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A Hybrid Approach of Mathematical Optimization for Multi-Objective Model of Islamic Banking

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Abstract The integration of economic and social objectives is essential for Islamic bank to stimulate economic growth through the effective management and allocation of wealth and resources. This article proposes a hybrid mathematical optimization between the analytic hierarchy process (AHP) and multi-choice goal programming (MCGP) methods. The hybrid methods make the amalgamation of economic and social objectives possible in the multi-objective model of Islamic banking. The AHP method is used to determine the priorities or weights on each of the economic and social objectives. MCGP on the other hand, serves as an optimizer to the Multi-objective Decision Making (MODM) model that fits the priorities to the objectives and possible target goals. Results confirmed on the practicality and flexibility of the hybrid AHP-MCGP model which enable Islamic banks to better utilize their financial resources based on the priorities and multiple target goals. The feasible achievement of multi-objective with an interval target goal has offered the avenue for the decision makers at Islamic bank to satisfy economic and social goals simultaneously.

Keywords Multi-objective; Analytic hierarchy process; Goal programming; Value-based intermediation; Islamic bank

Mathematics Subject Classification 90B50, 90C29, 91B32

1 Introduction

The objective of the existence of banking firms in the economy has experienced a significant paradigm shift from the traditional theories of financial intermediation. This is due to the efficient responses from banking firms to the changes in the financial services norms, where

many new financial products and services as well as the innovation in technology has become the driving force of change in the banking industry [1-2]. Additionally, the current changes in the banking industry landscape have been seen moving towards the transformation from business-as-usual objectives to the social financial integration objectives, which supports the United Nations' (UN) Sustainable Development Goals (SDGs) as to contribute to a sustained and inclusive economic growth, inclusive societies, environmental protection, financial stability, poverty alleviation, as well as equality in wealth distribution [3].

Parallel to the SDGs outlined by UN, the objectives of Islamic banking establishment were guided by the fundamental objectives of Islamic economics system that aim at steering economic and development of financial activities within the socioeconomic justice parameters [4]. The commonalities are deeply rooted in the foundation of shariah principles as a set of laws, norms and values that should govern the day-to-day operations in Islamic banking. As shariah represents the body of Islamic teachings, hence one of its objectives, or in a generic term known as *Maqasid al-Shariah*, is to promote the social well-being (*maslahah*) of the people.

The notion of the adoption of social objectives in Islamic banking has received interest in the literature for quite some time but has yet to gain a firm foothold in practice. The claims that the business direction of Islamic banking is misrepresented in practice is becoming a source of debate in various circles. Prominent Islamic economics scholars take the view that Islamic banking should strive in becoming the catalyst for economic growth through the equitable distribution of wealth and resources. Above all, the elements of inequity, injustice, and exploitation should be eradicated to avoid oppression in the society and to ensure inclusivity of all segments of society in access to the resources [5-8].

This article depicts that Islamic banking is an essential business organization that should uphold the integration of economic and social objectives. The conception of both objectives need to be consolidated to portray that Islamic bank is not pursuing its objective solely in terms of financial returns, but largely aiming at a more resilient and sustainable future growth for the well-being of the society [9]. Hence, Islamic banks are perceived to be distinctly different from their conventional counterparts in delivering the socio-economic impact to the society at large.

Despite the importance of this area, documented studies on the multi-objective function of both the economic and social objectives of Islamic banking are still limited. Previous studies that employ multi-objective decision making (MODM) model for banking firm were solely done on maximizing economic objectives which has become an integral part of the usual lexicon in the conventional banks. Additionally, investigations on the priority objectives of Islamic banking business from the viewpoints of practitioners or experts in the Islamic banking industry itself were also lacking.

Accordingly, a hybrid mathematical optimization that combines the analytic hierarchy process (AHP) and multi-choice goal programming (MCGP) methods is proposed in this article. Specifically, the AHP method is used to determine the weight of importance on each of the economic and social objectives. Meanwhile, MCGP serves as an optimizer to the MODM model that incorporates the weights to the objectives and possible target goals.

This hybrid model makes the economic and social objectives possible to be integrated into the MODM model of Islamic banking. The inclusion of the social objectives that seek to cater to the needs of multiple stake holders of Islamic bank is an area which sets this article different from the previous MODM model in banking firms.

2 Methodology

2.1 Analytic Hierarchy Process (AHP)

AHP process in this article includes five stages: (1) establishing the hierarchy of problem; (2) designing the pairwise comparison questionnaire; (3) calculating the criteria weighting; (4) calculating the eigenvector, and (5) testing for consistency [10]. In Stages (3) and (4), AHP uses prioritization methods to derive priority vectors or weights from pairwise comparison matrices. The most common and well-known prioritization method in AHP is the eigenvector method and is utilized in this article. In Stage (5), a consistency ratio (CR) is used to verify the credibility and reasonability of the evaluation, and to check for inconsistent causality or conflicts in subjective judgments. The CR is acceptable if it does not exceed 0.1 [10]. Equation (1) defines the consistency index:

$$CI = (\lambda_{\max} - n/(n-1) \text{ and } CR = (CI/RI_n). \tag{1}$$

The positive reciprocal matrix generated by valuation yields different consistency index (CI) values at each level. The λ_{max} is the maximized eigenvector of a pairwise comparison matrix. The n is an attribute of the matrix, and RI_n is a random index taken from Saaty [11] as shown in Table 1.

Table 1: Random Index

N	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0.58	0.90	1.12	1.25	1.32	1.41	1.45	1.49	1.54	1.48	1.56	1.57	1.59

AHP method in this article is used to derive the priorities or weightings on each of the economic and social objective in Figure 1 from the viewpoints of practitioners or experts who act as part of the decision makers at Islamic bank. Since reliable decisions are often based on consistent judgments, AHP has provided features on the consistency verification. This feature contributes greatly as a mechanism to review the inconsistency of judgments made by the selected practitioners as the respondents for this study.

The clarification and justification on each of the objectives concerned in the MODM model of Islamic banking in Figure 1 were determined based on various relevant sources. These includes journal articles, books, book chapters, essays, working papers, reliable online articles as well as speeches from the experts. The outcomes from the theoretical discussions and the content analysis were used to infer the importance, relevance and ethos that should be the underlying main and sub objectives in the Islamic banking operations.

2.2 Multi-choice Goal Programming (MCGP)

The philosophy of basic goal programming (GP) methods was to reduce the multiple goals achievement problem into a single objective of minimizing a positive/negative deviation from specific target goals/values or aspiration levels. Nevertheless, in certain real- life situation, decision makers prefer to set the aspiration levels in a range of interval values instead of

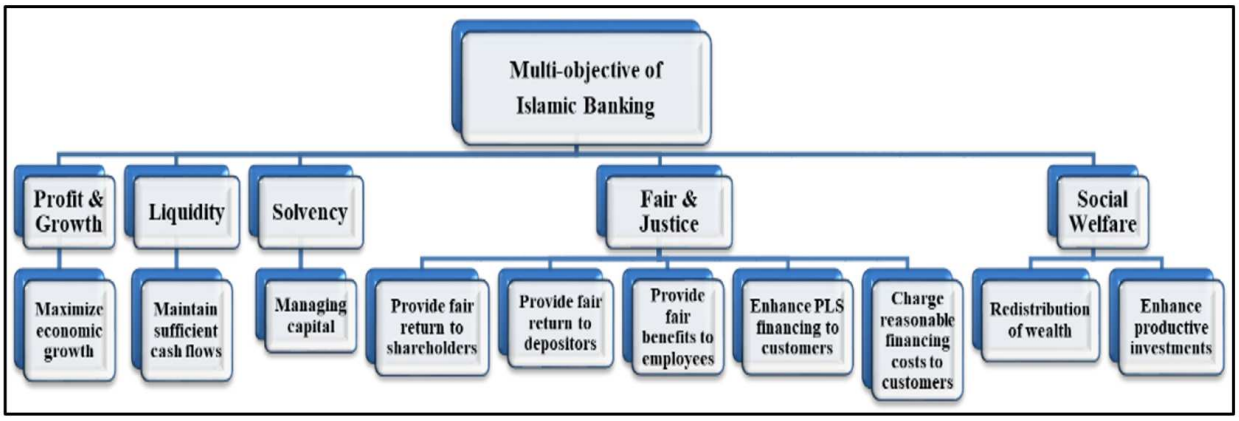

Figure 1: The Hierarchy Framework on MODM Model of Islamic Banking

providing a specific target value in making decision on the management objectives or goals to avoid underestimation of decision making [12].

Thus, as an optimizer to the MODM model in this study, the revised MCGP method by [13] is proposed to optimize the objective function following the concept of "one goal, mapping multiple aspiration levels". The MCGP-achievement functions can be formulated with auxiliary constraints and additional variables into two types of decision on target goals, which are *'the more the better'* (see Equations (2) – (6) and *'the less the better'* (see Equations (7) - (11)). Equation (4) and Equation (9) specifically serve as the distinctive feature in the MCGP method to cater for the two different types of decision for target goals. Equation (4) accommodates for the highest possible achievement of target goal preferred by the decision makers while Equation (9) is vice versa.

While there are several previous studies that have developed multi-objective model on the banking firms, none of the studies utilize MCGP that allows range of interval values for target goals to be flexibly represented in the model. This has provided the avenue for this study to address the issue on the possibility of underestimation or overestimation in deciding the suitable target level of objectives or goals by the decision makers.

For the case of 'the more the better'

Achievement function:

$$\text{Minimize } Z = \sum_{i \in m} (d_i^+ + d_i^-) + (e_i^+ + e_i^-). \tag{2}$$

Goals and constraints:

$$\text{s.t. } \sum_{j=1}^{n} a_{ij} x_j - d_i^+ + d_i^- = \mathrm{G}_i, \text{ for } i = 1, \ldots, m, \tag{3}$$

$$G_i - e_i^+ + e_i^- = G_{i,\max}, \text{ for } i = 1, \ldots, m, \tag{4}$$

$$G_{i,\min} \leq G_i \leq G_{i,\max}, \tag{5}$$

$$d_i^+, d_i^-, e_i^+, e_i^-, \ x_j \geq 0, \text{ for } i = 1, \ldots, m; j = 1, \ldots, n. \tag{6}$$

For the case of 'the less the better'
Achievement function:

$$Minimize\ Z = \sum_{i \in m} (d_i^+ + \ d_i^-) + (e_i^+ + e_i^-). \tag{7}$$

Goals and constraints:

$$\text{s.t.} \sum_{j=1}^{n} a_{ij}x_j - d_i^+ + d_i^- = G_i, \text{ for } i \ = 1, \ldots, m, \tag{8}$$

$$G_i - e_i^+ + e_i^- = G_{i,\min} \text{ for } i = 1, \ldots, m, \tag{9}$$

$$G_{i,\min} \leq G_i \leq G_{i,\max}, \tag{10}$$

$$d_i^+, d_i^-, e_i^+, e_i^-, \ x_j \geq 0, \text{ for } i = 1, \ldots, m; j = 1, \ldots, n, \tag{11}$$

where Z is the summation of all deviations, d_i^+ and d_i^- are positive and negative deviations attached to $|a_{ij}x_j - G_i|$, while $e_i^+$and e_i^- represent positive and negative deviations for $|G_i - G_{i,\max}|$ and $|G_i - G_{i,\min}|$. Upper and lower bound for the ith aspiration levels are represented by $(G_{i,\max})$ and $(G_{i,\min})$ respectively. G_i is introduced as a continuous variable with a range of interval values, where $G_{i,\min} \leq \ G_i \leq G_{i,\max}$, while x_j and a_{ij} are the decision variables and parameters respectively.

3 The Proposed Hybrid Approach

Figure 2 displays the overall procedure of the hybrid AHP-MCGP methods for the MODM model of Islamic banking. Collectively, AHP method is used in the initial process to determine the relative importance on weightings or priorities of Islamic banking objectives.

Nevertheless, AHP does not consider the limitation of financial resources in achieving both economic and social goals. For this reason, MCGP can compensate the limitation since MCGP model can be formulated to produce an optimal solution for financial resources allocations.

4 The Case Study

The proposed hybrid AHP-MCGP model described above has been applied to demonstrate its effectiveness on the MODM model of Islamic banking that integrates the economic and social objectives in one single model. The process starts with the AHP method in obtaining the priority weights from the selected experts of Islamic banks that have sat as part of the decision-making team with different types of employment background (e.g: Head of Strategy & Business Analytics, Head of International Finance & Capital Market, Head of Corporate Planning Department and Head of Shariah Department) and specializations.

From the purposive sampling of 20 respondents, only 70% of the pairwise comparison questionnaires can be utilized. That means, out of 20 sets of responses in this study, 14 had an acceptable level of CR less than 0.1. The rest of 30% or another 6 responses displayed more than 10% inconsistencies in answering the pairwise comparison questionnaires and thus discarded. The final 14 respondents were considered profound advantage with regards to making judgements based on their know-how and practical experiences. All the CRs calculated from

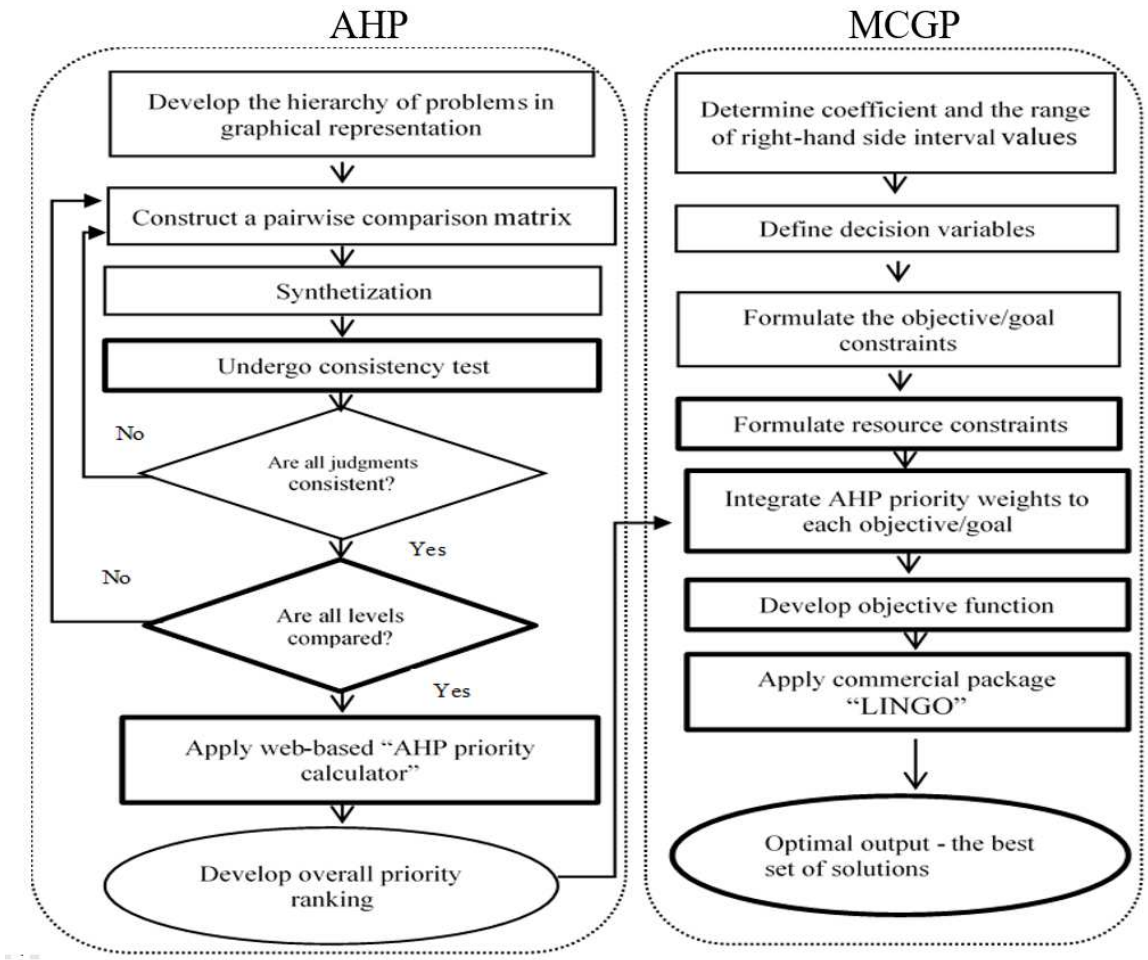

Figure 2: The Flowchart of the Hybrid AHP-MCGP Approach

the matrices were less than 0.1; implying that their decision is acceptable and not merely a random prioritization. The relative preference matrices produced by each expert were then aggregated to establish a single set of weight. The resulting weights from the AHP are shown in Table 2.

Then, the MCGP method is utilized to optimize the MODM model of an Islamic bank based on the resulting relative weights from the AHP, which directly gives effect to the financial resources' allocation function. The case study takes one of the prominent Islamic banks in Malaysia's financial portfolio data to validate the hybrid model. The data involves the period of 2007-2016 to represent the specification of target goals and various constraints in the MCGP model via the patterns and strategies taken by the bank in their assets and liabilities compositions for the optimization process.

The model is formulated as weighted MCGP model to incorporate the weights, W_j, derived from AHP and solved using LINGO 17.0 solver. The objective function in equation (12) involves the minimization of the total weighted deviations $d_1^+ \, and \, d_1^-$ from the target value of ten goals, $(G_1 - G_{10})$ of Islamic bank, which satisfy all the hard constraints in Equations (13) – (22) and other structural constraints involving decision variables as shown in Table 3.

Table 2: Aggregated Weights for the Objectives of Islamic Bank

Objectives	**Weights** (W_j)
G_1 - Maximize economic profit	0.2218
G_2 - Maintain sufficient cash flows	0.2551
G_3 - Managing capital	0.3081
G_4 - Provide fair return to shareholders	0.0313
G_5 - Provide fair return to depositors	0.0467
G_6 - Provide fair benefits to employees	0.0190
G_7 - Enhance PLS financing to customers	0.0115
G_8 - Charge reasonable financing costs to customers	0.0197
G_9 - Redistribution of wealth	0.0239
G_{10} - Enhance productive investments	0.0629
Total weights	1.000

Table 4, on the other hand describes the proxies used in the equations for G_1 to G_{10}, which are represented by the ratios as listed in the table.

The inclusion of the social objectives G_4 to G_{10} that seek to cater the needs of multiple stake holders of Islamic bank is the part which sets this study different from the previous studies on MODM model in banking firms. Previous studies [14-18] that employed the goal programming technique for banking firm were solely on maximizing economic objectives (i.e. G_1- G_3)which has become an integral part of the usual lexicon in the conventional banks. In addition, even though there are studies such as [15] which develop multi-objective model on the platform of Islamic banking, but none utilizes MCGP that allows range of interval values for target goals to be flexibly represented in the model.

Note that MCGP model in this study are applicable for several relevant goals such as G_2, G_4, G_5, G_7, G_8, G_9 and G_{10}. Respective equations related to these goals embed the auxiliary constraints and additional variables of e_i^+, e_i^- into the equations to satisfy the upper bound $|G_i - G_{i,max}|$ or the lower bound $|G_i - G_{i,min}|$ of the target goals derived by the decision makers.

Minimize $\boldsymbol{Z} =$

$$W_1\left(d_1^+ + d_1^-\right) + W_2\left(d_2^-\right) + \left(e_2^+ + e_2^-\right) + W_3\left(d_3^-\right) + W_4\left(d_4^-\right) + \left(e_4^+ + e_4^-\right) + W_5\left(d_5^-\right) + \left(e_5^+ + e_5^-\right) + W_6\left(d_6^+ + d_6^-\right) + W_7\left(d_7^-\right) + \left(e_7^+ + e_7^-\right) + W_8\left(d_8^+\right) + \left(e_8^+ + e_8^-\right) + W_9\left(d_9^-\right) + \left(e_9^+ + e_9^-\right) + W_{10}\left(d_{10}^-\right) + \left(e_{10}^+ + e_{10}^-\right) \quad (12)$$

subject to

$$(PL_1 + PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9 + PL_6) - KLI \times (L_2 + L_5 + L_6 + PL_1 + PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9 - PL_{10}) - d_1^+ + d_1^- = GR \times EP. \quad (13)$$

$$A_1 + A_2 + A_3 - G_2 \times (A_1 + A_2 + A_3 + A_4 + A_5 + A_6 + A_7 + A_8) - d_2^+ + d_2^- = 0$$
$$G_2 - e_2^+ + e_2^- = 50\%$$
$$20\% \leq G_2 \leq 50\% \tag{14}$$

$$(L_5 + L_6 + PL_1 + PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9 - PL_{10})$$
$$- \text{CAPR} \times (A_1 + A_2 + A_3 + A_4 + A_5 + A_6 + A_7 + A_8) - d_3^+ + d_3^- = 0 \tag{15}$$

$$(PL_1 + PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9) - G_4 \times (L_5 + L_6 + PL_1$$
$$+ PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9 - PL_{10}) - d_4^+ + d_4^- = 0,$$
$$G_4 - e_4^+ + e_4^- = 30\%,$$
$$13\% \leq G_4 \leq 30\%. \tag{16}$$

$$PL_5 + PL_6 - G_5 \times (L_1 + L_2) - d_5^+ + d_5^- = 0,$$
$$G_5 - e_5^+ + e_5^- = 4\%,$$
$$2\% \leq G_5 \leq 4\%. \tag{17}$$

$$PL_7 - 0.31 \times (PL_1 + PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9)$$
$$- d_6^+ + d_6^- = 0. \tag{18}$$

$$A_5 - G_7 \times (A_4 + A_5) - d_7^+ + d_7^- = 0,$$
$$G_7 - e_7^+ + e_7^- = 0.04\%,$$
$$0.01\% \leq G_7 \leq 0.04\%. \tag{19}$$

$$PL_1 - G_8 \times (PL_1 + PL_2) - d_8^+ + d_8^- = 0,$$
$$G_8 - e_8^+ + e_8^- = 30\%$$
$$30\% \leq G_8 \leq 60\%. \tag{20}$$

$$PL_9 - G_9 \times (L_5 + L_6 + PL_1 + PL_2 + PL_3 - PL_4 - PL_5 - PL_6 - PL_7 - PL_8 - PL_9 - PL_{10})$$
$$- d_9^+ + d_9^- = 0,$$
$$G_9 - e_9^+ + e_9^- = 3\%,$$
$$0.4\% \leq G_9 \leq 3\%. \tag{21}$$

$$L_2 - G_{10} \times (L_1 + L_2) - d_{10}^+ + d_{10}^- = 0,$$
$$G_{10} - e_{10}^+ + e_{10}^- = 60\%,$$
$$20\% \leq G_{10} \leq 60\%. \tag{22}$$

where KLI is the average of 6-months Kuala Lumpur interbank offer rate (KLIBOR), GR is the growth rate set above the previous year, EP is the economic profit for the previous year and $CAPR$ represents the minimum capital ratio requirement under banking supervision.

Table 3: The Decision Variables of the MCGP Formulation

Assets, Liabilities & Equities	**Decision Variables**
Cash and cash equivalents	*A1*
Interbank placements	*A2*
Investment in securities	*A3*
Debt-based financing	*A4*
Equity-based financing	*A5*
Statutory deposits with BNM	*A6*
Fixed assets	*A7*
Other assets	*A8*
Non-*mudharabah* deposits	*L1*
Mudharabah deposits	*L2*
Bills and acceptance payable	*L3*
Other liabilities	*L4*
Share capital	*L5*
Other reserves	*L6*
Retained earnings	*L7*

Profit/loss account	**Decision variables**
Income from financing activities	*PL1*
Income from other assets	*PL2*
Other related income	*PL3*
(Direct expenses)	*PL4*
(Income attributable to non-mudharabah depositors)	*PL5*
(Income attributable to mudharabah depositors)	*PL6*
(Personnel expenses)	*PL7*
(Other operating expenses)	*PL8*
(Zakat)	*PL9*
(Distributable profit to shareholders)	*PL10*

Table 4: Summary Descriptions for Goal Constraints

Main objectives	**Sub Objectives**		**Ratios (Proxies)**
Profit and growth	G_1	Maximize economic profit	* EVA = Net operating profit – KLIBOR(Invested capital)
Liquidity	G_2	Maintain sufficient cash flows	Liquid assets / Total assets
Solvency	G_3	Managing capital	Bank capital / Total assets
Fair & justice	G_4	Provide fair return to shareholders	Net operating profit / Total equity
	G_5	Provide fair return to depositors	Income attributable to depositors / Total deposits
	G_6	Provide fair benefits to employees	Personnel expenses / Net operating profit
	G_7	Enhance PLS financing to customers	** PLS financing / Total financing
	G_8	Charge reasonable financing costs to customers	Income from financing activities / Total income assets
Social welfare	G_9	Redistribution of wealth	*** Redistributive instruments / Net assets
	G_{10}	Enhance productive investments	*Mudharabah* deposits / Total deposits

Note: *EVA (Economic Value Added); **PLS includes *Mudharabah* and *Musharakah* financing; ***Redistributive instrument for this study only include zakat

Results from the proposed hybrid approach are shown in Table 5. The output presented in the third column of Table 5 reveals that the objective of minimizing both $d^+$and d^-, or either d^+or $d^-$of target goals for G_1 to G_{10} has been achieved, where all the deviations are equal to zero. In other words, it reveals that the objective of minimization the over-achievement and under-achievement of target goals for each objective are not violated. That means the model manage to achieve satisfactory solutions on target goals according to the needs and desires of the decision makers. For instance, the achievement of target goals on three objectives of G_4, G_5, G_6 under the fair and justice for different stakeholders managed to be achieved in the optimization process. The result of 14.73% for G_4 shows that the under-achievement of this goal is not violated because it falls within the specified target interval of 13% - 30%. The same goes to G_5, where the result of 2.21% falls within the target interval of 2% - 4%. Target goal for G_6 on the other hand, is set to be specific target goal of 31% and the result also reveals that the over-achievement and under-achievement of this goal is perfectly achieved when it shows $d^+$and d^- are equal to zero for G_6.

The fifth column of Table 5 displays the results on the overall model that includes the basic single target goals and the range of target goals for MCGP. The efficacy of the MCGP model

in terms of its ability to satisfy the goal decision of MCGP (e_i^+ and e_i^-) with '*the more the better*' or '*the less the better*' is captured in the last column of Table 5. It specifically shows the percentage of divergence to reach the highest or lowest bound of the specified target goals. For example, goal G_4 with '*the more the better*' decision, deviate 15.27% to achieve the highest bound of target goal of 30%, while goal G_5 only achieve 2.21% which makes 1.79% less to reach the upper bound of target goal of 4%.

The deviations occurs when the needs to compromise among the objectives arise in the optimization process. In other words, if one objective manages to achieve the MCGP goal decision on target goals, then the target goals of several other conflicting objectives might either be fully achieved or partially achieved.

Having said that, the results agree with the reality of decision-making problems situation. As much as the decision makers would like to possibly achieve the predetermined target goals perfectly for all the objectives, the deviation of certain objectives might occur especially due to conflicting objectives. From the practical point of view, in situations where the goal or objective manage to be achieved within the predetermined interval, it can also be implied that the decision makers have the advantage to control the suitable target goals on both the upper and the lower side of the interval aspiration level. If the aspiration level interval is selected at its minimum position (i.e., '*the less the better*' case), then the upper bound may be interpreted by the decision makers as a critical point from which the achieved objective should not be significantly exceeded. However, if an achieved target cannot be reached within the interval, decision makers may prefer that it be kept as close as possible to the specified interval bounds, either upper or lower limitation [19].

Table 5: Results on the Achievement of Target Goals of MCGP Model

Goals	Target Goals	Achievements	MCGP Gol Decision	Results	Deviation
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
G_1	$669,516.226$	$d^+, d^- = 0$	N/A	$669,516.23$	N/A
G_2	$20\% - 50\%$	$d^- = 0$	The more the better	50%	$e_2^+, e_2^- = 0$
G_3	8%	$d^- = 0$	N/A	8%	N/A
G_4	$13\% - 30\%$	$d^- = 0$	The more the better	14.73%	$e_4^+ = 0$ $e_4^- = 15.27\%$
G_5	$2\% - 4\%$	d^-	The more the better	2.21%	$e_5^+ = 0$ $e_5^- = 1.79\%$
G_6	31%	$d^+, d^- = 0$	N/A	31%	N/A
G_7	$0.01\% - 0.04\%$	$d^- = 0$	The more the better	0.04%	$e_7^+, e_7^- = 0$
G_8	$30\% - 60\%$	$d^- = 0$	The less the better	59.09%	$e_8^- = 29.9\%$ $e_8^- = 0$
G_9	$0.4\% - 3\%$	$d^- = 0$	The more the better	0.40%	$e_9^+ = 0$ $e_9^- = 2.60$
G_{10}	$20\% - 60\%$	$d^- = 0$	The more the better	3006%	$e_{10}^+ = 0$ $e_{10}^- = 29.94\%$

5 Conclusion

This study proposes a hybrid AHP-MCGP model and its application to the MODM model of Islamic banking. This approach can simultaneously handle the multiple and conflicting goals characteristic of decision problems such as to integrate both economic and social goals for Islamic bank and to apply to the allocation of financial resources problem. The proposed model goes beyond the basic GP model on Islamic banking study to add the flexibility of incorporating priorities using AHP on the objectives of Islamic bank from the expert's viewpoint. The MCGP model, on the other hand, offers the flexibility to set the level of target goals in a range of interval values instead of fixed or specific value to avoid underestimation or overestimation of decision making on the management objectives. The decision model proposed ten socio-economic objectives for Islamic banking, taking into account, (i) assets and (ii) liabilities items of an Islamic bank as the structural constraints. The application of the MCGP technique combined with AHP methodology proved to be a flexible tool to optimally prioritize the allocation of financial resources to the different relative weights of socio-economic objectives, a feature that is particularly important in situations where the decision maker can choose between different objectives, subject to several constraints. In addition, due to the uncertainty or imprecision issue, it may be appropriate for decision makers to determine an interval target goal or aspiration level for any relevant objective, instead of a single or specific target goal. In a nutshell, the overall findings on the feasible achievement of multi-objectives in Islamic bank through the hybrid AHP-MCGP model show the potential that the proposed model may contribute to satisfy the demand for Islamic bank to pursue their economic and social goals. This is in line with the 'Value-based Intermediation (VBI)' concept as highlighted by the Bank Negara Malaysia [20] for the quest of social justice and equality in wealth and value creation by the Islamic bank.

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