

**UNIVERSITI TEKNOLOGI MARA**

**TECHNICAL REPORT**

**A COMPARATIVE STUDY OF INTUITIONISTIC  
FUZZY ANALYTIC HIERARCHY PROCESS (IFAHP)  
WITH DIFFERENT SETS OF TRIANGULAR  
INTUITIONISTIC FUZZY NUMBERS (TIFNs)**

**P31S18**

**NUR SYAHERA BINTI ISHAK (2016351403)  
SITI NUR SYAZWANI BINTI ZAINUDIN (2016596051)  
NUR SHAZWANI BINTI LAILA (2016729827)**

**Report submitted in partial fulfilment of the requirement  
for the degree of  
Bachelor of Science (Hons.) Management Mathematics  
Faculty of Computer and Mathematical Sciences**

**DECEMBER 2018**

## **ACKNOWLEDGEMENTS**

IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

Firstly, we are grateful to Allah S.W.T for giving us the strength to complete this project successfully.

We would also like to express our deepest appreciation to all those who provided us the opportunity to complete this project.

Our special gratitude goes to our final year project supervisor, Ms. Nor Faradilah Binti Mahad, who guided us in detail especially in writing this report and gives an enormous amount of advices so that this project will be a success.

Another token of appreciation would be for our lecturer who teaches us MSP660 subject, Sir Mohd Azdi Bin Maasar who guides us to succeed our project. We would also like to give a note of acknowledgement to our lecturers who gave us a lot of knowledge and lesson that we could not possibly learn by ourselves.

An expression of our gratitude will also be given to our parents who always provide us with different kinds of support so that we can be who we are now.

Last but not least, we would like to thank our friends for continuous support and responds whenever we ask for their cooperation for the sake of succeeding this project.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	ii
TABLE OF CONTENTS.....	iii
LIST OF TABLES.....	iv
LIST OF FIGURES.....	v
ABSTRACT.....	vi
CHAPTER ONE.....	1
INTRODUCTION.....	1
1.1 Motivation.....	1
1.2 Problem Statement.....	2
1.3 Objectives.....	3
1.4 Significance and Benefit of the Study.....	3
1.5 Scope of the Project.....	3
1.6 Limitation of the Project.....	4
1.7 Definition of Terms and Concept.....	5
CHAPTER TWO.....	6
BACKGROUND THEORY AND LITERATURE REVIEW.....	6
2.1 Background Theory.....	6
2.1.1 Triangular Intuitionistic Fuzzy Numbers (TIFNs).....	6
2.1.2 Intuitionistic Fuzzy Analytic Hierarchy Process (IFAHP).....	8
2.2 Literature Review/ Related Research.....	9
2.2.1 Analytical Hierarchy Process (AHP).....	9
2.2.2 Fuzzy Analytical Hierarchy Process (FAHP).....	10
2.2.3 Intuitionistic Fuzzy Analytic Hierarchy Process (IFAHP).....	12
CHAPTER THREE.....	13
METHODOLOGY AND IMPLEMENTATION.....	13
3.1 Methodology.....	13
3.1.1 Intuitionistic Fuzzy Analytic Hierarchy Process (IFAHP).....	15
3.2 Implementation of IFAHP.....	20
3.2.1 Case Study: Video Software Selection.....	20
CHAPTER FOUR.....	48
RESULT AND DISCUSSION.....	48
4.1 The Comparison of Weightage and Rank of Criteria and Alternatives Obtained by IFAHP Method between TIFN 1, TIFN 2 and TIFN3.....	48
4.2 Comparison of Consistency Sensitivity between the Three Sets of TIFNs.....	49
4.3 The Weightage Dispersion for Alternatives between the Three Sets of TIFNs.....	49
4.4 Kruskal-Wallis Test to Investigate the Difference Among the Weightage of Criteria and Alternatives with the Thre Sets of TIFNs Statistically.....	50
CHAPTER FIVE.....	52
CONCLUSION AND RECOMMENDATION.....	52
5.1 Conclusion.....	52
5.2 Recommendation.....	53
REFERENCES.....	54
APPENDIX A: Questionnaire of video software selection.....	57
APPENDIX B: Excel output for respondent 1 by using TIFN 1.....	61
APPENDIX C: Kruskal-Wallis Test output for criteria and TIFNs.....	62
APPENDIX D: Kruskal-Wallis Test output for alternatives and TIFNs.....	63

## LIST OF TABLES

Table 1: Definition of term and concepts. ....	5
Table 2: Pairwise Comparison of AHP Standard Scale.....	9
Table 3: Summary of previous study in FAHP.....	11
Table 4: Conversion of AHP preference number to TIFNs.....	16
Table 5: Linguistic variables for the importance of decision makers.....	17
Table 6: Random Indices of Sizes of Matrices.....	18
Table 7: Pairwise Comparison Matrix of Criterion by using TIFN 1 for $\lambda_1$ (respondent 1).....	21
Table 8: Linguistic Variables for Importance of Decision Makers .....	22
Table 9: Aggregated Matrix of Criterion for $\lambda_1$ .....	23
Table 10: Aggregated Matrix of Criterion for $\lambda_1$ until $\lambda_{45}$ for TIFN 1, TIFN 2 and TIFN 3. ....	24
Table 11: The Consistency Ratio (C.R) of criterion for 45 respondents by using TIFN 1 .....	30
Table 12: The Consistency Ratio (C.R) of criterion for 45 respondents by using TIFN 2 .....	31
Table 13: The Consistency Ratio (C.R) of criterion for 45 respondents by using TIFN 3 .....	32
Table 14: Final Entropy Weights of Criteria of $\lambda_1$ .....	33
Table 15: Final Entropy Weights of Criteria of $\lambda_1$ until $\lambda_{45}$ for TIFN 1, TIFN 2 and TIFN 3. ....	34
Table 16: Relative Weightage of Video Software Alternatives of $\lambda_1$ .....	43
Table 17: Weightage of Video Software Selection Problem by using TIFN 1, TIFN 2 and TIFN 3.....	44
Table 18: The comparison of weightage and rank for criteria by using IFAHP method between TIFN 1, TIFN 2 and TIFN 3 .....	48
Table 19: The comparison of weightage and rank for alternatives by using IFAHP method between TIFN 1, TIFN 2 and TIFN 3.....	49
Table 20: Hypothesis test summary of criteria in term of weightage of criteria .....	50
Table 21: Hypothesis test summary of three sets of TIFNs in term of weightage of criteria .....	50
Table 22: Hypothesis test summary of alternatives in term of weightage of alternatives .....	51
Table 23: Hypothesis test summary of three sets of TIFNs in term of weightage of alternatives.....	51

## ABSTRACT

Intuitionistic Fuzzy Analytic Hierarchy Process (IFAHP) has undeniably becoming well known as one of the methods to solve Multi Criteria Decision Making (MCDM) problems. MCDM tools help in doing selection or evaluation of multiple criteria in decision making. Basically, some of MCDM tools such as IFAHP use linguistic scale as a step in the method. However, linguistic scale for each individual may vary depends on individual interpretation. The information on the consequences of using different Triangular Intuitionistic Fuzzy Numbers (TIFNs) is also limited. Since FAHP can only be used to solve the fuzzy decision-making problems with the preference information of symmetrical distribution, IFAHP is proposed to deal with the uncertainty by taking both degree of the membership and non-membership function because it is more flexible and practical than fuzzy sets. This project aimed to apply the IFAHP method with different sets of TIFNs to solve MCDM problems. The project also aimed to compare the relative weightage and ranking of both criteria and alternatives for all respondents derived from the application of IFAHP with different sets of TIFNs. The study also aimed to check the consistency sensitivity between the three sets of TIFNs. The implementation of this method will use the data from a study made on video software selection. It is found that the ranking sequence for the five alternatives of three sets of TIFNs using the proposed method were different. Statistically, the relative weightage of the criteria and alternatives show that there is no significant difference among the criteria and alternatives of the three TIFNs. However, mathematically the weight dispersion for each criteria and alternatives were slightly different. The consistency sensitivity for the three TIFNs also shows different results with TIFN 2 and TIFN 3 have lower consistency sensitivity and TIFN 1 has moderate consistency sensitivity.