) | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |
| Present value | (8M) | (5.82M) | (19.824 M) | 6.008M | 5.464 M | 24.84 M |

NPV = $ 2.67 M

Based on the NPV calculation and results of the every options, below possible results can be identified.

Table 07 – Results of the different scenarios.

| | Scenario | Result ($) |
|---|---|---|
| Scenario 1 | Project stop | $ -2.5 mn |
| 2 | Prototype develop in Dec 2018 and Campbell field is selected as location | $ 38.95 mn |
| 3 | Prototype develop in Dec 2018, Laverton is selected as location and market is good. | $ 59.2 mn |
| 4 | Prototype develop in Dec 2018, Laverton is selected as location and market is poor. | $ 13.5 mn |
| 5 | Prototype couldn't develop in Dec 2018 and abandon the project. | $ -8 M |
| 6 | Modify the prototype and fail | $ -11.4M |
| 7 | Modify the prototype, success and Campbell field is selected as location | $ 20.74 M |
| 8 | Modify the prototype, success, Laverton is selected as location and market is good. | $ 34.78M |
| 9 | Modify the prototype, success, Laverton is selected as location and market is poor. | $ 2.67 M |

Further expected value also consider before make a decision. Expected values have been mentioned in decision tree diagram itself. Payoff value of continuing project is $ 31.1 M. If project stop, cost which already spent to market research become sunk cost. Therefore best option is continue the project. Then company need to develop the prototype. Decision need to be made based on the time which prototype can be developed. If the company achieve a target of complete prototype in December 2018, then company need to decide location for production. If only

consider the quantitative factors, Laverton need to be selected as a production location since payoff value is higher compared to Campbell field. If Campbell field select as a location, NPV will be $38.95 M. If Laverton select as a location, expected payoff value will be $45.5 M. There is 70% chance to market condition will be good therefore if market condition is good NPV will be 59.2 M. Even though market condition is poor, NPV will be $ 13.5M.

If company couldn't develop prototype in December 2018, there are two option available for management. One is abandon the project and other one is modify the prototype by taking another year. This lead to delay the project one year and after one year time market condition will be changed. There is only 40% chance to market condition will be good. If company couldn't develop prototype in December 2018, expected payoff of the project will be $- 2.32 M. However if company decide to abandon the project, loss will be $8 M. Therefore best option is modify the prototype by taking another year if company couldn't complete prototype in December 2018. Expected payoff value of developing prototype is $ 3.36 M. if prototype fail, cost will be increased by $ 6.4 M. If prototype will success then company need to decide the location for production. Expected payoff value of selecting Laverton is $ 15.5 M. On the hand, if Campbell field is selected as location NPV will be $ 20.74 M. Therefore only considering quantitative factors, selecting Campbell field is better option. However if market condition is good, NPV will be $34.78 M by selecting Laverton as location. But there is only 40% chance to market to be good. If market is poor NPV will be only $ 2.67M. Therefore considering probabilities and expected values, Campbell field is better location for production since company couldn't take much risk based on the current situation.

If Campbell field is selected as location, company can recruit skilled workers locally and warehousing and transporting facility can be obtained easily. If Laverton is selected as a location, transportation cost will be reduced since Laverton is located closer to port than Campbell field. Further if market condition is good, company can improve the production since production capacity is much higher. Further company can achieve economic of scale.

**Assumptions**

In this method, probability of select one location has been assumed as 50%. Further if prototype couldn't be developed in December 2018, probability of abandon the project or modify the

prototype has been assumed as 50%. And also success or failure of the modification is also assumed as 50%. Further it is assumed that Campbell field can be purchased same price ($ 6M) even in 2020.

**The Simple Multi Attribute Rating Technique (SMART)**

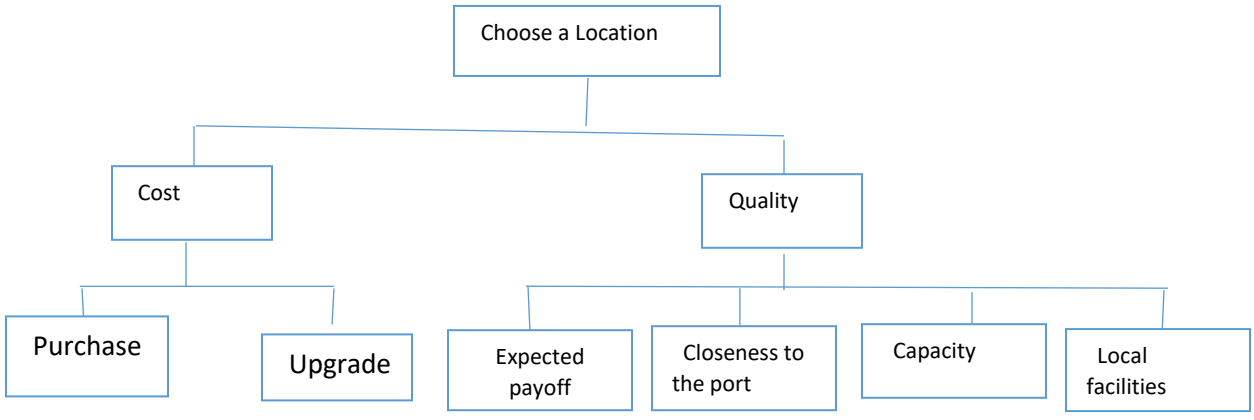
This method is used as an alternative method to decide which location need to select the production. Especially this method is useful to consider qualitative factors of two locations. This method is based on a linear additive model which mean an overall value of a given alternative is calculated as the total sum of the performance score (value) of each criterion (attribute) multiplied with the weight of that criterion. There are eight stages in the processes.

Stage 01 – Identify the decision maker. In this case higher management of Conroy Manufacturing Company is the decision maker.

Stage 02 – Identify the alternative courses of action. In this case, select a location for product among Campbell field and Laverton is the issue.

Stage 03 – Identify the criteria relevant to the issue. Below value tree has shown the relevant factors which relevant to the problem.

Figure 02 – A value tree for the location for the production.




Stage 04 – Assign value for each criteria. This is a numerical comparison of each factor of two location.

Stage 5 - Determine the weight of each of the criteria: The most important dimension would be gave an importance of 100. The next-most-important dimension is gave a number reflecting the ratio of relative importance to the most important dimension. This process is continued, checking implied ratios as each new judgments are made. Since this requires a growing number of comparisons there is a very practical need to limit the number of dimensions. It is expected that different individuals in the group would have different relative ratings.

Stage 6 - Calculate a weighted average of the values assigned to each option: This step allows standardization of the relative importance into weights summing to 1.

Stage 7 -Make a provisional decision.

Stage 8 – Perform sensitivity analysis to identify how robust the decision is to changes in the facts supplied by the decision maker (DTU transport, 2014).

**Recommendations**

Considering Conroy Manufacturing Company's products portfolio, it is a better option to continue this project since current products have relatively slow market share. One of the most important event of the project is develop a prototype in December 2018. Company need to allocate enough resources and expertise to develop the prototype since market condition could be change if prototype couldn't develop in December 2018. Further if company could develop prototype in December 2018, better to select Laverton as a location for production. If prototype couldn't be developed in Dec 2018, it is recommended to further modify the prototype even though expected payoff value is shown as negative. In here also company need to allocate required resources to modify the prototype successfully. If company could develop prototype successfully, then expected payoff value will be positive. In this case, it is recommended to select Campbell field as a production location.

**Strengths and limitations of the analysis**

Decision tree diagram which attempt to show the range of possible outcomes and later decisions made after the initial decision. There are several strengths and limitations of the decision tree method.

The main advantage of the decision tree approach is that show paths through possibilities, with alternative options leading towards desirable outcomes. Further it shows the uncontrollable and controllable events. Decision tree support management weight the possible consequences of one decision against another (Magee, 1964).

However even in Conroy manufacturing, company use heuristics to identify the market condition in 2020 and 2021 and decide the time which will take to complete the prototype. These heuristics sometimes can provide good estimates and decrease the efforts of decision makers and also they can lead to systematically biased judgements. Here company use anchoring heuristics.

In making decisions, anchoring could be a problem in the cost estimation, project duration and probabilities since forecasts that are used in the decision process could be biased by forecasters anchoring on the current value and doing insufficient adjustment for the effect of future conditions (Goodwin and Wright, 2014).

Further, assumptions made to develop decision tree are based on the availability heuristics. These assumptions are not associated with probabilities and just take as 50% chance to occur. Further many researches has highlighted that people tend to see desirable outcomes more probable than undesirable outcomes. Therefore overconfidence also impact to the make bias decision. Further research which is done by research firm in this case marketing department may not capture the real market situation.

New information reduce the uncertainty involved with decisions and increase the expected payoff value. Therefore company need to collect more real time information and need to get better idea about the situation. It will lead the assumptions which use to develop decision tree associate with probabilities and make better decisions. Company need to obtain information to identify the probability of success or failure of prototype modification. Further company need to identify that there is any bias on one location for production above other. Both of these factors are internal information. To get better understanding future market situation, Conroy Manufacturing Company can use scientific tests, market research survey or get support of consultant to obtain more accurate information. It is not possible to obtain perfectly reliable information however concept of expected value of perfect information (EVPI) can be more useful (Jones and Twiss, 1978).

## Conclusion

According to discussed decision analysis technique, it is indicted that always better to continue project rather than abandon it. However management of Conroy manufacturing company need to obtain more information and perform analysis to reduce associate risk. Further this business decision is always based on risk appetite level which company need to allow.

## References


Goodwin, P. and Wright, G. (2014) "Decision analysis for management judgement" Chichester: Wiley, pp 255- 257

Magee, J. (1964) "Decision trees for decision making". Harvard business review [online] available at: https://hbr.org/1964/07/decision-trees-for-decision-making access on: 01.03.2018

DTU Transport, (2014) "The simple multi attribute rating technique" [pdf] available at- http://miroslawdabrowski.com/downloads/MoV/The%20Simple%20Multi%20Attribute%20Rating%20Technique%20(SMART).pdf access on – 01.03.2018

Jones, H. and Twiss, C. (1978) "Forecasting technology for planning decision" London: McMillan press Ltd.

Bryson, J. and Anderson, S. (2000) "Applying large group interaction methods in the planning and implementation of major change efforts". Public administration review