I. J. Mathematical Sciences and Computing, **2024, 1, 39-45**
Published Online on February 8, 2024 by MECS Press (http://www.mecs-press.org/)
DOI: 10.5815/ijmsc.2024.01.05

A Novel Model for Recommending Information Systems with Suitable Cloud Computing Provider

Samah Ibrahim Abdel Aal*
Lecturer, Faculty of Computers and Informatics, Zagazig University, Egypt
Email: SIAbdelaal@fci.zu.edu.eg
ORCID ID: https://orcid.org/0009-0000-3947-9854
*Corresponding Author

Received: 07 September, 2023; Revised: 11 October, 2023; Accepted: 09 December, 2023; Published: 08 February, 2024

Abstract: Cloud computing has been adopted widely by information systems due to its scalability and availability of resources and services. Cloud computing can provide different types of services through internet for Information Systems (IS). There are many cloud computing providers such as Google, Microsoft, and IBM are seeking for adopting of cloud services. Selecting the suitable cloud provider can maximize the benefits of cloud services. There is a need to determine the suitable cloud computing provider to achieve organizations' goals and maximize the benefits of cloud services. This work aims to introduce a decision support model based on trapezoidal neutrosophic numbers for determining the suitable cloud computing provider. The proposed model is applied by the Zagazig University (ZU) and the results indicated that the model can provide flexible method that can handle uncertainty in decision making for detecting the suitable provider. Also, the results show that the proposed model can support information systems in the choosing the suitable cloud computing provider.

Index Terms: Information Systems (IS), Zagazig University (ZU)

1. Introduction

The cloud computing technologies are applied in many organizations. The cloud computing model involved: broad network access, rapid elasticity, and resource pooling, self-service, and measured service. Cloud computing can be considered as a source of IT infrastructure which provides organizations with their needs to achieve their goals. The key concept of cloud computing is that the hardware, the software, storage, databases, and any other resource can be rent from cloud computing provider. There are many cloud computing providers are seeking for adopting of cloud services. Information systems which utilized cloud computing options can enhance business value and performance. Selecting the suitable cloud provider can maximize the benefits of cloud services. So that; there is a need to determine suitable cloud computing provider. According to [1, 2, 3] the neutrosophic numbers are best fit inconsistent data and can support decision making This work aims to introduce a decision support model based on trapezoidal neutrosophic numbers for determining the suitable cloud computing provider. The results indicated that the proposed model can help information systems in the choosing the suitable cloud computing provider. This paper is arranged as: the first section gives introduction for this work; the second section gives cloud computing services form information systems viewpoint; the third section introduces cloud deployment model form information systems perspectives; the fourth section provides challenges and risks of cloud computing form information systems perspectives; the fifth section introduces the Single Valued Trapezoidal Neutrosophic Numbers; the sixth section gives the novel model with numerical example and describes the proposed model to detect the suitable cloud computing provider; the seventh section gives conclusion; the finally provides references.

2. Cloud Computing Services Form Information Systems Viewpoint

According to [4] cloud computing can increase productivity and enhance processes in information systems. By applying the concept of cloud computing in information systems, clients can use resources that are sold by providers. Cloud computing has three service models that give different levels of resources which can be rent [5]:

- ***Software as a Service:*** provides software / applications,
- ***Platform as a Service:*** provides environments and development tools,
- ***Infrastructure as a Service:*** introduces servers, storage, and networks that make use of virtualization to introduce services.

According to [6] information systems that make use of cloud computing can enhance business value and performance through improving their processes. The following figure can highlight this concept.

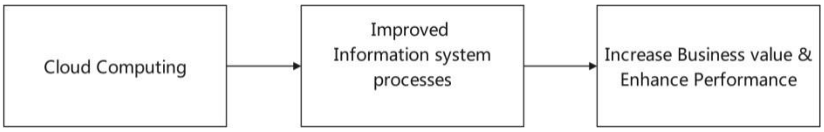

Fig. 1. Impact of Cloud Computing on IS and organizations

3. Cloud Deployment Models Form Information Systems Perspectives

There are three primary cloud computing deployment models for information systems as shown in figure 2

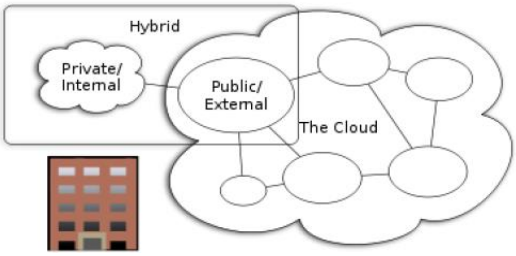

Fig. 2. Categories of Cloud Deployment Models

A. Public cloud: provides environment for IS as publically accessible
B. Private cloud: manage and control services and infrastructure used by IS.
C. Hybrid cloud: compromised both private and public.

4. Success Factors of Cloud Computing of Cloud Computing Form Information Systems Perspectives

Cloud Computing can provide many success factors for all types of organizations and many types of information systems [7]. The Success Factors of cloud computing can be summarized as the follows:

- **Cost Reducing:** Clients no need to pay to create and enhance infrastructure [8]. Clients can use resources that are sold by providers.
- **Flexible:** Provides enable IS to access services.
- **Redundancy and Reliability:** Focus on redundancy to ensure reliability [9].
- **Scalability:** Expand computing resources [10].
- **Collaboration:** Due to the similarity and flexibility resources, cooperation can be done among providers [11].
- **Efficiency:** Ability to use all services everywhere.
- **Virtually:** By using virtual machines, consumers can use application, storage and communication virtually.
- **Availability:** services available to clients whenever they request.

5. Challenges and Risks of Cloud Computing Form Information Systems Perspectives

According to [12] there are many organizations seek slow toward applying cloud computing due to some risks and limitations as: data loss, account hacking, less control over, attacks [13, 14]. These risks lead to a collection of challenges such as shown in the following figure that introduces different types of challenges of cloud computing [15].

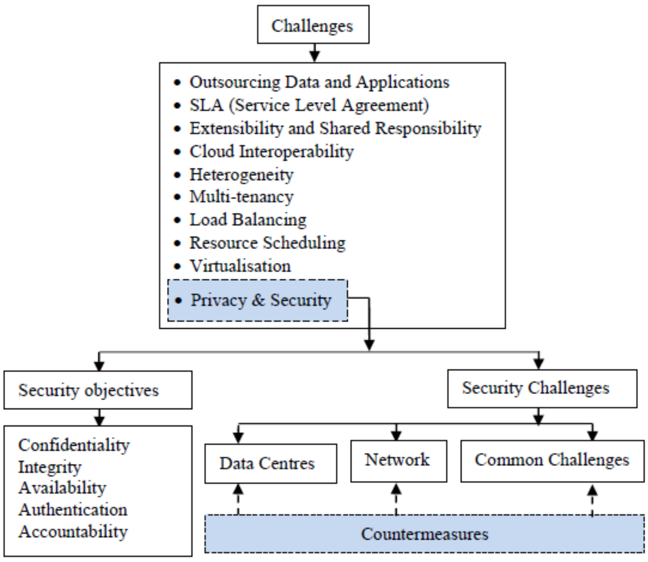

Fig. 3. Types of cloud challenges

6. The novel Model Based on Single Valued Trapezoidal Neutrosophic Numbers for Selecting Suitable Cloud Computing Provider

The SVTN-numbers have been introduced in many applications [16,17].

1- **Definition 1**: Based on [18] the SVTN-numbers $\bar{a}$ can be represented as: $\bar{a} = ((a, b, c, d); w_{\bar{a}}, u_{\bar{a}}, y_{\bar{a}})$ and its (truth $\mu_{\bar{a}}(x)$, indeterminacy $\upsilon_{\bar{a}}(x)$ and falsity $\lambda_{\bar{a}}(x)$) membership functions are :

$$\mu_{\bar{a}}(x) = \begin{cases} \frac{(x-a)w_{\bar{a}}}{b-a}, & a \le x < b \\ w_{\bar{a}}, & b \le x \le c \\ \frac{(d-x)w_{\bar{a}}}{d-c}, & c \le x \le d \\ 0, & \text{otherwise} \end{cases} \tag{1}$$

$$\upsilon_{\bar{a}}(x) = \begin{cases} \frac{(b-x+u_{\bar{a}}(x-a))}{b-a}, & a \le x < b \\ u_{\bar{a}}, & b \le x \le c \\ \frac{(x-c+u_{\bar{a}}(d-x))}{d-c}, & c \le x \le d \\ 0 & ,\text{otherwise} \end{cases} \tag{2}$$

$$\lambda_{\bar{a}}(x) = \begin{cases} \frac{(b-x+y_{\bar{a}}(x-a))}{b-a}, & a \le x < b \\ y_{\bar{a}}, & b \le x \le c \\ \frac{(x-c+y_{\bar{a}}(d-x))}{d-c}, & c \le x \le d \\ 0, & \text{otherwise} \end{cases} \tag{3}$$

Definition 2: According to [19,20] let $\bar{a} = ((a_1, b_1, c_1, d_1); w_{\bar{a}}, u_{\bar{a}}, y_{\bar{a}})$, $\bar{e} = ((a_2, b_2, c_2, d_2); w_{\bar{e}}, u_{\bar{e}}, y_{\bar{e}})$ be two SVTN-numbers and $\gamma \neq 0$ be any real number, then

$$\bar{a} + \bar{e} = ((a_1 + a_2, b_1 + b_2, c_1 + c_2, d_1 + d_2); \min\{w_{\bar{a}}, w_{\bar{e}}\}, \max\{u_{\bar{a}}, u_{\bar{e}}\}, \max\{y_{\bar{a}}, y_{\bar{e}}\}) \tag{4}$$

$$\bar{a}\bar{e} = \begin{cases} ((a_1a_2, b_1b_2, c_1c_2, d_1d_2), \min\{w_{\bar{a}}, w_{\bar{e}}\}, \max\{u_{\bar{a}}, u_{\bar{e}}\}, \max\{y_{\bar{a}}, y_{\bar{e}}\})(d_1 > 0, d_2 > 0) \\ ((a_1d_2, b_1c_2, c_1b_2, d_1a_2), \min\{w_{\bar{a}}, w_{\bar{e}}\}, \max\{u_{\bar{a}}, u_{\bar{e}}\}, \max\{y_{\bar{a}}, y_{\bar{e}}\})(d_1 < 0, d_2 > 0) \\ ((d_1d_2, c_1c_2, b_1b_2, a_1a_2), \min\{w_{\bar{a}}, w_{\bar{e}}\}, \max\{u_{\bar{a}}, u_{\bar{e}}\}, \max\{y_{\bar{a}}, y_{\bar{e}}\})(d_1 < 0, d_2 < 0) \end{cases} \tag{5}$$

$$\gamma\bar{a} = \begin{cases} ((\gamma a_1, \gamma b_1, \gamma c_1, \gamma d_1); w_{\bar{a}}, u_{\bar{a}}, y_{\bar{a}})(\gamma > 0) \\ ((\gamma d_1, \gamma c_1, \gamma b_1, \gamma a_1); w_{\bar{a}}, u_{\bar{a}}, y_{\bar{a}})(\gamma < 0) \end{cases} \tag{6}$$

6.1 The Values and Ambiguities for SVTN –Numbers

Let $\bar{a}$= ((a, b, c, d); $w_{\bar{a}}$, $u_{\bar{a}}$, $y_{\bar{a}}$) is an arbitrary SVTN-number; then the concept of cut (or level) of SVTN-numbers can be introduced as the following:

1- α-cut set of the SVTN-number $\bar{a}$ for truth-membership is calculated as:

$$[L\bar{a}(\alpha), R\bar{a}(\alpha)]=[\frac{(w_{\bar{a}}-\alpha)a+\alpha b}{w_{\bar{a}}}, \frac{(w_{\bar{a}}-\alpha)d+\alpha c}{w_{\bar{a}}}]$$

If f(α) =α, where f(α)∈ [0, 1] and is monotonic and non-decreasing of αα ∈ [0,$w_{\bar{a}}$]

$$V_{\mu}(\bar{a}) = \int_0^{w_{\bar{a}}}[(a+d)+\frac{(b+c-a-d)\alpha}{w_{\bar{a}}}]\,\alpha\, d\alpha = \frac{(a+2b+2c+d)(w_{\bar{a}})^2}{6} \tag{7}$$

$$A_{\mu}(\bar{a}) = \int_0^{w_{\bar{a}}}[(d-a)-\frac{(d-a+b-c)\alpha}{w_{\bar{a}}}]\,\alpha\, d\alpha = \frac{(d-a+2c-2b))(w_{\bar{a}})^2}{6} \tag{8}$$

2- β -cut set of the SVTN-number $\bar{a}$ for indeterminacy membership is calculated as;

$$[\acute{L}\bar{a}(\beta), \acute{R}\bar{a}(\beta)] = [\frac{(1-\beta)b+(\beta-u_{\bar{a}})a}{1-u_{\bar{a}}}, \frac{(1-\beta)c+(\beta-u_{\bar{a}})d}{1-u_{\bar{a}}}]$$

If g(β)=1−β, whereg(β) ∈ [0, 1] and g(β)is monotonic and non-increasing of β ∈ [$u_{\bar{a}}$, 1], the value and ambiguity of the SVTN-number $\bar{a}$ can berepresented as:

$$V_{\upsilon}(\bar{a}) = \int_{u_{\bar{a}}}^1\left[(a+d)+\frac{(b+c-a-d)(1-\beta)}{1-u_{\bar{a}}}\right](1-\beta)\, d\beta = \frac{(a+2b+2c+d)(1-u_{\bar{a}})^2}{6} \tag{9}$$

$$A_{\upsilon}(\bar{a}) = \int_{u_{\bar{a}}}^1[(d-a)-\frac{(d-a+b-c)(1-\beta)}{1-u_{\bar{a}}}](1-\beta)\, d\beta = \frac{(d-a+2c-2b)(1-u_{\bar{a}})^2}{6} \tag{10}$$

3- γ - cut set of the SVTN-number a for falsity-membership is calculated as

$$[\acute{\acute{L}}\bar{a}(\gamma), \acute{\acute{R}}\bar{a}(\gamma)] = [\frac{(1-\gamma)b+(\gamma-y_{\bar{a}})a}{(1-y_{\bar{a}})}, \frac{(1-\gamma)c+(\gamma-y_{\bar{a}})d}{(1-y_{\bar{a}})}]$$

Where γ ∈ [$y_{\bar{a}}$, 1].If h(γ)=1- γ , where h(γ) ∈ [0, 1] and h(γ)is non-increasing of γ ∈ [$y_{\bar{a}}$, 1], the value and ambiguity of the SVTrN-number$\bar{a}$ are;

$$V_{\lambda}(\bar{a}) = \int_{y_{\bar{a}}}^1[(a+d)+\frac{(b+c-a-d)(1-\gamma)}{1-y_{\bar{a}}}](1-\gamma)\, d\gamma = \frac{(a+2b+2c+d)(1-y_{\bar{a}})^2}{6} \tag{11}$$

$$A_{\lambda}(\bar{a}) = \int_{y_{\bar{a}}}^1[(d-a)-\frac{(d-a+b-c)(1-\gamma)}{(1-y_{\bar{a}})})](1-\gamma)\, d\gamma = \frac{(d-a+2c-2b)(1-y_{\bar{a}})^2}{6} \tag{12}$$

6.2 The Values and Ambiguities Index of the SVTN-numbers

Let $\bar{a}$ = ((a, b, c, d); $w_{\bar{a}}$, $u_{\bar{a}}$, $y_{\bar{a}}$) be a SVTN-number. The values and ambiguities index method can be adapted and generalized to the SVTN-numbers and they can be respectively calculated for λ∈ [0, 1] as following:

$$V(\bar{a},\lambda) = \frac{(a+2b+2c+d)}{6}[\lambda w_{\bar{a}}^{2}+(1-\lambda)(1-u_{\bar{a}})^2+(1-\lambda)(1-y_{\bar{a}})^2] \tag{13}$$

And

$$A(\bar{a},\lambda) = \frac{(d-a+2c-2b)}{6}[\lambda w_{\bar{a}}^{2}+(1-\lambda)(1-u_{\bar{a}})^2+(1-\lambda)(1-y_{\bar{a}})^2] \tag{14}$$

Let E = ((a, b, c, d); w_E ,u_E,y_E), D = ((a, b, c, d); w_D ,u_D ,y_D) be two SVTN-numbers. The comparative method for E and Dcan defined as:

1. If V (E, λ) < V (D, λ), then E < D
2. If V (E, λ) > V (D, λ), then E > D
3. If V (E, λ) = V (D, λ), then

- If $A(E, \lambda) < A(D, \lambda)$, then $E < D$
- If $A(E, \lambda) > A(D, \lambda)$, then $E > D$
- If $A(E, \lambda) = A(D, \lambda)$, then $E = D$

7. The Novel Model with Numerical Example

The information system center of Zagazig University (ZU) at Egypt wants to rent more storage to handle the huge amount of student data. The zagazig university applied the proposed method to detect the more suitable cloud computing provider. The ZU applied needs to choose the best provider according to the following characteristics

- Cost
- Flexibility
- Reliability
- Scalability
- Availability

Given the following table:

Table 1. Linguistic term and corresponding Linguistic values

linguistic term	Linguistic values
Very Poor (VP)	((0.1, 0.1, 0.1, 0.1); 0.5, 0.3, 0.3)
Poor (P)	((0.2, 0.3, 0.4, 0.5); 0.6, 0.2, 0.2)
Fairly Poor (FP)	((0.3, 0.4, 0.5, 0.6); 0.7, 0.1, 0.1)
Medium (M)	((0.4, 0.5, 0.6, 0.7); 0.8, 0.0, 0.1)
Fairly Good (FG)	((0.5, 0.6, 0.7, 0.8); 0.7, 0.3, 0.3)
Good (G)	((0.7, 0.8, 0.9, 1.0); 0.8, 0.2, 0.2)
Very Good (VG)	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)

Phase 1: Create a linguistic table as the follows:

Table 2. Linguistic Table

Criteria	Provider 1		Provider 2	
Cost	**VG**	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)	**VG**	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)
Flexibility	**VP**	((0.1, 0.1, 0.1, 0.1); 0.5, 0.3, 0.3)	**M**	((0.4, 0.5, 0.6, 0.7); 0.8, 0.0, 0.1)
Reliability	**VG**	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)	**FP**	((0.3, 0.4, 0.5, 0.6); 0.7, 0.1, 0.1)
Scalability	**FP**	((0.3, 0.4, 0.5, 0.6); 0.7, 0.1, 0.1)	**VG**	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)
Availability	**VG**	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)	**VG**	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)

Phase 2: Compute the normalized values
$R= ((a_{ij}/\bar{a}^{+}, b_{ij}/\bar{a}^{+}, c_{ij}/\bar{a}^{+}, d_{ij}/\bar{a}^{+}); w_{\bar{a}ij}, u_{\bar{a}ij}, y_{\bar{a}ij})$, such that $\bar{a}^{+} = \max \{r_{ij}.\ i \in I_{row}, j \in I_{columns}\}$

Table 3. Normalized values

Criteria	Provider 1	Provider 2
Cost	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)
Flexibility	((0.1, 0.1, 0.1, 0.1); 0.5, 0.3, 0.3)	((0.4, 0.5, 0.6, 0.7); 0.8, 0.0, 0.1)
Reliability	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)	((0.3, 0.4, 0.5, 0.6); 0.7, 0.1, 0.1)
Scalability	((0.3, 0.4, 0.5, 0.6); 0.7, 0.1, 0.1)	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)
Availability	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)	((1.0, 1.0, 1.0, 1.0); 0.9, 0.1, 0.1)

Step 3: Compute $u_{ij} = \omega_i r_{ij}$ (for $i \in I_{rows}$, $j \in I_{columns}$),

$$U = \sum_{i=1}^{row} u_{ij} = \left(\left(\sum_{i=1}^{row} a\, \omega_i r_{ij}, \sum_{i=1}^{row} b\, \omega_i r_{ij}, \sum_{i=1}^{row} c\, \omega_i r_{ij}, \sum_{i=1}^{row} d\, \omega_i r_{ij}\right);\ \text{Min } w_{\bar{a}ij}, \text{Max } u_{\bar{a}ij}, \text{Max } y_{\bar{a}ij}\right)$$

$\omega = (\omega_1, \omega_2 \ldots \omega_{row})$ be the weight value of alternatives,
Where $\omega_i \in [0,1]$, $i \in I_{row}$, and $\sum_{i=1}^{row} \omega_i = 1$ ω = (.20, .10, .10, 30, and 30)

Table 4. The weighted values

Criteria	Provider 1	Provider 2
Cost	((0.20, 0.20, 0.20,0.20); 0.9, 0.1, 0.1)	((0.20, 0.20, 0.20,0.20); 0.9, 0.1, 0.1)
Flexibility	((0.01, 0.01, 0.01, 0.01); 0.5, 0.3, 0.3)	((0.04, 0.05, 0.06, 0.07); 0.8, 0.0, 0.1)
Reliability	((0.10, 0.10, 0.10, 0.10); 0.9, 0.1, 0.1)	((0.03, 0.04, 0.05, 0.06); 0.7, 0.1, 0.1)
Scalability	((0.09, 0.12, 0.15, 0.18); 0.7, 0.1, 0.1)	((0.30, 0.30,0.30, 0.30); 0.9, 0.1, 0.1)
Availability	((0.30, 0.30,0.30, 0.30); 0.9, 0.1, 0.1)	((0.30, 0.30,0.30, 0.30); 0.9, 0.1, 0.1)

Phase 4: calculate the sum table

Table 5. The sum values

Criteria	Provider 1	Provider 2
The sum	S1=((0.70, 0.73, 0.76, 0.79); 0.5, 0.7, 0.3)	S2= ((0.87, 0.89, 0.91, 0.93); 0.8, 0.7, 0.1)

Phase 5: Apply the values index of two providers

Table 6. The Values index of two providers

	Providers 1 V (S1, λ)	Providers 2 V (S2, λ)
V_μ	.18625	.576
V_υ	.06705	.081
V_λ	.36505	.729
V (S, λ)	V (S1, λ) =.18625λ +.06705 (1- λ) + .36505 (1- λ)	V (S2, λ) = .576λ + .081 (1- λ) + .729 (1- λ)

Table 7. The ranking results of the two providers

λ	Providers 1 $V_{(S1, \lambda)}$	Providers 2 $V_{(S2, \lambda)}$	ranking
0	.4321	.81	**Providers 2 > providers 1**
.3	.3583	.7398	**Providers 2 > providers 1**
.5	.3091	.6930	**Providers 2 > providers 1**
.7	.2600	.6462	**Providers 2 > providers 1**
1	.1862	.576	**Providers 2 > providers 1**

From table (7) for all values of **λ**, the results show that the best provider is providers 2.

Values: 0, and .3 where λ < **.**5, the results show when the recommender has negative feeling the result is: providers 2 > providers 1, the best provider is providers 2. Values: where λ = .5 shows that the recommender is between positive and negative feeling, the result is providers 2 > providers 1, the best provider is providers 2.

Values: .7, .1 where λ >.5, the results show when the recommender has positive feeling, the result is providers 2 > providers 1, the best provider is providers 2. The results represents that the proposed model can introduce a new method to detect the suitable cloud computing provider.

8. Conclusion

This work aimed to create a novel decision support model depends on SVTN-numbers for recommending information systems with suitable cloud computing provider. The proposed model is applied by the Zagazig University (ZU) and the results concluded that the proposed model provides a flexible model that can handle uncertainty in decision making for detecting the best provider to rent the needed storage for handling students' information. Also, the results concluded that the recommender model can help information systems in choosing the suitable cloud computing provider.

References

[1] Deli I., and Şubaş Y., 'A ranking method of single valued neutrosophic numbers and its applications to multi-attribute decision making problems.' Int. J. Mach. Learn. & Cyber, (2016).

[2] Ye, J. 'A multi criteria decision-making method using aggregation operators for simplified neutrosophic sets', J. Intell. Fuzz. Syst., Vol. 26, (2014), 2459–2466.

[3] Li D., Nan J., and Zhang M., 'A ranking method of triangular intuitionistic fuzzy numbers and application to decision making.', Int. J. Comput. Intell. Syst, Vol 3, No. (5), (2010) ,522–530.

[4] Miller, M. "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Indianapolis: Que Publishing (2008).

[5] Carlin, Sean, and Kevin Curran, Cloud computing security, (2011).

[6] Algrari A., "The Impact of Cloud Based Information Systems on Organization's Performance", IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727, Volume 19, Issue 2, Ver. II, (2017), 42-46 www.iosrjournals.org DOI: 10.9790/0661-1902024246 www.iosrjournals.org

[7] Deepa.B, Srigayathri.S and Visalakshi.S, A Review on Cloud Computing International Journal of Trend in Research and Development, 4(1), (2017), ISSN: 2394-9333 www.ijtrd.com IJTRD

[8] Sharif, Amir M., "It's written in the cloud: the hype and promise of cloud computing". www.emeraldsinght.com/174-0398.htm. Journal of Enterprise Information Management Vol. 23 No.2. (2010).

[9] Tuncay Ercan, "Effective use of cloud computing in educational institutions". www.sciendirect.com. Procedia Social and Behavioral Sciences (2010).

[10] Buse, Razvan Florin. "Why Use Cloud Computing?" Annals of University of -Economic Sciences Series, (2011), 228-231.

[11] Abadi, Daniel J. "Data Management in the Cloud: Limitations and Opportunities." IEEE Data Eng. Bull, (2009), 3-12.

[12] N Mahantesh Birje, Praveen S. Challagidad, R.H. Goudar, and Manisha T. Tapale "Cloud computing review: Concepts, technology, challenges and security", International Journal of Cloud Computing, (2017).

[13] Joel, G., Darren, E., Robin, R. and Qing, T. Benefits and challenges of three cloud computing service models', 2012 Fourth International Conference on Computational Aspects of Social Networks [CASoN], (2012), 978-1-4673-4794-5/12/2012 IEEE.

[14] Rajnish, C. 'A survey on cloud computing security, challenges and threats', International Journal on Computer Science and Engineering [IJCSE], Vol. 3, No. 3, 1227–1231, (2011), ISSN: 0975-3397.

[15] Gurudatt, K., Nikita, C., Ruchitra, C., Rani, W. and Rajnikant, P. 'Cloud security challenges', 7th International Conference on Telecommunication Systems, Services, and Applications [TSSA], (2012), 978-1-4673-4550-7/12/2012 IEEE.

[16] Ye J., 'Multi criteria decision-making method using the correlation coefficient under single-value neutrosophic environment.' Int. J. Gen. Syst, Vol.42, (2013), 386–394.

[17] Ye J., Trapezoidal neutrosophic set and its application to multiple attribute decision-making. Neural. Comput& Applic. Vol 26, (2015), 1157–1166.

[18] Smarandache F., 'Neutrosophy: Neutrosophic Probability, Set, and Logic: Analytic Synthesis & Synthetic Analysis.' Ameri. Res. Press: Rehoboth. DE. USA, (1998).

[19] Chen J., and Ye J., 'Some Single-Valued Neutrosophic Dombi Weighted Aggregation Operators for Multiple Attribute Decision-Making.', Symmetry. MDPI. Vol. 9, No. 6, (2017).

[20] Subas Y., 'Neutrosophic numbers and their application to Multi-attribute decision making problems (In Turkish)', (Master's Thesis, Kilis 7 Aralık University, Graduate School of Natural and Applied Science), (2015).

Author' s Profile

Samah Ibrahim Abdel Aal is a lecturer at the information systems department, faculty of Computers and Informatics, Zagazig University where graduated and is now a Ph.D., Egypt. She is teaching several courses for information systems management, expert systems, mathematics, cloud computing logic design, programming, information systems, database systems, IoT, big data, data security, quality management, Cloud Computing, and information systems analysis and design.

How to cite this paper: Samah Ibrahim Abdel Aal, "A Novel Model for Recommending Information Systems with Suitable Cloud Computing Provider", International Journal of Mathematical Sciences and Computing(IJMSC), Vol.10, No.1, pp. 39-45, 2024. DOI: 10.5815/ijmsc.2024.01.05