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Research Article
A New Conceptual Model for BYOD Organizational Adoption

Zainab Alansari, Safeeullah Soomro, Mohammad Riyaz Belgaum and Shahaboddin Shamshirb

AMA International University, College of Computer Studies, Building 829, Road 1213, Block 712, P.O. Box 18041, Salmabad, Kingdom of Bahrain

Abstract

Background and Objective: Due to rapid growth in the information technology, enterprises are seeking the most reliable and valuable solutions for their profits. One of recent solutions is to applying a method of Bring Your Own Device (BYOD) in organizations. The primary aim of this study is to identify and prioritize the criteria influencing the BYOD organizational adoption. **Materials and Methods:** The implementation of BYOD allowed the employees to use their personal devices for organizational tasks. This study proposed a new conceptual model regarding the same which contains two main criteria and five sub-criteria for each. The proposed method is based on modified fuzzy-AHP (Analytic Hierarchy Process) approach which is used to find the weight of each criterion and sub-criterion. **Results:** Among the ten sub-criteria influencing the BYOD organizational adoption, the Information Security Policies (with a final weight of 0.186) is placed in the first priority and Technical Complexity (with a final weight of 0.008) is positioned in the last priority. **Conclusion:** In this study, a new conceptual model is suggested by identifying the criteria influencing BYOD organizational adoption. On the basis of results, it is concluded that the proposed technique can enhance the quality in an organization.

Key words: Bring your own device adaption, modified fuzzy, analytic hierarchy process

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Corresponding Author: Zainab Alansari, AMA International University, College of Computer Studies, Building 829, Road 1213, Block 712, P.O. Box 18041, Salmabad, Kingdom of Bahrain Tel: +97333375525

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Organizations are seeking to increase the availability and exchange of data with the minimum cost due to the rapid growth of information technology[1]. Although many organizations are aware of the technologies advantages such as portable computers, still many of these technologies are not welcomed due to the control issues and data security[2]. One of the recent method which is used by enterprises is BYOD which is the abbreviation of Bring Your Own Device. By applying this method, all the employees and sometimes the customers can use their personal devices for organizational tasks[3]. In fact, BYOD means using personal devices to conduct official business duties[4].

Advantages and challenges of using BYOD can be examine in three parts: Organizations, consumers and IT department of an organization. In some of these avails, the freedom of using personal devices will increase the work style and personal values. Using personal devices for organizational tasks and individual works will increase job satisfaction, reduce the complexity of using employer's device and improve the work experience. Organizations can also achieve some profit by using BYOD policy. The employees spend more time to devote to tasks, especially on holidays. Therefore, BYOD is an important lead to employee's empowerment.

One of the activities of the IT department in organizations is the management of the IT equipment's life cycle. BYOD is an opportunity for the IT department to get relieved of the device's life cycle management which is considered as a part of a nonstrategic asset of an organization. One of the other tasks of IT department is to teach the employees how to use the organizational devices which by BYOD implementation, the employees can use their personal devices which require less training[5]. Moreover, the significant tasks of saving the device's life cycle and maintenance will be assigning to themselves. By eliminating these jobs, IT departments can devote more time to strategic projects[6].

Recently, Businesses are seeking to achieve the benefits of productivity and return on investment through customer's technology (e.g., smartphones and tablets)[7]. According to IDG Enterprise study in December 2013[8], Over 1155 experts in the IT field, Staff and consumer's devices are widely accessing to applications and companies have many expectations from this process. Nearly half of the experts believe that mobile phone applications, increases individual productivity and almost 70% have witnessed to the return of capital by using consumer devices (phones and tablets)[8].

According to the review of previous studies, there is no article to consider and prioritize the criteria affecting the acceptance and implementation of BYOD. Only Hensema[3] studied the same which assume that productivity and catalyst conditions are the two important criteria of BYOD organizational adoption; however, most of the research literature focused on security and sovereignty. Amoako-Gyampah and Salam[9] used the advanced finding model of technology acceptance to implement the enterprise resource planning system.

Based on consumers' increasing use of personal devices in performing tasks and risks or benefits of using these devices as well as the consideration of policy criteria and the adoption technology criteria which were not considered by previous researches, providing a model to guide the organizations for BYOD implementation seems necessary.

MATERIALS AND METHOD

The conceptual model of this research is a combination of previous relevant studies and interviews with experts. According to investigations carried out, the model presented in this study considers as a new model as it presents a new framework for identifying the factors influencing BYOD organizational adoption which was not provided in any of the previous studies. Figure 1 shows the conceptual model of research.

To design the research conceptual model, the previous relevant studies were reviewed and after identifying the key criteria and interviewing with experts, the criteria that are affecting the BYOD organizational adoption have been divided into two groups as "Behavioural Intention of Using Technology" and "Policy-Specific Criteria". According to the available published papers, each of these criteria are divided into five sub criteria. The following, will be some discussing on the criteria and sub-criteria of the new conceptual model.

Behavioral intention of using technology:

- **Tangible results using technology:** The understanding level which gained from technology adoption results. The people accept the new technology when the results have positive impact and they feel it worth the effort[10]
- **Relation to work:** When the technology is consistent with the job, people are more willing to accept[10]
- **Management support:** This is the primary criteria in technology adoption. Commitment of top management is essential to ensure the adoption by creating a supportive context for IT organizations[10]
- **Technical support:** Involves the technical aspects of user needs such as education, guidance and advice from experts[10]

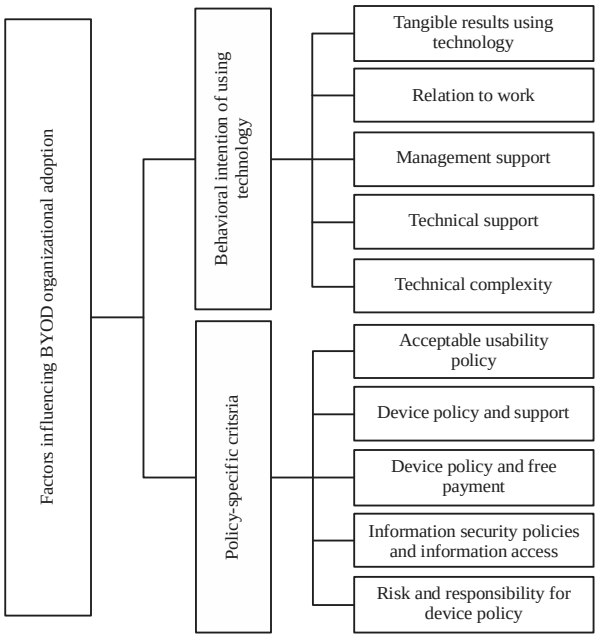

Fig. 1: Conceptual Model (BYOD Organizational Adoption)

- **Technical complexity:** It states the understanding of the difficulties' amount (degrees) to realize and use the certain types of information technologies[10]

Policy-specific criteria:

- **acceptable usability policy:** Involves in an agreement between the employee and the organization. Based on which employees must follow certain rules (Such as the level of authorized use of the system in working hours) [11]
- **Device policy and support:** Defines policies such as the level of organization support of different operating systems, Self-determination of supported devices, Determining the level of access to data and applications and the manner of device support by the IT department[2]
- **Device policy and fee payment:** Organizations must determine the amount and manner of personnel equipment costs payment, Communication and exchange of data and taxes[12]
- **information security policies and information access:** Includes policies such as not being able to connect to unsecured networks, Use of special browsers, Some restrictions on access or upload of data and data transfer[13]
- **risk and responsibility for device policy:** There should be guidelines to determine clearly that whom the devices and data belong to? Who is responsible for devices data loss? and what is the organization responsibility of individual's personal data loss[2]?

Fuzzy analytic hierarchy process (FAHP): FAHP is a method which by developing AHP based on fuzzy logic, allows the researchers to use the non-exact data in the analysis. In this study, the researchers used the triangular fuzzy numbers proposed by Hu *et al*.[14] Which can be seen in Table 1.

Modified fuzzy analytic hierarchy process (FAHP) with development analysis of Chang, DA-yong: For the implementation of AHP with fuzzy logic, in 1996, Chinese researchers called Chang[15] presented a development analysis. The numbers that are used in this method are triangular fuzzy numbers. Each triangular fuzzy number is shown with Eq. 1 and 2 is subjected to the Eq. 3 joint functions:

$$\tilde{A} = (l, m, u) \tag{1}$$

$$l \leq m \leq u \tag{2}$$

$$\tilde{u}(x) = \begin{cases} 0 & x < l \\ (x-l)/(m-l) & l \leq x \leq m \\ (u-x)/(u-m) & m \leq x \leq u \\ 0 & x > u \end{cases} \tag{3}$$

In the paired comparisons method, for each of the matrix rows, the Sk value which is also a triangular fuzzy number is calculated using Eq. 4:

Table 1: Qualitative terms and their corresponding triangular fuzzy numbers

Linguistic variables	No. of positive triangular fuzzy	No. positive reciprocal triangular fuzzy
Extremely strong	9, 9, 9	0.11, 0.11, 0.11
Intermediate	7, 8, 9	0.11, 0.13, 0.14
Very strong	6, 7, 8	0.13, 0.14, 0.17
Intermediate	5, 6, 7	0.14, 0.17, 0.20
Strong	4, 5, 6	0.17, 0.20, 0.25
Intermediate	3, 4, 5	0.20, 0.25, 0.33
Moderately Strong	2, 3, 4	0.25, 0.33, 0.5
Intermediate	1, 2, 3	0.33, 0.5, 1
Equally Strong	1, 1, 1	1, 1, 1

$$S_k = \sum_{j=1}^{n} M_{kj} \times \left[\sum_{i=1}^{m}\sum_{j=1}^{n} M_{ij}\right]^{-1} \quad (4)$$

The k represents the number of rows, the i and j represents options and criteria respectively. In this method, after calculating Sk, the large degree towards each other has to be calculated. In general, if M_1 and M_2 are two triangular fuzzy numbers, the large degree of M_1 towards M_2 will be defined as Eq. 5:

$$\begin{cases} V(M_1 \geq M_2) = 1 & \text{if } m_1 \geq m_2 \\ V(M_1 \geq M_2) = \text{hgt}(M_1 \cap M_2) & \text{if } m_1 \leq m_2 \end{cases} \quad (5)$$

So, that will have Eq. 6:

$$\text{hgt}(M_1 \cap M_2) = \frac{(l_2 - u_1)}{(m_1 - u_1) - (m_2 - l_2)} \quad (6)$$

Furthermore, to calculate the weights of the criteria in the matrix of pairwise comparisons the Eq. 7 will be used:

$$W(Xi) = \min \{V(S_i \geq S_k)\}\ k = 1, 2, ..., n;\ k \neq I \quad (7)$$

Therefore, measuring the vector weight will be calculated using Eq. 8 which is the non-weighted coefficients vector of FAHP:

$$W' = [W'(x_1), W'(x_2), ..., W'(x_n)]^T \quad (8)$$

These matrices will be weighted with the help of Eq. 9:

$$W_i = \frac{W_i'}{\sum W_i'} \quad (9)$$

To achieve a holistic perspective in decision-making which is an outcome of all the expert's opinion, the paired comparison matrices must be combined. To achieve this purpose, the geometric mean method will be used in group decision-making. The Eq. 10 shows the relationship between the composition of the experts. In this definition, L is the number of decision makers:"

$$X_{ij} = \left(\prod_{L=1}^{k} \tilde{X}_{ijL}\right)^{\frac{1}{k}} \quad (10)$$

In most of the available resources such as books and articles, the FAHP along with Chang's development analysis is used. This method is used sometimes in calculating the negative weights of criteria and sub-criteria which are considered as its primary defect. For preventing the calculation of negative weights and solving these problems, Chang proposed that firstly the decision matrix converts to normal cellular and then run the FAHP along with Chang's development analysis. Most of the researchers didn't pay attention to this solution. This study uses the modified Chang's method which is normalization of cellular matrix before using the technique, to prevent the calculation of negative weights.

Reliability Assess in multi-criteria decision-making techniques is different from reliability Assess in statistics. For each extracted decision matrix from the expert's view, the percentage of incompatibility must be calculated. Thus, it will show if there is any reasonable consistency between paired comparisons decision makers. To determine the reliability of fuzzy decision making, the incompatibility percentage of each of the final matrix is calculated. If the definite matrix of paired comparisons is consistent, paired comparisons will be a compatible matrix phase16. Therefore, the fuzzy decision matrix changes to matrices containing final numbers. For this purpose, the Center of Area (CA) method is used which means converting the fuzzy numbers to non-fuzzy numbers. Calculation of this approach for fuzzy numbers is shown in Eq. 11:

$$CA = \frac{(u - l) + (m - l)}{3} + l \quad (11)$$

Table 2: Final weight of the two criteria to target and prioritize them

Criteria's sign	Criteria's name	Criteria's weight	Priority
C1	Behavioral intention of using technology	0.398	2
C2	Policy-specific criteria	0.602	1

Table 3: Final weight of all criteria and sub-criteria and prioritize them

Criteria's	Sub-criteria	Sub-criteria's weight	Final sub-criteria's weight	Priority
Behavioral intention of using	Tangible results using technology	0.352	0.140	3
	Relation to work	0.176	0.070	6
	Management support	0.332	0.132	5
	Technical support	0.119	0.047	9
	Technical complexity	0.021	0.008	10
Policy-specific criteria	Acceptable usability policy	0.271	0.163	2
	Device policy and support	0.113	0.068	7
	Device policy and fee payment	0.224	0.134	4
	Information security policies and information access	0.309	0.186	1
	Risk and responsibility for device policy	0.083	0.049	8

RESULTS

For the result AHP and Chang[15] approach were implemented and weight of each criterion were calculated. As can be seen in Table 2, the Policy-specific criteria with the weight of 0.602 is more important than the criteria of Behavioral Intention of Using Technology and achieved the first rank.

After calculating the weight of main criteria's, the weight of sub-criteria's has to be estimated and prioritized. Therefore, each sub criteria have to multiply by its main criteria. The results of these calculations are presented in Table 3.

DISCUSSION

This study is benefited from a group decision-making process and decision tables shows all the result of the geometric mean of all of the 11 completed questionnaire by experts, managers and IT specialist in Bahrain (For the brevity sake, presenting of each table and FAHP was prevented).

Integrated matrix derived from expert opinion is given and calculating the percentage of inconsistency tables, all were obtained a result less than 1.0, which represents its consistency and reliability. Finally, it proceeded to criteria prioritizing using Chang's finding developed methods. To prevent the calculation of negative weights, first converting the regular decisions matrices to cellular matrices and then applying FAHP with chang[15] development Analysis approach. It is notable that for shortening the article, the details of each calculating were filtered and only cellular normalized decision tables are shown. Other sub-criteria priorities are shown in Table 3.

CONCLUSION

This study proposed a new conceptual model by identifying the criteria influencing BYOD organizational adoption. Previous studies did not explore the issues raised in this research or just have been referred shortly. The study, by the use of interviews, expert opinions and review of previously related researches provided a new conceptual model which includes two main criteria intention in the use of technology and policies. Each of these two criteria also covers five other sub-criteria. This research prioritizes aspects of the conceptual model using modified Fuzzy Analytic Hierarchy Process.

SIGNIFICANT STATEMENTS

BYOD provide high flexibility in any location to increase the employee's access to organizational works.

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