Fuzzy Based Principal's Leadership Skills Assessment Model for Secondary Schools

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ABSTRACT

The present study suggests the use of a fuzzy inference system (FIS) model to assess the leadership skills of secondary school principals. To assess the principals' leadership skills, teachers' perceptions of these skills concerning various items are collected by using a five-point Likert scale. Further, these values are categorized into linguistic variables that are used as input in a fuzzy inference system to get an overall principal leadership skills score. The implementation of our model for a secondary school in Pakistan highlighted weaknesses in leadership skills, which may need suitable planning to enhance these skills. This FIS model acts as a device to help the policymakers in judging several components of leadership in those institutes in which they are serving. This study implies that school principals would be more effective if they possess leadership skills. The skills would enable them to turn schools into effective schools.

JEL Classification: *C88, D7, J24, Y10.*

Keywords: *School leadership, leadership skills, Teacher Perception, Fuzzy inference system*

INTRODUCTION

Educational leadership is an act through which employees are influenced in the surroundings to attain goals (Connolly, James, & Fertig, 2019). Though educational leadership is undertaken idyllically and maturely, yet practically it does not need the responsibility for the operational mode of the educational co-ordination (Connolly et al., 2019).

Leadership is a vital element for enactment of every institute. Schools are also like other organizations that need leadership, which will make things ensue. The social disparities existing in schools make it essential for the school establishments to raise the value of leadership because it is a key for improvement in every single school. Additionally, there is a necessity for the authorities in schools and other stakeholders to escalate the aspects of situational leadership and make it compulsory for the success of schools (Cobbinah & Agyemang, 2019).

This process of leadership often inspires the individuals working in a team, motivates, and escorts them about the success of the institute (Haq, 2011). Every head of the school should apply some methodologies in his or her everyday activities to make the school competitive, assist learners in doing well, and supporting the school to attain its vision (Cobbinah & Agyemang, 2019). Similarly, James (2015) and Vroom and Jago (2007) articulate that leadership ought to be considered as the general process to inspire the individuals or team and stimulate them towards attaining a shared goal. Leaders show definite leadership skills,

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lacking these leadership skills, societies would not consent them as leaders. Due to these leadership skills, a leader can change the status of an organization and make it more successful, while a lack of leadership can bring defamation to the organization. Therefore, leadership is the main factor responsible for the achievement or letdown of an organization (Burstein, Sohal, Zyngier, & Sohal, 2010; James, 2015). Leaders build their vision with the consensus of the staff to prioritize specific goals. While Algahtani (2014) states, that leader mostly focuses on his/her imagination and objectives and ensures that admirers are following him/her properly.

Drawing inclination towards the importance of leadership for organizations like schools, various researchers articulate that leadership is one of the vital factors for institutional effectiveness (Muijs, 2011). Leadership behaviors influence the establishment of open systems that stimulate OCB in school instructors (Hanson, Bangert, & Ruff, 2016). Furthermore, leadership is the most probable factor for the smooth working of an association (Tatlah, Ali, & Saeed, 2011). However, unfortunately, in some regions especially in developing countries leadership is not playing its role in making schools more effective. Mulford (2008) advocates that the startup of training gatherings for educational and school leaders is now found very common. However, it is also a fact that such kinds of training are scarce across the globe and can be observed in a few parts of the world. Similarly, Khan (2013) also endorses that instructive and informative training are rarely established for educational leaders in Pakistan because it requires financial assistance that can be availed from foreign-funded agencies. Therefore, to investigate whether school leaders serving in secondary schools retain leadership skills, the current study is conducted to propose a leadership assessment model through the perception of secondary school teachers.

The leadership assessment for secondary school principals requires human reasoning-based inputs concerning various parameters. These responses of participants are often inaccurate or fuzzy in natural surroundings. Fuzzy logic-based assessment models are beneficial to capture the inaccuracies and uncerta.inty in decision making. Therefore, the contemporary study emphasizes the use of a fuzzy inference system (FIS) based model to assess the leadership skills of the secondary school principals. The model, in this case, has been established by seeing the monotonic behavior of hierarchal FIS. While the working procedure of the proposed model is demonstrated and authenticated by means of the case studies from secondary schools in Pakistan. The inputs in this model are skill rating of the principals concerning various dimensions and sub-dimensions, which are gathered from the secondary school teachers. A well-established list of the dimensions and sub-dimensions to evaluate the leadership skills of the principal is presented in the next section. The result of the leadership evaluation process helps policymakers to stand in a better position to increase the leadership skills of the principal.

This study contributes a new and exciting scientific assessment method to evaluate the skills and capabilities of the school heads working in the selected schools. The survey in hands will enhance knowledge of the reader regarding the capabilities of the school leaders and enable him how these skills can be measured via Fuzzy logic.

The rest of the paper is such that: the forthcoming section portrays a brief literature review. Soon after that Section 3 presents the research scheme, while section 4 belongs to the proposed

model. After that, in section 5, the FIS-based model is applied and authenticated in secondary schools from Pakistan. Finally, in Section 6, the discussions and conclusions are being presented.

LITERATURE REVIEW

Leadership Skills in the Schools

Quality education is the primary concern of parents. Various studies have been piloted to probe into the issue of the sub-standard education system in Pakistan. One of the problems identified by the researchers is the leadership incompetency in these schools.

Niazi (2012) Conducted a study and found out that the people who joined this department are not devoted to their jobs. Similarly, the principals are not performing their role for the sound development of the teachers in their profession. Exploring the reasons for the let-down of school leaders in Pakistani schools (Alam, 2012). Khan, Saeed, and Fatima (2009) articulated that school heads get promotions directly from their teaching jobs and they neither have any experience as administrators, nor they possess any leadership skills. Memon and Bana (2005) state that the majority of the schools are functioning without an efficient leader. Piaw, Hee, Ismail, and Ying (2014) articulate that leadership expertise is essential for a leader before joining his office. Richter, Lewis, and Hagar (2012) advocates that these leadership abilities are termed as behavioral

Organizational and transformational skills. These leadership skills come through leadership training. Khan (2013) highlights that these leadership trainings are conducted through foreign-funded projects and only a few principals are able to avail these trainings. So this deficiency of leadership skills has a vast impact on the quality of education. Furthermore, the extraordinary eminence of teaching and headship is most indispensable for fruitful pedagogy (Peleg, 2012). Comparatively, there has been a little investigation on the starring character and effect of educational heads inside education systems in the undeveloped world, mainly Pakistan is one of them (Rizvi, 2010; Simkins, Sisum, & Memon, 2003). Thus, the current study is going to dig out the neck and neck position of leadership competencies of the school heads. The results would provide a guideline for policymakers for improving leadership roles in schools.

Leadership skills assessment methods

Leadership is considered as more imperative to turn as a catalyst during a transformation process in an educational institute (Hallinger & Heck, 2011). Katz (1955) was among those people who suggested that headship ought to be skillful and he set up that leadership hinge on primarily on elementary skills: Social or interactive, practical, and abstract skills (Akinola, 2013). The evolution of leadership skills is a concern and subject of many discussions for the span of time. Several subjects like management, psychology, and sociology stress the part of a leader for cost-effective sustainability and communal well-being (Artamonova, Tarasova, & Blaginin, 2019). Heads can be recognized by their management skills. Therefore, Thus individuals who do not own leadership abilities will not be acknowledged as a leader by any group in any state of affairs (Silva, 2014). Leadership talents can be measured through the perception of the teachers (Niqab, Sharma, Ali, & Mubarik, 2015). Similarly, Akinola (2013) also conducted a study for leadership skills measurement through the perception of the

teachers and principals. Polat (2009) led a study to measure side by side strength of the OCB through the opinion of the teachers. Dikshit and Dikshit (2014) found the level of OCB of the managers through the perception of the senior officers. This study is also using the perception of the teachers to find out the level of leadership skills through a survey instrument.

Fuzzy Based Assessment Models

For the assessment of leadership skills, the evaluation methods require perceptions of decision-makers towards various metrics, which are usually fuzzy or inaccurate. Fuzzy logic-based models have evidenced very valuable for judgment making based on human rationale (Ayağ, Samanlioglu, & Büyüközkan, 2013). The fuzzy logic-based valuation approaches have been used in several areas such as petroleum manufacturing (Zhang, 2007). Property Management (Baja, Chapman, & Dragovich, 2002), Mining and Mineral Sector (Kommadath, Sarkar, & Rath, 2012), Manufacturing sector (Singh, Olugu, Musa, & Mahat, 2018). Reliant on the fuzzy logic, the Fuzzy Inference System (FIS) techniques have also been used in industrialized organizations. Like, modeling of exterior coarseness in face refining by (Kovac, Rodic, Pucovsky, Savkovic, & Gostimirovic, 2013), intelligent robotic assembly by (Gokulachandran & Mohandas, 2015), optimization of using machine (Iqbal, Asi, & Jinap, 2013) and suppliers' workout appraisal by (Ordoobadi, 2009). Similarly, (Amindoust, Ahmed, Saghafinia, & Bahreininejad, 2012) projected the FIS technique useful for supplier choice that depends on the sustainability appraisal. The constraint of most of the studies conducted is that fuzzy approaches have been planned without keeping in the notice the monotonic way of acting of a system.

The successful consequences of an appraisal depend on the choice of a suitable set of metrics. The metrics ought to be vigorous and straightforward, repeatable and reliable, cost-effective in facts findings, complement monitoring requirements, and consistency with the administration's vision.

RESEARCH GAPS AND MODELS

Several studies conducted in Pakistan about quality education both in public and private sector schools. These studies have emphasized that the foremost reason for the low quality of education is the deficiency found in terms of leadership skills in these schools (Niqab, Sharma, Kannan, & Ahmed, 2017).

The Literature on the evaluation of leadership skills shows that there is a lack of the use of fuzzy techniques that can capture the uncertainty associated with decision making. Further, there is a lack of fuzzy tools that consider the monotonic behavior. This paper is an effort to cover this research gap.

Research design

The present study aims to promote a performance assessment model that will assess the leadership skills of the secondary school principal. This model will help the decision-makers to contemplate the need for possession of leadership skills for the principals and will assist in developing strategies for further enhancing leadership skills through training for the (existing) principals. The framework for the principal leadership skills is presented in Figure 1. The leadership skills assessment model is constructed by a hierarchal fuzzy inference system take

on from Singh, Olugu, and Fallahpour (2014), as shown in Figure 2. The principal leadership assessment methodology is based on the perception of the teachers working with the Principals.

The leadership assessment skills divided into three components: Behavioural, organizational, and transformational leadership skills. While transformational leadership skills refer to the school prophecy, staff agreement, professional improvement, problem resolving abilities, and ordering goals (Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000). The measures for the organizational skills are abiding rules and regulations, staff co-operation, provision of resources and behavioral management plan (Allais, 2012) whereas behavioral leadership skills can be measured through a behavioral management plan, social skills, staff support and knowledge of stakeholders about behavioral management plan (Richter et al., 2012). The procedures and their conforming metrics for leadership expertise valuation are accessible in Table 1. Based on the contribution of human reasoning in the assessment process, the calculation module is centred on the fuzzy logic conceptions.
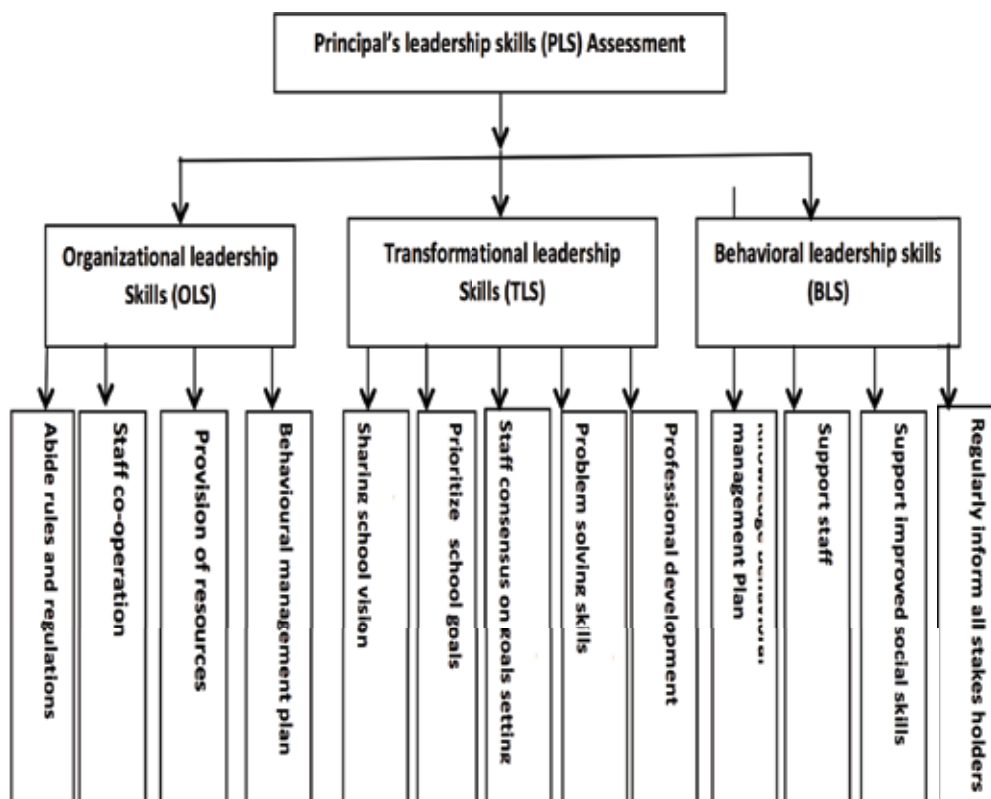

Figure1. *Principal Leadership skills performance assessment framework*

Table 1:
Performance measures and metrics for leadership skills assessment

Aspects/Measures	Metrics
Transformational leadership skills	
Sharing school vision	Leads staff in establishing and implementing a school vision to achieve specific goals. Leaders have the ability that they have an idea for school success in challenging circumstances.
Prioritize school goals	Encourage staff to prioritize school goals, such as achieving excellent results and student development.principals and community expects high performance for which school prioritizes certain goals.
Staff consensus on goals setting	Develop staff consensus for goal setting, decisions taking and implementing school vision. Leadership is not a solo flight, so staff consent is necessary for the effective functioning of any organization.
Problem-solving skills	Have the ability to solve various problems occurring in routine and develop staff consensus for solving problems.
Professional development	Continuous efforts for the professional development of the staff to meet the requirements of the 21st century. Introducing new teaching-learning techniques through various training programs.
Organizational leadership skills	
Abide rules and regulations	The principal makes sure that school agrees with the rules set by the district, provincial and Federal authorities, and school's functioning within the premises of these rules.
Staff co-operation	The principal must have the quality to promote staff unity and co-operation. Curricular and co-curricular activities can be organized successfully only when there will be staff unity and co-operation.
Provision of resources	Principals' duty also includes the provision of materials such as audio-video aids for the successful operationalization of the teaching-learning process and to achieve school wide goals.
Behavioral management plan	Develops school wide behavioral management plan for the effective functioning of the school and provides resources for establishing this behavioral management plan. Behavioural management plan helps in grooming the staff and students.
Behavioral leadership skills	**Behavioral leadership skills**
Regularly inform all stakes holders	Regularly inform all the stakeholders (students, teachers and community) about the newly introduced behavioral management plan, its implementation and effectiveness.
Support improved social skills	Always appreciate if someone behaves well, shows improved social skills as these improved social skills enhance students learning potential.
Support staff	Support staff by guiding staff in understanding behavioral management plan and fully support staff for its implementation.
Knowledge about behavioral management Plan	N staff should clearly understand the behavioral management plan, its purpose and effectiveness for school.

Suggested Fuzzy valuation model

Literature at hand and conjoint practices propose that presently, there is no conventional technique exists to examine the role of Principals/teachers (Mago & Kumar, 2019). Due to its intrinsic imprecision and ambiguity, this study analyzes the efficiency of school teachers/Principals subject to various features by means of fuzzy logic(Mago & Kumar, 2019). A fuzzy inference instrument is designed to choose the conceivable value of educators/Principals (Mago & Kumar, 2019). The recommended fuzzy logic-based system is regular with that refereed by the professionals and can be applied to forecast the probable values of teachers/Principals (Mago & Kumar, 2019).

The fuzzy set theory offers a decision framework to incorporate inexact judgments intrinsic in the workers induction process (Turskis, Dzitac, Stankiuviene, & Šukys, 2019; Zadeh, 1965). The presented fuzzy set theory tries to agree with imprecise and ambiguous data, even in circumstances where statistics is grounded on particular assessments and well-defined in philological situations. Furthermore, Zadeh applied a fuzzy set theory to a constant change from one session to another in the progress of judgment support models.

 Mamdani FIS is pragmatic in the present study to improve the model as it forecasts realistic consequences with a relatively artless configuration, and also in line for the instinctive and discovering nature of the rule base (Jassbi, Serra, Ribeiro, & Donati, 2006). The fundamental perceptions of the fuzzy inference system deliberated for a scheme of this offered system have been argued in the following subcategories, and the depiction of the recommended system has been clarified through two stages in Figure 2.
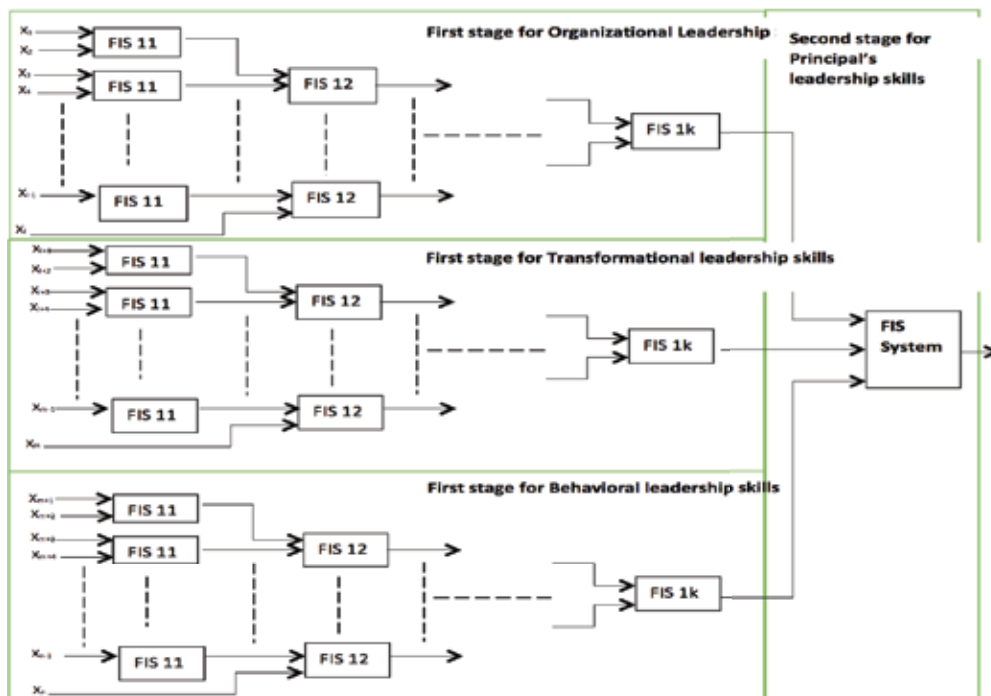

Figure 2: *The proposed PLS assessment model*

Fuzzy participation in the suggested model

In the presented model, the performance of the principal leadership concerning various sub-dimensions is based on teachers' perception of the principal. The input variables for the assessment of the principal's leadership skills commonly have numerous uncertainty (Vinodh & Balaji, 2011). Thus, the use of three-sided or (and) trapezoidal membership roles are indorsed. In the present study, trapezoidal fuzzy information are used for decisive the prominence of measures and scales, and assessing the PLS of principal with reference to well-established sub-dimensions. A trapezoidal fuzzy numeral can be symbolized as Ã= (a, b, c, d), as displayed in figure-3.

Membership role for participation and outcome

A fuzzy set is regarded as a relationship (characteristic) utility that allocates to each entity a score of participation ranging (Turskis et al., 2019; Zadeh, 1965). Several types of participation utilities are presented. The group management procedures are essential to design and assess a set of diverse substitutes. While the furthermost important assignment is to discard those substitutes which do not come across lower limits of the essential criteria (Turskis et al., 2019; Zadeh, 1965).

Three fuzzy arrangements of membership role are functional at Ist and 2nd phases for both inputs purpose and output purpose in the fuzzy inference system. Thus at the Ist stage, the fuzzy distribution in expressions of dialectal variables comprises of 'Low,' 'Medium,' and 'High.' These included variables are the same in fuzzy figures on a range of figures from 1-5, as displayed in Table 2.

Table 2.
Linguistic variables for inputs at both stages and outputs at first stage

Low	(1, 1, 2, 3)
Medium	(2, 2.5, 3.5, 4)
High	(3, 4, 5 5)

At the next phase, fuzzy arrays in positions of dialectal variables for involvement purpose are identical as in the first phase. During this phase, dialectal variables for outcome as the principal leadership score are measured as 'Low,' 'Medium,' and 'High.' Therefore, nominated variables are similar to fuzzy quantities on the weighbridge, such as ranging from 1-5 (as shown in Table 3).
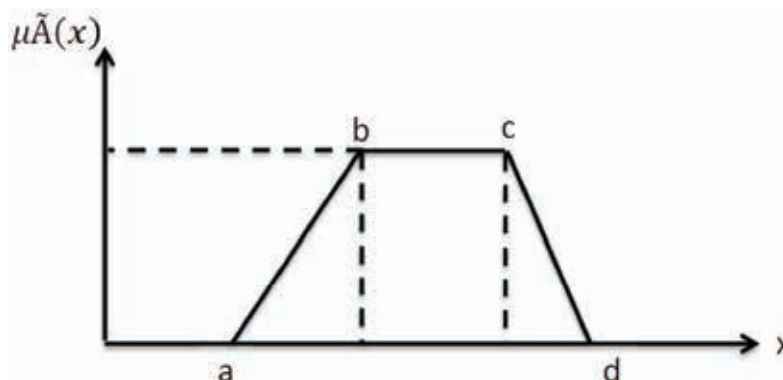

Figure 3: *Trapezoidal membership function*

Table 3.

Linguistic variables for output at second stage

Low	(1, 1, 2, 3)
Medium	(2, 2.5, 3.5, 4)
High	(3, 4, 5 5)

Fuzzy set-ups

Binary fuzzy actions, addition, and the multiplication of fuzzy arrangements are used in the contemporary model. Suppose an example, imagine that A and B are two trapezoidal fuzzy quantities. Then,

$$A = (a_1, a_2, a_3, a_4) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(1)$$
$$B = (b_1, b_2, b_3, b_4) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(2)$$
Then,
$$A + B = (a_1 + b_1, a_2 + b_2, a_3 + b_3, a_4 + b_4) \dots\dots\dots\dots\dots........(3)$$
$$A * B = (a_1 * b_1, a_2 * b_2, a_3 * b_3, a_4 * b_4) \dots\dots\dots\dots\dots\dots..(4)$$

Fuzzy guidelines in the suggested model

Depending on professional knowledge, fuzzy statute sets are settled for this proposed model. The procedures are intended on the basis of close to the notion for every FIS, as displayed in Table-4 & 5.

Table 4.

Fuzzy rule base matrix for the first stage

First Input Second Input	Poor	Medium	Good
Low	Low	Low	Medium
Medium	Low	Medium	Medium
High	Medium	Medium	High

Table 5.

Fuzzy rule base matrix at the second stage

First Input	Second Input	Third Input	Output	First Input	Second Input	Third Input	Output
Low	Low	Low	Low	Medium	Medium	High	Medium
Low	Low	Medium	Low	Medium	High	Low	Medium
Low	Low	High	Low	Medium	High	Medium	Medium
Low	Medium	Low	Low	Medium	High	High	High
Low	Medium	Medium	Medium	High	Low	Low	Medium
Low	Medium	High	Medium	High	Low	Medium	Medium
Low	High	Low	Medium	High	Low	High	Medium
Low	High	Medium	Medium	High	Medium	Low	Medium
Low	High	High	Medium	High	Medium	Medium	Medium
Medium	Low	Low	Low	High	Medium	High	High
Medium	Low	Medium	Medium	High	High	Low	Medium
Medium	Low	High	Medium	High	High	Medium	High
Medium	Medium	Low	Medium	High	High	High	High
Medium	Medium	Medium	Medium				

Combination and Defuzzification

Considering the situation of collective choice-making, the skill level values are prerequisites to be amassed to gain a single fuzzy digit for each entry. In the present study, the fuzzy integers are accumulated via the arithmetic ordinary operator (Detyniecki, Bouchon-meunier, Yager, & Prade, 2000). Accumulative level of the skill of principal with reverence to ith item can be represented by $A_i^{\%} = [(a_{1i}, a_{2i}, a_{3i}, a_{4i})]$ and computed as

$$a_{1i} = \frac{1}{p}\sum_{k=1}^{p} a_{1i}^k \;;\; a_{2i} = \frac{1}{p}\sum_{k=1}^{p} a_{2i}^k \;;\; a_{3i} = \frac{1}{p}\sum_{k=1}^{p} a_{3i}^k \; \text{and} \; a_{4i} = \frac{1}{p}\sum_{k=1}^{p} a_{4i}^k \tag{5}$$

Where p is the number of the teachers and $A_i^{\%} = [(a_{1i}^k, a_{2i}^k, a_{3i}^k, a_{4i}^k)]$ is the opinion of kth teacher about the skill level of the principal with reverence to i[th] item.

It is mandatory to defuzzify the fuzzy integer into a real digit at every level of grading. The center of area (COA) technique has been smeared for defuzzification as symbolized by Eq (6).

Monotonic conduct of the suggested model

For submissions constructed on fuzzy inference, a compulsory prerequisite is that the productivity of the fuzzy system ought to be monotonic with reference to its involvements (Kouikoglou & Phillis, 2009). However, Won, Park, and Lee (2002) articulated the circumstances in which the defuzzified outcome of a Mono-stage TSK fuzzy structure is a non-reducing outcome of its participation. These circumstances are conveyed as under:

"State-1. The rule centers ought to be non-reducing.

State- 2. The weights applied in the defuzzification ought to be part wise categorized and non-reducing.

Stae-3. The membership functions assigned to the inputs should be piece-wise differentiable, in the sense that they should continue on the corresponding domains and differentiable at all but a finite number of points. Moreover, for any pair of fuzzy sets A and B, if A < B then [dμA(x)/dx]/ μA(x) ≤ [d μB(x)/dx]/ μB(x), for all x where μA(x) and μB(x) should be differentiable."

Kouikoglou and Phillis (2009) have determined that the situations studied in Won et al. (2002) are enough for the monotonicity of several stages, categorized fuzzy structures if every inference state fulfills conditions 1 and 2, and then the fundamental inputs gratify condition-3.

The rule base adopted in the suggested model is growing. Therefore the highest value of outcome fuzzy arrays as displayed in figure 3 fulfills condition 2. While Won et al. (2002) have referred situation 3 for a trapezoidal participation function to the essential inputs in FIS is voiced as:

"Fuzzy systems assigned trapezoidal membership functions Ã= (a, b, c, d) are piece-wise differential, if ap≤ aq, bp≤ bq, cp≤ cq, and dp≤ dq for all membership functions (1…p, q,..m), where 1≤ p≤ q≤ m."

As shown in Figure 4, in the suggested model, membership roles allocated to each fundamental item are rendering to state- 3 for trapezoidal relationship.
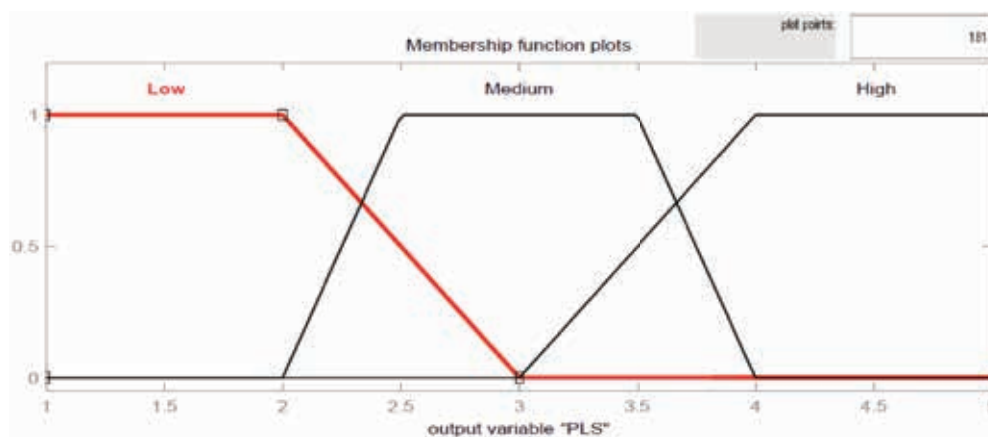

Figure 4: *Membership functions associated with output 'PLS' at the second stage*

Description of suggested Model

In the present suggested model, the output as the principal leadership skill (PLS) score of secondary school principals is subject to several independent element's participation values. Numerically, this can be characterised as;

$$SS = f(x1, x2, x3… xn) \tag{7}$$

For the implementation of this model, the teacher are asked to rate the principals' leadership skills concerning various items, as given in Table 1.

The proposed model consents the dimensions from teachers belonging to the secondary schools via a five-point Likert scale (1-5). The scale used to gather the level of skills (1- Does not exhibit this skill, 2-Exhibits this skill but not effective, 3- Is somewhat effective, 4- Is effective, and 5- Is very effective). Depending on the score obtained after evaluation for every item, the obtained values are categorised with a semantic variable. The philological variables, Low, Medium and High, are shown by fuzzy association roles (1,1,2,3), (2,2.5,3.5,4), and (3,4,5,5) correspondingly. Depending on the fuzzy logic procedure, the proposed model adopted the participation utilities and fuzzy guidelines depend on adept opinions to determine the outcomes at both phases. These inferences from stage 1st are applicable for inputs of stage 2 to find out the general PLS value of the principal.

To find the concluding PLS score, the proposed model is divided into two phases, as highlighted in Figure-2. Thus, in the first state, there are 3 sets of hierarchal fuzzy structures to work out the acts of the 3 features (i.e., OLS, TLS, and BLS). To get away from the rule violation, it is recommended to use two retorts and three membership chores for every single fuzzy system at the earliest stage. The act of the principal with admiration for each entry is well thought-out as input for the fuzzy structures at this level. The recital ratings of the principal with respect to each item considered as the input given by the teachers when they are applying the fuzzy rule-based arrangement to assess their PLS.

It ought to be noted that afterward choosing 2 by 2 inputs if one of the input variable leftovers, it would be well-thought-out as an outcome adaptable of a fuzzy arrangement in that classification as exposed in Figure-2. The first phase is sustained such that all input variables are lodged, and the sum of outputs for every sort is condensed to one. Presently, this study three outcome variables in the earliest phases, which are well-thought-out as participation variables at the next stage. Thus, at the next stage, the three participation variables characterize OLS, TLS and BLS. Consequently, it is recommended to apply three inputs and 3 membership utilities for a fuzzy arrangement at this level. The outcome of the second phase of the fuzzy system delivers the combined PLS score of the principal.

Description of suggested Model

In this segment, the implication of the suggested model is exemplified by showing a case study in the FDC Secondary school. The FDC Secondary school Peshawar cantonment is located in Peshawar city, Pakistan. This school was established in 1972 and there are 70 teaches, and the strength of students is around 700. This school provides education from class Nursery to Higher secondary (intermediate level). Permission for data collection of the school was obtained from Regional Education Director, Pakistan Air Force. This model required the input from teachers of the secondary school to assess the principal's leadership skills. After deliberations with teachers, the fuzzy based technique is acknowledged as an all-inclusive and broad style to be applied for PLS assessment. Twenty teachers from FDC Secondary school participated in this evaluation process.

Description of suggested Model

The data is anticipated to make it suitable for one or alternative of the entire categories. However, in any circumstance, decision-makers need to adopt methods appropriate to their data and to the questions they desire to answer. While Likert familiarised Likert scales in the 1930s(Likert, 1932; Turskis et al., 2019) as an instrument for the extent and valuation of attitudes. From that time, Likert-type measures have turn into more widespread in several fields of judgment-making regarding leadership (Stoklasa, Talášek, & Luukka, 2018; Turskis et al., 2019).

It is the utmost extensively used method for scale answers in survey research because the Likert scale has been termed as a simple instrument to practice and can be investigated adequately as interval or fuzzy measures (Allen, McAleer, & Singh, 2017; Turskis et al., 2019).
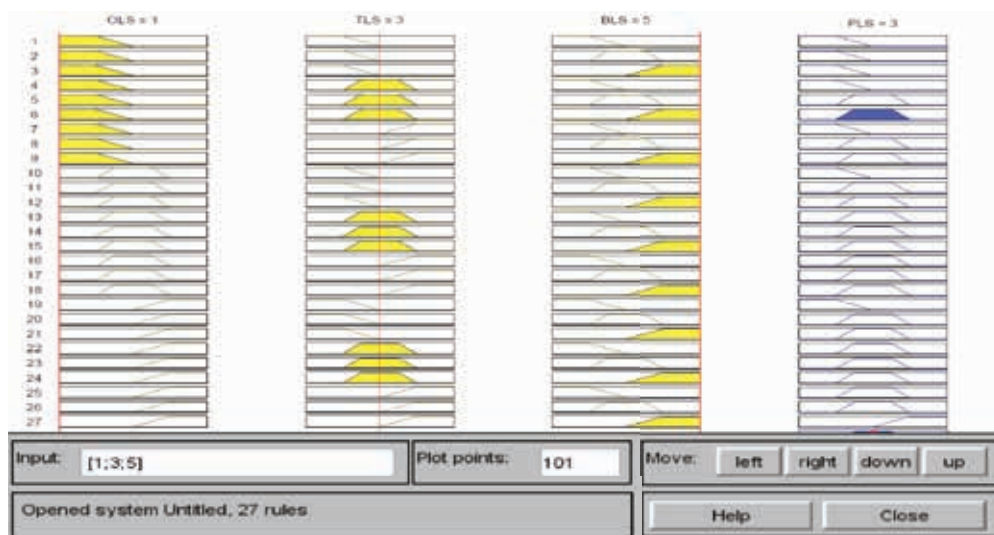
The teachers of the secondary school have been asked to rate the principal skills concerning the items presented in Table 1 at a five-point Likert scale. Twenty teachers from the said school have returned the completed survey form. After receiving the responses, in the next step score for each item has been aggregated. To aggregate all the answers, the averaging operator has been applied. The principal's skill score obtained for each item, which is classified with linguistic variables, where ($1 \leq x \leq 2.33$), ($2.33 < x \leq 3.67$), and ($3.67 < x \leq 5$) represent Low, Medium and High respectively. The membership functions are chosen to fully fit the categorization of the skill levels as presented above. The averages of the principal's skill with respect to various items that are considered as input to the hierarchal fuzzy inference system are shown in Table 6.

Table 6:
Principal skill's concerning various items

Items	Skill rating of Principal	Corresponding Linguistic Variable
TLS 1	2.62	Medium
TLS 2	4.08	High
TLS 3	4.28	High
TLS 4	4.11	High
TLS 5	4.37	High
OLS 1	4.36	High
OLS 2	4.43	High
OLS 3	4.30	High
OLS 4	4.08	High
BLS 1	4.00	High
BLS 2	4.36	High
BLS 3	4.34	High
BLS 4	4.32	High

Implementation and result extraction

For the purpose of application and output, input scores from the data collection process are conceded to the FIS system to get the PLS score. Therefore, the application model is presented in Figure-1. To match the Principal Leadership Skill, two dummy Principals are brought together as the ideal Principal and the non-ideal Principal. Lastly, the PLS score of the real principal alongside with the dummy principals are considered as presented in Table 7. To show the arrangement of rule observer in the model, which signifies the working of the FIS model, one FIS has been selected. Rule observer of FIS at the second phase of PLS value is presented in Figure-5.

Figure 5. *Rule viewer for a case in an illustrative example*

In the rule observer, every rule is strategized sideways a row, and every contributing variable is at the end of the uppermost of a column. The input score of variables are differentiated by drawing the red line and the outcome is found along column demonstrating the outcome variable. For instance, in the present case, there are three contributing variables and three association function, the number of rules is 27 (33) to get the outcome. To confirm these guidelines, involvement for variables likes OLS, TLS, and BLS have been found increased and outcome as PLS is examined. Three participating variables have diverse ranging from 1-5 and outcome score found ranging from 1-5. The outcome seeming for the second phase FIS for PLS value is represented in Figure-6. It is found that growing the participation values escalations the outcome value of the PLS score

Table 7.
Validation of the proposed model

Principals	Assessment result (PLS score)				
	COM	MOM	SOM	LOM	BOM
Ideal	4.23	4.5	4.0	5	4.24
Real	4.23	4.5	4.0	5	4.24
Non-ideal	1.77	1.5	1	2	1.72

The use of this proposed model is verified by gaining the PLS value of the principal, which at all times lies between values of ideal, and that's of non-ideal. A defuzzification ought to be functional before conclusions are drawn. The defuzzification is another procedure of bringing into being a quantifiable outcome in crunchy logic, assumed fuzzy logic, and corresponding participation degrees (Turskis et al., 2019).

The suggested method is grander to conformist techniques because the recommended technique has the proficiency to make group choices in the fuzzy setting. Therefore, the fuzzy set theory is an influential tool to resolve such difficulties (Turskis et al., 2019).

This proposed model is also verified through applying diverse defuzzification procedures, like the center of area procedure (COM), the bisector of the area procedure (BOM), mean of maximum method (MOM), similarly, smallest of maximum method (SOM), and like largest of maximum method (LOM). As presented in Table-7, valuation outcomes for altogether three principals are similar in all defuzzification approaches and verified the validity of this proposed model.
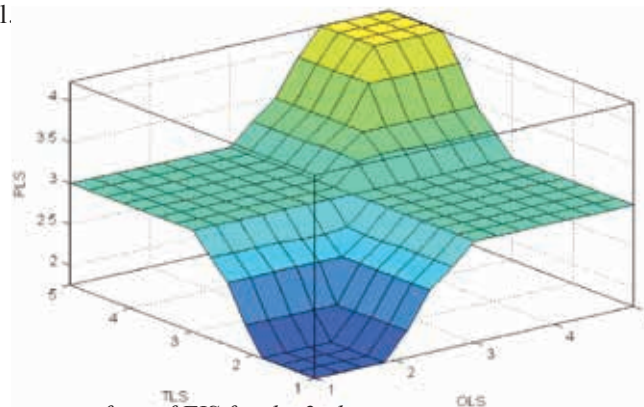

Figure 6. *The output surface of FIS for the 2nd stage*

DISCUSSION AND CONCLUSION

Results reveal that leadership skills possessed by the Principal in FDC School are of high level as perceived by the teachers. There may be certain factors of this high level; one of them is leadership characteristics, and another one is the structural capital. Leaders spent additional time with their followers and these leaders know the strong professional point of the personnel (Algahtani, 2014). Lunenburg (2011), recommended the features of leader which he possesses by birth or gains through certain training: they emphasis on people, look towards future, fluent by showing vision, produces the future, authorize, coworkers, do the accurate things, practices inspiration, uses clashes, acts once and for all. Structural capital comprises sources of awareness that an institute has, i.e., procedure, the function of the institute, and workers practice this organizational capital with the understanding and expertise they have (Vergauwen & Van Alem, 2005). Structural capital mainly comprising, prophecy of the institute, administration policies, philosophy, managerial culture, chronicles and working procedures (Awan & Saeed, 2014). From results, it is found that either FDC school has good leaders due to their inherent characteristics or training they availed being a part of the structural capital of this school.

This paper grants a fuzzy inference structure model for Principal Leadership Skill valuation for a secondary school. In the present study, an attempt is made to slot in three magnitudes of the leadership skill (i.e., OLS, TLS and BLS) for overall PLS assessment of the secondary school principal. A well-established list of items has been considered to assess the OLS, TLS and BLS. Finally, combining these three aspects, the overall PLS has been obtained. The skill level of the principal concerning various items depending on the teachers' insight is suggested in the present model. This valuation model can be applied to multiple teachers. The proposed model is numerically vigorous as it mollifies the monotonic activities of the hierarchal fuzzy arrangement. This model could be used by policymakers of the schools to measure the PLS of the principals and to recognize the weak areas, which necessitate more care. Grounded on the valuation, decision-makers can develop their choices about future activities obligatory to increase the general PLS. Forthcoming research could look into the growth of models to pinpoint the areas of further improvement to enhance the overall PLS Score. Enhancement of leadership skills is a time-consuming and conscientious process, for which working out and enlightening will show a vital role (Artamonova et al., 2019).

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