A Study on OS Selection Using ANP Based Choquet Integral in Terms of Cyber Threats

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Abstract

Cyber-threats are recent and important issue for institutions, companies, organisations and especially for countries in recent years. Malicious codes are one of the most effective tools for making systems vulnerable. Because of that selecting operating system (OS) in computer and communication systems is a critical decision that can significantly affect future competitiveness, security, and performance of organizations. An operating system is a critical tool for developing applications for institutions and companies so any misstep might cause serious losses local, national and international. The aim of this study is to develop a decision model based on Analytic Network Process (ANP)-choquet integral integration that select an appropriate operating system for critical computer systems by taking subjective judgments of decision makers into consideration. The proposed approach was based on ANP-choquet integral method. An ANP is used for determining the weights of the criteria by decision makers and then choquet integral is applied in ranking of the operating systems. The finding of this research indicates that the ANP based choquet integral prediction result is more suitable than single ANP model. Two phase OS selection process evaluates many OS selection criteria and their subcriteria.

Keywords- Cyber threats, Operating system selection, Analytic Network Process, Choquet integral

1. Introduction

In recent years, the information security research has been the subject of much attention. Organizations are becoming increasingly vulnerable to potential cyber threats such as network cyber attacks because of information processing and internet accessibility increase. Because of this, there exists a need to select more strength and powerful OS. Selecting durable OS provide secure and safe transactions through the use of firewalls, Cyber Attack Detection Systems (CADS's), encryption, authentication etc.

The quick evolution of IT forces system security professionals to a competitive environment. Government agencies, enterprises, and even individuals, are confronted by technology replacement decisions more frequently as technology upgrades speed up. Because of this, it becomes necessary to take decisions more often for the update of the technology. Government agencies, enterprises, firms and organizations should consider the changes and update the information technologies. One of these technology-related changes occurs in operating systems. Operating system is system software responsible for the direct control and management of the hardware, basic system operations and operation of applications. It provides links to the memory, input/output devices and file system [1],[2].

Operating system choice is crucial for companies or organizations in terms of IT infrastructure reliability [3]. Selection procedure of operating systems should be considered a variety of criteria. Choquet integral has been used for that reason in this case.

The paper is organized as follows. Section 2 illustrates the key features of operating systems. Section 3 explains the background of the ANP and choquet integral techniques used in this research and the related literature. Section 4 describes the proposed ANP-choquet integral OS selection model. The work is also finally concluded in Section 5.

2. Key Features of Operating Systems

An OS should ensure tasks and service management features in order to meet enterprise computing needs. Tanenbaum [2] and Galvin [1] categorize these features as follows: Process Management, Storage Management, Protection and Security, Distributed Structure and Software Features (Fig.1).

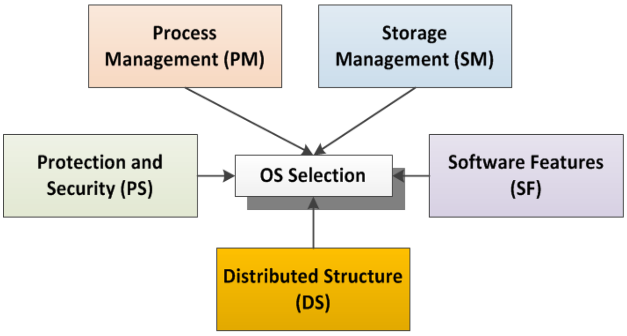

Fig. 1. Main features of an operating system.

2.1. Process Management (PM)

A Process is an instance of a computer program. It is being sequentially executed by a computer system. PM has the ability to run several computer programs concurrently [4]. Most modern operating systems support processes that have multiple threads. Some of the subcriteria that operating system is responsible in connection with process management are given below: process handling (pmPH), multithreading (pmMT) and process synchronization (pmPS). The subcriteria of “pmPH”, “pmMT” and “pmPS” form “Set3” cluster in ANP model.

2.2. Storage Management (SM)

Main memory is usually too small to accommodate all the data and programs permanently. Thus, the computer system must provide secondary storage to back up main memory. Today’s computer systems use disks as the primary on-line storage medium for information. The file system provides the mechanism for on-line storage and access to both data and programs residing on the disks [4],[5]. Subcriteria of storage management that is used in ANP model are: file system interface (smSI), mass-storage structure (smMS) and file system implementation (smFS).

2.3. Protection and Security (PS)

Protection is an internal problem. However, security must consider both the computer system and the environment. To defend the processes from cyber threats is essential for the operating systems. Protection refers to a mechanism for controlling the access of programs, processes, or users to the resources. These are determined by the computer system [2],[5]. Computer resources must be guarded against cyber terrorists, cyber activists and special cyber attack teams. PS criteria include two subcriteria for ANP model. These are protection (psPR) and security (psSE).

2.4. Distributed Structure (DS)

A distributed system is a collection of processors that do not share memory or a clock. Instead, each processor has its own local memory, and the processors communicate with one another through communication lines such as local area or wide area networks. Main topics related with distributed structure are network structures, distributed system structures, distributed file systems and distributed coordination. It is important to know that it is sometimes impossible to determine the exact events order in a distributed system. Timestamps and mutual exclusion can be used to provide a consistent event ordering [2],[5]. DS criteria consisted of two subcriteria: distributed file systems (dsDF) and distributed coordination (dsDC).

2.5. Software Features (SF)

An operating system must provide applications and tools, bugs and coding, graphical user interface, availability and support criteria [3]. Programming Interface provides several ways for developers to access to system resources such as kernel objects, I/O devices and etc. Graphical User Interface takes advantage of the computer’s graphics capabilities to make interacting user and operating system easier. Applications and tools must be always available and should be supported by developers in order to satisfy user requests

[2],[5]. In this study, operating system's software features are evaluated for their specialities. Programming interface (sfPI), graphical user interface (sfGU), availability and support (sfAS) are selected software features subcriteria for proposed ANP model.

3. ANP and Choquet Integral

3.1 Overview of ANP

The ANP is a relatively simple and systematic approach that can be used by decision makers [6],[7],[8]. ANP is a general form of AHP, introduced by Saaty [9],[10]. The AHP also is a case of the ANP and contains neither feedback between nor loops within the criteria clusters representing inner dependence. Reaching a conclusion is sometimes impractical and unclear to acquire exact judgments in pairwise comparisons. ANP can meet required formation for uncertain and vague pairwise comparisons [11],[12]. ANP method also gives better elucidation in decision making process [13]-[16]. Basic definitions of ANP are given below.

Definition 1:

A local priority vector (eigenvector), *w*, is computed as an estimation of relative importance of the elements compared by solving the following equation [9].

$$Aw = \lambda_{\max} w \tag{1}$$

where $\lambda_{\max}$ is the largest eigenvalue of the pairwise comparison matrix A.

Definition 2:

Saaty [9] proposed a normalization algorithm for approximate solution for w. The matrix, which shows the pairwise comparison between factors, is obtained as follows:

$$A = \left[a_{ij}\right]_{nxn} \qquad i = 1, \ldots\ldots., n \tag{2}$$

Significance distribution of factors as a percentage is obtained as follows:

$$B_i = \left[b_{ij}\right]_{nx1} \qquad i = 1, \ldots.., n \tag{3}$$

$$b_{ij} = a_{ij} \Big/ \sum_{i=1}^{n} a_{ij} \tag{4}$$

$$C = \left[b_{ij}\right]_{nxn} \qquad i = 1, \ldots\ldots, n \quad j = 1, \ldots.., n \tag{5}$$

$$w_i = \sum_{j=1}^{n} c_{ij} \Big/ n \qquad \Rightarrow W = [w_i]_{nx1} \tag{6}$$

Definition 3:

Consistency of pairwise matrix is checked by consistency index (CI). The consistency of elements comparisons are calculated as follows:

$$D = \left[a_{ij}\right]_{nxn} \; x \; \left[w_i\right]_{nx1} = \left[d_i\right]_{nx1} \tag{7}$$

$$E_i = \frac{d_i}{w_i} \qquad i = 1, \ldots\ldots.., n \tag{8}$$

$$\lambda = \sum_{i=1}^{n} E_i \Big/ n \tag{9}$$

$$CR = CI/RI \tag{10}$$

In the equations above, CI, RI and CR represent consistency indicator, random indicator and consistency ratio, respectively. For accepted consistency, CI must be smaller than 0.10 [9].

Definition 4:

If the matrixes is irreducible and primitive, the limiting value is obtained by raising *w* to powers, as shown in the following expression [18]:

$$W^{\infty} = \lim_{k \to \infty} W^k \tag{11}$$

Definition 5:

The supermatrix representation of a hierarchy with three levels is as follows:

$$W = \begin{array}{r} \\ goal \\ criteria \\ alternatives \end{array} \begin{array}{c} \begin{array}{ccc} \text{g} & \text{c} & \text{a} \end{array} \\ \begin{bmatrix} 0 & 0 & 0 \\ w_{21} & 0 & 0 \\ 0 & w_{32} & I \end{bmatrix} \end{array}$$

where w_{21} vector that represents the impact of the goal on the criteria, w_{32} is a vector that represents the impact of the criteria on each of the alternatives. *I* is the identity matrix. *W* is referred to a supermatrix [19].

3.2 Choquet Integral

The choquet integral method can be seen as a fuzzy integral method based on any fuzzy measure [20]. This provides an alternative computational structure for aggregating information. Sugeno [21] introduces the concepts of fuzzy measure and fuzzy integral to express the grades of importance for criteria, which is useful to model the preference structure. Fuzzy measures, according to Sugeno, are obtained by replacing the additive requirement of classical measures with weaker requirements of monotonicity (with respect to set inclusion) and continuity. Sugeno and Terano [22] integrate the λ-additive axiom to reduce the difficulty of collecting information. In literature choquet integral has been used in different studies and applications [8]-[11].

3.2.1. Fuzzy Measure

Fuzzy measure *g* is a set function defined on the power set $\beta(X)$ of X and satisfies the following properties [12],[13]:

If there are two criteria such as A and B;

$$g:\beta(X)\rightarrow[0,1]$$

$$g(\varnothing)=0,\qquad g(X)=1$$

(Boundary conditions) (12)

$$if\ A,B\in\beta(X)\quad and\quad A\subset B\ \ then\quad g(A)\le g(B)$$

(Monotonicity) (13)

$$In\,\beta(X),\ if\ \ A_1\subset A_2\subset A_3\subset A_4\subset,\ldots,$$
$$and\ \bigcup_{i=1}^{\infty}A_i\in\beta(X),$$
$$then\ lim_{i\to\infty}g(A_i)=g(\bigcup_{i=1}^{\infty}A_i)$$

(Continuity from below) (14)

$$In\,\beta(X),\ \ if\ \ A_1\supset A_2\supset A_3\supset A_4\supset,\ldots,$$
$$and\bigcap_{i=1}^{\infty}A_i\in\beta(X),$$
$$then\,lim_{i\to\infty}g(A_i)=g\left(\bigcap_{i=1}^{\infty}A_i\in\beta(X)\right)$$

(Continuity from above) (15)

A λ-fuzzy measure g_λ is a measure with the following property:

$$\forall A,B\in\beta(X),\quad A\bigcap B=\varnothing \tag{16}$$

$$g_\lambda(A\bigcup B)=g_\lambda(A)+g_\lambda(B)+\lambda g_\lambda(A)g_\lambda(B)$$

where $\lambda\in(-1,\infty)$ (17)

If $X=\{x_1,x_2,\ldots,x_n\}$ fuzzy density $g_i=g_\lambda(\{x_i\})$ will have the following form: (18)

$$g_\lambda(\{x_1,x_2,\ldots,x_n\})=\sum_{i=1}^{n}g_i+\lambda\sum_{i_1=1}^{n-1}\sum_{i_2=i_1+1}^{n}g_{i_1}g_{i_2}+\ldots \tag{19}$$
$$+\lambda^{n-1}g_1g_2,\ldots,g_n$$

$$=\frac{1}{\lambda}\left|\prod_{i=1}^{n}(1+\lambda g_i)-1\right|\quad for-1\le\lambda<\infty \tag{20}$$

If $\lambda>0$ then $g_\lambda(A\cup B)>g_\lambda(A)+g_\lambda(B)$. This means that the evaluation of the set {A,B} is larger than the sum of evaluations for the sets {A} and {B}. *This is called* ***superadditivity***. i.e., the multiplicative effect exists in {A, B}.

If $\lambda<0$ then $g_\lambda(A\cup B)<g_\lambda(A)+g_\lambda(B)$ This means that the evaluation of the set {A, B} is smaller than the sum of evaluations for the sets {A} and {B}, i.e., the substitutive effect exists in {A, B}. *It is called* ***subadditivity***.

If $\lambda\neq0$ indicates that the λ-fuzzy measure g_λ is ***nonadditivity*** and there is an interaction betweenA and B.

If $\lambda=0$ then $g_\lambda(A\bigcup B)=g_\lambda(A)+g_\lambda(B)$. This means that the evaluation of the set {A, B} equals to the sum of evaluations for the sets {A} and {B} It is called additivity. If $\lambda = 0$ indicates that the λ-fuzzy measure g_λ is additive, and there is no interaction between A and B.

The fuzzy measure is often used with fuzzy integral for the purpose of aggregating information evaluation.

3.2.2. Fuzzy integral

Let h be a measurable function from X to $[0,1]$. Assuming that $h(x_1) \geq h(x_2) \geq .... \geq h(x_n)$ then a fuzzy integral (Eq.21) is defined as follows [21],[29],[30].

$$(C)\int hdg = h(x_n)g(H_n)+\left[h(x_{n-1})-h(x_n)\right]g(H_{n-1})+\ldots+\left[h(x_1)-h(x_2)\right]g(H_1)$$
$$= h(x_n)\left[g(H_n)-g(H_{n-1})\right]+h(x_{n-1})\left[g(H_{n-1})-g(H_{n-2})\right]+\ldots+h(x_1)g(H_1) \qquad (21)$$
$$where\ H_1=\{x_1\}, H_2=\{x_1,x_2\},\ldots\ldots, H_n=\{x_1,x_1,\ldots,x_n\}=X$$

The basic concept of Eq. (13) can be illustrated as shown in Fig.2.

Furthermore,
if λ=0 and $g_1 = g_2 = ... = g_n$
then $h(x_1) \geq h(x_2) \geq .... \geq h(x_n)$ (22)
is not a necessary condition.

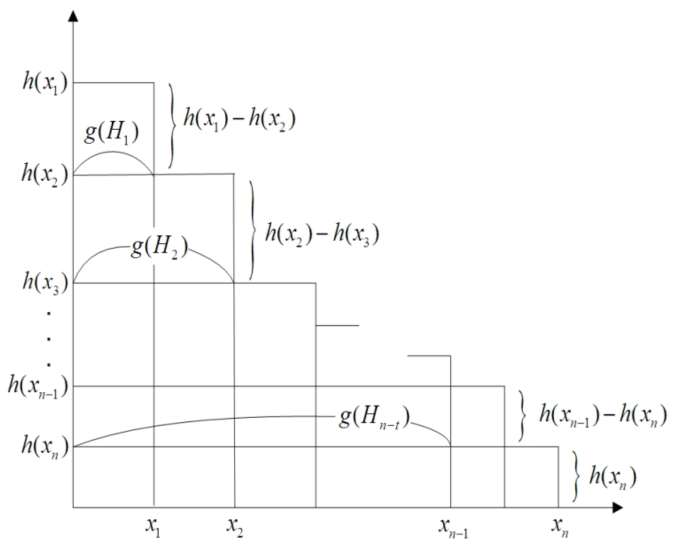

Fig. 2. The graphical illustration of choquet integral.

4. Proposed ANP-Choquet Integral OS Selection Model

In this study, an ANP based choquet integral decision support system is developed. SuperDecisions software is applied for ANP model since it allows researchers for deriving local priorities as well as for solving some complex matrix operations, such as raising the supermatrix to powers. The architecture of OS selection model is compiled of two main stages: setting up ANP model for obtaining weight values and using choquet integral for selection process (Fig. 3). ANP model has evaluated process management (PM), storage management (SM), protection and security (PS), distributed structure (DS), software features (SF) and their subcriteria. Choquet integral has used PM, SM, PS, DS and SF criteria's weights as input in fuzzy integral calculation process.

Five popular and widely used operating systems evaluated in this section. These are Ubuntu (UBT), Ms-Win (WIN), MAC, Fedora (FED) and Slackware (SLACK). Evaluation process made according to PM, SM, PS, DS and SF criteria. Evaluation stages and their steps are given below (see also Appendix A).

Stage 1: Analytic Network Process (ANP)

Step 1: Determine clusters, critera and subcriteria to be used in the proposed model. The main selection criteria and subcriteria are identified in this step by the OS experts. Five criteria PM, SM, PS, DS and SF are determined as alternatives for the ANP model.

Step 2: Set up ANP network structure including clusters, criteia and alternatives using Super Decisions software. The model is formed by criteria and alternatives determined in the first step (Fig.4).

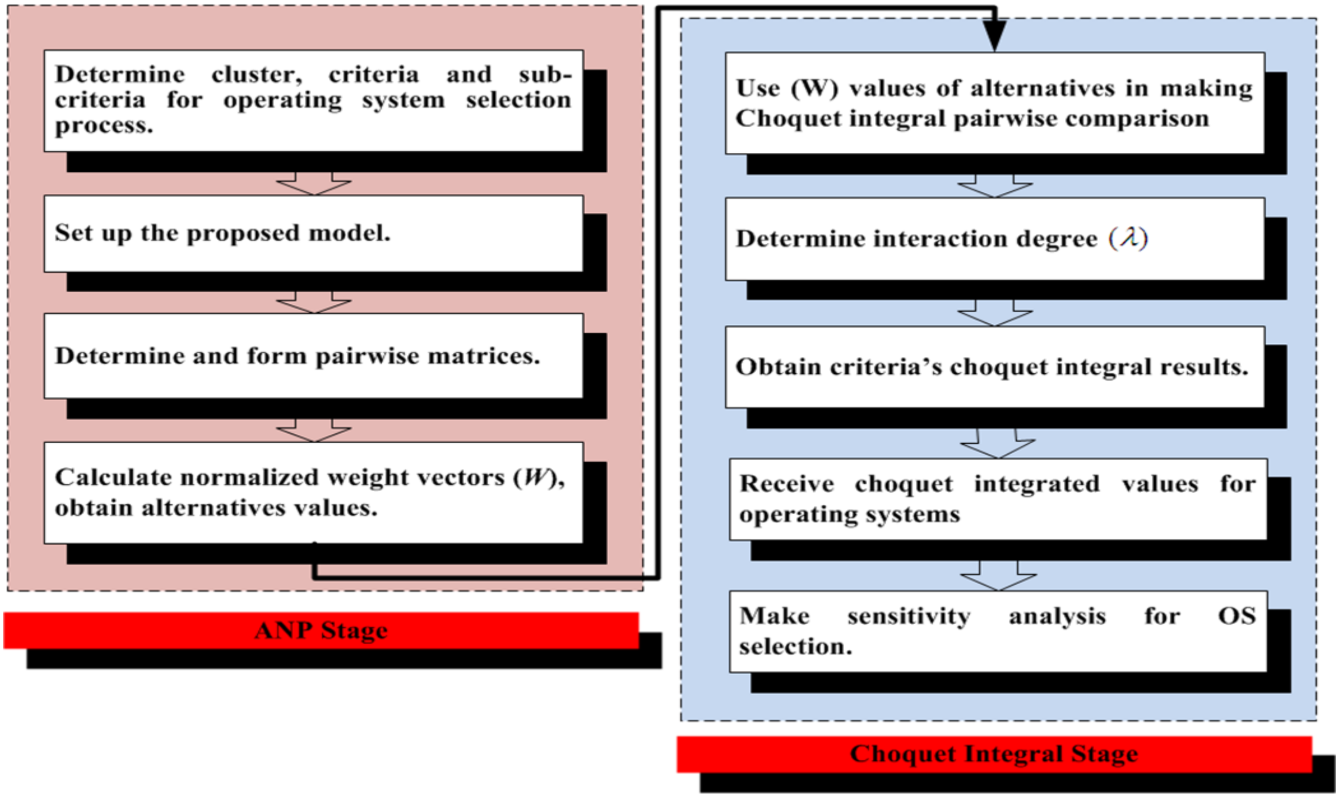

Fig. 3. Main stages and steps of OS selection model.

Table 1. Scale of relative importance [9],[31]

Intensity of Importance	Definition
1	Equal importance
3	Moderate importance
5	Essential or strong importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	Intermediate value between adjacent scale values

Step 3: Construct and form pairwise comparison matrixes of the criteria. Inserted data to ANP model must include relative importance in order to take into account relative weights [19]. Pairwise comparison matrixes are formed by computer experts using the scale given in Table 1.

Step 4: Calculate normalized weight vectors (w) and obtain alternative values from limit matrix. Super Decisions limit the weighted supermatrix by raising it to a sufficiently large power k (where k is an arbitrarily large number) until it converges into a stable supermatrix. The weighted supermatrix is raised to large powers until all elements in each row converge in the software. Limit supermatrix shows the importance weights of factors (See Appendix B limit matrix table of proposed ANP model)

Stage 2: Choquet Integral and OS Selection

Step1: Use ANP weight values for choquet integral

Pairwise comparison is a widely used judgement method either for deriving criteria-weights or for evaluating alternatives according to a given criteria [9],[17].

ANP model gives us weights of alternatives when it is solved (Table 2- check these results in limit matrix-Appendix B) Obtained weight results are used for choquet integral calculations.

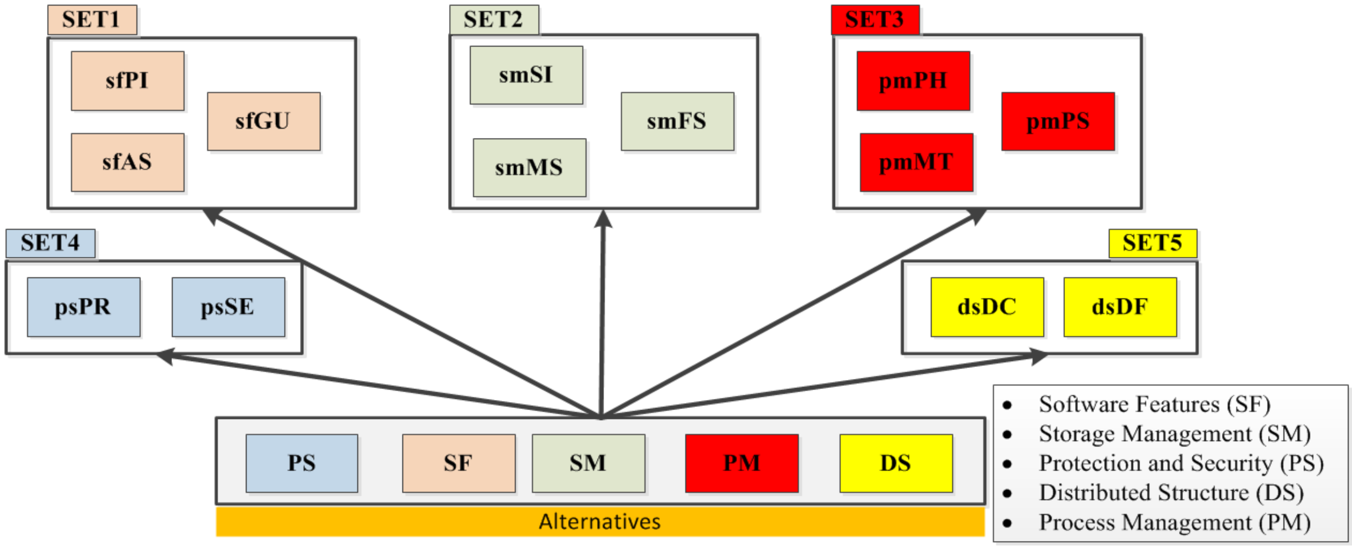

Fig. 4. Proposed ANP model.

Table 2. ANP criteria outputs.

Main Criteria Used in Choquet Integral	Weights
DS	0.08304
PM	0.00714
PS	0.01495
SF	0.00476
SM	0.00346

Step 2. Determining interaction degree

Interaction degree λ is used in the evaluation. λ =3 in model.

Step 3. Obtaining results

Obtained results from proposed example are given in Appendix A. Evaluation scores for operating systems' criteria are; {DS}= 0.5870, {PM}= 0.0304, {PS}=0.0668, {SF}= 0.0199 and {SM}= 0.0144. Here, DS criteria got the high score then others.

Step 4. Choquet integrated values

Operating system experts gave score to each OS for Ubuntu, MS-Win, Mac, Fedora and Slackware (Table2). Operating systems have been evaluated over 10. For instance, Ubuntu scores are DS= 8, PM= 7, PS=8, SF= 8, SM= 7 as seen Table 3.

Table 3. Choquet integrated values.

	DS	PM	PS	SF	SM	Choquet Integrated Values
UBT	8	7	8	8	7	7.83788
WIN	6	7	8	7	6	6.19645
MAC	8	5	7	8	9	7.47576
FED	8	6	8	8	8	7.77701
SLACK	6	8	7	8	6	6.18179

Ubuntu OS received the highest score of 7.837 at the end of the calculation process.

Step 5. Sensitivity analysis

From the coloured graph (Fig 5), Mac OS (Blue line) is most preferred OS when $\lambda < 0.5$. If λ value increases, $\lambda > 0.5$, then Ubuntu OS gets high score. Ubuntu is the best OS between $10 > \lambda > 0.5$ values. If λ value remains between $6 > \lambda > 0.5$, OS order of preference will be the same. When λ is $8 > \lambda > 6$, Win OS will be third one.

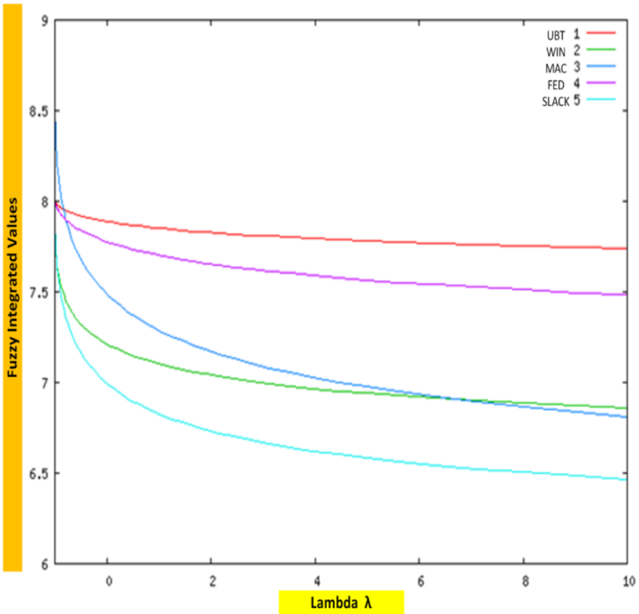

Fig. 5. Sensitivity analysis.

5. Conclusion

Today the number and impact of cyber-threats are increasing rapidly. Selection of appropriate operating system has vital importance for organizations, government agencies, and enterprises. A firm may have some positive results in its interested competition area. It is possible to get better results in costs, time-efficiency and increased work performance by using suitable OS. In this paper, ANP based choquet integral was used to select for some of widely preferred and used for operating systems. Pairwise matrix calculation for determining the weights of the criteria and priority values of operating systems has been done by ANP method and then choquet integral was used. Although choquet integral has complex calculation procedure, it is a useful approach for evaluating multiple criteria alternatives. Choquet integral is one of the outranking methods for multi-criteria decision-making and can be used for ranking alternatives. This approach enables experts and users to select more suitable operating system for a specific purpose and requirement.

Previos studies have shown that if a selection model contains many criteria and subcriteria, this may results possibility of conflict and complexity. Thus, unlike previous OS selection studies, this study made a different approach in using the ANP alternatives as input for choquet integral. The interdependence among the criteria should be taken into consideration by computer experts in order to select appropriate OS. ANP based choquet OS selection efforts will create overall improvement instead of using single ANP method.

ANP based choquet integral is a strong reasoning method under conditions of incertitude. The finding of this research indicates that the prediction result of ANP based choquet integral is more suitable than single ANP model. Two phase OS selection process evaluates many OS selection criteria and their subcriteria. Therefore, model gives trustable OS selection results

The researchers may compare the performance of ANP-choquet integral with other meta-heuristics (e.g. genetic algorithm, artificial neural network, fuzzy neural networks) specifically to test whether choquet integral approach has any advantage in operating system selection.

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APPENDIX

Appendix A: Main steps of λ Fuzzy Measure-Fuzzy Integral, and Choquet Integral Evaluation Scores (Table A).

Appendix B: Limit matrix of ANP model (Table B).

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APPENDIX A

Infrastructure of main steps; λ Fuzzy Measure and Fuzzy Integral [28]

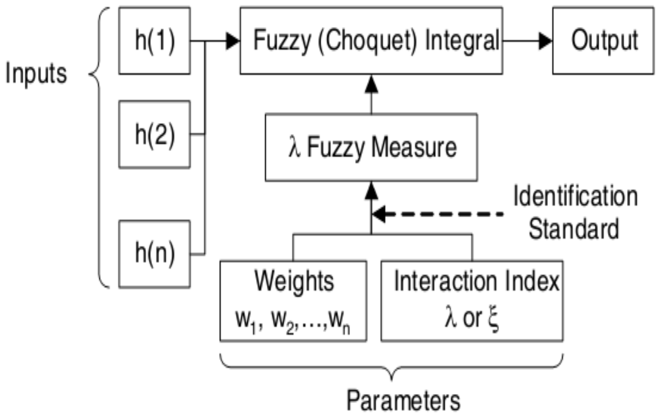

Table B. Identified Fuzzy Measure for OS Criteria

Sets	Fuzzy Measure
{}	0
{DS}	0.587003
{PM}	0.0304166
{DS, PM}	0.670984
{PS}	0.0668746
{DS, PS}	0.771645
{PM, PS}	0.103394
{DS, PM, PS}	0.872474
{SF}	0.0199812
{DS, SF}	0.642172
{PM, SF}	0.0522211
{DS, PM, SF}	0.731186
{PS, SF}	0.0908646
{DS, PS, SF}	0.837882
{PM, PS, SF}	0.129573
{DS, PM, PS, SF}	0.944755
{SM}	0.0144082
{DS, SM}	0.626784
{PM, SM}	0.0461395
{DS, PM, SM}	0.714395
{PS, SM}	0.0841735
{DS, PS, SM}	0.819407
{PM, PS, SM}	0.122271
{DS, PM, PS, SM}	0.924595
{SF, SM}	0.0352531
{DS, SF, SM}	0.684337
{PM, SF, SM}	0.0688865
{DS, PM, SF, SM}	0.7772
{PS, SF, SM}	0.1092
{DS, PS, SF, SM}	0.888507
{PM, PS, SF, SM}	0.149581
{DS, PM, PS, SF, SM}	1

APPENDIX B

Table B. Limit matrix of proposed ANP model

	DS	PM	PS	SF	SM	sfAS	sfGU	sfPI	smFS	smMS	smSI	pmMT	pmPH	pmPS	psPR	psSE	dsDC	dsDF
DS	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304	0.08304
PM	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714	0.00714
PS	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495	0.01495
SF	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476	0.00476
SM	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346	0.00346
sfAS	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592	0.06592
sfGU	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373	0.16373
sfPI	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712	0.02712
smFS	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519
smMS	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994	0.01994
smSI	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511	0.01511
pmMT	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505	0.01505
pmPH	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519	0.02519
pmPS	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532	0.01532
psPR	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483	0.14483
psSE	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311	0.1311
dsDC	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541	0.15541
dsDF	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274	0.08274