

Table of Content

Certificate	iii
Declaration by the Candidate	v
Copyright Transfer Certificate.....	vii
Acknowledgement.....	ix
Abstract	xi
Table of Content	xv
List of Figures	xix
List of Tables	xxi
List of Symbols	xxiii
List of Abbreviations	xxvii
Chapter 1 Introduction	1
1.1 Decision Making.....	1
1.1.1 Decision Making with Single Decision Maker	2
1.1.2 Group Decision Making.....	3
1.2 Approaches to Group Decision Making	7
1.2.1 GDM without Consensus.....	7
1.2.2 GDM with Consensus.....	8
1.3 Group Decision Patterns	9
1.3.1 GDM in Multi Attribute setting (MAGDM).....	10
1.3.2 GDM in Preference Relation setting (PRGDM).....	11
1.4 Research Questions	13
1.5 Motivation.....	15
1.6 Contributions.....	17
1.7 Thesis Organization	18
Chapter 2 Preliminaries and Literature Review	21
2.1 Preliminaries	21
2.1.1 General CRP Framework.....	21
2.1.1.1 Preference Representation Structure.....	22
2.1.1.2 Aggregation Function	24

2.1.1.3 Consensus Measure	25
2.1.1.4 Feedback Mechanism	26
2.1.2 Bounded Confidence	28
2.1.3 Blockchain	28
2.2 Literature Review	31
2.2.1 CRPs for Heterogeneity of DMs.....	31
2.2.2 CRPs for Feedback Cost.....	34
2.2.3 CRPs for Unavailability of DMs.....	37
2.2.4 CRPs for Security and Trust Issues.....	39
Chapter 3 2-Phase Consensus With Customized Feedback Based Group Decision Making Involving Heterogeneous Decision Makers	41
3.1 Background	42
3.2 Proposed Models	43
3.2.1 Phase 1: Decision Makers Provide Preferences	45
3.2.2 Phase 2: Inter-Consensus Reaching Phase.....	46
3.2.2.1 Consensus Measure	46
3.2.2.2 Feedback Recommendation	49
3.2.3 Phase 3: Intra-Consensus Reaching Phase.....	54
3.2.3.1 Consensus Measure	54
3.2.3.2 Feedback Recommendation	56
3.2.4 Phase 4: Calculation of Final Decision.....	59
3.3 Computational Complexity Analysis	59
3.4 Numerical Example and Simulation Analysis.....	60
3.4.1 An Illustrative Example.....	60
3.5 Simulated Experiments.....	69
3.5.1 Comparison from Theoretical Perspectives.....	76
3.6 Summary	79
Chapter 4 Tolerance Based Moderator Guided Heterogeneous Group Decision Making Involving Experts and End-Users.....	83
4.1 Background	83
4.2 Proposed Model.....	86
4.2.1 Expert Consensus Solution (ExCS)	88
4.2.2 End-Users' Cumulative Solution (EuCS)	95
4.2.3 Global Consensus Solution.....	97
4.3 An Illustrative Example.....	101

4.3.1 Illustration of Expert Consensus Solution (ExCS)	103
4.3.2 Illustration of End-user Cumulative Solution (EuCS).....	105
4.3.3 Illustration of the Global Consensus Solution (GCS).....	106
4.4 Performance Evaluation and Discussions.....	106
4.4.1 CRP Visualization.....	106
4.4.2 Comparison with Existing Consensus Reaching Models	108
4.4.3 Impact of Threshold degree θ	110
4.4.4 Impact of Presence of Experts and End-Users	111
4.4.5 Impact of End-Users' Opinion	112
4.4.6 Impact of ExCS and EuCS on Final Decision Result	113
4.5 Summary	114
Chapter 5 A Consensus Model to Manage Unavailability of Decision Makers in Group Decision Making	117
5.1 Background	117
5.2 Proposed Methods.....	119
5.2.1 Dynamically Generating Weights Process	120
5.2.2 Consensus Measure	122
5.2.3 Feedback Mechanism based on Availability of DMs	122
5.3 Illustrative Example	128
5.4 Simulation and Comparison Analysis.....	132
5.4.1 Effect of number of unavailable and available DMs.....	132
5.4.2 When the opinion of unavailable DMs is not considered	134
5.4.3 Discussion	135
5.5 Summary	138
Chapter 6 Considering Security and Bias in Group Decision Making.....	141
6.1 Background	141
6.2 Issues in Centralized Group Decision Making System.....	144
6.3 Blockchain for Group Decision Making.....	147
6.4 Proposed Decentralized Group Decision Making.....	150
6.4.1 Overall System Architecture.....	151
6.4.2 Proposed Decentralized Group Decision Making Model	152
6.5 Interactions and Message Sequence.....	157
6.6 Implementation	159
6.7 Experimental Analysis	162
6.7.1 Demonstration of the Proposed GDM	162

6.7.2 Analysing the Proposed GDM model	165
6.7.3 Security Analysis.....	168
6.7.4 Gas Cost analysis.....	170
6.8 Discussion	178
6.9 Summary	179
Chapter 7 Conclusion and Future Research Directions	181
7.1 Conclusion.....	181
7.2 Future Research Directions	186
List of Publications.....	189
References	191