



NEAR EAST UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
BUSINESS ADMINISTRATION PROGRAM

**PERSONNEL SELECTION BASED ON
THE SELF-CONFIDENCE LEVEL OF THE DECISION MAKER:
A FUZZY APPROACH**

GUNAY IMANOVA

MASTER'S THESIS

NICOSIA
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MASTER'S THESIS

THESIS SUPERVISOR
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NICOSIA
2019

ACCEPTANCE/APPROVAL

We as the jury members certify the 'Personnel Selection Based on the Self-Confidence
Level of the Decision Maker: A Fuzzy Approach'
prepared by GUNAY IMANOVA defended on 14/01/19
Has been found satisfactory for the award of degree of Master

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DECLARATION

I am Gunay Imanova, hereby declare that this dissertation entitled 'Personnel Selection Based on the Self-Confidence Level of the Decision Maker: A Fuzzy Approach' has been prepared myself under the guidance and supervision of Prof. Dr. Serife Zihni Eyupoglu in partial fulfillment of The Near East University, Graduate School of Social Sciences regulations and does not to the best of my knowledge breach any Law of Copyrights and has been tested for plagiarism and a copy of the result can be found in the Thesis.

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January 14, 2019

Gunay Imanova

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ABSTRACT

PERSONNEL SELECTION BASED ON THE SELF- CONFIDENCE LEVEL OF THE DECISION MAKER: A FUZZY APPROACH

Personnel selection is considered as the decisive factor of the companies' overall success rate. Appropriate personnel selection is desired in order to enhance the human capital of an organization. As the nature of all selections, personnel selection involves the decision making process. In other words, for effective and efficient personnel selection process managers (or accountable subordinate) who are decision makers (DM), should generate and analyze the possible alternative candidate pool for a vacant position. In order to select the most appropriate and suitable candidate it might be needed to use several effective tools such as linear programming or LP model to be able to obtain the overall ranking weights for the candidates and to minimize the sum of information deviation between the judgment or preference relations of DM and the priority vector w . A novel approach for more robust decision making and solution is based on fuzzy preference relations with indicated self-confidence levels of the decision makers.

Although existing literature involves various types of preference relations such as linguistic preference relations, fuzzy preference relations, multiplicative preference relations, and so forth, in these formats self-confidence level of DM is not taken into account. In this paper personnel selection decision making process is investigated to select the most suitable or optimal candidate for a vacant faculty position by considering linguistic self-confidence level of DM based on preceding provided preference value. Validity of the new considered approach has been proven by the numerical examples that comprise 5 alternatives and 5 criteria.

Keywords: Decision making, Personnel selection, Fuzzy preference relations, Self-confidence levels, Linguistic preference relations, Linear programming, Human resources management.

ÖZ

KARAR VERİCİNİN ÖZGÜVEN DERECELERİNE BAĞLI PERSONEL SEÇİMİ: BULANIK MANTIK YAKLAŞIMI

Personel seçimi, şirketlerin genel başarı oranlarının belirleyici unsuru olarak görülmektedir. Organizasyonların beşeri sermayelerini geliştirmeleri için doğru personel seçimi yapmaları gerekmektedir. Bütün seçim süreçlerinde olduğu gibi personel seçiminde de karar verme eylemi gerekmektedir. Diğer bir deyişle, etkili ve verimli personel seçimi için karar verici durumunda olan İnsan Kaynakları yöneticisi (veya yetkili alt personel) açık pozisyona esasen yeterli sayıda uygun aday havuzu oluşturmalı ve uygun adayları incelemelidir. Karar verici doğru ve en uygun aday seçiminde Doğrusal Programlama (DP) gibi bazı etkili araçlardan yararlanarak adayların öncelik derecelerini ve sıralamasını öğrenebilir ve karar vericinin alternatifler üzerindeki tercih ilişkileri ile öncelik vektörü arasındaki bilgi sapmasını da en aza indirgenebilir. Oluşturulan yeni ve daha sağlam karar verme yaklaşımı bulanık tercih ilişkisi ve özgüven derecelerini ele almaktadır.

Daha önceki edebiyat çalışmalarında bulanık tercih ilişkisi, dilsel tercih ilişkisi ve çarpımsal tercih ilişkisi gibi birçok tercih ilişkileri konu edilmiş, fakat bu tercih ilişkilerine ilişkin özgüven dereceleri veya seviyeleri konu alınmamıştır. Bu çalışmada, karar vericilerin bulanık tercih ilişkileri üzerine belirttikleri dilsel özgüven dereceleri dikkate alınarak personel seçimi için karar verme sürecine ilişkin araştırmalar ve karşılaştırmalar yapılmış ve en uygun adayın seçilmesi sağlanmıştır. Yeni yaklaşımın geçerliliği örnek problemlerle kanıtlanmıştır.

Anahtar Kelimeler: Karar verme, Personel seçimi, Bulanık tercih ilişkileri, Özgüven dereceleri, Dilsel tercih ilişkileri, Doğrusal programlama, İnsan Kaynakları yönetimi.

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ABBREVIATIONS

AHP	Analytic Hierarchy Process
CI	Consistency Index
CR	Consistency Ratio
DM	Decision Maker
HR(M)	Human Resources (Management)
LP	Linear Programming
MCDM	Multi-criteria Decision Making
NF	Intuition-Feeling
NL	Natural Language
NT	Intuition-Thinking
RI	Random Index
SF	Sensation-Feeling
ST	Sensation-Thinking
TOPSIS	Technique for Order Preference by Similarity to Ideal Situation

INTRODUCTION

In our continuing lives we have to make various critical non-programmed and programmed decisions. Individuals need to choose; the movie to watch; the meal to cook; the university and field to study; the job to work; the strategy to follow for organizational success; and so forth. Decision making is simply the process of generating and analyzing feasible alternatives and selecting one or more of them as required (Dessler, 2004). Judgment, rules, heuristics, intuition, and creativity are all the key factors of decision making process. Personnel selection is one of the important decisions to be made by the manager; Human Resources manager in bigger companies or by general managers or other related decision makers (DMs) in smaller companies in order to find the most appropriate or optimal candidate to match with the job requirements, and in turn to achieve the organizational goals and objectives. The organizational goal may be an increase in revenue by 30% (percent) in four years, or rise in profit or productivity by 5.5% in two years. To achieve this goal manager may have to motivate and influence the personnel towards achieving more by offering incentives (financial, praise, recognition, benefit, and so forth), and may have to hire more associated personnel as required. Hiring optimal personnel is crucial for the overall success of the organization.

Research Objective: Our purpose is to identify the best candidate for a particular vacant faculty position taking into account the novel preference representation format with self-confidence levels of the DMs. Fuzzy logic is used in order to cope with the uncertainty and incomplete information presented in expressing or indicating the preference of one alternative candidate over another alternative candidate with respect to criteria. Using a new approach we propose the use of self-confidence levels on indicated fuzzy preference evaluations (according to judgment based on interview and test results) of managers or other related DMs who deal with the personnel selection problem to decrease the information loss. By deriving a linear programming model we intend to minimize the information deviation between the DM's preferences and the priority vector w .

CHAPTER 1

THE DECISION MAKING PROCESS

As a nature of a human being, we are perpetually subject to decision making even in our daily simple problems. Deciding on what to eat, which university to apply and study, the most suitable job to work on, how to improve or develop business in a new direction through global expanding, whether to shrink or pursue the standing position and wait for the best time to take an action in the market, and all other such kind of related issues need decision making capability (Aliev, Huseynov, 2014). According to Adair (2000) decision making process comprises some stages such as problem recognition, collection of data or information, developing alternatives to be evaluated, choosing an alternative, and finally implementing decision and evaluating the final results for constant and continued efficacy and effectiveness.

Dessler (2004) and Solomon (2007) describe problems as the difference between desired and the actual state, and it stimulates most decisions. Decision is stated as a choice among available alternatives. Decision making is simply the process of generating and analyzing possible available alternatives and selecting one or more of them Dessler (2004).

Lunenburg (2010), states that decision making is a recyclable and an iterative process that follows a logical sequence. For instance, to generate and choose an alternative, decision maker (DM) must identify the problem first and so forth. Recyclable means if any problem exists in any stage DM can turn back to fix the problem aroused. It is shown in the figure 1.

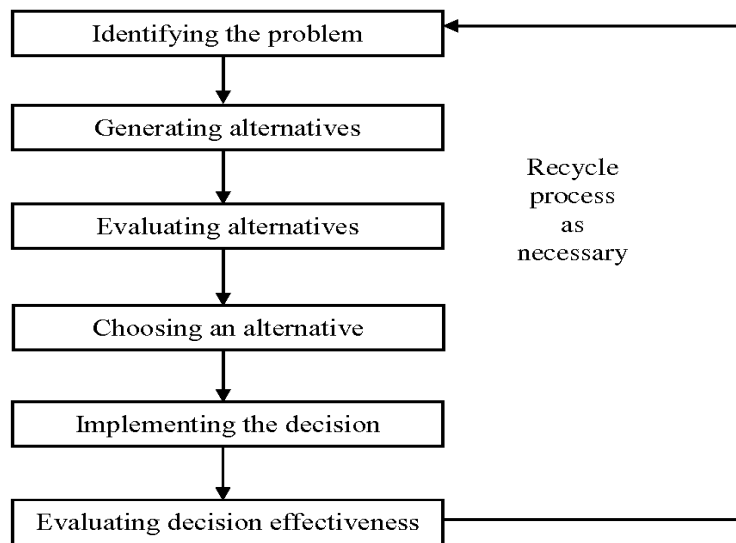


Figure 1: The Decision Making Process
(Lunenburg, 2010)

1.1 Identifying Problem/Problem Recognition

Solomon (2007) conceived that problem recognition occurs whenever a person perceives that there is a small or big, simple or complicated problem that is needed to be solved. He explains it with an explicit example; a driver has a problem if he/she is at the end of his/her petrol in an unanticipated time in a highway. The problem can also be recognized if there is a dynamic environment in which “standard of comparison” or the working environment for an individual is changed. For instance, a manager can be used to be an autocratic leader who is the only one to make related organizational decisions without regarding the employees’ ideas. However, as the expectations or the standard of comparison of both the employees and the organizations are changing and developing, manager alters her/his leadership style to other styles such as democratic or participative style in which the leader (manager) highly considers the decisions and the ideas of the employees while making organizational decisions. On the other hand, manager can change her/his leadership style when she/he recognizes something going wrong with the democratic leadership style, and can use backup style or in other words adopt autocratic leadership style to take more control over employees and making related decisions.

Human resource management department has organizational goals and objectives to accomplish for instance; effective and valid recruitment process (that includes personnel selection, training and development etc.) which in turn will reduce employee training and employee turnover costs, increase productivity and performance, and commitment (Harlan & Anne, 1980). Thereby, setting these goals and objectives lays the groundwork for identifying related problems, deciding which actions to follow, and finally evaluating the results (Lunenburg, 2010). Consequently, decision is considered as an effective decision if it was able to solve the identified problem, in other words if manager was able to accomplish the desired goals and objectives. Lunenburg (2010) states that effective decision maker realizes the significance of correctly identifying the related problems. According to Kepner and Tregoe (1997), first stage of decision making (i.e. identifying problem) is the critical phase to reach a sound decision as a result and also it is easier to decide on what the problem is not. They noted that better problem definition leads to better quality decisions at the end.

Problems can be identified by internal and external environment auditing (Lunenburg, 2010). Problem is realized according to the obstacles that provide dissatisfaction. So, managers have to constantly control the progress of their organizational activities in order to follow a smooth path which directs to achievement of desired goals and objectives. To uncover possible threats and opportunities that might affect goals and objectives managers can do risk analysis with tools such as Scenario and SWOT analysis (Hillson, 2002). These analyses can be used whenever decisions such as whether to expand the business are considered.

Lunenburg (2010) also brought forward that identifying problem must be explained with its situation that specifically causes the problem. Hence, we can achieve the desired solution or decision as a result.

1.2 Generating/Developing Alternatives

Casey, Getz, and Galvan (2008) state that under intensive negative feelings such as panic, anger, anxiety, and doubt people usually avoid generating

alternatives and they are focused on deciding at once without searching for alternative.

According to Stevenson (2009), the ability to make successful decisions usually associated with generating suitable alternatives or criteria. The decision makers have to develop and identify such alternative that can be used as a solution of the problem. He states that identifying alternatives or criteria depends on cost-profit analysis, improved productivity, return on investment, image of the company, increase in demand and other related subjects. For instance, investing in advanced personnel selection strategies will return back with low turnover rate and accordingly low costs. The creativity and the experience that a decision maker possesses under the given situation nature, usually determine the possible quality and number of criteria or alternatives. Identifying alternatives always carries risk of overlooking (i.e. leaving out of account) other more possible predominant alternatives. As a result, the solution reached might not be the optimal as it is thought. On the other hand it might be not possible to identify or develop all the possible alternatives because of the need for more deal of time, money and creativity. However, it is a well-known principle that through more sound exertions on developing alternatives, more justified and optimal decisions can be made accordingly (Stevenson, 2009). Dessler (2004), states that expert decision makers see alternatives as "the raw materials or elements of decision making". According to them alternatives show a particular set of potential choices that a manager needs to achieve for desired objectives. To develop good alternatives decision makers must discover their creativity. This can be realized by trying to develop as many alternatives as possible. Next step is to expand searching for more information benefiting from experts' experience, and other related people. The main point here is to remember the targeted objectives, and by asking "How to achieve?" question decision maker is able to generate related good alternatives (Dessler, 2004).

1.3 Evaluating/Analyzing Alternatives

Analyzing and comparing alternatives is the next step in decision making process. Evaluation process is usually enhanced by using different statistical

or mathematical tools and techniques such as linear programming (Stevenson, 2009).

According to Dessler (2004), decision making carries risk and danger as it mentioned earlier. He explains it as making decision today and feeling it tomorrow. For instance, HR manager hires the personnel today with a higher salary than other companies offer to get a competitive advantage, however, after one month manager notices that paying such a higher amount of salary makes other personnel reluctant because of unjust treatment. Here another question arises; "Given the right objectives how to select an appropriate alternative?". Hereby, it is considered as the most difficult and complex part of decision making process which needs future forecasting. Perfect or certain conditions and environments comprise the relevant parameters such as stable demand for the company's products or services, and the cost of production, which have known consequences and values for the future. Since the outcomes are known, decision makers make their decisions under certainty. According to Statistical Decision Theory, in organizational problem solving and decision making processes managers confront with three conditions of environments; which are certainty, risk, and uncertainty.

Certainty condition under classical theory can be reached with a relatively stable economy and competitive equilibrium. Simon (1979) describes the decision making under uncertainty as bounded rationality that is used to replace the classical theory of rational choice of human beings. This new model describes how decisions should be made when DM has to search for alternatives that have imperfectly known consequences (such as *expected* values of future sales, and demand) because of uncertainty exists in the environment and the limited computational capabilities. Simon (1979) states that utility maximization is not always desired in searching for alternatives. Instead, DM terminates the searching for other possible alternative whenever he/she finds the convenient one that meets his/her aspiration and desire for a good alternative. He called this selection model "*satisficing*". In decision making approach DM can be satisfied by either discovering the optimal or best solution by working out the burden of mathematical computations to

tackle a more simplified world problem or choosing the satisfactory solution that is more relevant to a realistic world situation. Simon (1979) also states that both approaches are used interchangeably in management science problems. With this new approach, Simon (1979) brought forward that human beings cannot be always fully rational. Therefore, Zadeh (1975) has suggested an approach that can manage the uncertainties in real decision making processes. The theory suggested by Zadeh (1975) is fuzzy set theory, which can be used as the mathematical fundamentals for the creation of an eligible formal basis for bounded rationality ideas for more realistic decisions (Aliev & Huseynov, 2013). Aliev and Huseynov (2013) state this relationship on the basis of imperfect or limited information knowledge of human beings (which is the basic focal point of bounded rationality), and their desire for evaluating information in linguistic variables. Imperfect information refers to vague, uncertain, unreliable, indefinite/incomplete, imprecise or partly true information (Zadeh, 2009). Zadeh (2009) as cited in Imanov, Ozkilic, and Imanova (2017) states that it is very rare for the information presented in a real world situation or problem to be the perfect information.

Fuzzy set theory includes linguistically described imperfect information. According to Zadeh (1975), linguistic variable has values in the form of words or sentences in an artificial or natural language (NL). This results from the limited computational abilities of human beings, who are thinking and reasoning in natural language propositions instead of complex mathematical expressions. From another point of view, human beings who have limited and imprecise knowledge prefer linguistic evaluations that allow vagueness, uncertainty, and impreciseness in decisions. Consequently, DMs achieve satisfactory and approximate results (as bounded rationality suggests) and it is called approximate reasoning in fuzzy logic (Aliev & Huseynov, 2013). Approximate reasoning connotes neither exact nor very inexact reasoning (Zadeh, 1975). To put in another way, approximate reasoning is the process of achieving a possible imprecise result from the given imprecise assumptions (Pal & Mandal, 1991). Therefore, fuzzy logic is dissimilar with the classical Boolean logic.

Zadeh (1975) explains linguistic variable with some examples; for instance, age, temperature, height are linguistic variables if the given values are linguistic (qualitative) instead of numerical. Age has values such as young, not young, very young, old, not very young, not very old, etc., instead of 21, 22, 23, 24, etc. So linguistic variable's (e.g. Age) values (young, old) are generated from the primary terms (age), a collection of hedges such as very, slightly, extremely, quietly, etc., and connectives of 'and' and 'or'. However, age is generally a numerical variable so; we use compatibility function that associates with the linguistic value of the given variable. For example, value or fuzzy subset 'old' A associates each age within the given age interval (e.g. $[0, 100]$) with a real number in the interval $[0, 1]$, that shows the compatibility or grade of membership of any age u in the linguistic value 'old' A , $\mu_A(u)$, $\mu_A: U \rightarrow [0, 1]$. Compatibility of age 80 with 'old' might be 0.8; on the other hand, 27 might be 0.2.

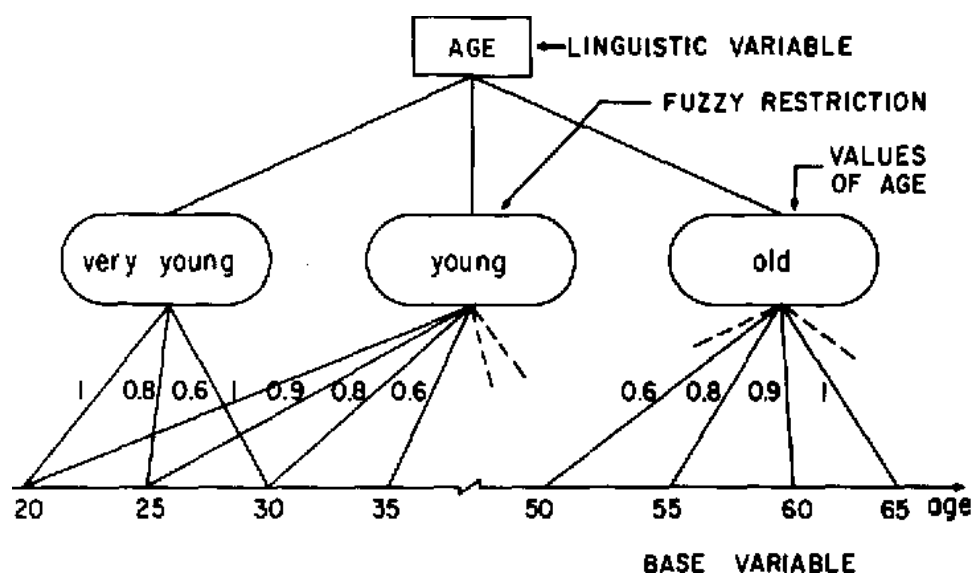


Figure 2: Hierarchical Structure for a Linguistic Variable and Values with Associated Compatibility
(Zadeh, 1975)

Furthermore, Pal and Mandal (1991) as cited in Zadeh (1975) state that Boolean's two valued logic of truth values or propositions that can be either 0 or 1 (false or true, respectively), is limited with crisp binary values and intolerable to imprecise and incomplete information. However, fuzzy logic also provides the intermediate values within the crisp values of 0 and 1. Truth

qualifications such as very true, not very true, false; possibility qualifications such as possible, almost possible, almost impossible; and probability qualifications such as likely, unlikely, more likely, extremely likely, probable, improbable, are all three basic qualification types of fuzzy logic that enable the linguistic responds with human reasoning to the questions such as “Is North Cyprus close to Turkey?”. The answer may be fairly true, quite true, not very true, and so forth.

As it is stated in Aliyeva (2017) classical decision making approaches are not practical in uncertain information or vagueness existing environment. In such an environment DM is provided with extended classical multi-criteria decision making (MCDM) in other words, fuzzy (type-1 and type-2) MCDM that enable DM to explain his/her preferences in incomplete information and to reach a sound decision.

Dessler (2004) states three steps for an effective evaluation of alternatives. Firstly, through process analysis DMs have to put themselves into the future in their minds. As Dessler (2004) states anticipating and looking into the future or tomorrow is a valuable analytical skill. In his book he states process analysis as solving the existing problem by thinking broadly from the beginning to the end of the process, using the imagination at each phase to guess what actually could happen by choosing an alternative.

Secondly, it is suggested to eliminate inferior alternatives or in other words, delete them from the possible alternatives list if they have little or no possibility of success.

And finally, author proposes organizing the rest of alternatives in Consequences matrix form. This consequences matrix or table shows the DM's objectives (horizontally), and alternatives (vertically). In each box of the table, there is a short statement that shows the related consequences of one alternative to the associated objective.

1.3.1 Decision Making Criteria

As Stevenson (2009) states, DMs develop a payoff table that estimates, or determines the payoff or outcome related to each possible future conditions or state of nature. Evaluation process of alternatives is conducted through decision criteria for uncertainty such as;

- Maximin is choosing the best possible payoff alternative among the worst possible payoffs. This criterion is based on pessimistic approach.
- Maximax is choosing the alternative with best payoff or outcome, without considering any payoff lower than the best. This is an optimistic approach.
- Laplace criterion relies on suggestion that the states of nature are equally possible. With this approach DM chooses the alternative with the best average outcome or payoff among all other alternatives.
- Minimax regret criterion seeks to minimize the regret by minimizing the separation between the best possible payoff alternative (for each state of nature) and the given possible payoff.

Decision making under risk lies between the certainty and uncertainty dominated environments. Here, for each state of nature the probability of occurrence is known. Generally, expected monetary value criterion approach is used to make decisions under risk. The expected value is computed by summing up all the weighted payoffs (multiplying the related probability of occurrence by the payoff for each state of nature) for an alternative given. The alternative with the highest expected value is selected.

A decision tree is another approach to be used in decision making instead of payoff tables, especially for evaluating situations which involve sequential decisions such as whether to expand a company after realizing a higher demand for goods/services than expected. Its branches and nodes, i.e. schematic representation shows the possible available alternatives and their possible outcomes, payoffs, or returns. As a result of analyzing, alternative with the highest expected value or return is chosen as a decision.

DM may want to obtain the perfect information for example about consumer behavior for marketing research. To receive that additional information DM might have to pay money to related legal experts. Expected value of perfect information is the equation (expected payoff under certainty - expected payoff under risk) to find the maximum amount of tolerable cost or spending to obtain this additional information (Stevenson, 2009).

When DM confronts with the two states of nature such as low demand and high demand, it might be useful to conduct sensitivity analysis in order to designate the range of probability that gives the same alternative with the best payoff, in other words, graph shows how much the probability for state of nature can be changed to still obtain the same best alternative.

1.4 Making a Choice

After evaluating and eliminating the alternatives in the previous stage DM has left with two or more possible alternatives (Lunenburg, 2010). DM should make a choice according to main original objective such as attaining newly graduated personnel for a vacant position in finance department. However if the cost of training was important, manager would think about other convenient candidates who does not need the program of training and development which indicates more spending. Dessler (2004) declared that unless the right choice is made analyses conducted by a DM is useless. Gilboa (2010) proposes to choose the alternative that is feasible, satisfactory, and acceptable. Lunenburg (2010), states that the DM might be able to choose more than one alternative simultaneously. Author explains it with a simple example of hiring an English teacher. If the principal is between two strong candidates, he/she can propose the vacation to one candidate and keep the other candidate under observation. So, if the first candidate does not meet the standards, school principal will already have the good alternative to replace the teacher.

1.4.1 Making Better Decisions

Dessler (2004) put forward some techniques that can help the DM to improve the quality of making decisions.

1.4.1.1 Increasing Knowledge

As a first step, increasing the knowledge is advised. Even for simple and daily decisions basic information is needed. For more complicated decisions more knowledge and information is required. To increase the knowledge DM may always ask more and more questions such as “Who? What? When? Where? Why? How much?”. For example who is selling the land and why?, how much can you afford to pay? etc. are all objective related questions.

Experience is the treasure for decision making that cannot be replaced. Internship during education, entrepreneurship, global expansion, marketing development, etc. are all act as negative and positive directors for upcoming operations.

Using consultants' or other people's experience which the DM lacks is a substantive issue.

Carrying out research relative to the targeted objective can enable the DM to achieve more information. For example, searching for the trade barriers, culture, and traditions adopted in the country that the company wants to enter will give a rich information base about its economic, politic, sociologic, etc. situations.

1.4.1.2 Intuition of DM

Dessler (2004) explains intuition as a cognitive process. An individual makes decisions instinctively, based on that individual's accrued knowledge and experience. *Intuitive* decision makers rely on trial-and-error method, because without considering much more available information, they tend to try one alternative after another and so on until the DM finds the best or optimal alternative according to their inner nature. On the other hand, *systematic* decision makers tend to follow a more logical and step by step approach in order to solve a problem. Studies about both types of decision makers indicates that, DMs in situations which allows enough time for the evaluation

of all possible alternatives, can be systematic. However, using instincts for better decisions is also needed.

1.4.2 Different Decision Making Styles

Since many years, researchers have been studying on different decision making styles adopted by DMs. For example, school principals, HR managers, sales directors, finance managers, etc. are all responsible for management functions of planning, organizing, leading and controlling, and all of these management functions (regardless of title or level of managers) involve the decision making. (Dessler, 2004). However, managers and other DMs make decisions using different approaches or styles. Therefore, it is worthwhile to discuss different decision making styles.

General Decision-Making Style (GDMS)

Scott and Bruce (1995) have suggested that decision making style is closely associated with the individual's customary and learned response, rather than his/her personality traits, in a given specific situation. General Decision-Making Style involves five decision maker categories; intuitive, rational, spontaneous, avoidant, and dependent.

- **Intuitive:** This style relies on an individual's inner senses or feelings of what is right rather than searching for a rational source of reason in making decision. Scott and Bruce (1995) stated that intuitive decision makers prefer to use their "hunches and feelings" primarily in decision making.
- **Rational:** Decision makers like to search in detail to gather correct information, and evaluate the alternatives in a reasonable manner. Primary purpose of the rational style is to make logical and systematic decisions, by considering all angles of the alternatives chosen to achieve the required goals and objectives. Planning careful decisions (programmed decisions), and verifying the source of information are other characteristics of rational decision making style.

- Spontaneous: Decision makers generally have impulsive nature during making decisions. They make quick decisions that are seemed as natural or native. Time is important so decision maker act immediately to complete the decision making phase, as soon as possible.
- Avoidant: Decision-maker has propensity to delay or cancel the decision making process as much as possible, and make last minute appeal decisions whenever they confronted with pressure. He/she probably has unsettling feelings towards making decisions and that can be the reason to avoid decision making.
- Dependent: Dependent decision maker usually refer to or ask somebody for advice before making important decisions. Support for a direction from others is critically important for a decision maker.

Myer's (1976) work on "human information process" is one of the preliminary approaches towards decision making styles, and this study would provide a basic for further implications and studies. Carl G. Jung's work on "psychological types" explains the variances in human behavior which are associated with the individuals' dissimilar preferences to use their minds as a result of difference in mental functioning or use of different hemispheres of a brain. Individuals' discrete perception and judgment of situations are all related concepts for differences in behavior. His theory of psychological types helped Jung to formulate a model for methodological investigation of these differences in human behavior. Psychological types consist of four dimensions which are **E**xtraversion – **I**ntroversion (EI), **S**ensation– **I**ntuition (SN), **T**hinking–**F**eeling (TF), and **J**udging–**P**erceiving (JP). Although these four dimensions or combinations provide a matrix of 16 distinct personality types, four main styles among them can be taken to produce decision making styles by taking into account that while perception is carried out by Sensation S, and/or Intuition N, judgment is based on Thinking T, and/or Feeling F. Hence four decision making styles are produced by congregating above mentioned two ways of Perceiving with two ways of Judging. The four styles produced are sensation-thinking (ST), sensation-feeling (SF), intuition-

thinking (NT), and intuition-feeling (NF). The ST decision making style owned individual or manager gives full weight to the facts and details that can be gathered and verified rationally by her/his senses. This style is mainly based on strict rules. The SF decision making style owned individual, also emphasize perception by her/his sensations. However, in this case individual likes to judge the situations by her/his feelings or creating a friendly and a sympathetic environment. NT style users prefer to seek for new truths rather than what is seem to be true by only taking the summary of the situations. They rely upon to see the big picture rather than a part of a puzzle. NF style user individuals bear combinations of intuitive and feeling characteristics for perception and judgment respectively. NF processing style relies upon the ability of understanding and communicating with the people in an enthusiastic and insightful manner (Myers, 1976). They can be illustrated by the according vocations as; ST as a technician, NT as a planner, SF as a teacher, and NF as an artist. Furthermore, description of the above mentioned decision making styles depend more on how the individual judge (process) the information, rather than how it is perceived or gathered (Taggart & Robert, 1981).

Individuals as managers should be flexible in terms of processing decision making styles (Barnard & Chester, 1938), to be able to survive in or cope with the changing business management environment. Due to these changes managers should be able to fit their decision making styles to different confronted situations. Hence, managers may sometimes need to decide as a technician, planner, teacher, or an artist (Taggart, Robert, 1981).

According to Taggart and Robert (1981) as cited in Ogarca (2015), managers could be distinguished related to their approached decision styles such as; "Improve your work performance or you will be dismissed from your post!" (Factual, impersonal, practical) can be an example response of a **ST** manager, "If your performance does not improve, you will be sent to another post" (Prospective, impersonal, logical) might be a **NT** manager's approach which is a more middle-of-the-road course of conduct, manager might embrace the **SF** style and say "You need to evolve yourself, what can we do to help you develop yourself?" (Factual, personal, sympathetic and friendly),

and lastly, “You are able to increase your work performance, we want to offer a suggestion” (prospective, personal, enthusiastic) can be an example approach of a **NF** style adopting manager. As a result, managers should bear in mind that they can embrace any one of the above mentioned decision making styles that fits best to the different situational factors such as restricted time frame, behavior of the subordinate employee, or team principles.

One of the best known decision making style models is stated by Rowe and Mason (1987). According to this model, individuals use dominantly either their right hemisphere or left hemisphere of brain. Rowe and Mason (1987) stated that style of an individual depends on his/her specific tendency to think and act in a given situation. In other words, decision style of a person is the way, that he/she perceives and understands the stimulus and responds it in a preferred manner, according to personality and background. They identified two key dimensions that describe the working of our mind. They are cognitive complexity and value orientation. An individual may have a high tolerance to uncertainty or low tolerance to uncertainty. Values can be directed towards human and social concerns or towards technical concerns and duties. Thereby, composition of these two dimensions can generate four Cognitive Complexity Model decision making styles: directive, analytical, conceptual, and behavioral.

- **Directive style** is characterized by low cognitive complexity for which individuals use less complex mental structures to find the nuances in a given situation, and associated with the Jung’s sensing-thinking or ST style (Robert James Moretti, 1994). They have low tolerance for ambiguity and are fact oriented. They value tasks and technical concerns. Directive managers involve in structured (or planned) tasks, and technical concerns. They are punctual and offer quick satisfying but not necessarily optimal solutions among limited alternative solutions. Managers bearing directive style tend to be more autocratic or dominative over other employees.

- **Analytical style** is related to Jung's preference of intuition-thinking or NT style. Analytical thinkers generally have high tolerance for ambiguity, and directed towards task and technical concerns. They try to reach the possible extensive perspective through analysis or examination, planning, and forecasting. Although both directive and analytical styles are autocratic and logical in approach, in analytical approach, individual evaluates the alternatives to make the optimal decision.
- **Conceptual style** is associated with Jung's typology of intuition-feeling or NF style and has high tolerance for ambiguity and uncertainty. Conceptual thinkers are oriented to social concerns and highly value people. They are idealist thinkers, and like leaders encourage participation and contribution. They focus on ethics in conducting business. Conceptual style is characterized by the need for achievement through exploring new opportunities, formulating new strategies, and being creative and risk taker, in a large time period. They need recognition, freedom, praise or positive feedback.
- Finally, **behavioral style** related to Jung's perspectives of sensing-feeling or SF is characterized by low tolerance for ambiguity (low cognitive complexity). Behavioral style decision makers value people and social issues. They prefer face-to-face communications and discussions rather than written statistical or quantified reports as in the case of conceptual style. They consider the subordinates' decisions and suggestions. Behavioral managers are persuasive, supportive, empathetic, and they avoid conflicts.

Rowe and Mason (1987) have stated that a typical individual has one or two dominant styles that are mentioned above. Furthermore, most people have one or two backup (supportive) styles to be used. They stated that alignment is the matching of an individual's style to the specific demands of decision making structures. Conceptual and Behavioral styles have less logical approach compared to directive and analytical styles. Left hemisphere of our brain is dominant if we use analytical and/or directive styles, which are task oriented. On the other hand, if we use conceptual and/or behavioral style,

then right hemisphere of our brain becomes dominant, means that we are people oriented.

Rowe and Boulgarides (1992) have stated that an individual's decision style may account for the behavior of that individual such as managing and responding stress, problem solving capabilities, and the way he/she thinks.

		<i>Left brain hemisphere</i>	<i>Right brain hemisphere</i>
Cognitive Complexity	High	Analytic Enjoys solving problems/puzzles Uses considerable data Undertakes careful analysis Strong need for achievement (in the form of challenges)	Conceptual Creative and humanistic Broad and long-term focus Seeks independence Strong need for achievement (in the form of recognition)
	Low	Directive Aggressive and autocratic Acts rapidly Uses rules and intuition Strong need for power	Behavioral Supportive and empathetic Prefers communication/discussion Uses intuition rather than data Strong need for affiliation
		Task Oriented	People Oriented
		Values	

Figure 3: Decision Style Model
 (Martinsons & Davision, 2007)

Weighing alternatives includes numerically (quantitatively) weighing each alternative's importance related to given criteria (Dessler, 2004). Alternative ranking or weighting can be objective i.e. based on known and certain facts, subjective i.e. based on DM's judgment as in fuzzy preference relations, or evaluation, information obtained from literature survey, and experience (Fülöp, 2005), or the integration of both objective and subjective assessments to make the decision more credible and balanced (Wang & Parkan, 2005). Decision matrix is used to illustrate and ease the process of weighting or assessment of criteria based alternatives.

Pursuing right time for decision making is crucial. DM in a bad mood tends to be more aggressive and intolerable, whereas, in better situations, DM tends to be more relaxed, indulgent, and generous to a fault. Tolerance for faults is a great advantage when the final decision couldn't bring the desired results.

Improving creativity for better, original decisions is a must as Dessler (2004) said. Rewarding and recognizing the creative ideas, encouraging brainstorming without strictly criticizing the participants involved, being open to different point of views and perspectives, opinions, management levels or departments, all are acting as key factors for the creativity. Another point is to provide suitable or comfortable places with interesting attributes for participants and to allow written ideas for more introvert participants to express their creativeness.

1.4.3 Psychological Traps That Cause Biases in Decision Making

Heuristics are the rules or approximations that are used in decision making process through previous experiences gained to make a new choice, instead of systematically following the decision making steps such as gathering as much information as possible. Although heuristics may involve biases, they may also be very useful in situations where imperfect information or under uncertainty conditions exist (Gigerenzer & Gaissmaier, 2011). Anchoring is another trap that offers itself by putting unnecessary high weights to the firstly received information. Hammond, Keeney, and Raiffa (1998) define the anchoring with an example of a marketer who tries to anticipate the future sales of products in a dynamic marketing environment by only looking at the previous years' sales lists (first available information), which in turn produces unanticipated sales results. They recommend DMs to check for more available information from other people or sources, and to give enough weight to other information achieved. Dessler (2004) describes psychological set as the barrier approach to DM's creativity to generate alternative decisions. Difference in perception also considered as a trap in decision making. As the all DMs' points of views are not identical, interpreting problems differently is inevitable. So, marketing manager must review the

organizational problems not only in point of marketing, but from financial, HR, accounting, production, and etc. departments also.

1.5 Conclusion for Chapter 1

This chapter provides the basic principles and background information for decision making process, which comprises both daily and administrative decision making under certainty, risk, and uncertainty or with imperfect information given. Decision making appears in every stage of our lives, so to think out of box we need to break the barriers or psychological traps in front of our creativity for more effective and efficient decision making process.

CHAPTER 2

HUMAN RESOURCE MANAGEMENT (HRM) AND PERSONNEL SELECTION PROCESS

2.1 Importance of the HRM

Wright and McMahan (1992) have stated that Human Resource Management system is the pattern of programmed-planned HR activities to be accomplished in order to achieve the organizational goals and objectives. On the other hand, all managers involve in basic recruiting, interviewing, selecting, training, compensating personnel processes, and that is why all the managers need these fundamental staffing skills. Also, HRM was used to known as personnel management. (Dessler, 2004). Therefore, employee and personnel are used interchangeably in this paper.

HRM consists of all management decisions and practices which have a direct impact or influence on human recourses that are the main resources (capital) for organizations in order to achieve organizational goals and objectives. (Shahnawaz & Juyal, 2006). Strategic HRM is achieved by generating and implementing the HR strategies which are integrated with the organizational strategies that assist the company in accomplishing the general organizational goals and objectives (Armstrong & Taylor, 2014). Becker and Huselid (1998) put forward the significant positive impact of HR practices such as recruitment and selection on personnel's motivation, creativity, and productivity. Huselid (1995) as cited in Wright, Gardner, and Moynihan (2003), has emphasized the effect of these practices on lower turnover, higher corporate performance, and more productivity.

According to Barney (1991) and, Lado and Wilson (1994) sustainable competitive advantage can be achieved through HR practices by allowing development of core competencies, generating organizational knowledge, and building strong social relationships. The automated machines are impracticable when there are no educated and trained human personnel or workers to start those machines. Therefore, HRM is the essential, inimitable, and bigger part of management and its practices should be prominent for the organizations' strategic success. (Dessler, 2004). Walton and Lawrence (1985) state basic function areas of HRM as job analysis (design), hiring required employee with appropriate personnel selection, training and development practices for personnel improvement, rewarding and appraising system (financial and motivational), influencing employee towards participation, and employee compensation (wages, salaries, insurance, incentives, etc.).

2.2 The Recruitment and Selection Processes

Huo, Huang, and Napier (2002) emphasized that the selection of the most appropriate employees in order to cover the vacant positions or vacancies is the fundamental purpose of all HR and line managers. As Dunnette and Borman, (1979); also Mendenhall, (1987) had explained why this is important for the organizations by emphasizing that the misfit between the employee and the job could highly influence the performance of other HRM practices and functions, and in turn all the organization.

2.2.1 Recruitment

Recruitment is the process of finding the most needed or desired resources of an organization (Slusarczyk & Golnik, 2014). The managers who decide to hire the new personnel should identify the basic job requirements through job analysis as a first step. Then in accordance with the given information company personnel or HRM develops the job description and job specification. Job specification comprises the needed skills, experience and traits needed by the personnel or employee to help to achieve the organizational goals and objectives, whereas, job description includes the

information and summary about the job itself right alongside the required duties of the job. (Dessler, 2004).

Attracting the possible applicants to the vacant position, or simply the recruiting process can be conducted in two ways, which are within company/internal selection, or through advertising. (Slusarczyk & Golnik, 2014).

Internal. Gusdorf (2008), states that internal selection or in other words, promotion from within provides motivation, and enhances performance and productivity of employees as a result of desire to achieve personal goals of status and increased salary. The superiority of inside applicants is their familiarity and likely commitment to company. Therefore, training of an employee in order to learn company's principles and policies is not required. The drawback is the possible loss of more creative, productive, or expert external personnel (Gusdorf, 2008). Also it is stated that promotion from within is more applicable for top line managers.

Personnel referrals and job posting are used in internal selection. Traditionally, publicizing the vacant faculty post was conducted through posting the announcement on bulletin boards. However, as a result of advanced technology announcements with job description or specification are conducted through intranet and e-mail system. Current employee references become more important when the process results with a win-win situation or in other words, employer gains the new needed employee and the existing employee receives the reward. (Gusdorf, 2008).

External. External recruitment can be accomplished through private employee agencies where experts send the related skills possessed applicants. Although its fee is high, process reduces the time needed for the recruitment. Advertisement is another alternative to announce the open position and appeal the applicants. Dessler (2004) emphasizes the importance of appropriate medium of advertisement to attract the qualified personnel. Announcements can be through local news papers and journals,

TVs, radios, internet in terms of online applications, social media announcements, and etc. Today many big companies use internet or online applications which decrease the cost, enable quick and lots of responses by a simple process of posting the announcement on the homepage, and also attract distant applicants, instead of traditional expensive and time consuming advertising (Gusdorf, 2008).

2.2.2 Selection

Personnel selection is the decision made by the manager or in other words, by the DM to choose the optimal or best fitted personnel among possible alternative pool of applicants or candidates, using some selection tools and techniques (Dessler, 2004; Gusdorf, 2008). Adequate selection of personnel is crucial for the manager's success, because the success of manager depends on his/her personnel's success in operating the given responsibilities. As a consequence, good personnel selection enables the accomplishment of organizational goals and objectives. (Slusarczy & Golnik, 2014).

According to Bratton and Gold (2003), validity and reliability play great roles in the selection process. Reliability involves the control of whether the recent evaluation (judgment) results of applicants are similar or same with the results achieved in the past. Furthermore, test scores become reliable if the results follow the similar pattern today. Validity involves the appropriateness of the selection procedure that judges the candidates' skills and abilities.

Although there are no uniform international technique for personnel selection, most applied screening practices are tried to be discussed in this paper.

Interviews and psychometric tests are known as the most popular selection or screening techniques among all of the selection devices (Harlan & Anne, 1980). Furthermore there are other techniques such as the resumes or CVs of the applicants; application blanks to gather applicants' background information such as education, military status, language knowledge, past experiences, etc.; work samples enable the DM or employer to demonstrate

the cognitive skills, or coordination and planning ability of an applicant in implementing the knowledge to the practice; detectors of deception is used to examine the tendency towards lying, theft, or honesty using tests as paper and pencil; thought samples measure the motivation for achievement, power and affiliation, but device is considered to be less reliable; and written structured recommendations of applicants that shows the work history or success of an applicants can be a good source for screening them. Prior to conducting the selection process, managers should consider the reliability and validity of the technique to be used. Selection technique should appropriately measure the quality of the candidate or applicant associated with the job requirements (Harlan & Anne, 1980). As it is mentioned by Robertson and Smith (2001), overall researches show that applicants prefer unstructured interviews and work samples rather than tests.

2.2.2.1 Interviews for Selection

Surveys put forward that the most preferred personnel selection technique is interview. Interviews are used widely and in different concepts or formats. Interviews can be grouped in three formats: structured interview, semi structured interview, and unstructured interview.

- Least applied interview is **structured interview**. Relatively close-ended questions prevent deviations from the interview schedule of order of questions asked, and any possible probes, and also this interview provides standardized questions rather than specific or tailored (Harlan & Anne, 1980). Therefore, interviewer will not reach an idea for the candidate's certain behavior. Although these weaknesses, many researchers have shown that structured interviews are quicker to conduct, reliable and valid (Schwab & Heneman, 1969; Wiesner & Cronshaw, 1988). According to Moscoso (2000) candidates that possess comprehensive knowledge and job experience tend to prefer structured questions as this type of interview may be best fit to their positions. On the other hand, some of the researches put forward the importance of judgmental assessment on executives' selection (Guion, 1998). Dipboye (1994) states that interviewers use more

formal job analysis to gather detailed information about required job skills, abilities and knowledge by the structured interviews.

- **Unstructured interviews** consist of relatively open-ended questions. Some questions could be added or eliminated as required, and this explains why they sometimes called discovery interviews, and interviewers hereby are highly motivated, as Harlan and Anne (1980) state. This method enables candidate to deeply explain his/her own feelings through choosing their own words to answer the questions. Besides, it enables interviewer to understand the way of candidate acts. This technique enables the interviewer to change or adapt the different question for different candidates (Schmidt & Hunter, 1998) for possible in-depth understanding of candidates' capabilities. Dipboye (1994) states that unstructured interviews are mostly preferred by NF or intuitive-feeling style owned interviewers whose decisions are mostly based on intuitive judgments and feelings (as it has been mentioned in the first chapter). According to Dipboye (1994), unstructured personnel selection interviews are less reliable and valid than structured ones, because they include more subjective information gathering and intuitive rankings. Halo effect can be given as an example of cognitive bias. This situation can be described with an example of beautiful or attractive candidate being perceived as more intelligent and suitable for the job requirements although other candidates may have similar or identical qualifications and skills. Certainly, it may show differences within different occupations and situations so, it is not correct to state a direct relation between attractiveness bias and the personnel selection process (Chiu & Babcock, 2002; Caki & Solmaz, 2013). However, candidates may prefer unstructured interviews as they provide more sincere or informal interview conditions, and enable to express themselves more easily. Other possible reasons for this preference by interviewers may be limited knowledge about structured interviews, and power desired to judge the results or to prevent the monotony of structured questions (Zee, Bakker, & Bakker, 2002).

- Most preferred type is **semi-structured interview** as Dipboye (1994); Harlan & Anne (1980) state. It is comprised of the particular broad area of questions such as related to past experiences, education life, accomplishments or rewards, and etc. (Imada & Hakel, 1977). This technique is based on gathering certain data about each candidate that will provide fundamental, but usually not comparable information as each interview is somehow specific by its length of time, sequencing, phrasing, and different interviewee and interviewer. It is considered as more time consuming format.
- There are also **group** and **multiple** interviews (Harlan & Anne, 1980):

Group interviews involve two or more (multiple) interviewers asking questions jointly to a single candidate (sometimes called panel interview); an interviewer with a group of candidates to be interviewed; or a combination of them which includes multiple interviewers with multiple candidates. Interviewers can compare the information gathered to understand the applicants' understanding of situation. Also it can give an idea about ability of the applicant to work in a group. A group interview with multiple interviewers ensures higher validity as it reduces possible biases through pool of interviewers' information (Dipboye et al., 2001).

Multiple interviews involve one candidate and two or more independent interviewers in multiple independent interview sessions, asking different questions. This reduces the possible biases for selection decisions and makes it more valid technique through combining the assessment of one interviewer by the assessments of another interviewer in order to fill the knowledge gap (Harlan & Anne).

2.2.2.2 Personality/Psychometric Tests

Personality tests such as Big Five personality tests or Myers-Briggs personality indicator based on Jung's personality typology are conducted to gain information about certain interpersonal and motivational strengths of the candidates that in turn might affect job related performance and absenteeism

(Harlan & Anne, 1980). For instance, based on five main characteristics of each candidate, they are scored and then according to the results achieved through testing, managers, interviewers or DMs become able to decide whether the candidate fits with the job requirements. Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism are the big five personality factors. For example, for veterinary, friendly and careful nature is required, which in turn depends on the 'openness' and 'agreeableness' characteristics. According to 12 years study on the personality tests' validity of usage in personnel selection process, it is shown that personality tests might be merely valid when it is applied to specific department with a specific purpose and situation (Guion & Gottier, 1965). For instance, some tests may be valid for a particular department whereas, similar tests may be invalid within a different department. Therefore, DM should do the necessary research about how to measure and test personnel in a particular situation and with a particular purpose before conducting the test. On the other hand, according to Barrick and Mount (1991) personality test of Big Five personality dimensions have a particular effect on job performance of personnel from different occupations. Their study concludes that Conscientiousness, Extraversion, and Openness to Experience have positive significant impact on job performance and they are valid predictors. Other dimensions (Agreeableness and Emotional stability) are also valid predictors but with less positive correlation. Many studies for example, Christiansen et al. (1994); Ones and Viswesvaran (1998) have underscored the validity and reliability of personality tests in personnel selection by testing the fake responses given by the candidates that highly reduce the validity. Faking practices of candidates exist as a result of the desire to create a good image through responding by *desired* right or positive answer, unless the candidates try to be honest (Morgeson et al., 2007). Consequently, faking present candidates will alter the test's results that include biases in ranking order of candidates. Morgeson et al., (2007) put forward that although faking indicators are not effective in increasing validity, it may be useful to use questions that provide multiple statements or scales with equal perceived desirability responses and in turn candidates without careful and linked responses in personality tests might be removed.

2.2.2.3 Clinical and Statistical Approaches

Clinical selection approach is based on the interviewer's or DM's judgment on an applicant's test scores and information gathered from the (unstructured) interview (Born and Scholarios, 2005). DM's perception plays a big role in selecting the appropriate candidate to fit the vacancy. Experience and intuition of DM enable him/her to turn the data gathered into a final decision (Färber, Weitzel, & Keim, 2003). Färber, Weitzel, and Keim, (2003) have stated that although the subjectivity and unreliability exist in the decision, clinical or judgmental selection approach might be very useful than statistical or mechanical solutions in some situations. They explain mechanical approach as objective, isolated from human interference, and transparent data that should be quantifiable. Statistical method for the personnel selection process might be handled using weights to assign the most necessary criteria through detailed job analysis and job description (Born and Scholarios, 2005). For instance, applicants might be needed to get at least the minimum required score for each necessary and most required criterion given during interview, tests or work samples (the multiple cut-off model). Finally, DMs compare applicants according to achieved scores and make selection decision accordingly. Researches has shown that mechanical method is more valid and reliable than clinical/ judgmental method, but the combination of two separate methods generates even more accurate results (Ganzach, Kluger, & Klayman, 2000; Färber, Weitzel, & Keim, 2003; Carless, 2009). An example for this combination might be integration of DM's overall aggregated judgment about an applicant with his/her scores received from tests and interviews.

2.3 Conclusion for Chapter 2

We can conclude with an overall interpretation about recruitment and selection practices as the fundamental practices of HRM that may provide a competitive advantage for the company in the long run. Furthermore, in order to achieve this competitive advantage DMs should avoid biases or errors in personnel selection processes. Being able to select the most suitable personnel that matches the job requirements involves decision making based on more rational and statistical choices through weighting or ranking

personnel, instead of decision that is merely based on more intuitive or judgmental interpretations (clinical approach).

Many researches put forward the related studies about the validity of interviews. As a result, it is indicated that for many situations and occupations more structured interviews provide more validity, or in other words, they measure what is required - the most suitable personnel.

Personality tests which are mostly used in personnel selection might be improved to increase their validity by decreasing the level of fake responses of candidates. In fact, it is difficult to let the level down but, the studies on providing scales of answers in tests rather than merely true or false statements might be improved more to be able to achieve more reliability (achieving similar or consistent results over time) and validity.

To sum up, human resources are the fundamental capital of the organizations even the organizations that use mechanical machines which are working according to written rules and information gathered from human experts. Therefore, external or internal recruiting, selecting practices, training and appraising personnel are all crucial and must be carefully conducted in order achieve the organizational objectives, strategies and goals.

CHAPTER 3

PERSONNEL SELECTION DECISION BASED ON SELF-CONFIDENCE

3.1 Preference Relations-Representation of the Preferences

As it is mentioned in the previous chapters, decision making process that is selecting the feasible optimal alternative or option among possible alternatives set is transpired almost every phase of our lives. Herewith studying on decision making processes becomes crucial in many fields of study such as Social Psychology, Operations Management, AI (Artificial Intelligence), etc. as, Chiclana, Herrera, and Herrera-Viedma (1998) have stated. In the fields of Management Science, especially HR, industrial engineering, and other business management practices, decisions made associated with the appropriate personnel selection have huge impact on organizations' strategic success. An example of personnel selection problem based on multi-criteria decision making that comprises 5 criteria and 6 alternative candidates is given in one of the well-known books (Aliev & Aliev, 2001). Here, authors have used compositional rule of inference in order to choose the optimal alternative candidate in accordance with the given required criteria. Bogdanovic and Miletic (2014) put forward the efficiency and the success of multi-criteria decision making approach in personnel selection and evaluation process by improving the approach through integration of Analytic Hierarchy Process (AHP) which is developed by Saaty (1980), that eases the process of comparing the weighted criteria based on expert's or DM's preferences, and determining the overall priority of alternatives based on each criterion; and PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) that is developed by Brans

and Vincke (1985), which method enables the DM to decide based on the final ranking of alternatives with preference function. Dağdeviren (2008) suggests fuzzy AHP usage whenever criteria preferences obtained from the DM include impreciseness or uncertain information that might be in qualitative structure. For example, Fuzzy AHP is efficient in representing uncertain or imperfect information based preferences of the DM through enabling the use of intermediate boundaries for value expressions, instead of a single value to generate evaluation matrix (Chan et al., 2008). Other fuzzy approach based multi-criteria studies also have effectively disclosed the importance of decision making in different areas (De Brucker, Macharis, & Verbeke, 2011; Pohekar & Ramachandran, 2004; Kahraman, Cebeci, & Ulukan, 2003; Jiang & Eastman, 2000).

Some other important methods for personnel selection have been performed and achieved effective solutions. One of them is TOPSIS decision tool that provides both positive-ideal and negative-ideal solutions and gives the ranking of alternatives to enable the DM to select the optimal personnel that matches with the job requirements (Sang, Liu, & Qin, 2015; Şenel, Şenel, & Aydemir, 2018). Hudson, Reinerman-Jones, and Teo, (2017) review different decision making approaches for effective personnel selection process that indeed plays a key role for organizational success.

It is seemed from the previous researches and studies that pair comparison of one alternative over another alternative, or in general words, preference relations that represent the DM's expression of opinions over possible alternative sets, are significantly related to efficiency and efficacy of the overall decision making process. For example, in personnel selection preference relations on a pair of alternative candidates can be represented by the degree of preference or intensity for alternative candidate i over alternative candidate j , i.e. $\rho_{ij} = \mu_{\rho}(x_i, x_j)$ with $X \times X$ matrix, where X stands for the set of possible alternative candidates for the vacant faculty post. However, different DMs may follow different approaches to provide their preferences or comparisons over the fuzzy set of alternatives X , because of

different or special personality, motivation factors, attitudes and ideas possessed by each DM (Chiclana, Herrera, & Herrera-Viedma, 2001). Therefore, Chiclana, Herrera, & Herrera-Viedma (2001) state the mainly used preference relations or evaluations by DM that may be used in personnel selection as well. Widely used preference relations include fuzzy preference relations (Chiclana, Herrera, & Herrera-Viedma, 1998; Fodor & Roubens, 1994) multiplicative preference relations (show ratio of preference for x_i over, x_j), utility functions (refer to the DM' utility evaluations) and linguistic preference relations (Herrera-Viedma et al., 2004; Xu, 2004, Herrera-Viedma et al., 2005, etc.).

3.2 Fuzzy Preference with Self-confidence

Novelty confronts us when we take into account the self-confidence level of the DM, which is the consideration that was unfortunately not studied, or neglected in the above considered and other related researches.

As it is stated in Zarnoth and Sniezek (1997), confidence level of a DM is related to how strongly he/she believes the specific statement given is the optimal response. Previous study about reciprocal intuitionistic fuzzy preference relations was integrated with confidence/consistency level on the expert DMs' opinions (Ureña et al., 2015). Novel approach was put forward in Liu et al. (2016) that is, fuzzy preference relations with self confidence level.

In our study we implement the fuzzy preference relations with self confidence on personnel selection problem in order to choose the optimal candidate that matches with the vacant job requirements.

3.3 Preliminaries

In this part we cover the basic information about the fuzzy preferences, linguistic variables for self-confidence (Aliev & Aliev, 2001), and fuzzy preference with self-confidence (Liu et al., 2016; Liu et al., 2017).

Fuzzy preference relation (also sometimes called additive preference relations) P on a finite set of possible alternatives $X = \{x_1, x_2, \dots, x_n\}$, is a relation on $X \times X$ (matrix) with membership function of $\mu_p : X \times X \rightarrow [0,1]$, and $\mu_p(x_i, x_j) = p_{ij}$, where P_{ij} indicates the degree/intensity of preference of alternative x_i over x_j of DM (Liu et al., 2016). Fuzzy preference relation might be indicated by $P = (p_{ij})_{n \times n}$, where $n \times n$ is a matrix.

$p_{ij} = 0.5$, denotes indifference between x_i and x_j ,

$p_{ij} > 0.5$, denotes a definite preference for x_i over x_j ,

$p_{ij} = 1$, denotes the maximum degree of preference for x_i over x_j ,

With the assumption of; $p_{ij} + p_{ji} = 1$, and $p_{ii} = 0.5$ (for the verified asymmetry of given preferences).

Linguistic variables for self-confidence indicate the linguistic terms used to describe the self confidence level of the DM. As it has been covered in chapter 1, linguistic variable has values that are expressed in natural language (NL) or in other words, values are in the form of words or sentences instead of numerical quantities (Zadeh, 1975). The purpose is to be able to achieve a satisfying solution or decision for the real world problem which involves grand human thought processes or decision making complexity. Therefore, Zadeh (1975) developed the principle in order to deal with the vagueness and uncertainty present in humanistic systems, which systems are affected by human judgment, perception, and feelings (educational systems, political systems, economical systems, etc.). Therefore we might also conclude that based on Rowe and Mason's (1987) decision styles, Analytical style and Conceptual style user DMs that have high tolerance for ambiguity and cognitive complexity, and able to work in uncertain environment may use Zadeh's (1975) principle of linguistic variable and fuzzy logic to decide in a real world framework. Zadeh (1975) states that by using linguistic variables, tolerance for impreciseness can be exploited to achieve a robust solution and to decrease the solution cost.

The potential advantage of using linguistic variables is its characterizations that do not restrict the DM to represent the information in the form of specific or crisp values. Our previous example covers *Age* linguistic variable with its possible linguistic values (and hedges) of 'young, not young, middle aged, not very old, old, and extremely old', etc. within the linguistic variable *Age*'s term-set. Naturally, age is expressed in numbers such as 1, 2, 3, 4, 5, 6, 7,..., 100, etc. so these numbers (values) underlie the base variable for *Age*. Using the base variable's values linguistic value 'old' within the term-set of *Age* may be represented as a label for fuzzy restriction (what we mean by old) that is characterized by a compatibility function. Compatibility function for the fuzzy restriction indicates the association between each value in the base variable, and a number in the $[0,1]$ interval. For instance, compatibilities of the quantified ages 21, 28, and 35 for the fuzzy restriction labeled 'young' may be 1, 0.7, and 0.2, respectively (Zadeh, 1975). Illustration for this example is given below in figure 4. Furthermore, hierarchical structure for the relation between *Age* variable, its fuzzy restrictions, and base variable values are given in figure 2.

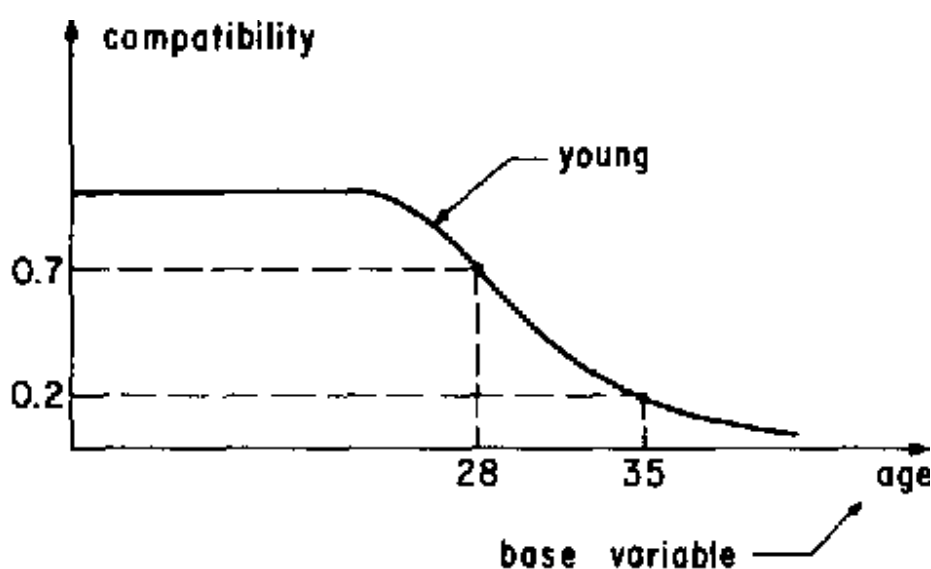


Figure 4: Compatibility Function Example for 'young' Labeled Fuzzy Restriction
(Zadeh, 1975)

Linguistic terms might be used for other variables such as *Height*, *Weight*, *Truth*, etc., also. For *Truth*, linguistic terms or values might be true, moderately true, extremely true, untrue, and so forth. An example of weather

forecasting may be given as “*most* probably it will rain tomorrow” instead of “80 percent it will rain tomorrow”, or “cold day” are all fuzzy events because human understanding of weather dynamics is not enough for precise indication of rain probability (Zadeh, 1975).

On the basis of above mentioned reasons, in this paper we use linguistic terms to describe self-confidence levels of DMs, for example;

$$S=\{\text{low, medium,..., very high}\} \quad (1)$$

Fuzzy preference with self-confidence is the new subject that we aim to use for more reliable and correct decision makings. According to Liu et al. (2016) DMs do not always denote self-confidence on the preceding preference due to limited or scarce time, excellence or knowledge. Moreover, previous studies take into account only two types of self-confidence levels that are either DM is with self-confidence for the given preference information, or DM is without self-confidence if the preference information based on pair wise comparison of alternatives is not given. On the other hand, multiple self-confidence levels can be denoted by DMs, if the proper and suitable mathematical tools and technique is provided. Within this type of preference relation, each alternative element comprises two parts. First part involves DM's actual fuzzy preference value in terms of a pair of alternative candidates. The second part indicates the DM's self-confidence level that is described in ordinal linguistic terms scale associated with the preceding fuzzy preference value provided. This index is represented as follows;

$$P = (P_{ij}, S_{ij}) \quad (2)$$

Where, P_{ij} denotes the degree of preference of alternative x_i over alternative x_j , and S_{ij} denotes the self-confidence level on the P_{ij} .

Liu et al. (2018) propose the self-confident multiplicative preference relations usage to investigate the consensus based group decision making and according to this process they have found out some robust results such as:

1) information loss from preferences may be reduced by providing self confidence levels; 2) using multiplicative preference relations with self-confidence level adjustments can improve the success ratio and the speed of the decision making process.

Zadeh (2011) as cited in Liu et al. (2017) proposes the use of Z-number principle which is somewhat associated with using linguistic self-confidence levels on preference evaluations. Zadeh (2011) states that each Z-number consists of two parts A and B, i.e. $Z = (A, B)$. A stands for the (fuzzy) constraint or restriction, while, B the second component indicates the measure of certainty or reliability on the first part A. Both A and B are given in natural language, NL (e.g. 90 days, very sure).

3.4 Methodology for the Solution

As we have mentioned earlier, selecting the optimal or best candidate among the possible group of applicants that is best suited for the particular vacant position's requirements and the organization may in turn supply the organization with the competitive advantage. Thereby, here we understand the importance of the personnel selection technique and problem.

The problem is to choose the optimal candidate for a given vacant faculty post. Here we are considering the job related multiple criteria given according to job analysis and job description (see Appendix A) to be able to compare the possible alternative candidates, and make a selection. The criteria used for decision making are given as follows (here we assume all criteria as equally important for the faculty, i.e. all the criteria given below have equal weights, w):

- Publication Results (C1)
- Industrial Experience (C2)
- Teaching Quality (C3)
- Grant Taking Ability (C4)
- Intelligence Level (C5)

(Vacant faculty position might be assumed for instructors or academician candidates in a particular university.)

There are 5 possible alternative candidates. This can be shown as a finite set:

$$A = \{a_1, a_2, a_3, a_4, a_5\}$$

The aim is to derive the priority vector of fuzzy preference relation with self confidence $w = \{w_1, w_2, w_3, w_4, w_5\}$, that minimizes the total information deviation between the DM's (fuzzy) preference relations and vector w . At the end, ranking of candidates as $\{w_1, w_2, \dots, w_5\}$ gives the DM ability to find and choose the best alternative candidate.

We use pair wise comparisons over all possible alternatives that are associated with our personnel selection problem (multi-criteria decision making (MCDM) problem) which is based on various criteria and candidates (alternatives). To sum up, our objective or aim is to select the most appropriate personnel for the vacant position, with the given criteria (publication results, industrial experience, technical skills, and so forth), and available alternatives (personnel candidates A_1, A_2 , and so forth). There are some steps as follows:

1. Relative importance of each decision criterion is determined by the DM. In this example study, each criterion possesses equal weights.
2. Pair wise comparisons or evaluations for alternatives (in our case candidates) in terms of each criterion are conducted according to fuzzy preferences of an expert DM.
3. Aggregated preference matrix over the all alternatives is calculated by synthesizing all of the pair wise fuzzy preference matrix results into one aggregated fuzzy preference matrix.
4. Furthermore, related consistency of the indicated preferences over the alternatives is calculated by Consistency Index (CI) based on eigenvector method developed by Saaty (1980).

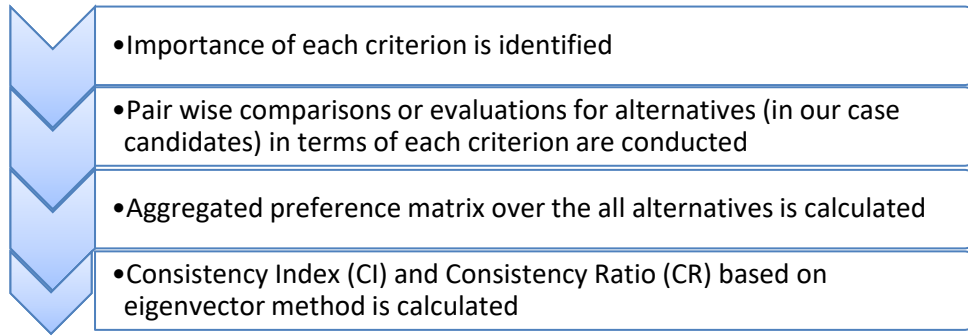


Figure 5: Research Model

Each criterion is regarded as equally important. We perform pair wise comparisons for each pair of alternatives A_i , $i = \overline{1,5}$ with respect to each criterion C_i , $i = \overline{1,5}$ considered. In this regard, we have to repeat this evaluation five more times for each criterion given. An example of fuzzy preference relation matrix for criterion 1 (C_1) is presented below (table 1).

C_1	A_1	A_2	A_3	A_4	A_5
A_1	0.5	p_{12}	p_{13}	p_{14}	p_{15}
A_2	p_{21}	0.5	p_{23}	p_{24}	p_{25}
A_3	p_{31}	p_{32}	0.5	p_{34}	p_{35}
A_4	p_{41}	p_{42}	p_{43}	0.5	p_{45}
A_5	p_{51}	p_{52}	p_{53}	p_{54}	0.5

Table 1: Fuzzy Preference Relation with Respect to C_1

Table shows the p_{ij} which indicates the degree or intensity of preference of alternative candidate A_i over alternative candidate A_j . Also it is assumed that, $p_{ij} + p_{ji} = 1$, and $p_{ii} = 0.5$. For example, pair wise comparison of A_3 over A_5 gives $p_{35} = 1 - p_{53}$, and for alternative A_3 $p_{33} = 0.5$.

In the next step after each (five) fuzzy preference evaluations of alternatives based on each criterion is performed, we need to generate an aggregated preference matrix by aggregating all five fuzzy preference matrices obtained. Aggregated matrix is shown below in table 2.

	A ₁	A ₂	A ₃	A ₄	A ₅
A ₁	(0.5)	(0.9)	(0.9)	(0.2)	(0.9)
A ₂	(0.1)	(0.5)	(0.9)	(0.1)	(0.3)
A ₃	(0.1)	(0.1)	(0.5)	(0.3)	(0.2)
A ₄	(0.8)	(0.9)	(0.7)	(0.5)	(0.8)
A ₅	(0.1)	(0.7)	(0.8)	(0.2)	(0.5)

Table 2: Aggregated Preference Matrix

In this new approach of fuzzy preference relations with self-confidence DM firstly provides the preference values considering the pair of alternatives as it is shown in table 2. However, in the real world situation or practice this matrix is frequently inconsistent because of some account error given by the expert DM on preference evaluations. In the case of full consistency $\lambda_{\max}=n$ and the maximum eigenvalue is denoted as λ_{\max} . Deviation from consistent approximation of evaluations by an expert DM is expressed by $\lambda_{\max} \geq n$. Thus, to ensure and measure consistency of provided evaluations we compute Consistency Index (CI) developed by Saaty (1980). Equation is given below.

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (3)$$

Here, λ_{\max} indicates the maximum eigenvalue, where n is the number of pair wise comparison matrices \mathbb{R} (in our case 5). To compare this value Saaty (1980) suggests using Random Index indicated by RI, which is simply the estimated average CI acquired from a large number of randomly generated reciprocal (fuzzy preference) matrices of the same order (Table 3).

n	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48

Table 3: Random Index (RI)

(Saaty, 1980)

The matrix is accepted as consistent as long as the ratio CI/RI is less than or equal to 0.1, otherwise preference evaluations are accepted as inconsistent.

Here, threshold 0.1 or CI=0.1 means only the 10% judgment by the expert is inconsistent as a result of random judgment. Ratio values more than 0.1 are not considered as appropriate for a consistent decision making.

In our case consistency index based on matrix presented in Table 2 is calculated as follows (Table 4 and Table 5).

A₁	$(0.5+0.9+0.9+0.2+0.9)/5 = 0.68$
A₂	$(0.1+0.5+0.9+0.1+0.3)/5 = 0.38$
A₃	$(0.1+0.1+0.5+0.3+0.2)/5 = 0.24$
A₄	$(0.8+0.9+0.7+0.5+0.8)/5 = 0.74$
A₅	$(0.1+0.7+0.8+0.2+0.5)/5 = 0.46$

Table 4: Eigenvector Calculation

Eigenvector	0,68	0,38	0,24	0,74	0,46
Total sum	1,60	3,10	3,80	1,30	2,70
Max	$((0.68*1.6)+(0.38*3.1)+(0.24*3.8)+(0.74*1.3)+(0.46*2.7))=5.38$				

Table 5: λ_{\max} (Maximum Eigenvalue) Calculation

Calculation of Consistency Index (CI) and Consistency Ratio (CR) by using the formula is given below.

$$CI = \frac{5.38 - 5}{5 - 1} = 0.095$$

$$CR = \frac{CI}{RI} = \frac{0.095}{1.12} = 0.08 < 0.1$$

Hence, we can conclude that, as $0.08 < 0.1$, preference relation shown in Table 2 is consistent enough to make a proper decision.

After consistent fuzzy preference value elicitation, expert DM provides the self-confidence levels associated to the preceding part that consists of preference values. Self-confidence is described by linguistic terms.

Linguistic term set $S^{SL} = \{l_0, l_1, l_2, \dots, l_g\}$ (where l_0 may denote very low; l_1 may denote low; or l_5 may stand for extremely high) is used by the DM to characterize their self-confidence levels in the linguistic way. Assumptions for this method comprise $p_{ij} + p_{ji} = 1$; $p_{ii} = 0.5$; $s_{ij} = s_{ji}$; and $s_{ii} = l_g$.

In our case linguistic term set is described as $S^{SL} = \{l_0=\text{very low}, l_1=\text{low}, l_2=\text{poor}, l_7=\text{high}, l_8=\text{very high}\}$.

CHAPTER 4

RESULTS

Fuzzy preference relations information that is gathered from the expert or experienced DMs such as managers involves considerations, comparisons, and rankings based on each pair of possible alternative candidates. These considerations and rankings are performed based on previously identified criteria evaluations. Interviews and tests may be performed in order to ascertain and confirm whether the ability of the candidate meets the requirements related to job criteria. Here, we use a linear programming (LP) model to find the priority vector of fuzzy preference relation with self-confidence. Application of the LP model enables the simpler computation in a shorter time period, and can increase the precision of the solution or decision obtained. Linear programming is a quantitative technique used for the solutions of resource allocation problems. For example, for designing shipping schedule, selecting the best or optimal production mix to maximize the firm's profit or minimize the cost through best use of available machine and labor hours in a particular factory, or assigning personnel to various jobs as it is in our case (Dessler, 2004).

Fuzzy self-confidence related preference relation matrix is represented in table 6.

	A ₁	A ₂	A ₃	A ₄	A ₅
A ₁	(0.5, VH)	(0.9, VH)	(0.9, H)	(0.2, VH)	(0.9, H)
A ₂	(0.1, VH)	(0.5, VH)	(0.9, VH)	(0.1, VH)	(0.3, VH)
A ₃	(0.1, H)	(0.1, VH)	(0.5, VH)	(0.3, VH)	(0.2, H)
A ₄	(0.8, VH)	(0.9, VH)	(0.7, VH)	(0.5, VH)	(0.8, VH)
A ₅	(0.1, H)	(0.7, VH)	(0.8, H)	(0.2, VH)	(0.5, VH)

Table 6: Fuzzy Preference Relation with Self-Confidence

We use VH and H as our linguistic terms to enable the DMs to characterize or express their self confidence levels on the given preference values, that are described by triangular fuzzy numbers as: $A = (a, b, c)$, i.e. a- lowest value, b- middle/mean value, and c- highest value, respectively. Using triangular fuzzy numbers as shown in figure 5 instead of crisp values (0 or 1) provides tolerance for imprecise self-confidence levels of DMs (Zadeh, 1975).

$S^{SL} = \{l_0=\text{very low}, l_1=\text{low}, l_2=\text{poor}, l_7=\text{high}, l_8=\text{very high}\}$, where (mostly used);

$$H = \text{High} = \{0.7, 0.8, 0.9\}$$

$$VH = \text{Very High} = \{1, 1, 0.9\}$$

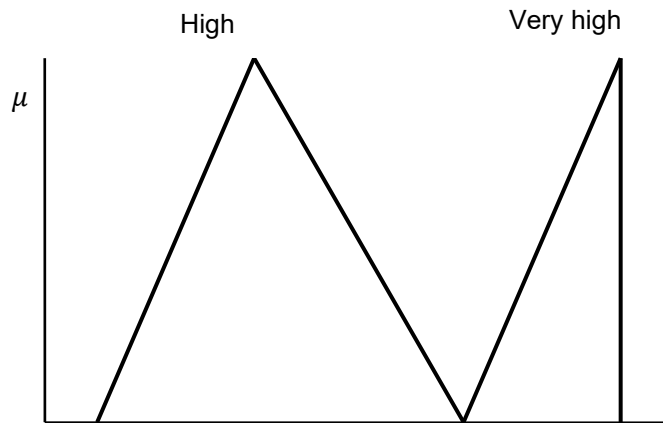


Figure 6: Triangular Fuzzy Numbers

In order to find the priority vector \mathcal{W} of fuzzy preference relation with self confidence levels we formulate the following linear programming model (4) (Liu et al., 2016). This linear programming model provides the priority vector that minimizes the sum of information deviation indicated as z_{ij} , between the DM's first preference value on pair of alternatives and the priority vector \mathcal{W} .

Objective function:

$$z = z_{12} + z_{13} + z_{14} + z_{15} + z_{23} + z_{24} + z_{25} + z_{34} + z_{35} + z_{45} \rightarrow \min \quad (4)$$

subject to

$$0.5w_1-0.5w_2-y_{12}=(0.9-0.5)=0.4$$

$$0.5w_1-0.5w_3-y_{13}=(0.9-0.5)=0.4$$

$$0.5w_1-0.5w_4-y_{14}=(0.2-0.5)=-0.3$$

.

.

.

$$0.5w_2-0.5w_5-y_{25}=(0.3-0.5)=-0.2$$

$$0.5w_3-0.5w_4-y_{34}=(0.3-0.5)=-0.2$$

$$0.5w_3-0.5w_5-y_{35}=(0.2-0.5)=-0.3$$

$$0.5w_4-0.5w_5-y_{45}=(0.8-0.5)=0.3$$

$$Z_{12}-4*y_{12}\geq 0$$

$$Z_{12}+4*y_{12}\geq 0$$

$$Z_{13}-3*y_{13}\geq 0$$

$$Z_{13}+3*y_{13}\geq 0$$

.

.

.

$$Z_{45}-4*y_{45}\geq 0$$

$$Z_{45}+4*y_{45}\geq 0$$

$$w_1+w_2+w_3+w_4+w_5=1$$

$$w_i\geq 0, i=\overline{1,5}$$

$$z_{ij}\geq 0, i,j=\overline{1,5}$$

Solution of the linear programming model (4) gives us priority vector of the alternative candidates as:

$$w = \{0.4, 0, 0, 0.6, 0\}$$

The optimal alternative is the candidate with the highest overall assessment value w . As a result we can conclude that the best candidate is $A_4 = 0.6$ (fourth alternative candidate), with minimized total information deviation of $z = 6.9$. Therefore, DM or manager is able to make decision on the optimal or most appropriate candidate, i.e. alternative 4, who is the most suitable and feasible personnel to hire.

To prove the validity and the feasibility of this new approach with self-confidence another example with different preferences can be given. Alternative example is given below.

	A_1	A_2	A_3	A_4	A_5
A_1	(0.5, VH)	(0.4, VH)	(0.6, H)	(0.8, VH)	(0.7, H)
A_2	(0.6, VH)	(0.5, VH)	(0.7, VH)	(0.9, VH)	(0.8, VH)
A_3	(0.4, H)	(0.3, VH)	(0.5, VH)	(0.7, VH)	(0.6, H)
A_4	(0.2, VH)	(0.1, VH)	(0.3, VH)	(0.5, VH)	(0.4, VH)
A_5	(0.3, H)	(0.2, VH)	(0.4, H)	(0.6, VH)	(0.5, VH)

Table 7: Alternative Example
(Eyupoglu & Imanova, 2018)

Again LP model is used to find the best alternative with the minimized total information deviation:

Objective function:

$$Z = Z_{12} + Z_{13} + Z_{14} + Z_{15} + Z_{23} + Z_{24} + Z_{25} + Z_{34} + Z_{35} + Z_{45} \rightarrow \min \quad (5)$$

subject to

$$0.5w_1 - 0.5w_2 - y_{12} = (0.4 - 0.5) = -0.1$$

$$0.5w_1 - 0.5w_3 - y_{13} = (0.6 - 0.5) = 0.1$$

$$0.5w_1 - 0.5w_4 - y_{14} = (0.8 - 0.5) = 0.3$$

$$0.5w_1 - 0.5w_5 - y_{15} = (0.7 - 0.5) = 0.2$$

$$0.5w_2 - 0.5w_3 - y_{23} = (0.7 - 0.5) = 0.2$$

$$0.5w_2 - 0.5w_4 - y_{24} = (0.9 - 0.5) = 0.4$$

$$0.5w_2 - 0.5w_5 - y_{25} = (0.8 - 0.5) = 0.3$$

$$0.5w_3 - 0.5w_4 - y_{34} = (0.7 - 0.5) = 0.2$$

$$0.5w_3 - 0.5w_5 - y_{35} = (0.6 - 0.5) = 0.1$$

$$0.5w_4 - 0.5w_5 - y_{45} = (0.4 - 0.5) = -0.1$$

$$Z_{12} - 5 * Y_{12} \geq 0$$

$$Z_{12} + 5 * Y_{12} \geq 0$$

$$Z_{13} - 3 * Y_{13} \geq 0$$

$$Z_{13} + 3 * Y_{13} \geq 0$$

$$Z_{14} - 5 * Y_{14} \geq 0$$

$$Z_{14} + 5 * Y_{14} \geq 0$$

$$Z_{15} - 3 * Y_{15} \geq 0$$

$$Z_{15} + 3 * Y_{15} \geq 0$$

$$Z_{23} - 5 * Y_{23} \geq 0$$

$$Z_{23} + 5 * Y_{23} \geq 0$$

$$Z_{24} - 5 * Y_{24} \geq 0$$

$$Z_{24} + 5 * Y_{24} \geq 0$$

$$Z_{25} - 5 * Y_{25} \geq 0$$

$$Z_{25} + 5 * Y_{25} \geq 0$$

$$Z_{34} - 5 * Y_{34} \geq 0$$

$$Z_{34} + 5 * Y_{34} \geq 0$$

$$Z_{35} - 3 * Y_{35} \geq 0$$

$$Z_{35} + 3 * Y_{35} \geq 0$$

$$Z_{45} - 5 * Y_{45} \geq 0$$

$$Z_{45} + 5 * Y_{45} \geq 0$$

$$w_1 + w_2 + w_3 + w_4 + w_5 = 1$$

$$w_i \geq 0, i = \overline{1,5}$$

$$z_{ij} \geq 0, i, j = \overline{1,5}$$

Here, solution (5) gives a different priority vector $w = \{0.33, 0.53, 0.13, 0, 0\}$. Therefore, with different preference evaluations and self-confidence levels the best alternative candidate becomes A_2 , with $z = 2.9$.

Herby, we can state that fuzzy preference values provided with self-confidence levels by DMs have a significant impact on the decision making results, and use of another example provides generalization.

DISCUSSION AND CONCLUSION

To sum up, in the last chapter we investigate a new kind of preference relations with self-confidence levels of DMs. Priority vector for candidate selection is obtained by formulating a linear programming model. Generally, decision makers have multiple self-confidence levels on their preferences provided, instead of either full self-confidence or without any self-confidence statements. So we can conclude that using fuzzy logic for preference relations on each possible pair of alternative candidates, and for expressing self-confidence levels on the given preference values exploits the tolerance for imprecision; improves subjective expressions or judgment; and enables DMs to work under uncertainty and with subjectivity in order to solve a real world problem such as personnel selection (Zadeh, 1975). Also, by this methodology of weighting each alternative in respect of each criterion and providing preferences according to expert's judgment, we somewhat provide an integrated method that includes both clinical and mechanical approaches. Furthermore, a numerical example for personnel selection decision is provided that gives us the optimal candidate for the vacant faculty position, an alternative example with different values is provided besides to prove the feasibility and validity of the approach.

In this paper we investigate the decision making process that appears almost in every phase of our lives. Therefore, decision making has become a crucial part of management as well. Human Resources Management, which involves the management of the most important capital of the organization- human being or personnel, is a managerial function that all managers somehow possess. Most of the managers take part in recruiting, interviewing, selecting personnel, and training processes in the case of necessity. One of the most sophisticated, and uncertainty or imprecision included staffing functions is the personnel selection process that involves interviews, various kinds of tests, and accordingly provided alternative candidate preferences, etc. in order to choose the best or the most optimal candidate for the vacant position, and in turn to accomplish the organizational goals and objectives, or a competitive

advantage in the market. Here we have formulated a new decision model on personnel selection process taking into consideration the self-confidence levels on fuzzy preference relations of decision makers (DMs) denoted in the linguistic terms. Using fuzzy approach allows DMs to indicate incomplete information knowledge on expressing their preferences. The priority vector of fuzzy preference relations with self-confidence, on pairs of alternative candidates and identified criteria, is obtained through the use of linear programming (LP) tool such as Linear Program Solver Optimization Package which minimizes the total information deviation z_{ij} between the DM's (fuzzy) preference and the priority vector w . The priority vector obtained enables the DMs to find the best alternative. Finally, the numerical examples given on decision making to choose the optimal alternative candidate for a vacant faculty post has proved the validity of the considered approach. Considered approach can be applied to group decision making problems for the future researches as well.

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APPENDIX A

Example of Job Description Template

Job Title:		Job Category:	
Department/Group:		Job Code/Req#:	
Location:		Travel Required:	
Level/Salary Range:		Position Type:	[i.e.: full-time, part-time, job share, contract, intern]
HR Contact:		Date posted:	
Will Train Applicant(s):		Posting Expires:	
External posting URL:			
Internal posting URL:			
Applications Accepted By:			
Fax or E-mail: (425) 555-0123 or someone@example.com Subject Line: Attention: [Recruiting or HR Department RE: Job Code/Req# and Title]		Mail: [Recruiting Contact or Hiring Manager] [Department, Company Name] [P.O. Box] [Street or Mailing Address with ZIP Code]	
Job Description			
Role and Responsibilities [Type a description of the essential roles, responsibilities and activities a candidate can expect to assume in this position, using the Details style. For bullets, use the Bulleted List style: Bulleted list item Bulleted list item For a numbered list, use the Numbered List style: Numbered list item Numbered List item]			
Qualifications and Education Requirements (or related Criteria) [Type a description of the work experience and educational background that a candidate should have when applying for position. Use the Details, Bulleted List, and/or Numbered List styles as needed.]			
Preferred Skills [Type a description of any additional skills or experience that would be considered favorable for a candidate who is applying for this position. Use the Details, Bulleted List, and/or Numbered List styles as needed.]			
Reviewed By:		Date:	
Approved By:		Date:	
Last Updated By:		Date/Time:	

Source: <https://templates.office.com/en-us/Job-description-form-TM10357174>