# Evaluation of Security Factors Effecting on Web-Based Service Adoption

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*Abstract:* - The immense growth of Information and Communication Technology in past few years has seen the emergence of movement from Traditional Service to Web-based Service. One of the main obstacles in front of this movement is the security concern of users which will results in rejection of Web-base service usage. This research is going to evaluate the security factors effecting on adoption of Web-based services. In this regard, the security dimensions related to electronic services are extracted then Exploratory Factor Analysis is employed to propose the conceptual model.

*Key-Words:* - Web-based Service, Electronic Service, Security Factor, Adoption, Perceived Security and Exploratory Factor Analysis

## 1 Introduction

Internet revolution is the main result for the appearance of many online based businesses, where significant impact took place on how businesses are implemented in new era. This revolution has caused an appearance of electronic services (e-services). E-service includes two main long-term trends which are switching economy from goods to services and the massive information economy together with electronic networks.

It is proven that Internet has changed the people lifestyle nowadays. For examples, citizens became journalists with using blogging and e-commerce sites confluence the global competition in the marketplace. However, this era may also contribute on massive cyber-crime [1]. There are many definitions for Web-based service or e-service. According to [2] web-based service is defined as the provision of interactional, content-centered and electronic-based service Web. For this study the Web-based service and e-service are used interchangeably [3].

As the Web-based consumer activity is set on the edge of dramatic growth, the fear on security issues can limit the development by arousing shoppers' concern about the electronic environment [4].

[5] introduced accountability, authentication, authorization, availability, confidentiality, integrity and non-repudiation as the security core which can be disrupted by a variety of attacks to the Web-based services.

This research is going to explore the security factors effecting on e-services adoption and then propose a new model to assess the influence of perceived security on user acceptance of e-service. In this regard, first, the security factors are extracted from literature and after that the new propose model is proposed using Exploratory Factor Analysis.

## 2 Security and Adoption

Despite the fact that majority of the Web sites are offering the security protection particularly for access control such as user names and passwords, there is still uncertainty on security of Internet [6]. Hence, it can be summarize that, though on-line security is still anticipated as the main challenge in electronic environment, user confidence can be heightened and managed using encryption and digital signatures [6]. Transaction security and personal information protection have been highlighted by [7] as vital factor for assessment on electronic environment security.

Customers are reluctant to adopt internet banking because of security and privacy concerns [8]. [9] stated that although customers have the strong confidents feeling about their banks, they still have their concerns about the online transaction since they do not feel confident in technology. According to [10], e-commerce and e-banking are two applications of electronic services, so the impact of security on adoption of e-services can be proposed.

Security has been known as one of the most significant factors affecting on technology acceptance [11] and it is extremely significant in customers' trusting that Web-based technology will

perform their intended and requested functions [12, 13].

Furthermore, [14] mentioned that security and privacy concerns have the negative effect on e-service adoption. Moreover, [15] stated that security is one of the most significant barriers to the acceptance of e-banking, and technology acceptance [16].

Since security is one of the vital obstacle and concern of information technology users [17], consumers' perception to information security is affecting their decisions making and behavior towards using Web-based services [18]. Thereupon, emphasizing on improving positive security and privacy perceptions are most significant factors for sustained activity in online environment [19, 20].

Online transaction safety and customer confidentiality are two security concerns in online transactios. For purchasing intention, online security played a critical role for users' perceptions [21, 22]. According to [23], perceived security has the direct influence on users intention to use Web based services. One of the obstacle in front of growth of online transactions is users' concerns about security and privacy [24].

## 3 Security Definition

[25] defined security as "the extent to which a consumer believes that making payments on-line is secure" in online environments. Moreover, the ability of the Web-based service providers to protect users' information and their financial transactions information from being stolen during transmission is another definition of security [26]. Security in e-commerce has been defined as "a threat that creates circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, fraud, and abuse" [27].

Freedom from danger, risk, or doubt is defined as security by [6]. According to [4] determining security perception is more crucial compares to the ease or utility of the innovation when user encounters with potential risky results related to an innovation. An e-service website is perceived to be secure while being able to protect clients' information from potential threats [26]. In current research, perceived security is defined as the extent to which users feel that security is significant in a particular application and consumers believe they can safely use the application.

## 4 Security Aspects

However, technology protections only are far from enough [28]. Numerous security issues should be taken into consideration to increase the whole security of e-service. According to the literature, thirteen antecedents of security namely; Confidentiality [5, 29-32], Privacy [19, 29, 33, 34], Integrity [11, 29, 30, 35], Input Validation [36], Authentication [5, 30, 37, 38], Accountability [1, 35, 36, 39], Minimum Benefits [32], Non-Repudiation [5, 29, 30, 37, 38], Authorization [1, 30, 32, 37, 38], Availability [5, 37, 40], Audit and Logging [1, 30, 32, 36, 39], Verification [1, 11], Configuration Management [32, 36] were extracted. The definitions of security aspects are as following.

Accountability is a proper mechanism to keep users accountable for their actions.

Auditing and Logging is an appropriate procedure to record actions in the system.

Authentication is a process to validate the identity of user.

Authorization is a process to granting of permission to users for accessing to particular resource, application and information.

Availability refers to the accessibility and usability of the service and system to operate.

Confidentiality is an appropriate means to prevent access to users' information by unauthorized person.

Configuration Management refers to how the security issues related to the system will be handled.

Input Validation is a process to determine the input errors and prevent for additional processing by filtering, scrubbing or rejecting input.

Integrity is a procedure that ensures information is not altered by unauthorized person and the message will be transmitted correctly.

Minimum Benefits is a mechanism ensures that users are able to take advantages of functions which they are allowed to perform.

Non-Repudiation is a process to ensure that no one can deny his/her performed action.

Privacy is a mechanism to provide users the ability to control over the flow of their personal information in terms of collection, usage, disclosure and subsequent access.

Verification is procedure to verify the user identity before using the system.

## 5 Methodology

In order to develop a model to assess the security factors affecting of adoption of Web-based service, first thirteen security dimensions has been extracted from literature. In second step, the Exploratory Factor Analysis (EFA) which is the theory

generating procedure is applied. In brief, EFA identifies representative variables from a much larger set of variables for use in subsequent multivariate analysis [41]. In this regard, survey technique was employed as a data collection method which is extremely flexible and could be used to gather information concerning almost any topic, from a large or small number of people [42].

Students were chosen as a group of respondent because in the context of Web-based services they are savvier than elder people, furthermore, Internet is a part of their daily life and they frequently use Web-based service such as online shopping and online banking.

## 6 Data Analysis

In order to ascertain scales internal consistency, Cronbach's alphas method is applied which is known as most proper measure of reliability for Likert-scale instrument [43, 44]. As the Cronbach's alphas range from 0.84 to 0.91, the constructs are deemed to have adequate reliability [43-47].

According to [48], for survey studies, the most significant validity issue is to determine how well the survey items measured the factors as proposed in the research model [48]. In order to measure the sampling adequacy, KMO and Bartlett test was performed. As it is shown in Table 1, the Bartlett has a significant value (p = .000) and the KMO overall (0.821) is higher than the conventional cut-off point (0.60). This indicates that the correlations observed in the variables are likely to contain common variance and the data are likely to factor well [48].

**Table 1:** KMO and Bartlett's Test

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .821 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 3033.697 |
| | df | 630 |
| | Sig. | .000 |

With the intention of explore the main variables to create a theory or model from a relatively large set of latent dimensions often represented by a set of items, Exploratory Factor Analysis is applied [49-52]. Table 2 shows the eigenvalues and explained total variance for the extracted components. K1 - Kaiser's method is the best known and most used in practice [53] because of its theoretical basis and ease of use [54, 55]. It suggests that only constructs which has the eigenvalues greater than one should be retained for interpretation. The eigenvalue criterion indicates that twelve factors should be retained and 65.60% of the variance has been explained. Table 3 presents the rotated component matrix and the components loaded on their corresponding construct. In order to provide the construct validity including both convergent validity and discriminant validity, the items with loading factor less than 0.5 and cross-loading greater than 0.35 are eliminated [56, 57]. Therefore, a total of five items are deleted. In next step, the interpretation process is carried out for allocating a name for that each of ten remained constructs. It is significant that labels of constructs reflect the theoretical and conceptual intent.

**Table 2:** Total Variance Explained

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 9.238 | 25.661 | 25.661 | 9.238 | 25.661 | 25.661 | 4.300 | 11.943 | 11.943 |
| 2 | 2.514 | 6.983 | 32.644 | 2.514 | 6.983 | 32.644 | 3.288 | 9.134 | 21.077 |
| 3 | 2.152 | 5.978 | 38.622 | 2.152 | 5.978 | 38.622 | 2.615 | 7.265 | 28.342 |
| 4 | 2.020 | 5.611 | 44.233 | 2.020 | 5.611 | 44.233 | 2.555 | 7.096 | 35.438 |
| 5 | 1.673 | 4.646 | 48.880 | 1.673 | 4.646 | 48.880 | 2.046 | 5.682 | 41.120 |
| 6 | 1.428 | 3.966 | 52.846 | 1.428 | 3.966 | 52.846 | 2.010 | 5.584 | 46.704 |
| 7 | 1.275 | 3.543 | 56.389 | 1.275 | 3.543 | 56.389 | 1.937 | 5.381 | 52.085 |
| 8 | 1.246 | 3.460 | 59.849 | 1.246 | 3.460 | 59.849 | 1.704 | 4.733 | 56.818 |
| 9 | 1.043 | 2.898 | 62.746 | 1.043 | 2.898 | 62.746 | 1.654 | 4.595 | 61.414 |
| 10 | 1.030 | 2.861 | 65.607 | 1.030 | 2.861 | 65.607 | 1.510 | 4.194 | 65.607 |
| 11 | .979 | 2.720 | 68.327 | | | | | | |
| 36 | .136 | .379 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.

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**Table 3:** Rotated Component Matrix and Components Loading on Constructs.

| | Items | Cronbach's alphas | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| V1 | Authentication 1 | .844 | .569 | .215 | .027 | .139 | -.072 | .319 | .287 | -.224 | .085 | .305 |
| V2 | Authentication 2 | .844 | .629 | .067 | .106 | -.154 | .193 | .130 | .172 | .069 | .143 | .278 |
| V3 | Authorization 1 | .844 | .673 | .071 | .012 | .257 | .099 | -.004 | .049 | .109 | .137 | .025 |
| V4 | Authorization 2 | .845 | .602 | .324 | -.086 | .245 | -.207 | .082 | .144 | .036 | -.055 | .200 |
| V5 | Verification1 | .842 | .715 | .092 | .254 | .280 | -.079 | .157 | .066 | .104 | -.136 | -.012 |
| V6 | Verification 2 | .842 | .794 | .156 | .164 | .102 | .073 | -.020 | .049 | .210 | -.008 | -.065 |
| V7 | Minimum Benefit 1 | .842 | .355 | .447 | .228 | -.078 | .014 | -.007 | .267 | .441 | .048 | .126 |
| V8 | Minimum Benefit 2 | .843 | .693 | .148 | .257 | -.114 | .039 | -.046 | -.089 | .300 | .181 | -.118 |
| V9 | Audit and Logging 1 | .842 | .246 | .554 | .043 | .004 | .024 | .131 | .245 | -.006 | .224 | .031 |
| V10 | Audit and Logging 2 | .845 | .056 | .700 | -.071 | -.014 | .161 | .100 | .113 | .066 | -.027 | -.006 |
| V11 | Audit and Logging 3 | .843 | .171 | .649 | .279 | .090 | .324 | .089 | -.115 | .026 | -.091 | -.118 |
| V12 | Configuration Management 1 | .845 | .158 | .614 | .252 | .343 | -.096 | -.277 | .150 | .024 | .236 | -.117 |
| V13 | Configuration Management 2 | .840 | .219 | .548 | .409 | .103 | .079 | .106 | .233 | .212 | -.039 | .024 |
| V14 | Privacy 1 | .847 | .223 | .045 | .612 | .326 | -.179 | -.084 | .170 | -.242 | .157 | -.092 |
| V15 | Privacy 2 | .846 | .100 | .062 | .758 | .089 | .120 | .017 | .098 | .087 | .064 | .014 |
| V16 | Privacy 3 | .844 | .158 | .235 | .583 | .302 | .039 | .257 | .103 | -.044 | -.132 | .107 |
| V17 | Adoption 1 | .849 | .072 | -.093 | .003 | .716 | .064 | .003 | .196 | .080 | .013 | -.101 |
| V18 | Adoption 2 | .847 | .065 | .153 | .206 | .761 | .165 | .072 | -.042 | .071 | -.038 | .052 |
| V19 | Adoption 3 | .846 | .227 | .181 | .155 | .611 | .098 | .149 | -.030 | -.169 | .019 | .167 |
| V20 | Security 1 | .845 | .001 | .100 | .153 | .222 | .731 | -.003 | .239 | .142 | .199 | .063 |
| V21 | Security 2 | .846 | .061 | .195 | -.058 | .146 | .816 | .101 | .128 | -.030 | .174 | -.008 |
| V22 | Security 3 | .843 | .126 | .433 | .303 | .143 | -.211 | .093 | .391 | .254 | .122 | -.022 |
| V23 | Security 4 | .844 | .136 | .030 | .243 | .170 | .216 | .471 | .371 | .237 | -.076 | .203 |
| V24 | Availability 1 | .847 | .089 | .149 | -.080 | .088 | .188 | .672 | .000 | .084 | .092 | -.117 |
| V25 | Availability 2 | .850 | .029 | .040 | .133 | -.002 | -.160 | .616 | -.075 | -.100 | .188 | -.008 |
| V26 | Availability 3 | .844 | .116 | -.035 | .294 | .475 | .193 | .527 | .110 | .196 | .007 | .124 |
| V27 | Confidentiality 1 | .847 | .172 | .057 | .109 | .240 | .255 | -.209 | .639 | .024 | .016 | -.084 |
| V28 | Confidentiality 2 | .845 | .063 | .319 | .114 | -.022 | .150 | .112 | .709 | .036 | -.064 | -.018 |
| V29 | Integrity 1 | .845 | .347 | .046 | -.027 | .021 | .160 | .100 | .123 | .726 | .153 | .010 |
| V30 | Integrity 2 | .845 | .302 | .380 | .040 | .142 | -.090 | -.025 | -.077 | .565 | .082 | .211 |
| V31 | Accountability 1 | .845 | .357 | .230 | .094 | -.134 | .208 | .175 | -.193 | -.029 | .622 | -.041 |
| V32 | Accountability 2 | .844 | .124 | .228 | .491 | -.054 | -.024 | .296 | -.001 | .137 | .286 | .375 |
| V33 | Non-Repudiation 1 | .848 | .005 | -.047 | .039 | .078 | .219 | .173 | .059 | .199 | .780 | .011 |
| V34 | Non-Repudiation 2 | .844 | .337 | .387 | .364 | .000 | .295 | .143 | -.133 | .150 | -.252 | -.058 |
| V35 | Input Validity 1 | .910 | .003 | .194 | .009 | -.088 | -.061 | .139 | .151 | -.068 | .117 | -.775 |
| V36 | Input Validity 2 | .845 | .380 | .209 | .122 | -.058 | -.084 | .170 | .261 | .082 | .250 | .550 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 16 iterations.

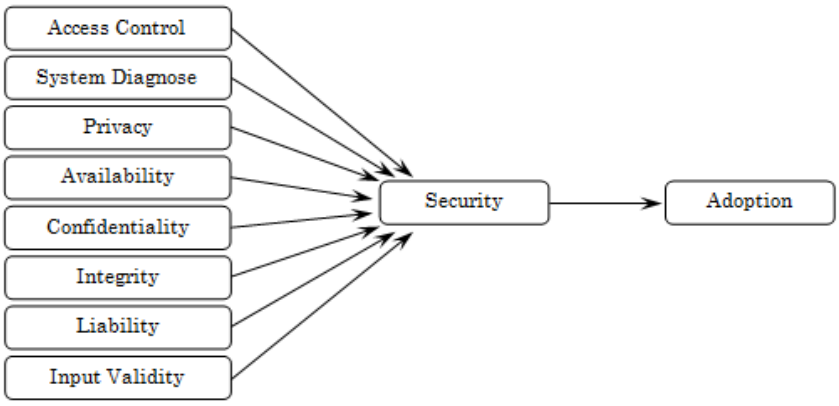


**Figure 1:** Conceptual Research Model

## 4 Discussion

People use Web-based service because it brings them convenience by saving time and minimizing efforts and at the same time there are still some who reject to use Web-based services because they have security concerns such as the safeguard of personal information.

In online environment, security has been becoming a more serious problem and many sophisticated security methods have been developed. Security is one of the main obstacles for electronic service acceptance. Results of the study show that security has the significant and direct influence on adoption of Web-based service.

In this research, ten factors have been generated and labeled as; (1) Access Control, (2) System Diagnose, (3) Privacy, (4) Availability, (5) Confidentiality, (6) Integrity, (7) Liability, (8) Input Validity, (9) Security and (10) Adoption.

In order to evaluate the security dimensions of Web-based services and also understand the effect affect of security on user acceptance of Web-based services, a conceptual model is developed as it is shown in Figure 1.

For future work, it is suggested to apply Structural Equation Modeling (SEM) as a confirmatory approach [58] is used to test the measurement model and the path model simultaneously.

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