CHAPTER IV

DATA COLLECTION AND PROCESSING

This chapter will discuss about the core of this research which are data collection and data processing. Data collection is an activity to gather the input data which will be processed for this research. Data processing is an activity to processes the input data which obtained in data collection to become a result by using certain method which selected by the researcher.

4.1 Data Collection

This research was taken in a batik manufacturer namely Sogan Batik Rejodani. In this research, it will be conducted a research about strategy selection by using SWOT and Fuzzy TOPSIS. First of all, researcher needs to collect data about SWOT. Then, based on the previous SWOT factor which has been gathered, the expert asked to formulate the strategy.

4.1.1 Company Profile

Researcher decided to conduct the research in a batik manufacturer in Sleman, Yogyakarta. The name of the company which selected by researcher is Sogan Batik Rejodani. The history of the company begins when a monetary crisis occurred in 1997. There were many Indonesian people who lost their job and triggered the increase of unemployed rate in this country. Because of that reason, the founder of this company built this company as a response to unemployment crisis in 2001.

The history of this company was not ended until that. In 2001 the company has learnt how to make batik in Nakula Sadewa batik company in Sleman, Yogyakarta. Other

than that, it also learnt about entrepreneurship through many seminars. One year after, the company proposed a business plan and proposal which were submitted to many investors, but unfortunately got rejected. Fortunately, the company obtained the investor from the owner's lecturer and family which worth 3 million rupiahs and another 7 million rupiahs after. The company cooperated with nature color batik artist and produced batik fabric, scarf, silk sarong with premium price between 2 million until 5 million rupiahs for upper class segment. Unfortunately, it did not work smoothly, because lack of marketing network. Hence, the stock has been piled up.

In 2003, the company started to produce their own product from the beginning in Rejodani village, train the batik artist from the beginning, bought batik equipment, with 3 production team. From 2004 until 2006, Sogan batik tried to target middle class segment which priced 60 thousand until 100 thousand rupiahs to be sold in some batik outlets in Yogyakarta and Jakarta, but unfortunately it did not work well because of very thin profit margin. Through Disperindag of Yogyakarta in 2007, the company was given facility for exhibition in domestic and international, and got some order for Japan until nowadays.

Finally, 2009 is the year of the rise of Sogan Batik. At this year, Sogan was introduced with online marketing from several friends. Other than that, some disabled people from Pesantren, Yakkum, Rehabilitation Centre Solo have joined this company in production division. The reason is because their financial condition is not good, but they need job for their daily needs. Their performance is very good, even compared to normal person. And also, the change of Sogan product become a specialized batik for Muslimah / Muslim family. At the end, in 2015, this company has employed 50 workers.

This batik company produces *batik tulis* and stamped batik. There are several equipments required to make a batik which are fabric, wax, dye, canting, and stamp. Almost all of their products are themed as Muslim and Muslimah batik. The company sells the batik to almost all cities in Indonesia. Even more, it also sells the products abroad to Hong Kong, Taiwan and South Korea. They also plan to sell their product to Australia and Malaysia. Currently, the country with most selling is in Hong Kong and Taiwan.

The company also designed some new patterns to create its own characteristic. Every product has its own story, not just a pattern without any meanings. It differentiates the products among other *batik* made from other batik manufacturer.

4.1.2   SWOT Factor

First of all, researcher needs to gather the SWOT factors from the company. The SWOT factors are the first input of this research. It is gathered from the experts by using interview method. The expert is asked to brainstorm and then explain the strengths, weaknesses, opportunities, and threats of the company. Below is the list of strengths, weaknesses, opportunities, and threats which researcher obtained:

Table 4.1 Table of Strengths

Code	STRENGHTS
S1	Handmade
S2	The pattern is own creation
S3	New design for each 3 months
S4	Modern batik with unique characteristic which inspired by Islam in Nusantara and the world
S5	Always learn newest online marketing strategy
S6	Online website and social media
S7	Located in the city of culture and tourist destination

Table 4.2 Table of Weakness

Code	WEAKNESSES
W1	Longer processing time compared to printed batik
W2	Unstable production
W3	Unstable sales
W4	Procurement process still not good
W5	Less famous compared to others branded batik

Table 4.3 Table of Opportunities

Code	OPPORTUNITIES
O1	The market area is still wide (Asia & Oceania)
O2	Many sources which can be used as inspiration for batik pattern
O3	The rise of Islamic fashion
O4	Indonesian government supports batik promotion
O5	The rise of social media and internet

Table 4.4 Table of Threats

Code	THREATS
T1	Plagiarism
T2	The rise of batik printing
T3	Tight competition
T4	Imported batik
T5	Price competition

4.1.3 IFE and EFE

In this research, researcher wants to combine between SWOT and Fuzzy TOPSIS. Several strategies must be eliminated in order to make the selection of strategy become narrower and accurate. IFE (Internal Factor Evaluation) and EFE (External Factor Evaluation) are used to find the suitable strategy for this company. Internal factor is factor which comes from inside of this business, so strengths and weaknesses factor are put together in IFE. The expert provides weight ranged from 1 until 4 on the questionnaire, but after that the weight must be ranged from 0 until 1 in these IFE and EFE table, and the total weight must be 1.

Table 4.5 Table of Internal Factor Weight

Code	INTERNAL FACTOR	Weight
S1	Handmade	4
S2	The pattern is own creation	4
S3	New design for each 3 months	3
S4	Modern batik with unique characteristic which inspired by Islam in Nusantara and the world	4
S5	Always learn newest online marketing strategy	4
S6	Online website and social media	4

S7	Located in the city of culture and tourist destination	2
W1	Longer processing time compared to printed batik	3
W2	Unstable production	4
W3	Unstable sales	4
W4	Procurement process still not good	4
W5	Less famous compared to others branded batik	3
	TOTAL	43

The weight must be ranged between 0 and 1, and the total weight must be 1. According to the table of internal factor weight above, the total weight is 43. It will become divider for all weights. For instance, factor S1 weight is 4, then the normalized weight is dividing 4 by 43 which is 0.093 as seen as in table below:

Table 4.6 Table of Normalized Factor Weight

Code	INTERNAL FACTOR	Weight
S1	Handmade	0.093
S2	The pattern is own creation	0.093
S3	New design for each 3 months	0.070
S4	Modern batik with unique characteristic which inspired by Islam in Nusantara and the world	0.093
S5	Always learn newest online marketing strategy	0.093
S6	Online website and social media	0.093
S7	Located in the city of culture and tourist destination	0.047
W1	Longer processing time compared to printed batik	0.070
W2	Unstable production	0.093
W3	Unstable sales	0.093
W4	Procurement process still not good	0.093
W5	Less famous compared to others branded batik	0.070
	TOTAL	1

In IFE, rating is the way out to differentiate internal strengths and weakness. Internal weakness is further divided in two categories namely minor weakness and major weakness same goes of the strengths (minor strength and major strength). The rating starts from 1 (major weakness), 2 (minor weakness), 3 (minor strength), and 4 (major strength).

Table 4.7 Table of Internal Factor Rating

Code	INTERNAL FACTOR	Weight	Rating
S1	Handmade	0.093	4
S2	The pattern is own creation	0.093	4
S3	New design for each 3 months	0.070	4
S4	Modern batik with unique characteristic which inspired by Islam in Nusantara and the world	0.093	4
S5	Always learn newest online marketing strategy	0.093	3
S6	Online website and social media	0.093	3
S7	Located in the city of culture and tourist destination	0.047	4
W1	Longer processing time compared to printed batik	0.070	2
W2	Unstable production	0.093	1
W3	Unstable sales	0.093	1
W4	Procurement process still not good	0.093	1
W5	Less famous compared to others branded batik	0.070	2
	TOTAL	1	

External factor is factor that comes from outside of this business, so opportunities and threats factor are put together in EFE. Below is the table of EFE, and the method is as the same as the IFE above, but with different input.

Table 4.8 Table of External Factor Weight

Code	EXTERNAL FACTOR	Weight
O1	The market area is still wide (Asia & Oceania)	4
O2	Many sources which can be used as inspiration for batik pattern	3
O3	The rise of Islamic fashion	4
O4	Indonesian government supports batik promotion	3
O5	The rise of social media and internet	4
T1	Plagiarism	4
T2	The rise of batik printing	1
T3	Thigh competition	4
T4	Imported batik	3
T5	Price competition	4
	TOTAL	34

The weight must be ranged between 0 and 1, and the total weight must be 1. According to the table of external factor weight above, the total weight is 34. It will become divider for

all weight. For instance, factor O1 weight is 4, then the normalized weight is dividing 4 by 34 which is 0.118 as seen as in table below:

Table 4.9 Table of Normalized External Factor Weight

Code	EXTERNAL FACTOR	Weight
O1	The market area is still wide (Asia & Oceania)	0.118
O2	Many sources which can be used as inspiration for batik pattern	0.088
O3	The rise of Islamic fashion	0.118
O4	Indonesian government supports batik promotion	0.088
O5	The rise of social media and internet	0.118
T1	Plagiarism	0.118
T2	The rise of batik printing	0.029
T3	Tight competition	0.118
T4	Imported batik	0.088
T5	Price competition	0.118
	TOTAL	1

In EFE, rating represents the response of firm towards the opportunities and threats. The higher the rating, the better response of the firm to exploit opportunities and defend the threats. The rating starts from 1 (poor response), 2 (average response), 3 (above average response), and 4 (superior response).

Table 4.10 Table of External Factor Rating

Code	EXTERNAL FACTOR	Weight	Rating
O1	The market area is still wide (Asia & Oceania)	0.118	4
O2	Many sources which can be used as inspiration for batik pattern	0.088	3
O3	The rise of Islamic fashion	0.118	4
O4	Indonesian government supports batik promotion	0.088	3
O5	The rise of social media and internet	0.118	3
T1	Plagiarism	0.118	2
T2	The rise of batik printing	0.029	3
T3	Tight competition	0.118	3
T4	Imported batik	0.088	1
T5	Price competition	0.118	3
	TOTAL	1	

To find the total score, score of each factor must be known by multiply weight and rating.

Table 4.11 IFE Matrix

Code	INTERNAL FACTOR	Weight	Rating	Score
S1	Handmade	0.093	4	0.372
S2	The pattern is own creation	0.093	4	0.372
S3	New design for each 3 months	0.070	4	0.279
S4	Modern batik with unique characteristic which inspired by Islam in Nusantara and the world	0.093	4	0.372
S5	Always learn newest online marketing strategy	0.093	3	0.279
S6	Online website and social media	0.093	3	0.279
S7	Located in the city of culture and tourist destination	0.047	4	0.186
W1	Longer processing time compared to printed batik	0.070	2	0.140
W2	Unstable production	0.093	1	0.093
W3	Unstable sales	0.093	1	0.093
W4	Procurement process still not good	0.093	1	0.093
W5	Less famous compared to others branded batik	0.070	2	0.140
	TOTAL	1		2.70

Table 4.12 EFE Matrix

Code	EXTERNAL FACTOR	Weight	Rating	Score
O1	The market area is still wide (Asia & Oceania)	0.118	4	0.471
O2	Many sources which can be used as inspiration for batik pattern	0.088	3	0.265
O3	The rise of Islamic fashion	0.118	4	0.471
O4	Indonesian government supports batik promotion	0.088	3	0.265
O5	The rise of social media and internet	0.118	3	0.353
T1	Plagiarism	0.118	2	0.235
T2	The rise of batik printing	0.029	3	0.088
T3	Tight competition	0.118	3	0.353
T4	Imported batik	0.088	1	0.088
T5	Price competition	0.118	3	0.353
	TOTAL	1		2.94

From the result above, the total score of IFE is 2.70 and EFE is 2.94. Then, those scores will be put to the SWOT quadrant below.
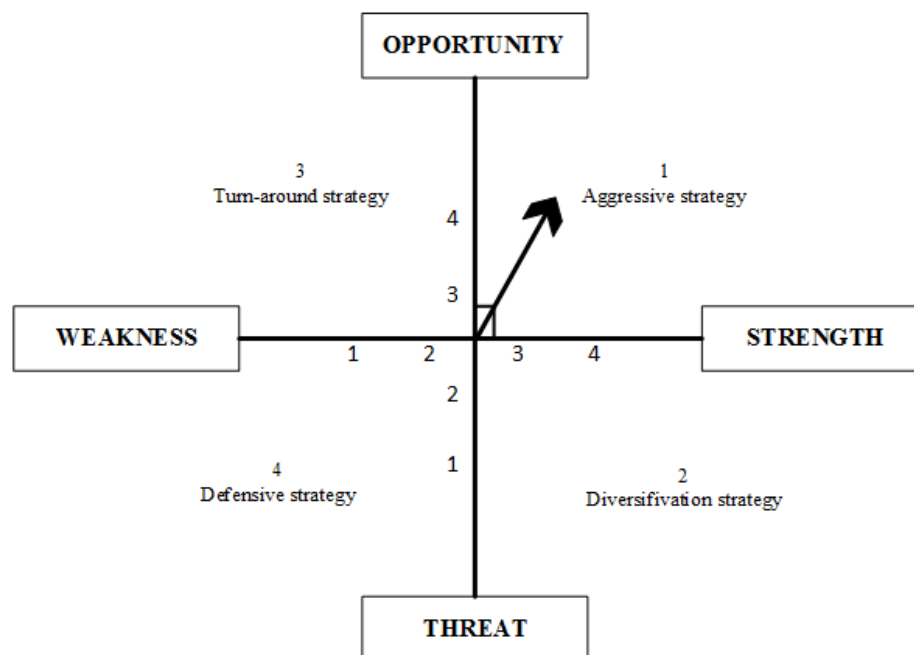
Figure 4.1 SWOT Quadrant

According to quadrant above, the most suitable strategy for this company is Aggressive Strategy or also known as SO Strategy, which means researcher should formulate the strategy based on Strength and Opportunity.

4.1.4 SWOT Strategy

After finishing the process IFE, EFE and the suitable company strategy was known from the quadrant which is SO Strategy, then the expert is asked to formulate strategy according to SWOT factor which has been gathered before. There are 4 strategies, which are SO strategy, ST strategy, WO strategy, and WT strategy. SO strategy means the strategy which made to response the Strengths and Opportunities factor. ST strategy means the strategy which made to response the Strengths and Threats factor. WO strategy means the strategy which made to response the Weaknesses and Opportunities factor. WT strategy means the strategy which made to response the Weaknesses and Threats factor. In this research, the suitable company position is in SO strategy, so the expert only formulates the selected strategy which is SO strategy.

Table 4.13 SO Strategy

Code	Strategy	Origin
SO1	Focus promoting Muslim batik to predominantly Muslim area	S4, O1, O3
SO2	Expand market area by focusing on Sogan characteristic	S2, S3, S4, S5, O1, O2, O4
SO3	Cooperate with Muslim fashion store	S3, S4, O3
SO4	Focus promoting product through social media and online marketing	S5, S6, O5
SO5	Improve batik gallery & workshop	S1, S7, O4

The reason why the expert formulates SO1 strategy is because the company wants to exploit current condition where Islamic fashion rising in many areas especially area with predominantly Islam religion. They try to utilize their strength by creating Islamic clothing combined by modern batik with unique characteristic which inspired by Islam in Indonesia and the world. The market will be focused to area with predominantly Islam religion.

SO2 strategy is formulated to exploit the campaign of Indonesia government that support batik promotion in domestic and foreign as well. To make differentiation with other batik product, they always make their own pattern and renewing it every 3 months. Other than that, they already sold their products to 3 Asian countries and in the future they will try to sell their product to 1 country in Asia and in Australia. In this strategy, the company will be more focus on developing their own pattern and offering the uniqueness of Sogan Batik Rejodani's characteristics to expand the market area.

SO3 strategy is formulated to exploit the rise of Islamic fashion by performing their strengths which is new design every 3 months, because there would be several competitors that sell their product through Muslim fashion store as well. Therefore, Sogan Batik Rejodani will be ready to compete with their competitor. Other than that, S4 strength is performed to make uniqueness when they sell their product in Muslim fashion store.

SO4 strategy is formulated because, internet and social media becoming popular nowadays. Fortunately, Sogan Batik Rejodani already had online website and several social media such as Facebook, Instagram, etc to sell their product. The company always learning newest online marketing strategy as well.

SO5 strategy is formulated because the company wants to exploit the opportunity for campaign from Indonesia government to support batik promotion. They want to offer the uniqueness when they promote their product by organizing batik workshop and improving their gallery. Because they create batik tulis and batik cap, they can offer how to make batik using traditional equipment like canting. Fortunately, their gallery located near the city of culture and tourist destination, Yogyakarta. Moreover, the government of Indonesia support the tourism in this country.

4.1.5   Fuzzy TOPSIS

SO strategy consists of 5 strategies. Therefore, researcher is going to rank those 5 strategies by using Fuzzy TOPSIS. The first step of Fuzzy TOPSIS is asked the expert to gives score between strategy and all SWOT factors as listed in Table 4.15 and Table 4.16 using linguistic variable as listed in Table 4.14 below:

Table 4.14 Linguistic Variable

Code	Linguistic Variable
VP	Very Poor
P	Poor
F	Fair
G	Good
VG	Very Good

Table 4.15 Rating of Strategy and All Factor

Code	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4	W5
SO1	VP	F	F	VG	VG	VG	P	VP	P	P	VP	VG
SO2	G	VG	VG	VG	F	F	G	F	P	P	P	F
SO3	VG	VG	VG	VG	VP	F	VP	F	G	P	G	VG
SO4	F	F	F	F	VG	VG	G	VP	P	P	P	G
SO5	VG	F	VP	VP	VP	G	VG	VP	VP	VP	VP	G

Table 4.16 Rating of Strategy and All Factor

Code	O1	O2	O3	O4	O5	T1	T2	T3	T4	T5
SO1	VG	VP	VG	VG	VG	P	F	VG	G	VG
SO2	G	VG	G	VG	F	VG	P	VG	G	VG
SO3	G	F	VG	G	F	VP	G	VG	G	VG
SO4	VG	P	P	VG	VG	F	VG	VG	F	VG
SO5	VP	VP	P	VG	G	G	VP	P	VP	F

4.2 Data Processing

4.2.1 Fuzzy TOPSIS

A. Value Conversion to Triangular Fuzzy Number (TFN)

The first step is to convert the linguistic variable from Table 4.15 and Table 4.16 into Triangular Fuzzy Number. For instance, the linguistic variable of SO1-S1 in Table 4.15 is VP. Then, the Triangular Fuzzy Number of VP is (0, 1, 3), and it will be input to Table 4.18. All linguistic variable from Table 4.15 and Table 4.16 are inputted into Table 4.18.

Table 4.17 Triangular Fuzzy Number

Linguistic Variable	Triangular Fuzzy Number
VP	(0, 1, 3)
P	(1, 3, 5)
F	(3, 5, 7)
G	(5, 7, 9)
VG	(7, 9, 10)

Table 4.18 Fuzzy ratings of Strategy and All Factor

Strategy	S1			S2			S3			S4			S5			S6			S7		
	l	M	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
SO1	0	1	3	3	5	7	3	5	7	7	9	10	7	9	10	7	9	10	1	3	5
SO2	5	7	9	7	9	10	7	9	10	7	9	10	3	5	7	3	5	7	5	7	9
SO3	7	9	10	7	9	10	7	9	10	7	9	10	0	1	3	3	5	7	0	1	3
SO4	3	5	7	3	5	7	3	5	7	3	5	7	7	9	10	7	9	10	5	7	9
SO5	7	9	10	3	5	7	0	1	3	0	1	3	0	1	3	5	7	9	7	9	10

Strategy	W1			W2			W3			W4			W5		
	L	m	u	l	m	u	l	m	u	l	m	u	l	m	u
SO1	0	1	3	1	3	5	1	3	5	0	1	3	7	9	10
SO2	3	5	7	1	3	5	1	3	5	1	3	5	3	5	7
SO3	3	5	7	5	7	9	1	3	5	5	7	9	7	9	10
SO4	0	1	3	1	3	5	1	3	5	1	3	5	5	7	9
SO5	0	1	3	0	1	3	0	1	3	0	1	3	5	7	9

Strategy	O1			O2			O3			O4			O5		
	l	m	u	L	m	u	l	m	u	l	m	u	l	m	u
SO1	7	9	10	0	1	3	7	9	10	7	9	10	7	9	10
SO2	5	7	9	7	9	10	5	7	9	7	9	10	3	5	7
SO3	5	7	9	3	9	10	7	9	10	5	7	9	3	5	7
SO4	7	9	10	1	3	5	1	3	5	7	9	10	7	9	10
SO5	0	1	3	0	1	3	1	3	5	7	9	10	5	7	9

Strategy	T1			T2			T3			T4			T5		
	l	m	u	L	m	u	l	m	u	l	m	u	l	m	u
SO1	1	3	5	3	5	7	7	9	10	5	7	9	7	9	10
SO2	7	9	10	1	3	5	7	9	10	5	7	9	7	9	10
SO3	0	1	3	5	7	9	7	9	10	5	7	9	7	9	10
SO4	3	5	7	7	9	10	7	9	10	3	5	7	7	9	10
SO5	5	7	9	0	1	3	1	3	5	0	1	3	3	5	7

B. Defuzzification

This research utilizes Center of Area method to do defuzzification. It is because of its simplicity and also practical. The defuzzified value of the triangular fuzzy number above can be obtained by utilizes below equation:

$$D = \frac{[(U - L) + (M - L)]}{3} + L$$

For instance, the defuzzified value of SO1-S1 in Table 4.16:

L   = 0

M   = 1

U   = 3

$$D = \frac{[(3 - 0) + (1 - 0)]}{3} + 0$$
$$D = 1.33$$

So, by utilitizes the equation above, the defuzzified value of SO1-S1 is 1.33. The defuzzified value of Table 4.18 can be seen in Table 4.19 below:

Table 4.19 Ratings after defuzzified

Alternative	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4
SO1	1.33	5.00	5.00	8.67	8.67	8.67	3.00	1.33	3.00	3.00	1.33
SO2	7.00	8.67	8.67	8.67	5.00	5.00	7.00	5.00	3.00	3.00	3.00
SO3	8.67	8.67	8.67	8.67	1.33	5.00	1.33	5.00	7.00	3.00	7.00
SO4	5.00	5.00	5.00	5.00	8.67	8.67	7.00	1.33	3.00	3.00	3.00
SO5	8.67	5.00	1.33	1.33	1.33	7.00	8.67	1.33	1.33	1.33	1.33
Alternative	W5	O1	O2	O3	O4	O5	T1	T2	T3	T4	T5
SO1	8.67	8.67	1.33	8.67	8.67	8.67	3.00	5.00	8.67	7.00	8.67
SO2	5.00	7.00	8.67	7.00	8.67	5.00	8.67	3.00	8.67	7.00	8.67
SO3	8.67	7.00	7.33	8.67	7.00	5.00	1.33	7.00	8.67	7.00	8.67
SO4	7.00	8.67	3.00	3.00	8.67	8.67	5.00	8.67	8.67	5.00	8.67
SO5	7.00	1.33	1.33	3.00	8.67	7.00	7.00	1.33	3.00	1.33	5.00

C. Normalize Decision Matrix

After the defuzzified value obtained, then the next part is normalizing decision matrix. This part also as the beginning of TOPSIS method after Fuzzy has been performed. The first step is researcher needs to square all defuzzified value in Table 4.19 and summarize all those squared values vertically. Then, all of the summarize results must be rooted. The last step is to divide all of defuzzified value in Table 4.19 by the rooted value. The result can be seen in table below.

Table 4.20 Normalized decision matrix

Alternative	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4
SO1	0.09	0.33	0.35	0.55	0.65	0.55	0.22	0.18	0.34	0.49	0.16
SO2	0.47	0.58	0.61	0.55	0.37	0.32	0.52	0.67	0.34	0.49	0.36
SO3	0.58	0.58	0.61	0.55	0.10	0.32	0.10	0.67	0.79	0.49	0.83
SO4	0.33	0.33	0.35	0.31	0.65	0.55	0.52	0.18	0.34	0.49	0.36
SO5	0.58	0.33	0.09	0.08	0.10	0.44	0.64	0.18	0.15	0.22	0.16
Alternative	W5	O1	O2	O3	O4	O5	T1	T2	T3	T4	T5
SO1	0.52	0.55	0.11	0.59	0.46	0.69	0.24	0.40	0.49	0.53	0.48
SO2	0.34	0.44	0.73	0.47	0.46	0.40	0.69	0.24	0.49	0.53	0.48
SO3	0.79	0.44	0.62	0.59	0.37	0.40	0.11	0.55	0.49	0.53	0.48
SO4	0.34	0.55	0.25	0.20	0.46	0.69	0.40	0.69	0.49	0.38	0.48
SO5	0.15	0.08	0.11	0.20	0.46	0.55	0.55	0.11	0.17	0.10	0.28

D. Calculate the weighted normalized decision matrix

The second part is weighting normalized decision matrix. In this part, the normalized decision matrix in Table 4.20 must be multiplied by the weight. Because the factors are as the same as in IFE and EFE, then the weight of all factor utilize from IFE and EFE table as well.

Table 4.21 Weighted normalized decision matrix

STRATEGY	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4
Weight	0.09	0.09	0.07	0.09	0.09	0.09	0.05	0.07	0.09	0.09	0.09
SO1	0.01	0.03	0.02	0.05	0.06	0.05	0.01	0.01	0.03	0.05	0.01
SO2	0.04	0.05	0.04	0.05	0.03	0.03	0.02	0.05	0.03	0.05	0.03
SO3	0.05	0.05	0.04	0.05	0.01	0.03	0.00	0.05	0.07	0.05	0.08
SO4	0.03	0.03	0.02	0.03	0.06	0.05	0.02	0.01	0.03	0.05	0.03
SO5	0.05	0.03	0.01	0.01	0.01	0.04	0.03	0.01	0.01	0.02	0.01
STRATEGY	W5	O1	O2	O3	O4	O5	T1	T2	T3	T4	T5
Weight	0.07	0.12	0.09	0.12	0.09	0.12	0.12	0.03	0.12	0.09	0.12
SO1	0.04	0.06	0.01	0.07	0.04	0.08	0.03	0.01	0.06	0.05	0.06
SO2	0.02	0.05	0.06	0.06	0.04	0.05	0.08	0.01	0.06	0.05	0.06
SO3	0.06	0.05	0.05	0.07	0.03	0.05	0.01	0.02	0.06	0.05	0.06
SO4	0.02	0.06	0.02	0.02	0.04	0.08	0.05	0.02	0.06	0.03	0.06
SO5	0.01	0.01	0.01	0.02	0.04	0.07	0.07	0.00	0.02	0.01	0.03

E. Determine the positive ideal and negative ideal solution

In this part, researcher needs to choose which factor is A* and A- value. Before to do that, all factors must be defined whether it is considered as benefit or cost. In this case, it is obviously that strengths and opportunities factors are considered as benefit, while weaknesses and threats factors are considered as cost. It can be seen in the table below:

Table 4.22 Benefit / Cost of the factor

Factor	Benefit / Cost
S1	Benefit (B)
S2	Benefit (B)
S3	Benefit (B)
S4	Benefit (B)
S5	Benefit (B)
S6	Benefit (B)
S7	Benefit (B)
W1	Cost (C)
W2	Cost (C)
W3	Cost (C)
W4	Cost (C)

W5	Cost (C)
O1	Benefit (B)
O2	Benefit (B)
O3	Benefit (B)
O4	Benefit (B)
O5	Benefit (B)
T1	Cost (C)
T2	Cost (C)
T3	Cost (C)
T4	Cost (C)
T5	Cost (C)

When factor X considered as benefit, then the highest value is A*, and the lowest value is A-. Otherwise, if factor X is considered as cost, then the lowest value is A*, and the highest value is A-.

Table 4.23 Positive ideal and negative ideal solution

	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4
Benefit/Cost	B	B	B	B	B	B	B	C	C	C	C
SO1	0.01	0.03	0.02	0.05	0.06	0.05	0.01	0.01	0.03	0.05	0.01
SO2	0.04	0.05	0.04	0.05	0.03	0.03	0.02	0.05	0.03	0.05	0.03
SO3	0.05	0.05	0.04	0.05	0.01	0.03	0.00	0.05	0.07	0.05	0.08
SO4	0.03	0.03	0.02	0.03	0.06	0.05	0.02	0.01	0.03	0.05	0.03
SO5	0.05	0.03	0.01	0.01	0.01	0.04	0.03	0.01	0.01	0.02	0.01
A+	**0.05**	**0.05**	**0.04**	**0.05**	**0.06**	**0.05**	**0.03**	**0.01**	**0.01**	**0.02**	**0.01**
A-	**0.01**	**0.03**	**0.01**	**0.01**	**0.01**	**0.03**	**0.01**	**0.05**	**0.07**	**0.05**	**0.08**
	W5	**O1**	**O2**	**O3**	**O4**	**O5**	**T1**	**T2**	**T3**	**T4**	**T5**
Benefit/Cost	C	B	B	B	B	B	C	C	C	C	C
SO1	0.04	0.06	0.01	0.07	0.04	0.08	0.03	0.01	0.06	0.05	0.06
SO2	0.02	0.05	0.06	0.06	0.04	0.05	0.08	0.01	0.06	0.05	0.06
SO3	0.06	0.05	0.05	0.07	0.03	0.05	0.01	0.02	0.06	0.05	0.06
SO4	0.02	0.06	0.02	0.02	0.04	0.08	0.05	0.02	0.06	0.03	0.06
SO5	0.01	0.01	0.01	0.02	0.04	0.07	0.07	0.00	0.02	0.01	0.03
A+	**0.01**	**0.06**	**0.06**	**0.07**	**0.04**	**0.08**	**0.01**	**0.02**	**0.02**	**0.01**	**0.03**
A-	**0.06**	**0.01**	**0.02**	**0.02**	**0.03**	**0.05**	**0.05**	**0.00**	**0.06**	**0.03**	**0.06**

F. Calculate the Euclidean distances of each alternative from the positive ideal solution and the negative ideal solution,

For separation from positive ideal step, all values in Table 4.23 must be divided by A*, and the result can be seen in Table 4.24 After that all of value must be summarized horizontally. Then, all of summarization results must be rooted, and the result can be seen in Table 4.25. To separate from negative ideal, the method is as same as when separating from positive ideal, but all values in Table 4.23 must be divided by A-.

Table 4.24 Separation from positive ideal (D+)

	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4
SO1	0.0021	0.0005	0.0003	0.0000	0.0000	0.0000	0.0004	0.0000	0.0003	0.0006	0.0000
SO2	0.0001	0.0000	0.0000	0.0000	0.0007	0.0005	0.0000	0.0012	0.0003	0.0006	0.0003
SO3	0.0000	0.0000	0.0000	0.0000	0.0026	0.0005	0.0006	0.0012	0.0036	0.0006	0.0039
SO4	0.0005	0.0005	0.0003	0.0005	0.0000	0.0000	0.0000	0.0000	0.0003	0.0006	0.0003
SO5	0.0000	0.0005	0.0013	0.0018	0.0026	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	W5	O1	O2	O3	O4	O5	T1	T2	T3	T4	T5
SO1	0.0007	0.0000	0.0029	0.0000	0.0000	0.0000	0.0002	0.0000	0.0014	0.0014	0.0006
SO2	0.0002	0.0002	0.0000	0.0002	0.0000	0.0012	0.0047	0.0001	0.0014	0.0014	0.0006
SO3	0.0020	0.0002	0.0001	0.0000	0.0001	0.0012	0.0000	0.0000	0.0014	0.0014	0.0006
SO4	0.0002	0.0000	0.0018	0.0021	0.0000	0.0000	0.0012	0.0000	0.0014	0.0006	0.0006
SO5	0.0000	0.0030	0.0029	0.0021	0.0000	0.0002	0.0028	0.0002	0.0000	0.0000	0.0000

Table 4.25 Result of separation from positive ideal (D+)

	Total	SQRT
SO1	0.012	0.108
SO2	0.014	0.117
SO3	0.020	0.141
SO4	0.011	0.105
SO5	0.018	0.133

Table 4.26 Separation from negative ideal (D-)

	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4
SO1	0.0000	0.0000	0.0003	0.0018	0.0026	0.0005	0.0000	0.0012	0.0018	0.0008	0.0039
SO2	0.0012	0.0005	0.0013	0.0018	0.0007	0.0000	0.0002	0.0000	0.0018	0.0008	0.0020
SO3	0.0021	0.0005	0.0013	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000
SO4	0.0005	0.0000	0.0003	0.0005	0.0026	0.0005	0.0002	0.0012	0.0018	0.0008	0.0020
SO5	0.0021	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004	0.0012	0.0036	0.0029	0.0039

	W5	O1	O2	O3	O4	O5	T1	T2	T3	T4	T5
SO1	0.0004	0.0030	0.0002	0.0021	0.0001	0.0012	0.0003	0.0001	0.0000	0.0002	0.0000
SO2	0.0010	0.0018	0.0018	0.0010	0.0001	0.0000	0.0012	0.0000	0.0000	0.0002	0.0000
SO3	0.0000	0.0018	0.0010	0.0021	0.0000	0.0000	0.0012	0.0002	0.0000	0.0002	0.0000
SO4	0.0010	0.0030	0.0000	0.0000	0.0001	0.0012	0.0000	0.0003	0.0000	0.0000	0.0000
SO5	0.0020	0.0000	0.0002	0.0000	0.0001	0.0003	0.0003	0.0000	0.0014	0.0006	0.0006

Table 4.27 Result of separation from negative ideal (D-)

	Total	SQRT
SO1	0.020	0.143
SO2	0.017	0.131
SO3	0.013	0.114
SO4	0.016	0.126
SO5	0.020	0.140

G. Calculate the Relative Closeness to the Ideal Solution

This is the final step of TOPSIS method. In this step, researcher uses equation below, where D+ is all rooted results of positive ideal in Table 4.25 and D- is all rooted results of negative ideal in Table 4.27.

$$V = \frac{D-}{[(D+) + (D-)]}$$

Table 4.28 Relative closeness to ideal solution

Alternative	D+	D-	V	%	Rank
SO1	0.108	0.143	**0.570**	**21.87%**	**1**
SO2	0.117	0.131	**0.530**	**20.33%**	**3**
SO3	0.141	0.114	**0.446**	**17.11%**	**5**
SO4	0.105	0.126	**0.546**	**20.95%**	**2**
SO5	0.133	0.140	**0.514**	**19.74%**	**4**
			2.606		

According to Table 4.28, strategy SO 1 has the highest score, while strategy SO 3 has the lowest score.