

Using a Multi-Criteria Decision Making Approach for Assessing the Factors Affecting Social Network Sites Intention to Use

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Abstract

Since the emergence of the first Social Networking Site (SNS) as a new means of communicating with other people, much research has attempted to identify empirically and theoretically the characteristics, history, and impact on human relationships of both Social Networking Sites and their users. Users' reasons for joining to Social Networking Sites is one of the research gap in the users' behaviour studies that their focus are on users' participations in Social Networking Site . This research aims to explore the factors that affect the intention to use in Social Networking Sites. Thus, our work aims to contribute to the literature by investigating the influential factors that cause the users adopt a SNS. Accordingly, we apply a Multi-Criteria Decision Making (MCDM) approach, fuzzy AHP, to evaluate the influential factors that cause the users adopt a SNS. Our findings show that the important factors influencing SNS users' intention for general purpose are Trust, Security and Performance expectancy.

Keywords: Fuzzy AHP, Social Networking Site, Adoption factors

1. Introduction

Social networking sites (SNS) have becoming a mass phenomenon, positioning as one of the most popular online means of communication. The contributions of SNS are sharing common interest, increasing the number of contacts and development online communities. Having one or more accounts in the SNS makes it one of the most attractive Internet's activities and now hundreds of millions of SNS applications to attract users and this number is growing rapidly.

Boyd and Ellison (2007) define SNS as "services based on Internet that allow individuals to build a public or semi-public profile within a system, create a list of other users that share a connection, and see and navigate through their list of connections and of those created by others within the system". Know and Wen (2010) defined SNS as "websites that allow building relationships online between persons by means of collecting useful information and sharing it with people. Also, they can create groups which allow interacting amongst users with similar interests". SNS specifically offer the users a space where they can maintain and create new relationships, as well as share information (Kolbitsch and Maurer 2006).

SNSs support the new connection among internet's users and remain previous social ties. For these reasons they have immense importance for both parties (individuals and businesses)(Alarcón-del-Amo, Lorenzo-Romero, & Del

Chiappa, 2013). There are numerous SNS build on various technologies, supporting a wide range of interests and practices. There are different kind of users with different cultures, tastes, etc., which emerge around the different kind of SNS; some SNS serve a diverse audience, while others attract people based on common interests, demographics, language, nationality (Boyd and Ellison 2007). Despite extensive research has examined the factors that lead people to adopt and use the SNS, few approaches have focused on the assess the importance of influential factors in this adoption process, since in order to understand SNS user behaviour, an initial review of the existing literature on this topic showed a strong focus on user participation and SNS applications, both of them assuming that users are already registered with the SNS. Our work aims to contribute to the literature by investigating the main motivations that a SNS user has for joining a new SNS. Thus, being interested in finding out what the main factors in joining a new SNS are, a fuzzy AHP model was implemented in order to answer this question.

2. Literature review

2.1 Definition

In the Web 2.0 (or Social Web) users are not just simple consumers of content created by professionals but they are

also able to generate, edit and disseminate content (Alarcón-del-Amo, Lorenzo-Romero, & Del Chiappa, 2013) SNS are one of the main application types available in the Web 2.0 environment (Constantinides et al. 2008).

The definition of social network in traditional theory in social network is the society of people and organizations who interact and sharing the value with each other's according to consequential relationships (Garton, Haythornthwaite, & Wellman, 1997; Kempe, Kleinberg, & Tardos, 2003; O'Murchu et al., 2004). Most focus of recently social network service is computer-mediated communication and online virtual community unlike the traditional social network service that their focus was the face to face relationships and friends relationships. Boyd & Ellison (2007) defined Social network services as "web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with those who share a connection, and view their list of connections and also those made by others within the system".

In this study social network services defined as a Web-based service that social networking services are based on a number of valuable and significant relationships such as activities friendship, interests, familial ties and more. Various reasons that cause people use SNS services are building and exploring the relationship, meeting new people, sharing information, provide ways to maintain contact with friends and family (Boyd, 2007). Kang et al (2009) showed that self-image congruity affect and regret are two determination of continues use of SNS services. Some studies introduced self-esteem as a moderator in relationship between social capital and use of SNS (Ellison, Steinfield, & Lampe, 2007; Steinfield, Ellison, & Lampe, 2008).

The importance of Effectual and Social factors are more than task-oriented systems such as office information systems. But until now few efforts have been done regarding them (Rau et al., 2008).

2.2 Factors affecting the adoption of SNS

This section creates a SNS factors by reviewing related researches to identifying the factors that have an effect on the intention to use on SNS. In this section a vast number of earlier studies were reviewed. About 42 papers resulted from reviewed papers which are focused on the effective factors in SNS adoption. The outcome of the review revealed the various determinants/factors of SNS intention behaviour, which is presented in Table 1 at the end of this discussion.

Huang, Hsieh and Wu (2014) looked at the gratifications and social network service usage and the mediating role of online experience and found that users' social gratifications- interaction- arousal were the major determinants that influence SNS users. Kwon, Park and Kim (2014) examined the factors that drive successful social networking services by conducting a comparative analysis of user acceptance of Facebook and Twitter. Their study revealed that perceived mobility, perceived

connectedness, perceived security, perceived usefulness, system and service quality, attitude, and flow experience were the major drivers of Facebook and Twitter users. Pornsakulvanich and Dumrong Siri (2013) investigated the external and internal effects on social networking site usage in Thailand and found them to be SNS motives, and external influences such as gender, age, income, occupation, and education as demographic variable. Their study considered users of Facebook, Hi5, and YouTube.

Choi, Jung and Lee (2013) discussed the factors that make users to switch from a local to a global social network site from a cultural, social, economic, and motivational perspective. They found that cultural factors such as cultural discount and cultural values; social factors such as social capital and network effect; economic factors such as switching cost, sunk cost, and expected benefit; expected benefit such as usefulness and ease of use were responsible for users switch from a local to a global social network site. Member use of social networking sites was empirically examined by Chen (2013). His study showed that enjoyment, social presence, ease of use, extroversion, perceived risk, Internet risk perception, privacy abuse concern, were influencing factors on SNS use by undergraduate students. The Prediction of different conceptualizations of system use: Acceptance in hedonic volitional within the context of Facebook was examined by Lallmahomed et al., (2013). Their findings show that performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic performance expectancy were major determinants in the study. Lu and Yang (2013) found that task characteristics, technology characteristics, social characteristics, task-technology fit, and social-technology fit were responsible for understanding the behavioral intention to use a social networking site. Several other studies have attempted in the past to determine the factors responsible for the adoption and use of SNS (Lin, Chiu, and Lim, 2011; Qin, Kim, Hsu and Tan, 2011; (Choi & Chung, 2013) and the intention to use these SNS (Jairak and Sahakhunchai, 2010; Yen, 2013).

Other studies have looked at the effects of cultural and social influence on users' acceptance of SNS (Qin, Kim, Hsu and Tan, 2011; Li, 2011; Zhang, 2010) while some others have looked at isolated cases of factors or variables that influence SNS usage and adoption such as privacy (Tan, Qin, Kim and Hsu, 2012), trust (Shin, 2010) and culture (Kim, Sohn and Choi, 2011). Bullinger et al., (2011) used Mixed method to conduct an empirical study and propose a model in an attempt to understand online collaboration technology adoption by researchers. Their findings show that performance expectancy (communication benefits and concerning noise), effort expectancy (computer self-efficacy, privacy and online technology experience), social influence (influence of peers and superiors), facilitating conditions (technology-facilitating and resource-facilitating conditions), user resistance (switching benefits and switching costs), were influencing adoption factors for the use of online collaboration technologies by researchers. The findings of

(Sabir, Ahmad, & Noor, 2013a) indicated that Perceived usefulness & social norm proved to be the most important factors. Results of Glass (2013) suggested that perceived ease of use, perceived usefulness and subjective norm critical mass and gender are significant in SNS adoption. Saeed and Sinnappan (2011) suggested a mind-shift in the adoption of Web 2.0 tools as compared to that of traditional Web technologies, i.e., Web 2.0 is more about enjoyment and social presence. (Nasri, 2012) employed in his model perceived enjoyment, snoop, information receiving, news and self-efficacy, in addition to attitude, perceived usefulness, social norm, perceived ease of use and intention to use Facebook. Leng et al., (2011) explored the factors that encourage students to adopt social network sites (SNS) in Malaysia. Their finding proved that perceived enjoyment is a more significant antecedent of attitude as compared to perceived usefulness. (Ernst, Pfeiffer, & Rothlauf, 2013) confirmed that Perceived Belonging positively influences both Perceived Enjoyment and Perceived Usefulness and, hence, also indirectly influences overall SNS adoption behavior. Aharony (2013) predicted factors that may influence the adoption of Facebook by information professionals within their organizations.

El-Haddadeh et al., (2012) offered a comprehensive overview of the adoption of social networking services through identifying various factors associated with ease of use, perceived usefulness, trust and loyalty and advertisement. Zeng & Lu (2012) in their study on one of the SNS showed that perceived enjoyment and perceived usefulness are most determinations of behaviour intention in SNS. The study by Al-Ghaith et al., (2010) showed that the most important factors that affect e-service adoption are, Perceived Complexity, Privacy and Compatibility respectively. The results of study by (Ünal, 2013) showed that (a) Futuristic teachers' do not prefer social networks for recognition and discovery of themselves and their peers in both types of university; (b) Rates of educational use of social networks is reasonably high for futuristic teachers'; (c) according to the type of foundation or state university duration of use of social networks varies for futuristic teachers' (d) levels of social networks is high for futuristic teachers' adoption. (Pai & Arnott, 2013) showed that belonging, self-esteem, hedonism, and reciprocity are the four key factors users attain through SNS adoption. (Jiang, 2011) proposed a conceptual model which places privacy concern as the focal point for SNS acceptance. The study by Al-Ghaith et al., (2010) showed that the most important factors that affect e-service adoption are, Perceived Complexity, Privacy and Compatibility respectively. Cheung and Lee, (2010) found that collective intention to use a social networking site is determined by both subjective norm and social identity. Table 2, shows the definition of factors which have most frequencies in social network sites adoption among different context.

As it is clear in the following table this study focused on those factors which are repeated more than two times among recently published studies. In other words, two is the threshold number for choosing factors in this research. According to (Escobar-Rodríguez & Carvajal-Trujillo, 2014) there are some similarity between some factors. Therefore, based on these similarity in this study perceived usefulness, perceived ease of use and subjective norm are considered as performance expectancy, effort expectancy and social influence respectively. As you can see from the Table 2, relevant factors affecting social network service adoption are included: Performance expectancy, Effort expectancy, Social influence, Facilitating conditions, Self-efficacy, Trust, Privacy, Security, Perceived enjoyment and Attitude toward technology. In the next section, Fuzzy AHP is introduced as a methodology for assessing the factors identified from the literature.

3. Fuzzy AHP

The AHP method was proposed by (Saaty, 1980; Saaty, 1994). Among Multi Criteria Decision Making (MCDM) techniques, it is a powerful approach to solve complex decision problems (Ahmadi et al., 2014; Raisian et al., 2014; Ibrahim et al., 2011; Nilashi et al., 2011a; Nilashi et al., 2011b; Nilashi et al., 2011c). AHP rank and prioritizes the relative importance of a list of criteria in decision making problems (Ahmadi et al., 2015). The elements for ranking can be critical factors and sub-factors which through pairwise comparisons amongst the factors by relevant experts using a nine-point scale are prioritized.

F-AHP was proposed by Buckley (1985) with incorporating the fuzzy theory into the AHP. Buckley (1985) started the F-AHP derives more precisely results rather than AHP for vague and subjective decision making problems. Both quantitative and qualitative can be used in F-AHP. In F-AHP, the uncertain comparison, judgment can be represented by the fuzzy number (Ahmadi et al., 2014). There are several types of membership functions for F-AHP where triangular fuzzy number is the special class of the fuzzy number whose membership defined by three real numbers, expressed as (l, m, u). The triangular fuzzy numbers are represented as follows:

$$\mu_A(x) = \begin{cases} \frac{x-l}{m-l}, & \text{if } l \leq x \leq m \\ \frac{u-x}{u-m}, & \text{if } m \leq x \leq u \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

Table 1

Prior Research on the factors affecting social network sites adoption.

No.	Author(s)/Year	Factors
1	(Huang, Hsieh, & Wu, 2014)	Users' social gratifications- interaction- arousal
2	(S. J. Kwon, Park, & Kim, 2014)	Perceived mobility- Perceived connectedness- Perceived security- Perceived usefulness- System quality - service quality- Attitude- Flow experience
3	(Pornsakulvanich & Dumrong Siri, 2013)	SNS motives- External influences
4	(Chen, 2013)	Enjoyment- Social presence- Ease of use- Extroversion- Perceived risk- Internet risk perception- Privacy
5	(Lallmahomed, Ab.Rahim, Ibrahim, & Rahman, 2013)	Performance expectancy- Effort expectancy- Social influence- Facilitating conditions- Hedonic performance expectancy
6	(Lu & Yang, 2014)	Task characteristics- Technology characteristics- Social characteristics- Task-technology fit- Social-technology fit
7	(G. Choi & Chung, 2013)	Perceived Social Capital- Perceive Usefulness- Perceived Ease of Use- Subjective Norm
8	(Xu, Ryan, Prybutok, & Wen, 2012)	Stylishness- Coordination- Immediate access- Affection- Escape- Disclosure- Leisure- Social presence- Loneliness
9	(Chang & Zhu, 2011)	Information motivation- Entertainment motivation- Connecting with old friends- Meeting new people- Conformity motivation-Attitude- Subjective norm- Perceived behavior
10	Kim, Sohn, & Choi, 2011	Seeking Friends- Seeking convenience-Seeking social support-Seeking information- Seeking entertainment
11	(Qin, Kim, Hsu, & Tan, 2011)	Perceived Ease of Use- Perceived Usefulness - Social -Critical mass -Subjective norm
12	(Shin, 2010)	Perceived security- Perceived privacy- Trust-Attitude
13	(Cheung & Lee, 2010)	Subjective norm- group norm- Social identity
14	(O. Kwon & Wen, 2010)	Social identity-Altruism- Telepresence-Perceived ease of use-Perceived usefulness- Perceived encouragement
15	(Tan, Qin, Kim, & Hsu, 2012)	Perceived usefulness-Perceived ease of use -Privacy concern
16	(Pinho & Soares, 2011)	Perceived usefulness- Perceived ease of use- Attitude
17	(Li, 2011)	Perceived enjoyment- Social influence- Sociability- Status
18	(Pillai & Mukherjee, 2011)	Perceived usefulness- Perceived ease of use- External variables- Attitude toward using
19	(Yen, 2013)	Social Influence- Utilitarian Value- Social Value- Hedonic Value
20	(Zhang, 2010)	Satisfaction- Sense of community- Information quality- System quality
21	(Osorio & Papagiannidis, 2014)	Attitude- Perceived usefulness- Perceived ease of use- Compatibility- Subjective norms- Peer influence- Superior influence- External influence- Perceived Behavioral Control
22	(Alarcón-del-Amo et al., 2013)	Attitude -Perceived usefulness-Perceived ease of use-Trust-Perceived risk
23	(Maier, Laumer, & Eckhardt, 2011)	Utilitarian outcomes- Hedonic outcomes- Social outcomes- Subjective norm- Perceived ease of use- Fear of technology
24	(Jairak & Sahakhunchai, 2010)	Perceived usefulness- Perceived ease-of-use- Perceived enjoyment- Privacy and security concerns- Reputation- Familiarity- Dispositional trust
25	(Kaba & Touré, 2014)	Effort expectancy-Facilitating conditions- Performance expectancy- Social influence- Voluntariness
26	(Choi & Chung, 2013)	Perceived ease of use-Perceived usefulness- Subjective norm- Perceived social capital
27	(Lin, Chiu, & Lim, 2011)	Age- educational level- gender - innovativeness- Relative advantage- Compatibility- Complexity- Trialability- Results demonstrability – Image- Technology cluster-
28	(Sabir, Ahmad, & Noor, 2013)	Perceived Usefulness - Perceived Ease of Use -Intention to Use -Attitude - Self-efficacy - Social Norm - Perceived Enjoyment - Snoop - News - Information receiving
29	(Glass, 2013)	Perceived Ease of Use- Perceived Usefulness- Social Influence- Demographic Factors
30	(Saeed & Sinnappan, 2011)	Perceived ease-of-use- perceived usefulness- perceived enjoyment - subjective norms
31	(Nasri, 2012)	Self-efficacy, subjective norm, perceived enjoyment, snoop- information receiving.

Table 1
Prior Research on the factors affecting social network sites adoption (Cont.).

32	(Leng, G. S., Lada, S., Muhammad, M. Z., Ibrahim, A. A. H. A., & Amboala, 2011)	Perceived ease of use- Perceived usefulness - Perceived enjoyment-Attitude-Social norms- Perceived behavioral control
33	(Ernst et al., 2013)	Perceived Belonging- Perceived Ease of Use- Perceived Enjoyment- Perceived Usefulness
34	(Aharony, 2013)	Extroversion- Agreeable- Conscientious- Neuroticism- Openness- Innovative- Age- Enjoyment- Perceived ease of use
35	(El-Haddadeh et al., 2012)	Perceived ease of use, Perceived usefulness, Trust- Loyalty -Advertisement
36	(Zeng & Lu, 2012)	Information sharing-Social connection-Self presentation- Perceived usefulness- Perceived enjoyment
37	(Ünal, 2013)	Utility (usefulness)- Perceived ease of use - Social influence, Facilitating conditions- Community identity
38	(Pai & Arnott, 2013)	Altruism- Normative pressure-Perceived encouragement- Perceived involvement- Social identity-Trust- Perceived enjoyment/playfulness- Telepresence- Perceived ease of use- Perceived usefulness
39	(Jiang, 2011)	Privacy- Assurance-Privacy- Awareness- Trust
40	(Bullinger, Renken, & Möslin, 2011)	Performance expectancy-Communication benefits –Noise-Effort expectancy- Privacy - Self-efficacy- Online tech’ experience-Social influence - Facilitating condition-User resistance
41	(Al-Ghaith et al., 2010)	Trust- Security- Privacy -Service Quality- Loyalty- Relative advantage- Compatibility- Complexity- Observability
42	(Cheung & Lee, 2010)	Subjective norm- Group norm- Social identity

Table 2
Definition of the important factors of social network sites adoption.

Factor	Definition	Reference
Performance expectancy	“The degree to which an individual believes that using the will help him or her to attain gains in job performance”	Venkatesh et al. (2003)
Effort expectancy	“The degree of ease/effort associated with the use of the system”	Venkatesh et al. (2003)
Social influence	“The degree to which an individual perceives that important others believe that they should use the new system”	Venkatesh et al. (2003)
Facilitating conditions	“The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system”	Venkatesh et al. (2003)
Self-efficacy	“judgment of one’s ability to use a technology to accomplish a particular job or task”	Venkatesh et al. (2003)
Trust	“Trust in SNS is defined as the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a	Shin (2010)
Privacy	“Control over the flow of one’s personal information, including the transfer and exchange of that information. The protection of the user’s privacy to be	Boyd (2008a); Boyd (2008b)
Security	“Users’ perception on security that is perceived security, which is defined as the extent to which a user believes that using a SNS application will be risk-	Shin (2010)
Perceived enjoyment	“as the extent to which the activity of using a social networking site is perceived to be enjoyable in its own right, apart from any associated	Chen (2013)
Attitude toward technology	“an individual’s positive or negative feeling about performing the target behaviour to use SNS”	Shin (2010)

For constructing pairwise comparisons of alternatives under each criterion or about criteria from the experts, similar to the pure AHP, a triangular fuzzy comparison matrix is defined as follows (it can be any type of membership functions):

$$\tilde{A} = (\tilde{a}_{ij})_{n \times n} = \begin{bmatrix} (1,1,1) & (l_{21}, m_{21}, u_{21}) & (l_{1n}, m_{1n}, u_{1n}) \\ (l_{21}, m_{21}, u_{21}) & (1,1,1) & (l_{2n}, m_{2n}, u_{2n}) \\ (l_{n1}, m_{n1}, u_{n1}) & (l_{n2}, m_{n2}, u_{n2}) & (1,1,1) \end{bmatrix} \quad (2)$$

Where $\tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij}) = \tilde{a}_{ij}^{-1} = (1/u_{ij}, 1/m_{ij}, 1/l_{ij})$

Different methods can be used for total weighs and preferences of alternatives which one of them is Fuzzy extent analysis proposed by Chang (1996). The steps of Chang’s extensive analysis can be summarized as follows:

First step: In this step we compute the normalized value of row sums (i.e. fuzzy synthetic extent) by fuzzy arithmetic operations presented in Eq. (3).

$$\tilde{S}_i = \sum_{j=1}^n \tilde{a}_{ij} \otimes \left[\sum_{k=1}^n \sum_{j=1}^n \tilde{a}_{kj} \right]^{-1} \quad (3)$$

In Eq. (3), \otimes denotes the extended multiplication of two fuzzy numbers.

Second step: In this step, we compute the degree of possibility of $\tilde{S}_i \geq \tilde{S}_j$ by Eq. (4):

$$V(\tilde{S}_i \geq \tilde{S}_j) = \text{sub}_{y \geq x}[\min(\tilde{S}_j(x), \tilde{S}_j(y))] \quad (4)$$

Which can be equivalently expressed as,

$$V(\tilde{S}_i \geq \tilde{S}_j) = \begin{cases} 1 & m_i \geq m_j \\ \frac{u_i - l_j}{(u_i - m_i) + (m_j + l_j)} & l_j \leq u_i \quad i, j = 1, \dots, n; j \neq i \\ 0 & \text{otherwise} \end{cases} \quad (5)$$

Third step: In this step, using Eq. (6), we calculate the degree of possibility of \tilde{S}_i to be greater than all the other (n-1) convex fuzzy numbers \tilde{S}_j .

$$V(\tilde{S}_i \geq \tilde{S}_j \mid j = 1, \dots, n; j \neq i) = \min_{j \in \{1, \dots, n\}, j \neq i} V(\tilde{S}_i \geq \tilde{S}_j), \quad i = 1, \dots, n \quad (6)$$

Fourth step: In this step, using Eq. (7), we define the priority vector $W = (w_1, \dots, w_n)^T$ of the fuzzy comparison matrix \tilde{A} as:

$$w_i = \frac{V(\tilde{S}_i \geq \tilde{S}_j \mid j = 1, \dots, n; j \neq i)}{\sum_{k=1}^n V(\tilde{S}_k \geq \tilde{S}_j \mid j = 1, \dots, n; j \neq k)}, \quad i = 1, \dots, n \quad (7)$$

4. Results of using fuzzy AHP

Using fuzzy AHP, the end weights of all factors were calculated which are presented in Table 3. From this table, it can be seen that the weights of factors are 0.121, 0.084, 0.072, 0.09, 0.044, 0.188, 0.099, 0.148, 0.087 and 0.067 for Performance expectancy, Effort expectancy, Social influence, Facilitating conditions, Self-efficacy, Trust, Privacy, Security, Perceived enjoyment and Attitude toward technology, respectively. The results indicated that Trust, Security and Performance expectancy are the main factors that cause the users adopt a SNS.

Table 3
Weights of the important factors of social network sites adoption.

Factor	Weight
Performance expectancy	0.121
Effort expectancy	0.084
Social influence	0.072
Facilitating conditions	0.09
Self-efficacy	0.044
Trust	0.188
Privacy	0.099
Security	0.148
Perceived enjoyment	0.087
Attitude toward technology	0.067

5. Conclusions

The focus of this study was to identify factors affecting an SNS user’s intention to SNS. The main objective of this study was to discover the level of importance of factors for SNS adoption. We conducted a survey which was questionnaire based to collect the data from the experts of the field. Accordingly, an appropriate approach was applied to analysis the data using a fuzzy AHP technique. The results indicated that Trust, Security and Performance expectancy are the main factors that cause the users adopt a SNS.

This study examined all types of SNSs as a research artifact. However, users of different types of SNSs may possibly exhibit different characteristics. Thus, future researchers may wish to study SNS user characteristics specific to the type of SNS.

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