

Choosing Best Alternative Using Decision Analysis to Maximize Revenue in Company X

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Abstract

As a company that moves in retail business specialized in selling daily needs, company X has developed their brand to become top of customers' mind with 12% rate of sales growth. However, the Board of Directors (BOD) of company X targeting the rate of sales growth should be 20%, therefore they decide to make an expansion to gain the sales rate, also follow the increasing demand, as well as maintain the customer satisfaction. This research focuses on determining the best alternative that can generate the highest revenue for Company X, using decision analysis tools (i.e. smart choice), decision tree and sensitivity analysis. This analysis will be presented in step-by-step in order to be able to generate the best alternatives by understanding the consequences, tradeoff, and uncertainties of the alternative.

Keywords: Decision Analysis, Business Expansion, Maximize Revenue, Smart-Choice

Abstrak

Sebagai perusahaan ritel yang menjual barang kebutuhan sehari-hari seperti makanan, minuman dan peralatan rumah tangga lainnya, Perusahaan X telah mengembangkan merek mereka hingga menjadi perusahaan yang paling dikenal di masyarakat dengan tingkat pertumbuhan penjualan hanya mencapai 12%. Untuk mencapai target penjualan 20%, menyeimbangkan kenaikan permintaan, dan mempertahankan kepuasan pelanggan, dewan direktur mempertimbangkan untuk melakukan ekspansi. Penelitian ini berfokus untuk mencari alternatif ekspansi terbaik yang mampu memaksimalkan peningkatan pertumbuhan Perusahaan X dengan menggunakan Smart-Choice, decision tree dan analisis sensitivitas. Tulisan ini akan disajikan dengan pendekatan langkah-demi-langkah yang akan memisahkan setiap keputusan dalam beberapa bagian untuk memudahkan analisa dan pemahaman

terhadap keputusan serta alternatif, sedemikian sehingga mampu memahami alternatif terbaik melalui konsekuensi-konsekuensi, tradeoff, serta ketidakpastian yang terdapat dalam alternatif.

Katakunci :Analisa keputusan, Pengembangan bisnis, Pendapatan Maksimal, Smart-choice

1. Background

Company X is a company that moves in retail business, specialize in selling daily needs (i.e. foods, beverages, and other household appliances). The company has develops their brand to be on top of customer's mind with a lot of branches located all over Bandung, resulting a 11.75% growing sales rate on 2008 to 2010.

Tabel 1. Company X Sales Growth for 2008 - 2010

Month	Growth Level	
	2008 to 2009	2009 to 2010
January	19%	8%
February	12%	11%
March	11%	7%
April	15%	5%
May	9%	15%
June	10%	10%
July	1%	30%
August	16%	11%
September	8%	14%
October	20%	14%
November	14%	12%
December	6%	4%
Average Growth	11.75 %	11.75 %

Eventhough the growth sales rate achieve almost 12 percent, but the Board of Director (BOD) of company X want to increase it to 20% within three years of timeframe. An expansion is chosen to achieve the company growth target, as well as increasing the supply on customer's demands of daily and household products, and maintaining customer satisfaction level. The objective of the expansion is to create a more comfortable place and offer a totally new experience for the customer.

Therefore this research tries to find the best expansion alternative that can generate the most revenue and maximizing the sales growth level of company X. The unit analysis will be company X Bandung branch which considering on doing an expansion. Decision analysis tools and methos used to find the best alternative are decision tree, sensitivity analysis, and smart choice.

2. Literature Review

2.1. Decision Tree

Decision tree is a method that can help the decision maker in making smart choice by providing a clear view and better understanding to the problem. Decision tree use a graphic approach in order to compare all the alternatives by assigning a value to those alternatives. Decision tree also guide the decision maker regarding the information is needed to be gathered and help the decision maker to judge the information more clearly and explicitly.

There are two advantages for decision maker analyzing alternative with decision tree. *First*, the decision tree uses graphic approach that can help in presenting the alternatives, possible outcome, and the systematic probability and to help understanding the complex decision in sequence. *Second*, decision tree use expected value to help the decision maker in comparing all the alternatives and can be modified easily when there is new available information.

Sensitivity Analysis

Sensitivity analysis is an analysis about the alternative robustness to change. It can help the decision maker to determine which variable is sensitive and test whether the alternative that consider as best alternative, will change if there is a change on the sensitive variable.

2.3. Smart Choice

Smart Choice approach is a straightforward proven approach for making a decision. Smart Choice break down the problem into several parts in order to get an insight analysis of decision called PROACT (Problem, Objectives, Alternative, Consequences, and Tradeoff) and an addition three steps .

First step is defining the fundamental problem, which will frame the whole decision made, generating alternatives, and the way to evaluate it. The *second* step is to specify the objectives that will be the decision criteria in determining the best alternative. Objective is divided into two categories, which is fundamental objective and means objective. The *third* step is to create imaginative alternatives, which is a range of potential action that can be chose by the decision maker to solve the problem that appears. The *fourth* step is to understand the consequences of each alternative, which is the effect, outcome, or result for choosing one particular alternatives by creating a table of consequences.

The *fifth* step is to grapple with the tradeoff, which is sacrificing one benefit or advantage of one alternative in order to gain other advantage from other alternatives that is more likely to satisfy the fundamental objective. The *sixth* step is to clarify the uncertainties in order to minimize the unlikely outcome. The *seventh* step is to define the risk tolerance level to balance the possibilities of positive consequences with the chance of occurrence. There are three type of risk tolerance level which is risk averse that avoid risk at all cost, risk neutral that only concerns with investment's expected return, and risk taker that willing to take an additional risk in order to receive higher gain with relatively low expected return. The *eight* steps which is also the last step in smart choice is to consider the linked decision that means considering the decision that need to be made in the future because of choosing one particular alternative.

3. Research Methodology

Firstly, this research is done by identifying the core problem. Then determine the goal and the scope of the research. A literature review and study from books, internet or other relevant references is done to add more information about the research. *Second*, two types of data are collected for this research. Primary data is collected through interview with the entrepreneur whose manage company X and secondary data about the company X current condition.

Those data then being analyzed by smart choice (with its eight steps) to determine alternatives that decision maker can choose. The alternatives then analyze through decision tree to determine which alternatives that can generate the most revenue. The alternative that has been generated by using decision tree then will be tested using sensitivity analysis in order to test each alternative's robustness to changes.

4. Data Analysis

4.1. Smart Choice (PROACT and 3 Additional Steps)

4.1.1. Define the Decision Problem

To define the decision problem, the respondents are being asked a basic question of "what trigger this decision to happen?"

The assumption of what the decision problem is company X wants to maximize the sales growth level by an average growth 20% per annum in the three years time frame. The trigger occasion is a conversation with the BOD of company X. The connection between the trigger and the problem is the BOD of company X is concern regarding what are the best expansion alternatives that can be taken to maximize the sales growth level to achieve an average growth of 20% per year in the three years time frame.

4.1.2. Define the Objective of the Research

Based on the interview that has been conducted, there are several objectives that the members of BOD want to fulfill. The objective are [1] maximize the sales growth level, [2] maximize building capacity to display more goods, [3] maximize customer satisfaction, [4] maximize number of the customers, [5] minimize cost, [6] maximize revenue.

All the objectives can be connected one with another and can be drawn as Figure 1 below.

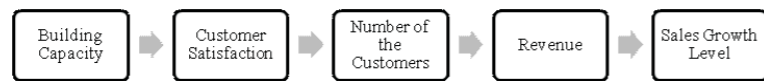


Figure 1. Fundamental and Mean Objectives

4.1.3. Define the Alternatives

In order to achieve both fundamental and mean objectives of Company X, they need to choose among the available alternatives that fulfill the criteria of the objectives. The alternative that is most likely able to fulfill the company objectives is an expansion alternative. Expansion alternative will create more space for the Company X to display more goods and also to give more space for the costumers and increase customer comfort and satisfaction. The expansion alternatives for Company X that can fulfill the company goals is divided into three which is whether [1] to expand in the current place (by renovate current building or create a new building), [2] find a new place suitable in creating a new branch for Company X (with high category, medium category or low category), and [3] do nothing.

Tabel 2. Categories for each Alternatives

Category	Character					
	Population	Cost	Total area needed	Building Area	Warehouse	Parking lot
High	High	High	2500 m ²	1500 m ²	-	1000 m ²
Medium	Medium	Medium	5000 m ²	2500m ²	750m ²	1250m ²
Low	Low	Low	10,000m ²	2500m ²	750m ²	6750m ²

For each alternatives generates different revenues that depends on the locaton, uncertainty, and cost that depends on the building value, planning and construction, land and fixture. Tabel 3 below show the revenue and cost for each alternative based on the current revenue of the branch that consider on doing an expansion.

Tabel 3. Revenue Value for each Alternative

Revenue	Expand in a new place			Expand in the current place	
	High	Medium	Low	Renovation	Create a new building
Success (in billion)	17,4598425	6,983937	3,4919685	8,380724	13,967874
Growth (1 year time period)	150%	0%	-50%	20%	100%

Tabel 4. Cost for each Alternative

Criteria	Expand in a new place (in a billion)			Expand in the current place (in a billion)	
	High	Medium	Low	Renovation	Create a new building
Building Value	10	5	5	1	10
Planning & Construction (Architect)	1,5	0,75	0,75	0,15	1,5
Land	50	50	30	0	24
Fixture	3,4875	1,1625	1,1625	0,1	4,65
Total Cost	82,2375	62,6625	36,9125	1,25	40,15

4.1.4. Define the Consequences

Each alternative has their own consequences regarding how well they will satisfy the objective of the decision makers. It is very important to understand the consequences of each alternative in order to be able to get a better understanding of the problem and alternative. The consequences summary is presented in Tabel 5 below.

Tabel 5. Consequences Table for each Alternative

Objectives	Expand in a new place			Expand in the current place	
	High	Medium	Low	Renovation	Create a new building
Revenue(in billion)	17,4598425	6,983937	3,491968.5	8,380724.4	13,967874
Sales Growth Level	150%	0%	-50%	20%	100%
Building Capacity	4500m ²	1500m ²	1500m ²	2000m ²	2000m ²
Numbers of Potential Costumer	High	Medium	Low	Medium High	Medium High
Cost(in billions)	82,2375	62,662	36,9125	1,25	40,15
Location	Excellent	Good	Bad	Good	Good

4.1.5. Define the Tradeoff

There is multiple objectives involve in this research and there is no alternative that can satisfy all the objectives. Therefore each alternative had tradeoff, which means that one alternative has better impact on one objective but worse on other objectives. Tradeoff also means that in

order to achieve something, there must be something that is going to be sacrifice. In order to help determine the tradeoffs of each alternative, table of consequences will be reuse but instead of using it with words, the table is going to be filling with rating range from 1 to 5. The alternatives that best fulfill the objectives will be rank 1 the second best will be rank 2 and so on.

Table 6. Tradeoff Table for each Alternatives

Objectives	Expand in a new place			Expand in the current place	
	High	Medium	Low	Renovation	Create a new building
Revenue	1	4	5	3	2
Sales Growth Level	1	4	5	3	2
Building Capacity	1	3 (Tie)	3 (Tie)	2 (Tie)	2 (Tie)
Numbers of Potential Costumer	1	3	4	2 (Tie)	2 (Tie)
Cost	5	4	2	1	3
Location	1	2 (Tie)	3	2 (Tie)	2 (Tie)

Based on Table 6, the alternatives that best fulfill the objective are the high criteria, however the high criteria need high cost too. The other criteria need less cost but also less satisfy the objectives. This is the tradeoff that needs to be made, in order to achieve something; there must be sacrifice that needs to be made. In this research the sacrifice that needs to be made is cost.

4.1.6. Clarify the Uncertainties.

The uncertainties that can occur in this research are [1] will it be profitable? [2] will the market be able to absorb? [3] will the place be crowded or going to be deserted? [4] will there be many competitors? [5] how about the supply continuity? [6] how about the economic condition?

The main uncertainty that become the members of board of director concern is regarding the target market. The company cannot sustain if they didn't have any income and the source of income is the costumers. Therefore the main concern is regarding whether the costumer will be able to absorb the market or not and whether they are willing to pay for the goods or not.

4.1.7. Define the Risk Tolerance

The boards of director being interviewed are actually a married couple that have managed Company X for a long time and had built the same experience and knowledge. However, both of the members of the directors actually have different kind of risk level. Mr. X is a risk lover because he willing to take risk in order to gain something more, while Mrs. Y is moderate to risk because she don't want to take a make an invest that consider as risky.

4.1.8. Consider Linked Decision

The decision maker needs to consider the linked decision, which is the decision that is going to be made after choosing one from the available alternatives. The linked decision that needs to be made is regarding the next step that needs to be done when the alternative has been chosen and whether the result of the alternative will be successful or not. If the decision proves to be success, then the boards of director need to think for the way to maintain the success and to continue on improving.

The boards of director can either create a plan for another expansion, adding new merchandise, etc. If the decision proves to be a failure, than the board of the managers need to think of a way to improve the condition by either do a marketing effort or create a program that will attract the costumer to come to Company X.

4.2. Decision Tree

In order to be able to create a decision tree, the probability and attribute of each alternative is needed. The probability that is going to be used in this decision tree is gathered from the interview with the members of board of director that is going to be summarizing in Tabel 7 below.

Table 7. Probability of Decision Maker for Decision Tree

Criteria	Mr X	Mrs Y
Find a new land		
High		
Success	70	70
Failure	30	30
Medium		
Success	80	80
Failure	20	20
Low		
Success	90	90
Failure	10	10
Expand in a current place		
Renovate		
Success	90	90
Failure	10	10
Create a new building		
Success	90	90
Failure	10	10

The probability for success in expanding in a new place with high criteria is 70% because of the higher uncertainty that occur in the area. This is due to the high competition and the high demand from premium market. The success rate for expanding in a new land with medium criteria is stated to be 80%. The reason is because there will be less competition in the area and people with medium economic condition tends to be easier to satisfied and meet their needs rather than the premium target market in the high criteria place.

The success rate for expanding in a new land with low criteria is stated to be 90% because the competition in low criteria area is considered as low to none and therefore will make Company X able to dominant the market. The success rate for expanding in the current land is stated to be 90% because business in the current land is growing each year and has a good prospect and therefore has a big chance of success. The attribute that is going to be used to determine the value of each alternative will be the revenue of each alternative (in billion). The revenue for the success probability is gathered from the alternative subchapter defines above; as for the failure probability the revenue is actually half the revenue of success probability. Based on the data that has been gathered above, the decision tree is going to be constructed to determine the best course of alternatives that will generate the most revenue for one year.

Tabel 8. Decision Tree Value Table

Alternative	Revenue (in billion)
Expand in a new place (High Success)	17.459842.5
Expand in a new place (High Failure)	8.729921.25
Expand in a new place (Medium Success)	6.983937
Expand in a new place (Medium Failure)	3.491968.5
Expand in a new place (Low Success)	3.491968.5
Expand in a new place (Low Failure)	1.745984.25
Expand in the current place (Renovation Success)	8.380724.4
Expand in the current place (Renovation Failure)	4.190362.2
Expand in the current place (Create a new building Success)	13.967874
Expand in the current place (Create a new building Failure)	6.983937

Based on the decision tree tools, the best alternatives that can generate the most revenue for one year period is to expand in a new place with high criteria with given probability that can generate revenue Rp 14.840.866.000. The alternative is then going to be analyzing by using the sensitivity analysis that consist of two parts.

4.3. Sensitivity Analysis

Sensitivity analysis is use to examine the robustness of the best alternatives generated before. Sensitivity analysis tools will create an analysis on each alternative by performing what-if model that will result in both tornado and spider chart. The result will help the decision maker in making a consideration regarding the critical variable that will become the focus of the decision maker in gathering information to anticipate the action in reducing the uncertainty.

4.3.1. Identify Sensitive Variable

The first part in conducting a sensitivity analysis is to identify the variable that is sensitive to change. This variable can be identifying by generating the tornado and spider chart. In order to create a sensitivity analysis, the decision maker needs to make an input and output scenario, which will be shown as Table 9.

Table 9. Sensitivity Analysis Input

Input Variable	Base Value	Low Extreme	Base Value	High Extreme
Expand in a new place (High Success)	17459842.5	8729921.25	17459842.5	34919685
Expand in a new place (High Failure)	8729921.25	4364960.625	8729921.25	17459842.5
Expand in a new place (Medium Success)	6983937	3491968.5	6983937	13967874
Expand in a new place (Medium Failure)	3491968.5	1745984.25	3491968.5	6983937
Expand in a new place (Low Success)	3491968.5	1745984.25	3491968.5	6983937
Expand in a new place (Low Failure)	1745984.25	872992.125	1745984.25	3491968.5
Expand in the current place (Renovation Success)	8380724.4	4190362.2	8380724.4	16761448.8
Expand in the current place (Renovation Failure)	4190362.2	2095181.1	4190362.2	8380724.4
Expand in the current place (Create a new building Success)	13967874	6983937	13967874	27935748
Expand in the current place (Create a new building Failure)	6983937	3491968.5	6983937	13967874
Annual Revenue	14840866.13			

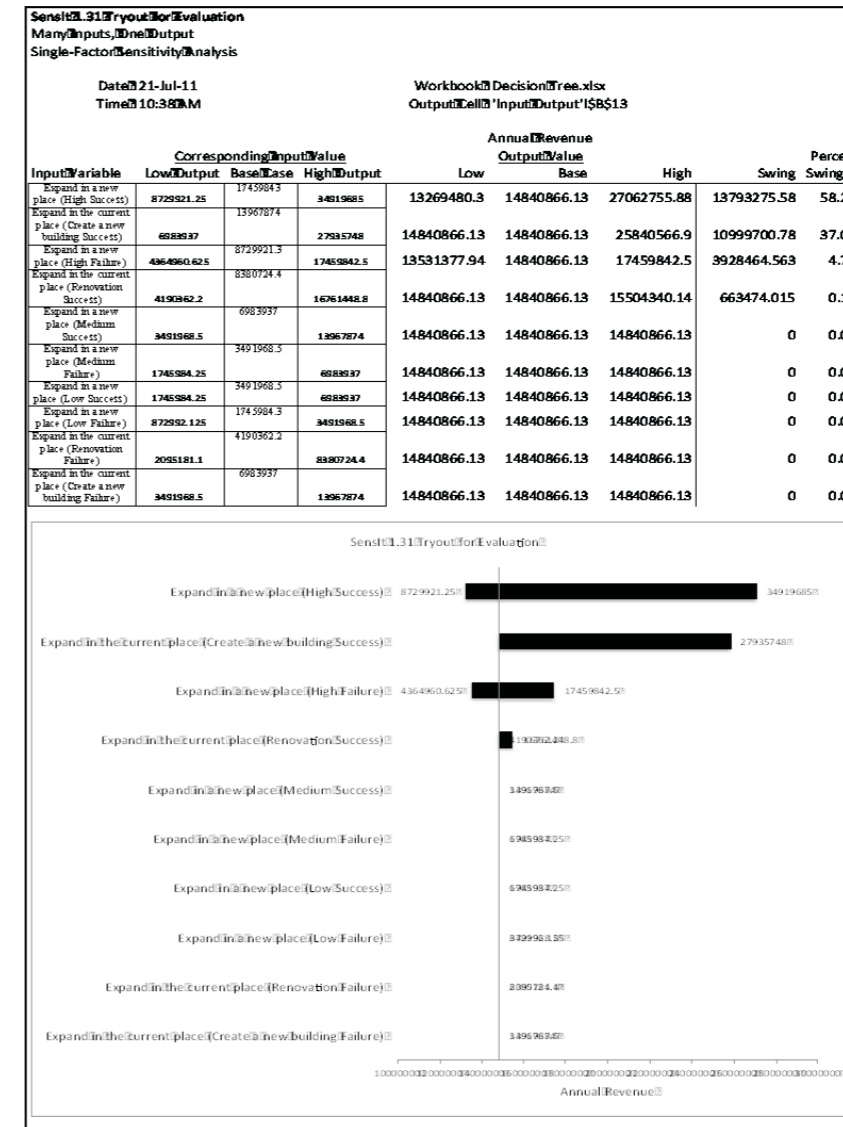


Figure 2. Sensitivity Analysis with Tornado Chart

The data for the base value is gathered from the revenue of each alternative gathered from the alternative revenue sub chapter. The probability of occurrence of each level that will happen is shown in the table low and high extreme. The low extreme is actually half the value of the base value and the high extreme is twice the value of the base value. The data is then processed using sensit tools that result in the tornado (Figure 2) and spider chart diagram (Figure 3).

The alternative in the tornado and spider chart is sorted with the name swing. In this research, swing is actually a rough measure of impact of each variable on the revenue generated. The tornado chart shows that the alternatives that has the most impact on the revenue is actually expand in a new place with high criteria and create a new building with success probability option. This indicate that the decision maker needs to focus on the expand building with high criteria and create a new building with success probability option as this option prove to be sensitive to change.

The spider chart indicates that the line that is nearly vertical indicates that the alternatives will have a big influence on the output value with just a small percentage of change. On the contrary, the line that is nearly horizontal indicates that the alternatives won't have big influence on the output value with just a small percentage of change. Based on the spider chart, the alternative that will have a big influence on the output value with just a small percentage of change will be expand building with high criteria and create a new building with success probability option.

The sensitivity analysis shows that the variable that is actually sensitive to change is actually the following variable, which is [1] *Expand in a new place (High Success)*, [2] *Expand in a current place (Create a new building Success)*, [3] *Expand in a new place (High Failure)*, [4] *Expand in a current place (Renovation Success)*.

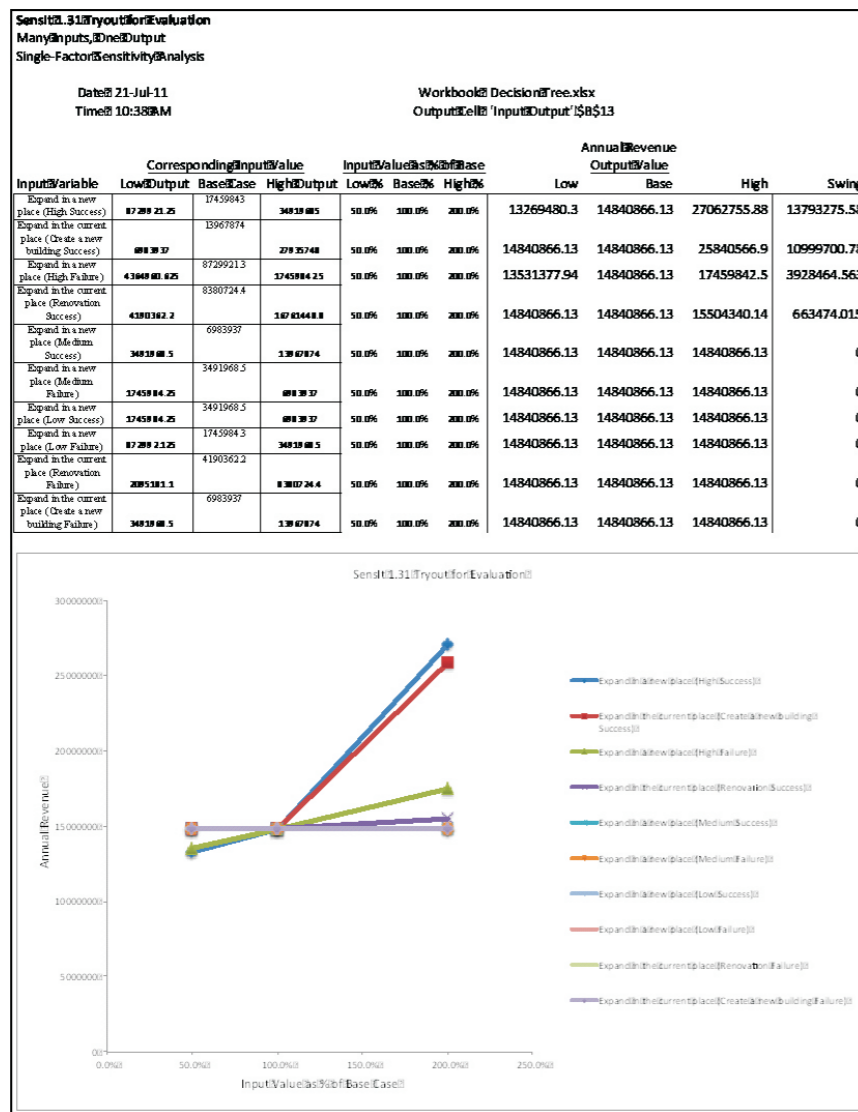


Figure 3. Sensitivity Analysis with Spider Chart

4.3.2. Decision Test

The result from the sensitivity analysis will be use to test the best alternatives generated by using the decision tree tools. This test purpose is to see the robustness of the alternatives with different scenario of one variable (low and high extreme value). The alternatives that will be use in this test is the alternative that is consider sensitive to change, which is the result from the sensitivity analysis conducted before. The change is going to be seen by using the decision tree with the change in the sensitive variable values.

a. Expand in a new place High Criteria (Success)

The first variable that is going to undergo a change of scenario is expanding in a new place with high criteria and success probability. The first test is conducting by inputting the low extreme value of the variable and the next step by inputting the high extreme value of the variable. The Decision Tree indicate that when the variable values is change to the low extreme which is 8729921.25, the best alternatives changes to the option 2 which is expand in a current place by creating a new building. However, when the variable values is change to the high extreme which is 34919685, the best alternative remain to alternative number one which is to expand in a new place with high criteria as seen figure 4.

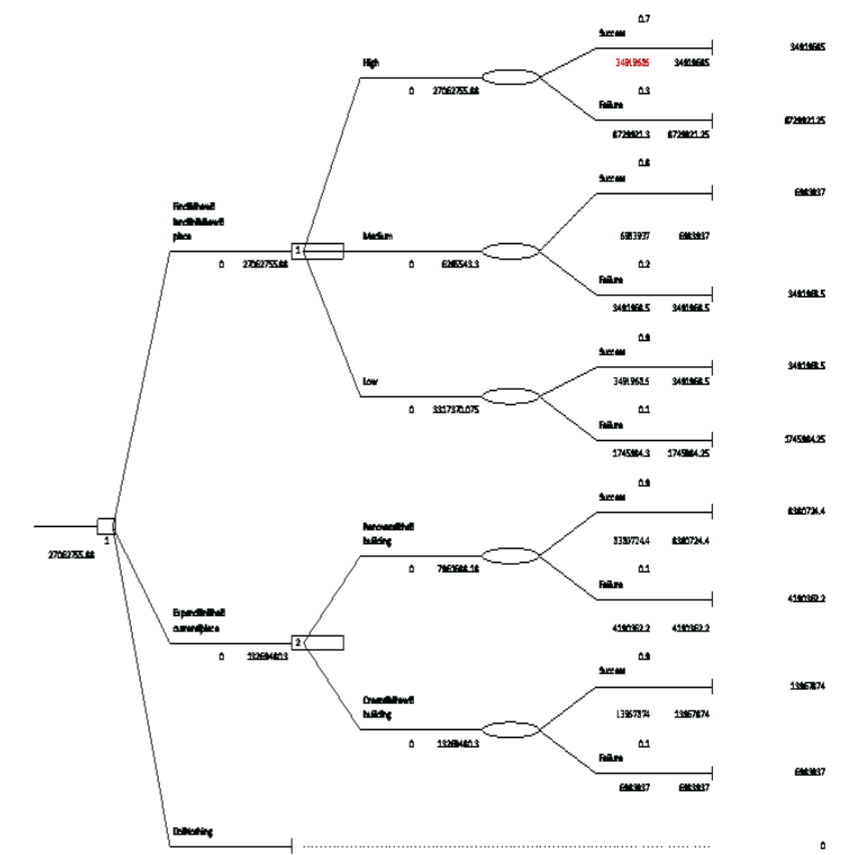


Figure 4. Decision Tree for Expand in a New Place (high success) High Extreme

b. Expand in current place by creating a new building (Success)

The second variable that is going to undergo a change of scenario is expanding in a current place by creating a new building and success probability. The first test is conducting by inputting the low extreme value of the variable and the next step by inputting the high extreme value of the variable.

The trees indicate that when the variable values is change to the low extreme which is 6983937, the best alternatives remain with alternative number 1 which is to expand in a new place with high criteria. However, when the variable values is change to the high extreme which is 27935748, the best alternative change to the alternative option number 2 which is to expand in the current place by creating a new building.

c. Expand in a new place High Criteria (Failure)

The third variable that is going to undergo a change of scenario is expanding in a new place with high criteria and success probability. The first test is conducting by inputting the low extreme value of the variable and the next step by inputting the high extreme value of the variable.

The trees indicate that when the variable values is change to the low extreme which is 4364960.625, the best alternatives remain to alternative number one which is to expand in a new place with high criteria. Meanwhile, when the variable values is change to the high extreme which is 17459842.5, the best alternative also remain to alternative number one which is to expand in a new place with high criteria.

d. Expand in a current place by doing a renovation (Success)

The fourth variable that is going to undergo a change of scenario is expanding in a new place with high criteria and success probability. The first test is conducting by inputting the low extreme value of the variable and the next step by inputting the high extreme value of the variable. The trees indicate that when the variable values is change to the low extreme which is 4190362.2, the best alternatives remain with alternative number 1 which is to expand in a new place with high criteria. However, when the variable values is change to the high extreme which is 16761448.8, the best alternative change to the alternative option number 2 which is to expand in the current place by doing a renovation.

The result of this test indicates that the best alternative generated using the decision tree, which is the option number 1 (expand in a new place with high criteria) is not robust. This means that in some different scenarios, this option turn out to not become the best option in expanding the business.

The best alternatives change to option number 2 which is to expand in the current place by creating a new building when the values of the expanding in a new place with high criteria (success) value is at the low extreme and the values of the expanding in a current place by creating a new building (Success) is at the high extreme. The best alternatives also changes to the option number 2 which is to expand in the current place by doing a renovation, when the value of the variables expand in the current place by doing a renovation (success) is at high extreme.

5. Conclusion and Recommendation

5.1. Conclusion

The alternative of expanding in a new place with high criteria will be the best option considering this alternative is the most robust and this alternative will consider as the best alternative when the values of the alternatives is at their basic and high extreme, while the other two alternatives become the best alternatives only when their value are at their high extreme. Company X also has developed their brand and has become a well-known brand in the market. Therefore the unlikely event of the occurrence of having a value at low extreme is consider as small and will still become the best alternative for Company X.

The best alternative of expanding in a new place with high criteria is also considered to be able to maximize the sales growth level of company X, because otherwise of being able to generate the most revenue, the location with high criteria is considered as very potential. The target market is the people who live around the area and most of the people who live in this area are consider being in a high class and therefore able to spend a lot of money on buying their daily needs because people with high economic condition tend to want the best product they can afford and ended up buying expensive products. The place that consider as high also will continue to grow even more that will result in an increase in the number of people who live there and will have a good impact on company X. Therefore the place with high criteria is very potential to generate the most growth and to help company X in realizing their goals.

5.2. Recommendation

Company X should choose to expand in a new place with high criteria, which means expanding in a place such as Setiabudhi or Dago Street. Even though the cost incur is considered as very high, it is actually an investment because the price of the building and the land will always increase because the location is consider as a good location. The revenue that is generated from this location is also the biggest of other alternatives consider this place is crowded and has become the center of activity.

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