Deciding on Alternatives to Meet the Need for a Bigger House: Personal Financial Decision Making Using Analytic Hierarchy Process

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ABSTRACT

This study demonstrates the application of the Analytic Hierarchy Process (AHP) to a complex personal financial decision-making problem. This study used AHP to assist a family facing the difficult and complex problem of meeting the need for a bigger house to accommodate their growing children. The family identified three alternatives: extending the current house, buying a new house or building a new house. AHP helped the family to identify the relevant criteria to judge the alternatives. It helped the family to structure the problem. Structuring improved understanding of the problem and helped them to make explicit trade-off. Based on careful and deliberate judgement, the family chose to buy a new house.

Keywords: Analytic Hierarchy Process, AHP, Financial Decision-Making, Multi Criteria Decision Making, Personal Finance.

INTRODUCTION

This study demonstrates how to use the Analytic Hierarchy Process AHP (Saaty, 1977) for a complex personal financial decision-making problem. The objective is to demonstrate how to organise and structure a complex problem using AHP. This study defines complex problems as (i) high stakes: the outcome of the decision has significant effects to the decision maker, such as increased costs, increased expenses and loss of income; (ii) unstructured: problems are difficult to understand and a large number of possible solutions exist; (iii) uncertainty: consequences of decisions are unknown; (iv) multiple factors: solutions are influenced by multiple conflicting factors and (v) diversity of problem participants: people relevant to the problems have different values, preferences and perspectives.

One area focusing on improving decision-making ability is decision analysis. The objective of decision analysis is to improve the ability of the

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human decision maker to make timely and better quality decisions. Decision analysis uses extensive algorithmic techniques to model and frame the decision environment. Sophisticated techniques produce results preferred by decision makers. However, the techniques require considerable time to understand and to utilize; model builders may not be aware of the weaknesses or assumptions of the model and decision makers may not fully understand how the model works (Rebonato, 2007). Simple decision-making methods have been criticised as producing unreliable results, being exposed to judgement biases and only representing part of the real problem. However, studies have shown that simple methods, rules and checklists can produce the answers sought by the decision makers (Aikman *et al.*, 2014; Gawande, 2009; Gigerenzer, 2014; Neth, Meder, Kothiyal, & Gigerenzer, 2014; Rebonato, 2007). Simple methods have been applied to many domains, ranging from financial problems to medical and hospitals.

This study aims to address the concerns. It aims to show how a simple technique can solve a complex problem. AHP is a simple and easy-to- use decision-making tool. It enables decision makers to go through complex and difficult decisions with care, improve their understanding of the problem and increase their confidence in the choices they make.

LITERATURE REVIEW

This section has two parts. The first part discusses previous studies on house purchasing decisions. The purpose is to identify decision-making issues faced by an individual or a family concerning house or property purchases. The second part discusses previous studies on AHP applications in finance. The purpose is to show AHP has been widely used in financial decision-making.

Personal Decision-Making on Housing.

Buying, extending or building a house is a major life decision. Normally, it is the single biggest expenditure a family will ever make. One of the first major decisions a family has to make before investing in a house is the type of housing meeting their needs. Park (1982) characterised joint (husband and wife) home purchasing decisions as being reached by a muddling-through process assuming little understanding of the method necessary to achieve the most desirable decision. According to Park (1982), people face complex decision tasks with limited information processing capabilities. They require considerable effort to learn and identify salient dimensions of the tasks as well as choice alternatives. People are also not used to measuring their spouse's preference function and decision strategies. A husband may not be able to identify his wife's preferences or choices associated with a certain dimension. Although each spouse aims to maximise the joint utility of the decision, they may not be able to process detailed information on the spouse's utility function or possess effective tools to identify the function. The consequence is that each spouse follows his or her own decision-making strategy while attempting to minimise conflict, causing them to grope through a recursive and discontinuous decision-making process.

Levy, D., *et al.*, (2008) documented similar findings: adult family members' decision-making process did not always occur in a linear fashion. Levy, D., *et al.*, (2008) stated that the process of purchasing a house is an inherently social activity. It involves setting goals, discussing and negotiating family needs, interacting with professionals, imagining modifications to future purchase and interpreting market trends. Levy, D., *et al.*, (2008) identified five decision-making stages made by families when purchasing a residential property: (i) problem recognition – whether to purchase a house; (ii) product specification such as location, price and number of bedrooms; (iii) information search – comparing properties or real estate agents in the market; (iv) in-depth analysis of a chosen house and (v) making the choice. Levy, D., *et al.*, (2008) further stated there is considerable literature on the residential decision-making process. However, less attention has been given to examining the ways households make decisions regarding specific house purchase. Khoo-Lattimore, *et al.*, (2009) used the projective technique known as ZMET (The Zaltman Metaphor Elicitation Method) to identify factors driving home purchasing decision. ZMET is a technique to understand decision-making behaviour of house purchasing.

AHP Applications in Finance

According to Zopounidis and Doumpos (2002), the globalisation of financial markets, the increased competition among firms, financial institutions and organizations, the rapid economic, social and technological changes, and the increased variety and volume of financial products have led to increasing uncertainty and instability in the financial and business environments. As a result, the importance of making efficient financial decisions has increased given the resultant complexity of the financial decision-making process. The situation has forced researchers and practitioners to use an analytic decision-making tool to address the complexity of financial problems and the importance of the decisions. The methodological framework of the analytic decision-making tool is well suited to the complex nature of financial decision-making problems.

Zopounidis and Doumpos (2002) investigated real-world application of the multi criteria decision-making (MCDM) method on financial decision-making. One of the MCDM techniques used is AHP. The study found AHP has been applied to bankruptcy and credit risk, portfolio selection and management, corporate performance evaluation, investment project decision, venture capital, country risk assessment, financial planning, and mergers and acquisition. The MCDM technique provides the following advantages to financial decision making: (i) structures complex problems (ii) includes both quantitative and qualitative criteria in the evaluation process (iii) is transparent in the evaluation, allowing good arguments in the decision and (iv) is a sophisticated, flexible and realistic scientific method in the decision making process. Stuer and Na (2003) investigated 256 studies published between 1955 and 2001 on the application of MCDM to finance. The study found applications of AHP in capital budgeting, selecting financial instruments, mergers and acquisitions, predicting bankruptcy, and forecasting foreign exchange rates.

ANALYTIC HIERARCHY PROCESS

Saaty (1987) defined AHP as a theory of measurement to derive a ratio scale from both discrete and continuous paired comparisons. AHP is a framework to execute both deductive and inductive thinking. The framework requires considering several factors simultaneously and making numerical trade-off between the factors to arrive at a synthesis or conclusion.

AHP Decision Making Steps

The following outlines and explains AHP decision-making steps.

Step 1: Understand the problem and define the decision goal.

Consider the environment surrounding the problem and collect relevant information representing the problem as thoroughly as possible. Define and identify the following aspects: the decision goal, criteria and alternatives. Criteria are factors used to judge the alternatives. Alternatives are variables to be judged.

Step 2: Organise the problem in a hierarchy.

Figure 1 shows a basic three level hierarchy. The following outlines how to build a hierarchy (Saaty, 2010). The decision goal is at the top level. Level 2 is the criteria to judge the alternatives. The bottom level of the hierarchy is the elements to be chosen or ranked. The elements can be alternatives, actions, consequences, scenarios or policies.

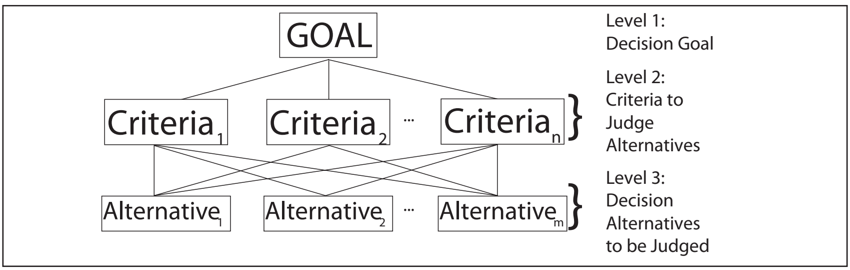

Figure 1: A Basic Three Level Hierarchy

Step 3: Evaluate preference for criteria and alternatives.

AHP uses pairwise comparisons to determine the relative preference or importance of alternatives for criteria. First, a decision maker decides which alternative is more dominant in the context of a criterion. Dominance means having properties satisfying the criterion more. Second, the decision maker decides the intensity of dominance using a scale of 1 to 9. Table 1 presents the comparison scale.

The following presents pairwise comparison questions for the hierarchy presented in Figure 1. The first step is to compare the criteria for the decision goal. For example, compare Criterion1 and Criterion2: Which criterion is more important or preferred for the decision goal and by how much more? The pairwise comparison judgements are translated into values based on the comparison scale presented in Table 1. The values are then used to develop a decision matrix as presented in Table 2. The first row of the matrix is read as the following: Criterion_1 is moderately more important compared to Criterion_2, and very strongly more important compared to Criterion_3. The relative scale of Criterion_2 to Criterion_1 is the inverse 1/3, and Criterion_3 to Criterion_1 is 1/7. The diagonal is 1 to express neutrality for the same criteria. The pairwise comparison questions are repeated for Criterion_2 and Criterion_3.

Table 1: AHP Pairwise Comparison Scale

Value	Definition
1	Equally important or preferred
2	Equally to moderately important or preferred
3	Moderately important or preferred
4	Moderately to strongly important or preferred
5	Strongly important or preferred
6	Strongly to very strongly important or preferred
7	Very strongly important or preferred
8	Very strongly to extremely important or preferred
9	Extremely important or preferred
Reciprocals	Reciprocals for inverse comparisons

Table 2: Decision Matrix for Criteria

Goal	Criterion_1	Criterion_2	Criterion_3
Criterion_1	1	3	7
Criterion_2	1/3	1	5
Criterion_3	1/7	1/5	1

The second step is to compare the alternatives for each criterion. For example, for Criterion_1, compare Alternative_1 and Alternative_2. Which alternative is more important or preferred and by how much more? From Table 3, Alternative_1 is moderately more preferred compared to Alternative_2, and extremely more preferred compared to Alternative_3. The pairwise comparisons questions are also repeated for Alternative_2 and Alternative_3.

Table 3: Decision Matrix for Alternatives

Criterion_1	Alternative_1	Alternative_2	Alternative_3
Alternative_1	1	3	9
Alternative_2	1/3	1	5
Alternative_3	1/9	1/5	1

Step 4: Calculate priority weight of criteria and alternatives.

The priority weights can be approximated using normalization of the geometric means of the rows (NGM). The NGM technique is also known as the Log-Least Square Method (Crawford, 1987, Crawford and Williams, 1985, Jong, 1984). The following outlines the steps of the geometric mean priority weight calculation:

Step 1: A decision matrix is developed from a decision maker's preference of the criteria and alternatives. Consider Matrix A, the decision matrix from Table 2:

$$A = \begin{bmatrix} 1 & 3 & 7 \\ 1/3 & 1 & 5 \\ 1/7 & 1/5 & 1 \end{bmatrix}$$

Step 2: Calculate the product of each row in the matrix. $\prod_i = \prod_{j=1}^{n} a_{ij}$, $i, j = 1, 2, \ldots, n$

$$A = \begin{bmatrix} 1 \times 3 \times 7 = 21 \\ 1/3 \times 1 \times 5 = 1.67 \\ 1/7 \times 1/5 \times 1 = 0.31 \end{bmatrix}$$

Step 3: Calculate the n-degree root: $A = \sqrt[n]{\prod_i}$

$$A = \begin{bmatrix} \sqrt[3]{21} \\ \sqrt[3]{1.67} \\ \sqrt[3]{0.31} \end{bmatrix}$$

Step 4: Sum up the value obtain in Step 3: $\sum_{i=1}^{n} \sqrt[n]{\prod_i}$

$$A = \sqrt[3]{21} + \sqrt[3]{1.67} + \sqrt[3]{0.31} = 4.25$$

Step 5: Normalized the value by dividing each element by the sum producing the weights.

$$p_i = \frac{\sqrt[n]{\prod_i}}{\sum_{i=1}^{n} \sqrt[n]{\prod_i}}$$

$$A = \begin{bmatrix} p_1 = \dfrac{\sqrt[3]{21}}{4.25} = 0.65 \\ p_2 = \dfrac{\sqrt[3]{1.67}}{4.25} = 0.28 \\ p_3 = \dfrac{\sqrt[3]{0.31}}{4.25} = 0.07 \end{bmatrix}$$

The priority weight corresponds to the relative importance or preference of the criteria. Table 4 presents the decision matrix and priority weight of the criteria. For the decision goal, $Criterion_1$ is the most important, followed by $Criterion_2$ and $Criterion_3$. Table 5 presents priority weight of the alternatives for $Criterion_1$.

Step 5: Aggregate the weights to obtain global or overall priority weight of alternatives

To calculate the overall or global weight of the alternatives, combine the priority weight of the alternatives for each criterion into a single matrix. Multiply row of the matrix with the priority weight of the criteria and normalise. Table 6 presents the combined priority weights of alternatives for each criterion and the global priority weight of the alternatives. $Alternative_1$ is most preferred compared to $Alternative_2$ and $Alternative_3$.

Step 6: Check consistency of the pairwise comparisons.

Consistency ratio (CR) measured the consistency of a pairwise comparison. $CR = CI/RCI$ and $CI = (\lambda_{max} - n)/(n-1)$. The random consistency index

Table 4: Decision Matrix and Priority Weight of Criteria for Decision Goal

$Criterion_1$	$Alternative_1$	$Alternative_2$	$Alternative_3$	Priority Weight
$Criterion_1$	1	3	7	0.65
$Criterion_2$	1/3	1	5	0.28
$Criterion_3$	1/7	1/5	1	0.07
				1.00

Table 5: Decision Matrix and Priority Weight of Alternatives for $Criterion_1$

$Criterion_1$	$Alternative_1$	$Alternative_2$	$Alternative_3$	Priority Weight
$Criterion_1$	1	3	9	0.67
$Criterion_2$	1/3	1	5	0.26
$Criterion_3$	1/9	1/5	1	0.06
				1.00

Table 6: Global Priority Weight of Alternatives

$Criterion_1$	$Alternative_1$	$Alternative_2$	$Alternative_3$	Priority Weight of Criteria	Global Priority Weight
$Alternative_1$	0.67	0.24	0.15	0.65	0.51
$Alternative_2$	0.26	0.36	0.35	0.28	0.30
$Alternative_3$	0.06	0.40	0.50	0.07	0.19
				1.00	1.00

Table 7: Random Consistency Index (RCI)

n	1	2	3	4	5	6	7	8	9	10
RCI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

Table 8: Calculating λ

A	Criterion$_1$	Criterion$_2$	Criterion$_3$	p	$A.p$	λ
Criterion$_1$	1	3	7	0.65	1.99	3.06
Criterion$_2$	1/3	1	5	0.28	0.85	3.04
Criterion$_3$	1/7	1/5	1	0.07	0.22	3.14

$$\lambda_{max} = \frac{\sum_{i=1}^{n} \lambda_i}{n} = \frac{3.06+3.04+3.14}{3} = 3.08\,,\ CI = \frac{3.08-3}{3-1} = 0.04\,,\ CR = \frac{0.04}{0.52} = 0.08 = 8\%$$

(RCI) is a pre-defined average random index derived from a sample size of 500 randomly generated reciprocal matrices. Table 7 presents the RCI values (Saaty, 1999). n is the number of elements in the decision matrix. λ_{max} is the maximum eigenvalue of the decision matrix. CR of less than or equal to 10 per cent is acceptable. CR above 10 per cent requires decision makers to revise their pairwise comparison judgements.

To find λ_{max} requires solving the equation $A.P$. A is the decision matrix and p is the priority weight. Both A and p are known. Solving the equation using power method of matrix algebra derives λ_{max}. Table 8 presents decision matrix and priority weight for criteria derived previously in Table 4.

CHOOSING THE BEST ALTERNATIVE

This section demonstrates how AHP assists a family to choose the best alternative to meet their need for a bigger house. A family is planning to have a bigger house to accommodate their growing children. They have three daughters and one son. The wife's aunt is also living with them. The current double-storey link house has four bedrooms and three bathrooms. The four bedrooms comprise one master bedroom, two children's bedrooms and one guest room. One bathroom is in the master bedroom, one is in the middle of the house and is shared by the children and one is in the guest room. The husband and wife occupy the master bedroom. The two older daughters are sharing the second bedroom. The third daughter and the youngest son are sharing the third bedroom. The aunt is using the guest room. The following demonstrates how AHP organises and structures the problem.

Step 1: Understand the problem and define the decision goal.

The family is facing the problem of needing more rooms in the house so the growing children do not have to share rooms. They also want to have a room for staying guests. The family plans to have two additional rooms for the children and one additional bathroom. They need a new guest room that includes a bathroom. The family is considering the following alternatives:

- Extend the current house (extend): Extend and renovate the current house to include three additional bedrooms and two additional bathrooms.
- Buy a new house (buy): The new house must have six bedrooms, three bathrooms and one guest room.
- Build a new house (build): The family already has a small piece of land. They can build a new house on the land. The new house must have six bedrooms, three bathrooms and one guest room.

The family identifies the following important criteria to judge the alternatives:

- Size of the house (size): size of rooms, number of rooms and total area of the house.
- Transportation (transport): convenience and proximity to school and work place.
- Neighbourhood (neighbours): security and degree of traffic.
- Yard space (yard): front, back, and side spaces.
- General condition (condition): extent to which renovations or repairs are needed.
- Financing (finance): availability and cost of financing.

Step 2: Organise the problem in a hierarchy.

Figure 2 shows the hierarchy of the problem. The top level is the decision goal - choosing betweeen the alternatives or the best house plan. The second level is the criteria to judge the alternatives. The third level is the alternatives.

Step 3: Evaluate preference for criteria and alternatives.

To evaluate the criteria, the family compares the criteria and decides which criterion is more important. They also have to decide the intensity of importance by referring to the AHP scale. The pairwise comparison questions for the criteria are: a)

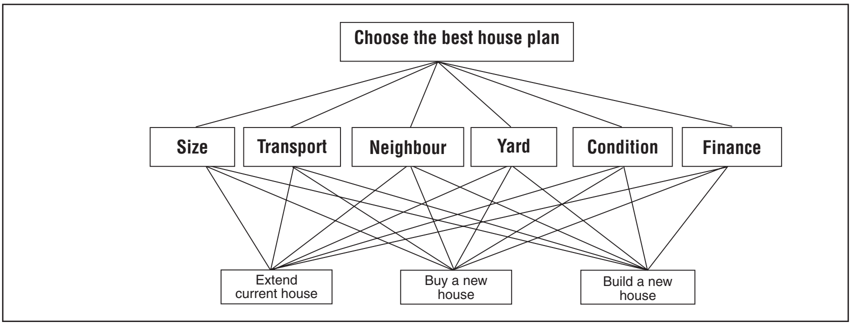

Figure 2: Choosing a House Plan Hierarchy

Table 9: Decision matrix and priority weight of criteria

Goal	Size	Transport	Neighbour	*Yard*	*Condition*	Finance	Priority Weight
Size	1	5	3	1	1	1	0.230
Transport	1/5	1	3	1/5	1/5	1/5	0.052
Neighbour	1/3	1/3	1	1/5	1/5	1/5	0.052
Yard	1	5	5	1	1/3	1/5	0.125
Condition	1	5	5	3	1	1	0.259
Finance	1	5	5	5	1	1	0.283
λ_{max} = 6.574	CR=9.30						1.000

Compare the criteria for the decision goal: For example, compare the size of the house and transportation. Which criterion is more important and by how much more? b) Compare the size of the house and neighbourhood: Which criterion is more important and by how much more?

To evaluate the alternatives, the family compares the house plans for each criterion. They decide which house plan meets the criterion more and by how much more. The pairwise comparisons questions for the alternatives are: a) In terms of size of the house, compare between extending the current house and buying a new house. Which plan is more preferred and by how much more? b) Compare between extending the current house and building a new house. Which plan is more preferred and by how much more? c) compare buying a new house to building a new house. Which plan is more preferred and by how much more?

Step 4: Calculate priority weight of criteria and alternatives.

Table 9 presents the decision matrix and priority weights for the criteria. The family judges the size of the house is strongly more important than transportation, moderately more important than neighbourhood, and equally important as yard space, condition of the house and financing availability. Table 10 presents the decision matrix of the alternatives for the criteria.

Step 5: Aggregate the weights to obtain overall priority weight of alternatives.

To get the overall ranking of the house plans, the priority weight of the house plans for each criterion are combined into a single matrix. The matrix is then multiplied by the priority weight of the criteria to obtain the global priority weight of the house plans. Table 11 presents the priority weight for the house plans for each criterion and the global weight of the house plan.

Step 6: Check consistency of the pairwise comparisons

The CR of the pairwise comparison judgements are less than 10 percent.

Table 10: Decision Matrix and Priority Weight of Alternatives for Criteria

Size	Extend	Buy	Build	Priority Weight	*Transport*	Extend	Buy	Build	Priority Weight
Extend	1	1/3	1	0.200	Extend	1	3	3	0.600
Buy	3	1	3	0.600	Buy	1/3	1	1	0.200
Build	1	1/3	1	0.200	Build	1/3	1	1	0.200
λ_{max} = 3.000	CR=0.00			1.000	λ_{max} = 3.000	CR=0.00			
Neighbour	Extend	Buy	Build	Priority Weight	*Yard*	Extend	Buy	Build	Priority Weight
Extend	1	5	5	0.714	Extend	1	1/3	1/3	0.142
Buy	1/5	1	1	0.413	Buy	3	1	1	0.429
Build	1/5	1	1	0.413	Build	3	1	1	0.429
λ_{max} = 3.000	CR=0.00			1.000	λ_{max} = 3.000	CR=0.00			1.000
Condition	Extend	Buy	Build	Priority Weight	*Finance*	Extend	Buy	Build	Priority Weight
Extend	1	1/3	3	0.234	Extend	1	1/5	1/5	0.090
Buy	3	1	5	0.650	Buy	5	1	1	0.455
Build	1/3	1/5	1	0.116	Build	5	1	1	0.455
λ_{max} = 3.052	CR=4.500			1.000	λ_{max} = 3.000	CR=0.00			1.000

Table 11: Global Priority Weight of Alternatives

	Size	Transport	Neighbour	Yard	Condition	Finance	Global Weight
Alternatives	0.230	0.052	0.052	0.125	0.258	0.283	-
Extend	0.200	0.600	0.714	0.142	0.234	0.090	0.218
Buy	0.600	0.200	0.413	0.429	0.650	0.455	0.506
Build	0.200	0.200	0.413	0.429	0.116	0.455	0.276

The family's pairwise comparison judgements are consistent.

RESULTS AND DISCUSSION

In AHP, the outcome of the decision depends on the structure of the hierarchy. The result obtained is unique to the specific hierarchy. AHP does not aim to produce a generalised result of a problem. The decision makers determine the criteria and alternatives based on the situation of the problem. The result is unique to the decision makers developing the hierarchy and entering the pairwise comparison judgement.

Figure 3 reveals that in terms of priority weight of criteria, the most important criterion is availability of financing, followed by condition of the house, yard space, size of the house, and transportation and neighbourhood. As for priority weight of alternatives, Figure 4 shows that for size and condition of the house, buy a new house is the most preferred alternative. For transportation and neighbourhood, extend the current house is the most preferred alternative. For yard space and financing availability, buy and build a new house are equally preferred. As for global priority weight of the alternatives, buy a new house has the largest weight, followed by build a new house and extend the current house.

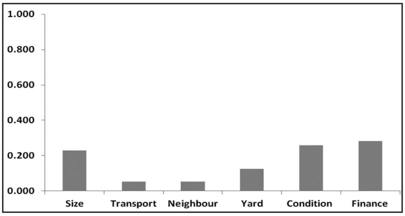

Figure 3: Priority Weight of Criteria

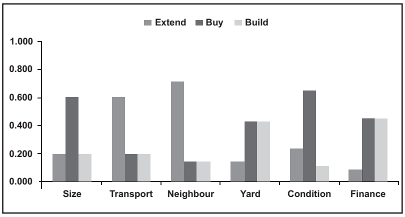

Figure 4: Priority Weight of Alternatives for Each Criterion

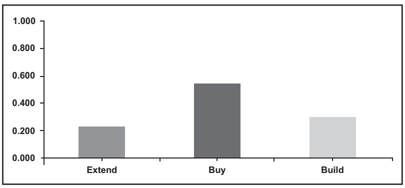

Figure 5: Global Priority Weight of Alternatives

This study documented the following AHP benefits and limitations to personal financial decision making:

AHP Benefits:

- **Simple and Easy to Use**

  AHP is a simple and easy-to-use decision-making tool. It is a simple, logical and easy-to-understand decision-making process. The participants understood how each step works towards achieving the decision goal. The simple aspects of AHP are: (i) It does not rely on extensive data or inputs; (ii) It uses simple calculations to derive the results. The calculation of the priority weights was done using free software from http://bpmsg.com; and (iii) It does not require a complicated market, economy or probability assumptions or estimation.

- **Improves understanding of a problem**

  The starting point of AHP is a well-structured problem with the following components clearly stated (i) the decision goal - the answer sought by the participants; (ii) the alternatives from which the decision will be made; and (iii) the criteria to evaluate the alternatives. Structuring and organising a problem requires in-depth understanding of the problem. The participants have to organise and sort their thinking and understanding. The hierarchy systematically structures their abstract understanding of influences, connections and interactions between criteria and alternatives and improves their understanding of the problem. The hierarchy synchronises the participants' vision and understanding of the problem to deliver better decisions.

- **Increases Transparency and Improves Problem Communication**

  The hierarchy is not just a diagram; it is also a communication tool. The hierarchy visualises the problem and enhances problem communication. It makes a problem transparent. It presents a holistic view of the problem by displaying the criteria and alternatives of the problem. It is a quick way to engage all participants in a problem. It enables them to criticise the reasoning and organisation of the problem constructively. It shows the trade-off the participants have to make when choosing one alternative over another.

AHP Limitations

- **Number of Pairwise Comparisons**

  The number of criteria and alternatives determines the number of pairwise comparisons. A hierarchy with m criteria and n alternatives has $m(m-1)/2 + m(n-1)/2$ number of pairwise comparison questions. Each decision matrix has $n(n-1)/2$ pairwise comparisons questions. The hierarchy has six criteria and three alternatives. The decision makers have to answer twenty-one pairwise comparison questions. Too many pairwise comparison questions decrease the participants' concentration. It increases the tendency of not answering all questions and producing missing values. Consequently, AHP cannot calculate the priority weights.

- **Decision Fatigue**

  Pairwise comparison questions are repetitive. As a result, the participants experienced decision fatigue. They randomly answered the questions instead of making careful and deliberate judgement. Randomly answering the questions increased decision inconsistency. As a result, the priority weights of the alternatives are not valid.

MAIN FINDINGS AND IMPLICATIONS

This study shows how to use AHP as an aid to improve personal financial decision- making. This section discusses the main findings and their implications to decision-making for personal financial planning. The results of the study show that AHP is a practical and effective tool to structure complex personal financial problems. AHP enables decision makers to disentangle a complex problem into manageable parts. It structures a complex problem using a hierarchy. The structure and function of the hierarchy provides an effective and practical way to think about, organise and break down personal financial problems. The hierarchy enables factors that are relevant to a particular personal financial problem to be organised in gradual, incremental and practical steps, from the more general in the upper level to the particulars in the lower levels. AHP is a decision-making tool that is relatively simple, logical and easy to understand, communicate and use. As a simple decision-making tool, AHP is useful for analysing and understanding complex personal financial planning problems. The AHP framework provides direct and clear guidance to model complex personal financial planning problems, starting from collecting relevant information concerning the problem, structuring the information in the hierarchy, and calculating priority weight and consistency ratio. A simple and easy to understand decision-making process can be communicated easily, therefore enabling problem participants to understand how the decision was reached. In uncertain environments and high-stake problems such as house purchasing or planning, it is important that the problem participants understand the decision-making process. In such an environment, simply knowing the decision is not sufficient. Problem participants need to know how the decision was arrived at.

CONCLUSION

The study concludes that AHP is a useful and practical decision-making tool for personal financial planning. It enables individuals, financial planners or financial advisors to have a more thorough understanding of the problem and help them to find the best answer for the problem. The following two findings reveal that AHP is a useful and practical decision-making tool. First, AHP can be used to structure a complex personal financial problem. The study demonstrates that a complex decision problem such as choosing a house plan can be simplified by using a systematic, easy-to-use and easy-to-understand decision-making process. As stated by Park (1982), people usually muddle through the decision-making process with little understanding of the method to achieve the desired decision. AHP is a systematic, easy-to-use and understand decision-making process, enabling decision makers to understand how a decision is achieved. Second, AHP is easy to use and understand, and improve communication of a problem. Levy, D., *et al.*, (2008) stated that the process of purchasing a house is a social activity. Family members set goals, discuss and negotiate family needs. Despite the discussion and negotiation, according to Park (1982), people are not used to measuring their spouse's preference function and decision strategies. A husband may not be able to identify his wife's preferences or choices associated with a certain dimension. AHP is an easy to use and understand decision-making process that improves decision makers' understanding of a problem. It increases transparency of a problem by structuring criteria and alternatives of a problem in a hierarchy. Structuring the problem helps decision makers and problem participants to see the important factors in choosing the alternatives. The pairwise comparisons force decision makers to make deliberate and clear judgement of alternatives for specific criterion. The pairwise comparisons force them to make deliberate trade-offs in choosing the alternatives. This easy-to-use and understand decision-making process improves communication of the problem and enables a decision maker to explain how a judgement is made. AHP, however, has its limitations. Depending on the number of criteria and alternatives, it may have too many pairwise comparisons questions and the questions are repetitive. Therefore, decision makers have the tendency to answer the questions randomly or ignore the questions. Taking both the strengths and limitations of AHP, this study concludes that AHP is a process for helping individuals, financial planners or advisors to find the best answer. It helps them to be as smart as possible in every personal financial decision they have to make. It enables them to disentangle the complexity and confront the ambiguity of personal financial decision-making problems.■

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