

UNDERSTANDING THE ADOPTION OF WEB DEVELOPMENT FRAMEWORKS – THE DETERMINANTS OF CONTINUANCE INTENTION

Anne Shanika Swaris¹, Vathsala Wickramasinghe^{*1}

¹*Department of Management of Technology, University of Moratuwa, Moratuwa 10400, Sri Lanka*
**correspondence: vathsala@uom.lk*

Abstract

The paper provides findings of a study that investigated determinants of the continuance intention of web development frameworks. The specific objectives were to identify factors that could influence continuance intention and test the effect of these factors in determining continuance intention. Hundred and fifty software development professionals in software engineering and design engineering job positions from 16 firms, which involved in web development as a key business activity, responded to the survey questionnaire. Six factors that significantly predict the continuance intention were identified, i.e., technical support experienced by users, management support experienced by users, personal advantage perceived by users, users' level of risk response, users' level of technology awareness, and users' level of optimism towards technology. The paper concludes with the discussion of implications of the findings for theory and practice.

Keywords

Continuance intention; technology adoption; web development; web application frameworks; web development frameworks

JEL Classification

J24 Human Capital, Skills, Occupational Choice, Labor Productivity

M15 IT Management

N95 Asia including Middle East

O31 Innovation and Invention: Processes and Incentives

O33 Technological Change: Choices and Consequences

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Introduction

Front-end web development plays a vital role in the software development. This ranges from developing a simple page of plain text to more intricate business solutions [1–3]. Our paper presents the findings of a study that investigated the factors affecting the adoption of web development frameworks in front-end web development with specific reference to continuance intention. Choosing a web development framework to work with and its adoption demonstrate a commitment [4]. Since the release of new web development frameworks happens almost every day, web developers are in an enigma on which frameworks to adopt, or which factors to consider when deciding to adopt a web development framework [1, 4–6]. In other words, when the target respondents are versatile web developers, investigations on their adoption decisions should go beyond initial acceptance [6]. Hence, the continuance intention becomes important as a measure of technology adoption [7–11].

It is a common belief that web developers prefer to explore newer web development frameworks and consider moving into new ones. However, all do not decide to adopt newer web development frameworks to complete their job tasks. Wieggers [12] states that some developers are reluctant to move into newer technologies while some of those who accepted at the outset do not reap full benefits from all the functionality available leading to sub-optimal usage of the technology. In a similar vein, Swacha and Kulpa [13, p.1] state “since the emergence of the first web development framework at the turn of the 21st century, many of these made a name for themselves and rose to wide popularity only to be later ousted by newer frameworks and sometimes even fall to obscurity”. Hence, it is important to understand factors that influence the adoption decision from web developers’ point of view. In this regard, Moströ and Ryrberg [4] emphasized the importance of distinguishing predictors in terms of technical and non-technical. However, most of the previous research concentrated on technical factors [14] whereas a few research mentioned the non-technical factors [4, 5] in the adoption of web development frameworks. Regarding non-technical human-related factors, Hong et al. [7, p.236] state “humans prefer options that cause no change to the status quo, and resist change because it often involves more work in a shorter timespan or simply because of the uncertainty associated with the change”. Hence, understanding human-related factors that determine continuance intention is very important.

The present study was conducted to understand human-related factors that predict the continuance intention of web development frameworks. Therefore, the specific objectives were to 1) identify factors that could influence continuance intention of web development frameworks, and 2) understand the effect of these factors in determining continuance intention of web development frameworks. An understanding of factors contributing to continuance intention decisions could contribute to creating an environment conducive for users to embrace new technologies. In the present study, new web development frameworks are considered as technologies new to the developer (user). Although a particular framework is new to the organization, the developer may have experience with it at his/her prior workplaces when considering the pace at which they hop from one workplace to another. Hence, building on the arguments of Wu and Lederer [15], the present study investigated the voluntary adoption of web development frameworks.

Literature review

Continuance intention of technology adoption

The literature on technology adoption describes the importance of understanding users’ continuance intention of newer technologies [8–11]. Users who have already tried a new web

development framework have to decide whether to continue or terminate its use [7–11]. Previous research such as Hong et al. [7], Jo and Bang [8], Lee and Kim [9], Sukma and Leelasantitham [10], and Tam et al. [11] showed that the determinants of initial acceptance of a new technology are insufficient to explain its continuance intention. Therefore, the present study investigated factors that determine the continuance intention of technology adoption.

Predictors of continuance intention

The continuance intention of technology adoption is complex since it could be influenced by many factors [7–11]. The present study investigated factors influencing continuance intention having human elements at the centre of focus. As reviewed below, six factors were taken into consideration, namely, technical support experienced by users, management support experienced by users, personal advantage perceived by users, users' level of risk response, users' level of technology awareness, and users' level of optimism towards technology.

Users' level of technology awareness

The literature suggests that users' prior experience with a technology can influence their adoption decision [4, 16, 17]. Dahawy and Kamel [16] state that when evaluating prior experience, the degree of similarity or dissimilarity is particularly important. Individuals who have prior experience with similar technologies could be more likely to adopt newer technologies [16, 18]. For example, individuals with experience in credit card transactions could be more likely to use mobile commerce [18]. Even though users do not have prior experience with similar technologies, they could heuristically develop positive attitudes towards newer technologies [7]. That is, such users may use their experience and available information as reference points to make decisions on the release of newer technologies as well as new features and upgrades of existing technologies [7]. Therefore, it is possible to assume that users' prior knowledge and experience with a particular web development framework, prior knowledge and experience with similar technologies in the context of web development, aspirations to be accustomed to newer technologies, and aspirations to be among the first to work with a particular web development framework could influence their adoption decisions. It is proposed:

H1: Users' level of technology awareness positively influences continuance intention

Users' level of optimism towards technology

Users' belief that a new technology can offer increased control, flexibility, and efficiency is important in technology adoption decisions. Hence, users' optimism towards newer technologies captures the general feeling towards a new technology as a good thing [9, 11, 19, 20]. Berger [19] states that optimism is a stable and reliable measure in explaining technology adoption. Erdoğan and Esen [20] showed that optimism towards a new technology increases perceived usefulness and ease of use, ultimately leading to intention to use. In the context of continuance intention of mobile applications, Tam et al. [11] found that performance expectancy and effort expectancy have significant effects. Oliveira et al. [18] also showed the direct effect of performance expectations over the adoption of new technologies. Lee and Kim [9] found that the hedonic value placed by users impacts the continuance intention of a social network service. Hong et al [7, p.236] state "users who perceive past upgrades to be useful are more likely to hold similar beliefs about the usefulness of future releases of new features". Taking optimism as a belief in increased functional control and efficiency of a new technology, it is proposed:

H2: Users' level of optimism towards technology positively influences continuance intention

Users' level of risk response

Users' level of risk response is the perceived risk in adopting a new technology. This indicates whether users welcome technological change and are comfortable with the technological change even though they perceive it as a challenge. Sultan and Chan [21] argued that users' willingness to take risks has a positive effect on the decision to adopt a new technology. Hence, those who are higher in their willingness to take a technological risk are more likely to try out and adopt new technologies [21]. Accordingly, the users' level of risk response is a valid consideration in information system research [22]. Users' willingness to take risks leads to individual innovation [19, 22]. However, according to Hong et al. [7], users are reluctant to take risks due to two reasons. First, the transaction cost of a new technology could compel users not to move away from the status quo [7]. For example, the perceived cost of learning a new feature [22, 23]. Second, the new technology could challenge the comfort perceived by users [7]. Hence, newer technology adoption decisions usually involve an element of risk, and users' attitude toward risk-taking could influence their technology adoption decisions. It is proposed:

H3: Users' level of risk response positively influences continuance intention

Personal advantage perceived by users

Personal advantage involves users' perception of result demonstrability in job task performance, increased marketability of the self, increased visibility at work, and increased opportunity for advancement [4, 17, 24–26]. In the context of information system use, users may accept a new system when the outcomes of acceptance are worth the effort [27]. Result demonstrability has a direct effect on technology adoption and users are willing to tolerate a system to gain benefits from its functionality when performing job tasks [25]. Further, the degree to which a new version/release has more advantages than the previous generation of technology is also important for social prestige [24], job marketability [24], and increased opportunity for advancement [25]. It is proposed:

H4: Personal advantage perceived by users positively influences continuance intention

Technical support experienced by users

Technical support encapsulates support to users from experts by way of specialized instruction, guidance, coaching, and consultation to use the technology concerned [28]. Previous research provides evidence for the vital role played by technical support in the adoption of newer technologies [17, 22, 29, 30]. For example, Igbaria et al. [29] showed that when the level of technical support is greater, the greater the success will be in adopting newer technologies. When considering technical support, the support coming from the technology developers is also paramount [29]. Since there are many open-source web development frameworks available, support from the creators of web development frameworks is vital for the technology adoption [17, 22]. Technical support from peers is also identified as important [17]. In the present-day, technical support from social media cannot be undermined [30]. Further, social networks facilitate developers to link with other users to find answers to issues or exchange opinions [26]. In addition, when a web development framework becomes popular, its community can provide the required technical support for fellow users [4, 23]. Therefore, technical support could come from many different sources to help solve issues as well as broaden knowledge and skills through the exchange of ideas, which could ultimately lead to the adoption decision. It is proposed:

H5: Technical support experienced by users positively influences continuance intention

Management support experienced by users

Management support plays a key role in technology adoption decisions [7, 8, 22, 25–27]. For example, Son et al. [27] stated that the degree to which top management understands and involves in promoting experimentation with newer technologies are vital in users' technology adoption decisions. The findings of Jo and Bang [8], Noor [22], Son et al. [27] and Zhang & Wu [26] are also in line with the contention that management support is crucial in users' technology adoption decisions. Management support could be in variety of forms such as verbal encouragement [29], confirmation [26], offering avenues for learning [29], encouragement for experimentation [29, 31], autonomy for voluntary use [15], and the provision of constructive feedback [31]. It is proposed:

H6: Management support experienced by users positively influences continuance intention

Method

Sample

The population of interest is software development professionals, who use web development frameworks in Sri Lanka. Following the recommendations of Sekaran and Bougie [32], the convenient sampling technique was used to identify respondents. Hundred and fifty software development professionals in software engineering and design engineering job positions from 16 firms, which were involved in web development as a key business activity, responded to the survey questionnaire. Regarding the firms, 28% of the firms had less than 25 software development professionals, 30% of the firms had 25 to 74 software development professionals, and 42% of the firms had more than 75 software development professionals in their monthly payroll. Table 1 shows the description of respondents.

Table 1: Description of respondents (source: authors)

Characteristic	
Age:	
Mean	28.2
Std. deviation	3.3
Education level (%):	
Diploma	11.3
Graduate (Equivalent professional qualification)	72.0
Postgraduate	16.7
Sex (%):	
Male	71.2
Female	28.8
Total years of experience in the IT industry:	
Mean	4.2
Std. deviation	2.6
Years of experience in the present workplace:	
Mean	2.2
Std. deviation	.86

Measures

Users' level of technology awareness was measured using items adapted from Dahawy and Kamel [16] and Hong et al. [7]. Users' level of optimism towards technology was measured using items adapted from Parasuraman [33]. Users' level of risk response was measured using items adapted

from Sultan and Chan [21]. Personal advantage perceived by users was measured using items adopted from Nan et al. [24], and Venkatesh and Davis [25]. The items from Sultan and Chan [21] and Igbaria et al. [29] were adapted to measure technical support experienced by users. The items from de Jong and Den Hartog [31], Son et al. [27] and Venkatesh and Davis [25] were adapted to measure management support experienced by users. Continuance intention was measured using the items adapted from Hong et al. [7] and Heerink et al. [34]. All the items used in the survey ranged from strongly agree (5) to strongly disagree (1). The exact measures used in our study can be found in Tables 2 and 3.

Methods of data analysis

Data were first tested for reliability using Cronbach's alpha. Factor structure was tested with Principal component factor analysis with varimax rotation. The average variance extracted was used to test convergent validity. After testing correlations, hypotheses were tested using regression analysis.

Results and discussion

Table 2 shows the results of factor analysis for continuance intention. The analysis derived one factor, which had Cronbach's alpha value of .8 and Kaiser-Meyer-Olkin's measure of sampling adequacy of .692 ($p < .001$). The total variance explained was 72% (71.663).

Table 2: Continuance intention (source: authors)

Item	Continuance intention
I intend to use improved versions (new releases) of the web development framework that I am working with at present	.878
I intend to continue using the web development framework that I am working with at present in my future web development projects	.859
I enjoy using the web development framework that I am working with at present	.800
Eigenvalue	2.15
% of Variance explained	71.66
Cronbach's Alpha	.800
Average variance explained	.716
Construct reliability	.883

Table 3 shows the results of factor analysis for independent variables. Six factors were derived, which were named as technical support experienced by users, management support experienced by users, personal advantage perceived by users, users' level of risk response, users' level of technology awareness, and users' level of optimism towards technology. The total item measure had Cronbach's alpha value of .785 and Kaiser-Meyer-Olkin measure of sampling adequacy of .557 ($p < .001$). The total variance explained by these six factors was 67% (67.405). As can be seen from Table 3, technical support experienced by users contributed to the highest variance of the six factors.

The descriptive statistics of the variables and correlations are shown in Table 4. The results of the regression analysis are shown in Table 5. All the independent variables significantly predict continuance intention. For example, with a regression coefficient of 0.163 ($p < .01$), users' level of technology awareness significantly positively predicts continuance intention. This supports H1. Accordingly, all the six hypotheses are supported. Adjusted R^2 of .632 ($p < .001$) conveys that all six independent variables account for 63% of the variance of continuance intention.

Table 3: Success factors – results of factor analysis (source: authors)

Item	F1	F2	F3	F4	F5	F6
Tech help available in the technical documentation for the web development framework that I am working with at present is adequate	.865					
Technical information available on social networks helped to solve queries I had while using the web development framework that I am working with at present	.743					
Clarity of the technical documentation that provides tech help for the web development framework that I am working with at present is sufficient	.598					
Peers provided technical help to solve problems with the web development framework that I am working with at present	.593					
My superiors' perception of my use of web development framework that I am working with at present stimulated me to continue its use		.844				
My superiors recognized my efforts to adopt the web development framework that I am working with at present		.764				
Feedback from my superiors for my use of web development framework that I am working with at present is useful		.736				
Mastering the web development framework that I am working with at present increases my opportunity for advancement			.936			
Mastering the web development framework that I am working with at present increases marketability of myself			.932			
My task efficiency increased with the use of web development framework that I am working with at present			.761			
I felt comfortable when moving into the web development framework that I am working with at present				.865		
I welcomed the technological change when I decided to use the web development framework that I am working with at present for the very first time				.749		
Working with the web development framework that I am using at present is a challenge that I am capable of handling				.663		
I devoted personal time to learning about new web development frameworks available for web development					.854	
I had sufficient knowledge about the web development framework that I am working with at present before using it for the very first time					.760	
I am highly interested in knowing new web development frameworks available for web development					.746	
Before using for the very first time, I believed that the web development framework that I am working with at present would increase my efficiency						.833
Before using for the very first time, I believed that the web development framework that I am working with at present would provide a greater level of functionality						.820
Before using for the very first time, I believed that the exchange of ideas with others would help me with the web development framework that I am working with at present						.753
Eigenvalue	2.37	2.04	2.04	2.02	1.89	1.77
% of Variance explained	13.18	11.35	11.31	11.22	10.48	9.85
Cronbach's Alpha	.751	.731	.877	.678	.685	.762
Average variance explained	.502	.613	.775	.583	.621	.644
Construct reliability	.797	.825	.911	.806	.831	.844

Note: F1: Technical support experienced by users; F2: Management support experienced by users; F3: Personal advantage perceived by users; F4: Users' level of risk response; F5: Users' level of technology awareness; F6: Users' level of optimism towards technology.

Table 4: Correlations (source: authors)

Variable	Mean	S.D.	1	2	3	4	5	6
1 F1	3.90	.45	-					
2 F2	3.76	.74	.011	-				
3 F3	4.28	.42	.249**	.122*	-			
4 F4	3.90	.55	.392**	.188*	.233**	-		
5 F5	3.77	.58	.215**	.243**	.140*	.281**	-	
6 F6	3.93	.42	.171*	.194*	.420**	.293**	.304**	-
7 Continuance intention	4.13	.46	.422**	.371**	.413**	.529**	.278**	.349**

Note: F1: Technical support experienced by users; F2: Management support experienced by users; F3: Personal advantage perceived by users; F4: Users' level of risk response; F5: Users' level of technology awareness; F6: Users' level of optimism towards technology. **p < .01; *p < .05.

Table 5: Regression analysis (source: authors)

Variable	β	R ² (Adj.)
F1: Technical support experienced by users	.443***	.632***
F2: Management support experienced by users	.398***	
F3: Personal advantage perceived by users	.352***	
F4: Users' level of risk response	.279***	
F5: Users' level of technology awareness	.163**	
F6: Users' level of optimism towards technology	.154**	

Note: Standardized coefficients are reported, ***p < .001; **p < .01

Discussion of findings and implications

When the world is experiencing a rapid succession of newer technologies, business firms should adopt these to reap strategic advantage over competitors. This is true for the specific context of web development. Web development firms urge developers to adopt newer technologies available to them quickly and efficiently. Hence, it is of the utmost importance to identify the determinants of adoption of web development frameworks with specific reference to continuance intention. A sample of software development professionals who daily engage in web development responded to the survey questionnaire developed for the study.

The findings led to identify six factors that influence the continuance intention of web development frameworks. These are technical support experienced by users, management support experienced by users, personal advantage perceived by users, users' level of risk response, users' level of technology awareness, and users' level of optimism towards technology. The results of the regression analysis showed that all six factors significantly positively predict continuance intention.

The findings showed the importance of adequate technical support to solve issues while working with the application and broaden knowledge and skills, which leads to using a new web development framework for the very first time as well as newer versions/upgrades of the same. Therefore, the findings of the study support the arguments of Ferreira et al. [23], Igbaria et al. [29], Myllärniemi et al. [17], Noor [22], and Moströ and Ryrberg [4]. Management support conveys encouragement for users to experiment with newer technologies and conveys that users' efforts are recognized. Management efforts also leads to create a work environment conducive for the continued use of newer technologies. This result supports the arguments of Hong et al. [7], Jo and Bang [8], Noor [22], Son et al. [27], and Zhang and Wu [26].

The findings led to suggest that when users perceive the advantages of results demonstrability in job task performance, increased marketability of the self, increased visibility at work, and increased

opportunity for advancement, they are inclined to continue the use. Hence, this finding supports the arguments of Moströ and Ryrberg [4], Myllärniemi et al. [17], Nan et al. [24], and Zhang and Wu [26]. Further, users who intend to adapt to the ever-changing technological environment and are willing to take risks may be inclined to use newer versions/upgrades not only in their current web development projects but also in their future projects. This finding supports the claims of Berger [19], Ferreira et al. [23], Hong et al. [7], Noor [22], and Sultan and Chan [21].

Furthermore, the findings showed that users who have prior knowledge and experience with a particular web development framework, prior knowledge and experience with similar technologies in the context of web development, aspire to be accustomed to newer technologies, and aspire to be among the first to work with a particular web development framework could develop continuance intention. These findings support the arguments of Dahawy and Kamel [16], Hong et al. [7], Moströ and Ryrberg [4], Myllärniemi et al. [17], and Oliveira et al. [18]. In addition, users who believe that a particular web development framework can offer increased functional control, flexibility and efficiency may continue to use it. This finding supports the claims of Berger [19], Erdoğan and Esen [20], Lee and Kim [9], and Tam et al. [11].

Overall, more understanding of users' continuance intention of newer technologies is vital since the considerations of users when deciding to adopt a certain web development framework are not well stipulated in the literature. When considering the limited empirical research available on the adoption of web development frameworks, the present study enriches the existing literature and offers academics and practitioners more insight into the adoption of new technologies with specific reference to continuance intention. Concerning academics and researchers, the present study provides a basis to develop more refined models of continuance intention of new technologies. Concerning practitioners, the present study provides an understanding of vital considerations of users when deciding to adopt newer technologies, which are valuable when creating a conducive environment to work in.

Regarding the limitations of the study, the sample size was limited to 150 that was selected using the convenient sampling technique. If diversity of respondents is an important criterion, the percentage of male respondents was considerably higher than female respondents. Future research could broaden the understanding of technology adoption by incorporating both technical and non-technical determinants of continuance intention to test not only the direct effects but also mediating and moderating effects.

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