CHAPTER 3

RESEARCH METHODOLOGY

The research concerns in the improvement project on service industry with Dragon Family Karaoke as the representative. The research is divided into several steps such as the preliminary study and observation to collect the information until conclusion and recommendation to provide the better improvement project on service industry. The methodology applied in this research is divided into several stages to form a systematical structure. The flowchart of several stages applied in this research is shown on Figure 3.1.

3.1. Preliminary Study and Observation

The preliminary study was conducted to investigate current issues, concepts and statements related to project selection, the application of AHP method and the project management in the research. In this research, the preliminary study was used to utilize the researcher point of view in implementing the AHP, conducting the sensitivity analysis and project management in the improvement project implementation on service industry.

The observation was conducted at Dragon Family Karaoke as the representative of service industry in this research indirectly and directly. The direct observation was the exploration in service industry by the researcher to find the possible way to solve the existing problem in the company. The indirect observation was the discussion with the manager, several staffs and customers in service industry with the preliminary study as the support in this activity.

3.2. Literature Review

The literature review began with selecting the documents in the ProQuest Databases Engines, several books and journals through various sources. The documents were sorted to “Peer Reviewed” and the publication year is between 2010 and 2016. The literature review in this research is classified into four categories. The categories are the Multiple Criteria Decision Making (MDCM), project selection, Analytic Hierarchy Process and the project management. The total of 23 papers is taken to contribute in the literature review.

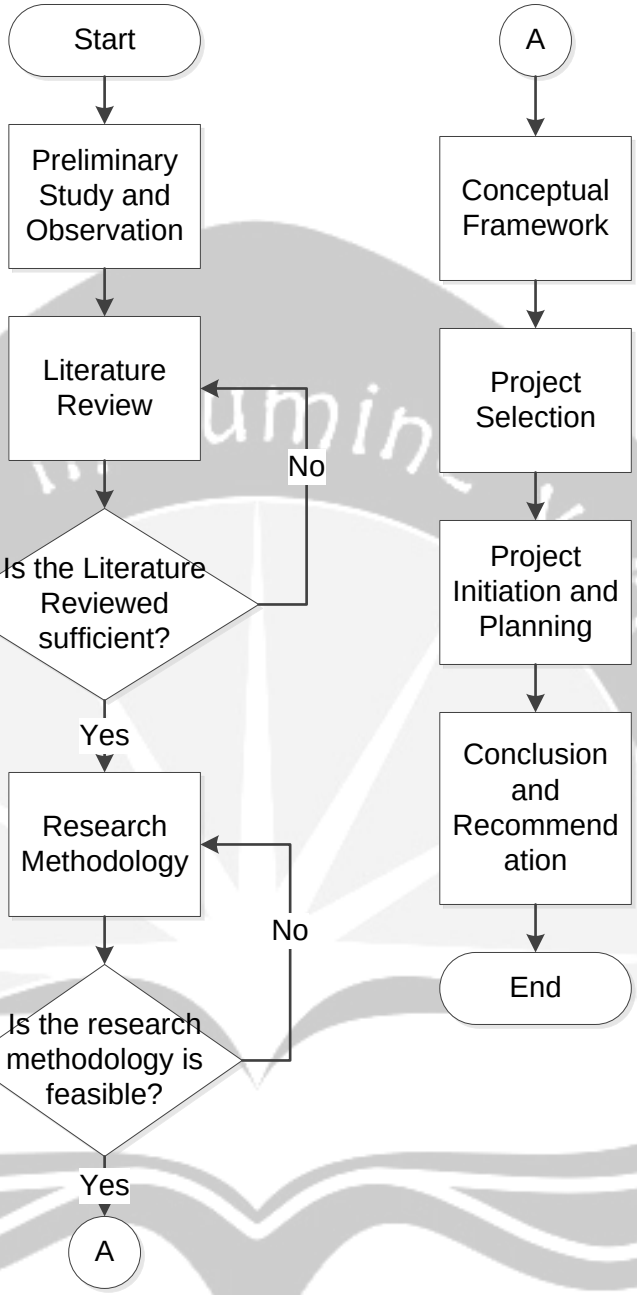


Figure 3.1. Flowchart of Research Methodology

3.3. Research Methodology

The research methodology in this research is generated based on the researcher's perspective with the knowledge from literature review and preliminary studies with the observation on the research location along with consultation and interview with the experts. The methodology was derived from the current issues related to customer satisfaction which performs as a trigger to the improvement in service industry.

3.4. Conceptual Framework

The conceptual framework is the generation of the scheme in this research as the structure of the proposed solution in solving the enhancement of customer satisfaction as the current issue in the organization. The conceptual framework presented a graphical scheme along with the relation of each activities and the issue to be solved. The conceptual framework brings the idea of the author in solving the issue. In the conceptual framework, the exploration of this research is explained in the form of commencement of the research to give an introductory description of the subject and issue covered in this research and followed by the determination of the improvement projects which were the alternatives in the project selection to describe the list of the improvement based on the interview with the owner of Dragon Family Karaoke.

3.5. Project Selection

The project selection began with the determination of possible improvement projects in Dragon Family Karaoke as the service industry. The list of possible projects is evaluated using AHP to generate the priority/weight of alternatives followed by the sensitivity analysis. Figure 3.2. illustrates the flowchart in project selection. The steps of project selection in this research is refer to Saaty (1987) with the addition of several steps as the adjustment to the current issues concerned in this research, consistency evaluation which refer to Deturck (1987) along with the sensitivity analysis which refer to Arbel (1987).

a. Hierarchical structure

Identification of hierarchical structure is conducted as the base for the design of pairwise comparison matrices. The first step was the composition of the criteria to select the improvement project to be implemented based on the owner's perspective. After obtaining the list of projects and the criteria in selecting the project, the hierarchical structure of decision problem was generated. The hierarchical structure for the Analytic Hierarchy Process adopted in this research is developed by Saaty (1980) and shown on Figure 3.3.

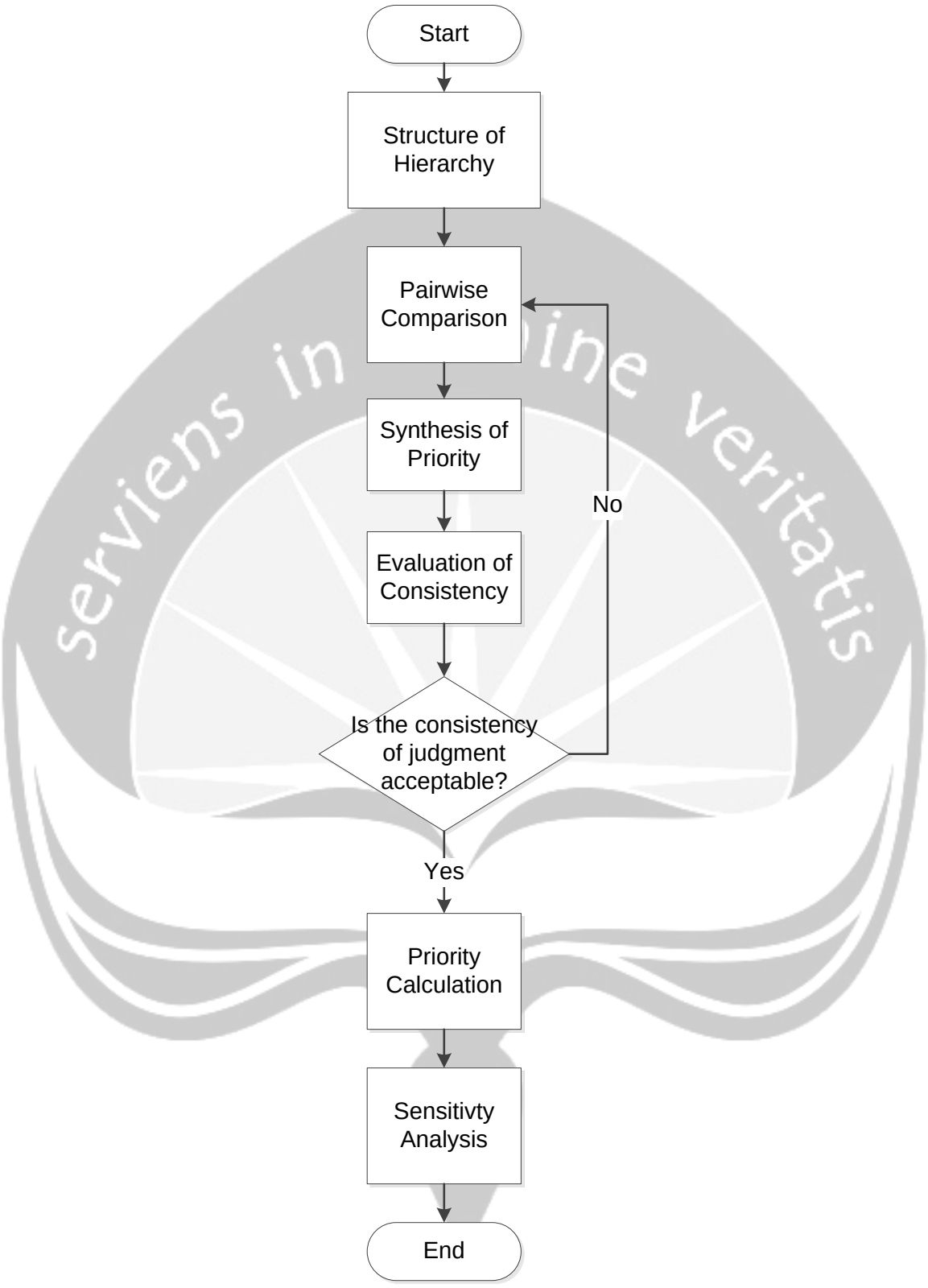
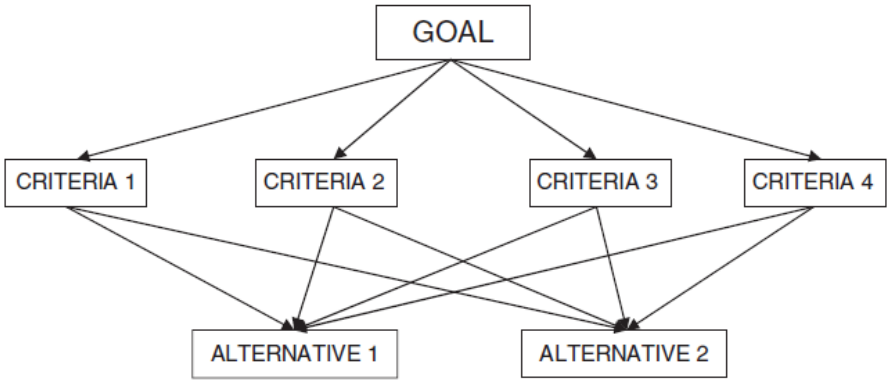


Figure 3.2. Flowchart of Project Selection



Source: Saaty(1980)

Figure 3.3. The Structure of Hierarchy

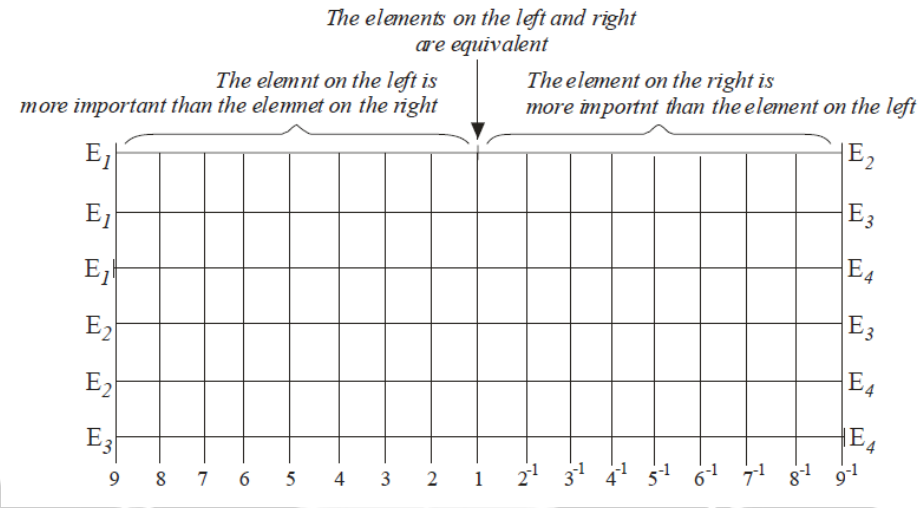
b. Pairwise Comparison

The pairwise comparison is established to be the basis in the evaluation of the owner's judgment to generate the priority/weight of the improvement projects. From the hierarchical structure on the previous step, the pairwise comparison matrices was generated which then applied as the basis in the questionnaire. The design of pairwise comparison matrices is based on the Saaty (1980) and shown on Table 3.1.

Table 3.1. The Pairwise Comparison Matrix

Criteria	C1	C2	C3	C4	C5	Cj
C1	1	a_{12}	a_{13}	a_{14}	a_{15}	a_{ij}
C2	1/ a_{12}	1	a_{23}	a_{24}	a_{25}	…
C3	1/a_{13}	1/ a_{23}	1	a_{34}	a_{35}	…
C4	1/a_{14}	1/a_{24}	1/ a_{34}	1	a_{45}	…
C5	1/a_{15}	1/a_{25}	1/ a_{35}	1/ a_{45}	1	…
Ci	1/a_{ij}	…	…	…	…	1

The questionnaire is utilized as an instrument to obtain the value of the pairwise comparison matrices based on the judgment of the owner. The structure of questionnaire is based on Cabala (2010) and shown on Figure 3.4.



Source: Cabala (2010)

Figure 3.4. The Pair Combinations for Four Elements

The scale for the judgment in questionnaire is refer to Saaty (2008) and shown in Figure 3.5. The result of the questionnaire was applied to compile the pairwise comparison.

c. Obtaining the weight

A principle from the Analytic Hierarchy Process is to obtain the weights of the improvement projects in this research. It begins with the transformation of the elements of a_{ij} in the initial pairwise comparison matrix (Matrix A) to matrix B refer to Saaty (1980) based on the following formula:

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \qquad (3.1.)$$

The calculation of the weight for the alternatives and criteria is based on the following formula:

$$w_i = \frac{\sum_{j=1}^{n} b_{ij}}{n} \qquad (3.2.)$$

Intensity of Importance	*Definition*	*Explanation*
1	Equal Importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity *i* has one of the above non-zero numbers assigned to it when compared with activity *j*, then *j* has the reciprocal value when compared with *i*	A reasonable assumption
1.1–1.9	If the activities are very close	May be difficult to assign the best value but when compared with other contrasting activities the size of the small numbers would not be too noticeable, yet they can still indicate the relative importance of the activities.

Source: Saaty (2008)

Figure 3.5. The Scale for Judgment

d. Evaluation of consistency

The evaluation of consistency is organized to determine the accuracy of decision maker, in this case is the owner of Dragon Family Karaoke in giving the value of judgment. The evaluation of consistency begins with the calculation of the maximum eigenvector (λ_{max}) with the following formula which refer to Saaty and Vergas (1990):

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(aw)_i}{w_i} \qquad (3.3.)$$

The weights (w), the size of matrix (n) and the value of initial pairwise comparison matrix (A) are used in calculation of maximum eigenvector. The maximum eigenvector will be used in the calculation of consistency index (CI) with the following formula:

$$CI = \frac{\lambda_{max} - n}{n-1} \qquad (3.4.)$$

The Random Index (RI) is obtained from table 3.2. based on the number of elements compared in the comparison matrix.

Table 3.2. Random Index

n	RI
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

The final step in the evaluation of consistency is by calculated the consistency ratio (CR) with the following formula and the experts' judgment are deemed acceptable if the CR is less than 10%:

$$CR = \frac{CI}{RI} \qquad (3.5.)$$

e. Priority Calculation

The priority calculation begins with combining the weights to make the provisional decision. The priority is calculated for each alternative with combining the weight of all the paths from the top of the hierarchy. The alternative will be ranked based on the value of priority.

f. Sensitivity analysis

Sensitivity analysis applied in this research as the parameter to the effects of the changes in the result of Analytic Hierarchy Process. Sensitivity analysis in this research is done within two categories. The first category is the sensitivity with respects to the goals and the second is the sensitivity analysis of the AHP in this research.

The sensitivity with respects to the goals is done by provides the graph of the weight related to the criteria. This sensitivity will be used to compare the ranking of the alternatives for each criterion.

The sensitivity analysis of AHP is done to evaluate the influence of the criteria to the weight of the improvement project. This sensitivity analysis refers to Hurley (2010) which enables the weights to be changed while maintaining the ranking order which was determined. The analysis is done by transform the matrix A into the matrix $[a_{ij}^{\alpha}]$.

3.6. Project Initiation and Planning

Project management is limited to the initiation and planning phase which refer to the concept by Turner *et al* (2012) where the project management on small to medium enterprises needs to be simplified due to smaller scope of the organization. Figure 3.6. shows the flowchart of the project management in this research. The steps of the project initiation and planning are refer to Westland (2006) with some development to the adjustment within the research.

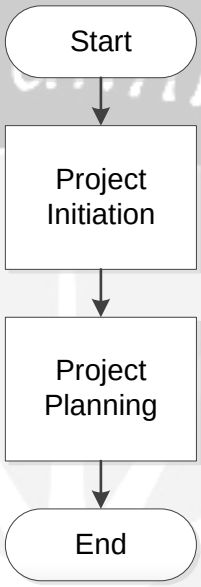


Figure 3.6. Flowchart of Project Management

a. Project initiation

The project initiation is the identification of business case for providing the current problem service industry based on the selected project. The business case was followed by the description of the project to give a detail explanation in the definition of the project. The terms of reference is conducted to outlining the objectives and scopes of the projecf. Figure 3.7. illustrates the processes in the project initiation.

Figure 3.7. Processes of Project Initiation

b. Project Planning

In the project planning phase, the detailed planning of the project is involved. The project planning conducted on this research is the project plan, financial plan, resource plan, quality plan and risk plan. The financial planning is giving the estimation of the budget which acquired in the project to the manager of the project. The financial planning identifies the labour, equipment and materials cost in the projects. The risk plan is divided into two phase, the first phase is the risk analysis and followed by the risk evaluation to assess the risk with highest priority on risk analysis. Table 3.3. shows the score for the likelihood and impact used in the risk analysis.

Table 3.3. Score of Likelihood and Impact

Score	Likelihood	Impact
20	Very Low	Very Low
40	Low	Low
60	Medium	Medium
80	High	High
100	Very High	Very High

The likelihood and impact will be applied to calculate the risk priority using the following formula.

$$Priority=(Likelihood+Impact)/\ 2 \quad (3.6)$$

Based on the priority, the risk will be classified into its priority as shown on table 3.4.

Table 3.4. Priority Rating

Priority Score	Priority Rating
0-20	Very Low
21-40	Low
41-60	Medium
61-80	High
81-100	Very High

The second step for the risk plan in this research is the risk evaluation. The risk evaluation is the step to analyze and examine the risk with the highest priority. The risk evaluation is an important factor to bring the successfulness in the implementation of the project because it brings the suggestion in the form of solution to prevent the highest priority risk in the project implementation.

3.7. Conclusion and Recommendation

The last step of the research is to give the conclusion and recommendation to the company. The conclusion is to give the brief description the result to service industry and to provide the result of the analysis in each step. The recommendation then will be given to describe the possible development to the future research related to the field in this research.