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Investigating Effective Factors in User Success in Digital Libraries

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Abstract

Digital libraries have attracted many attentions during last year's because they have made it possible to access information everywhere in the world. From the other hand, despite many studies on evaluating digital libraries and for the complicated nature of evaluating digital libraries, many studies should be done in this field. This paper aims to evaluate digital libraries via the conceptual model of Rahman. For this purpose, using Cochran formula, a sample size of 100 people was achieved through purposeful sampling method at 5% level. The results showed that service quality and time by satisfaction creation in the users and system service quality by motivating the users contribute to the user success.

Keywords: Digital libraries, user success, user satisfaction, Astan Ghods Razavi library.

Introduction

Fast Internet development leads to spreading interest in digital libraries and their related technologies, causing the documents and printed books to be digitalized[1]. Then, nowadays, digital libraries have got much content and many relations with different sources and applications via different protocols and standards at different levels[2]. So, different countries have had major investments on this field. For example, according to Ambati et al ,with the goal of digitalizing millions of the books , articles, scientific documents and making them accessible for the public freely, everywhere and time in the world, India has planned and accomplished many projects[3]. The results of this investment was digitalizing ten millions of the books and accessibility of about 33 million scanned papers in 30 districts of India. Generally, many studies have examined human factors like user behavior, satisfaction, information seeking abilities, and etc in digital libraries environments[4]. But, determination and measurement of all human variables in this field is intricate and sometimes frustrating[5]. Also, few studies have been done on investigating and comparing all above-mentioned factors or their correlations and their impacts on digital libraries. Arms[6]stated that change is an inseparable feature of digital libraries and a problem in their designing. Traditional libraries are not easily applicable and slowly changing. While, providing superior and newer services and technologies, digital libraries keep up with the changes of IT. So, new bases, planning, services, and activities of digital libraries have a dynamic nature which necessitates identification and corporation of user role. Thus, users should be regarded as important stakeholders of digital space. Many researchers have concluded that using digital libraries has many challenges and problems like low Internet speed, old computers[7, 8], old technological equipment that prevents from downloading a big deal of information and animations[9]. According to Jung[10], studying digital libraries' user is one of the most important challenges of informatics sections. Training is a key intervention to manage waste (in terms of both prevention and reduction), and occurs through organizations training teams of front-line employees to produce a waste analysis of their work areas[11]. Thus, user affecting factors for designing and developing efficient digital libraries will be introduced and discussed in this paper.

Literature Review: Digital libraries with strong advanced research supporting ability, high speed, and fast answering system, despite verbal, cultural, and interdisciplinary borders, search for the correct information sharing among different people[12]. Digital libraries can be defined from 2 aspects: from research aspect, gathered and organized content for users' interactions and usage and from library function as the institutes or organizations, providing informatics services in different forms[13]. Digital libraries refer to developing, increasing, and amalgamating all the activities that traditional libraries have[14]. According to Digital Libraries Initiative report, the role of private section is highlighted in developing digital libraries for providing necessary expertise, technologies, and software along with public section (archives, museums, and galleries). According to Digital Libraries Federation, digital libraries are the institutes providing the resources, expert staff, sectional structures, and intelligent access to information in which information accessibility and financial economization is assured. Enormous Internet progress and popularity has provided more access to the information resources of digital libraries. Digital libraries, regarded as an informatics system with the functions of mixing different local sources, providing digital libraries, and principal electronic resources via web and several users across the world are the focus of this paper.

Digital libraries as informatics system: As informatics systems, digital libraries mix different digital situations,

eliminating electronic resources of the libraries, distributed across the world and accessible by a site and some users. According to Noer[15], a significant function of digital libraries is providing latent facilities for manual works (like reform improvement) or delivery (of an auditory file or computer games) while there is not their traditional counterparts. In addition consider current expert systems technologies which typically rely on users of domain experts to manually input knowledge into knowledge bases[16]. Despite many debates on defining digital libraries content and context the terms" virtual" or "electronic' libraries are more common, The reasons making these 2 terms to be alike are as follows: i. Digital libraries are not just an institute or organization. ii. Digital libraries need a technology for connecting many sources. iii. Interconnection of many digital libraries and informatics sources should be delivered to the final user. iv. Global access to informatics system and digital libraries' resources is recognized as the final goal. v. The collections of digital libraries are not limited to storing documents, but include all the documents that can't be printed or physically apparent. In brief, digital libraries are information sources and important sections of any organization with many components and the goals of information collection, organization, and modification.

The success of informatics systems: Despite many studies on the success of informatics systems, there is not a consensus on one success factor[17]. According to Molla and Licker[18], it seems that the success of informatics systems is a complicated discussion topic among the researchers. One reason for this can be multidimensionality of the success of informatics systems which is interpretable in different (technical, personal, group, and organizational) levels, using many complementary (economic, financial, behavioral, and cognitive) factors. Like informatics systems, this issue is true for measuring the success of informatics systems of digital libraries. Too many numbers of correlated variables working in different levels make it possible to define the success of informatics systems. Fox[19] states that traditional measurement criteria like recalling capability are not significantly correlated with the total user success. Spector[20] mentioned that user satisfaction during searching information and working with informatics system is the only important measuring criteria for the user success in digital libraries. So, despite the debates on the ways an informatics system' s success can be measured, there is a consensus that user success in using informatics system is one of the most important measurement criteria for digital libraries. As home businesses begin to flourish, create spillovers through local areas and stimulate community's economic and social vitality[21]

User satisfaction: User satisfaction was regarded in this paper as the major criterion for informatics system's success. In other studies on this field, other criteria like user performance's range and user duties have been used to measure this multidimensional concept. Using this view in this paper has 2 advantages: it creates an opportunity for retesting the correctness of theories of user success in digital libraries; and the correctness of measurement tools for user success in digital libraries can be investigated. Xu mentions informatics literacy as an effective factor of using digital libraries. The most common definition of computer literacy has been represented by Association of College and Research Libraries. In this definition, computer literacy is defined as the person's ability in recognizing the time the information is needed and the ability of evaluating, classifying, and efficient use of needed information. Baroudi[22] provides user satisfaction in 3 major category and 22 combinations: i. System-related factors (variable reliability, correctness, correlation, and complementation), ii. Factor-related level (technical competition and the views of informatics system employees), and user-related factors (user feelings, user perceptions, cooperation, evaluation, and etc). Golafshani[23] introduced 29 factors in their last study. Eves and Olson[24] recognized 3 factors in user satisfaction. In a human environment like digital library people need to be connected directly with informatics system. According to Delone and Mcleans[25], there are 6 categories for organizational success one of which is user satisfaction. These 6 categories include: i. System quality: measuring the quality of system information processing. ii. System applications: response measurement and responsibility toward informatics system. iii. User satisfaction: measuring received responses to informatics system. iv. Personal effect: measuring the effect of received response on receivers' behavior. v. Organizational effect: measuring the effect of information on organizational behavior.

Finally, Delone and Mclins stated that user satisfaction is one of the most important and the most successful measurement criteria for informatics system.

User Success Model: According to Delone and Mclins, system quality and information quality can affect user satisfaction altogether or separately. Moreover, usage rate can affect user satisfaction and usage satisfaction positively or negatively. User satisfaction and satisfaction from system usage can be regarded as personal variables affecting organizational performance.

This model was criticized later. For example, it had many variables but was just tested in an individual package. Reset success model of informatics systems, this model in figure-1.

Considering all criticisms toward previous models and also new advances in this field, Delone and Mclins introduced a new model which was highly promoted than before. This model is represented in figure-2.

This model was the completed version of previous success models of informatics systems and one of the most important theories in this field. Many researchers believe that network benefits and the success of final users are the same or similar. So, instead of network benefit, user success is used here. Jung model is one of the most important models and theories in the success of informatics systems whose major drawback is that it is posed in a non-English country and cultural differences and translation issues should be regarded using it. From the other hand, Jung model was tested 9 years ago. So, it necessitates

more researches to discover the variables and more aspects for user and informatics system success[26]. In this respect, the reset model of Allen and Mclins is one of the most popular models for evaluating final user's success and satisfaction. This paper deals with user satisfaction in individual level rather than organizational level, because digital libraries are personal. A typical business customer will go through the following steps when buying: Identifying a need or problem: This may be highlighted by press coverage or advertising they have seen in the trade press[27].

The conceptual model of the research: This paper first tries to represent different models of user and informatics systems' success in informatics environment like digital libraries and develop a comprehensive model for the user success. According to above-mentioned points, and investigating previous literature and models, the conceptual model of this paper was represented in figure 3.

Hypotheses: The hypotheses of this research were as follows: i. Content affects user success in digital library via usage purpose. ii. Time line affects user success in digital library via usage purpose. iii. System quality affects user success in digital library via usage purpose. iv. Internal interest affects user success in digital library via usage purpose. v. Control affects user success in digital library via usage purpose. vi. Service quality affects user success in digital library via usage purpose. vii. Content affects user success in digital library via user satisfaction. viii. Time line affects user success in digital library via user satisfaction. ix. System quality affects user success in digital library via user satisfaction. x. Internal interest affects user success in digital library via user satisfaction. xi. Control affects user success in digital library via user satisfaction. xii. Service quality affects user success in digital library via user satisfaction.

Methodology

The present study is an analytical survey using descriptive methods with applied goals. Statistical population of this paper was digital library of Astan Ghods Razavi in Mashhad. Using Cochran formula and purposeful sampling, the sample volume of 100 people was achieved because only the academic users were the purpose of this paper.

Results and Discussion

Using Cochran formula, the 100 person sample had the error level of 0.05%. 77% of the population was women and 23% was men. 46% of the respondents were 25-34 years old, (table-3).

To analyze the hypotheses, a 2-stage method of modeling structural equations suggested by Alexander[28] was used. In first step, measuring model was made fit using confirmatory factor analysis. If the measurement model was confirmed, second stage could be followed. In second stage, path analysis was used in which the hypotheses were analyzed. Every latent variable with the questions measuring a considerable variable makes a measuring model. Structural equations describe the relations among the variables, combining multi-variable regression and factorial analysis[29,30]. It also helps testing more complicated equations and relations like confirmatory factorial analysis and time series analysis. Structural model measures the relationship between open and latent variables (to analyze data, AMOS software was used**.** To analyze data, first, the theoretical model for each hypothesis was fit for which fitness indices (CFI, GFI, and CMIN) were used[31]. In the case the model was confirmed, interrelations of the model including regression coefficients (effect coefficient) of the hypothesis and factorial loads of each question were examined using P values that should be smaller than 0.05. Total fitness indices are represented in table 4.

According to table 6, if the resulted values for k-square are less than 3, the model fitness is confirmed[32]. Resulted values show acceptable results for this index. GFI.CFI index should be over 0.9 that was true for this paper. The remaining matrix is important for evaluating total fitness (of prepared model) and trivial fitness (defined parameter between 2 variables). The acceptable values for RMSEA index, based on remaining matrix analysis should be less than 0.1 which was true for this paper, revealing good fitness of the model. The values of k-square for content, quality, and success were bigger than 0.05. So, the models for the hypotheses were acceptable and the next step could be taken.

Regression Coefficients of the Model: The regression model results showed no correlation between direct path, content, time line, system quality, internal interests, and control with the intermediation of use purpose. So, the direct path of service quality with the use purpose (regression coefficient: 0. 509), the direct path of service quality on user satisfaction with regression coefficient of 0.224, and indirect path with regression coefficient of 0.44 was confirmed. With regression coefficient of 0.415, time variable proved to affect user success in digital library via the intermediation of user satisfaction. In the conceptual model of this paper, value was regarded as a variable correlated with the attitudes toward Internet advertisements. To test hypotheses, a trivial index was used whose results are shown in table 6.

The results of regression coefficient model show that boredom is correlated with attitudes directly, but not through value (regression coefficient -0.27). From the other hand, amusement (coefficient = 0.19), reliability (coefficient = 0.17), and interaction (coefficient = 0.29), are directly correlated with user attitudes toward Internet advertisement. Also, amusement (coefficient = 0.29), reliability (coefficient = 0.27), and in formativeness (coefficient = 0.16) are directly correlated with user attitudes toward Internet advertisement via value. To test the hypotheses, a trivial index was used whose results are shown in table 7.

Due to P value of H1 (P=0.000 <0.05), H1 is confirmed at 95% confidence level and confidence coefficient of 0.44. So, the

effect of service quality on user success via user satisfaction is confirmed. H2 (p=0.009<0.05) was also confirmed for the confidence coefficient of 0.03 and 95% confidence level, revealing the indirect effect of time line on user success via user satisfaction. H3 was also confirmed for the confidence coefficient of 0.077 and 95% confidence level (p=0<0.05), revealing the effect of service quality on user success via use purpose. Due to the confidence coefficients of 0.0005, 0.03, and 0.038, (p= 0.824, 0.374, and 0.087>0.05) for H4, H5, and H6 in table 7, respectively, these hypotheses were not confirmed, implying the lack of time and content's effects on user success. Based on the results of H7, H8, H9, and H10, it can be said that quality and interest don't affect user success in digital libraries. H11 and H12 were also rejected for the error level of 0.05%.

Conclusion

Nowadays, digital libraries have turned into academic electronic environments and tools for knowledge and information sharing. This study tried to examine the effective factors in the success of digital libraries the most important of which was user satisfaction. 12 hypotheses were regarded to test the impacts of quality, control, content, time, and interest on user success via 2 intermediates of user satisfaction and use purpose. For a correct estimation of each model, a confirm atoryfactoriel analysis was used whose indices were good fitness, k-square, remaining matrix and adoptive indices. Confirming H1, represented service quality in digital libraries can affect user success via creating user satisfaction. This result agrees with the conclusion of Hools who introduced accessibility as an important step in making digital libraries. Then essential facilities for promoting service accessibility and ease of use in digital libraries should be provided. In a PHD thesis, XU stated that the existence of a correlation between library sources and identified standards and accessibility of the service with less need to expertise or experience affect using digital libraries.

According to H2 confirmation, providing up-date and correct information in the shortest time highly impacts user satisfaction and success while using digital libraries. This result consists with the results of Xu who introduced the lack of being up-date in digital libraries as one of the main problems of them.

Confirming H3, accessibility and truthfulness of digital libraries and used system's adoption with digital libraries also increase user's use purpose while exerting digital libraries, finally, affecting user and libraries success. Other hypotheses (the effects of content, system quality, interest, control, use purpose) didn't prove to impact user success via satisfaction and use purpose. This result consisted with the study of Rahman[33] who introduced the nature of digital libraries, the lack of familiarity with and education about digital libraries as user success's barriers. It is suggested that enough training should be provided for the users via gatherings, conferences, brochures or etc. to make users skillful in this respect. Since this study was done on only one digital library in a specific period, its results can't be generalized to other studies in this field without caution. So, it is suggested that more studies should be undertaken in digital libraries of other places, comparing their results together. More factors of user success in digital libraries like informatics literacy and user experience can be studied in further studies.

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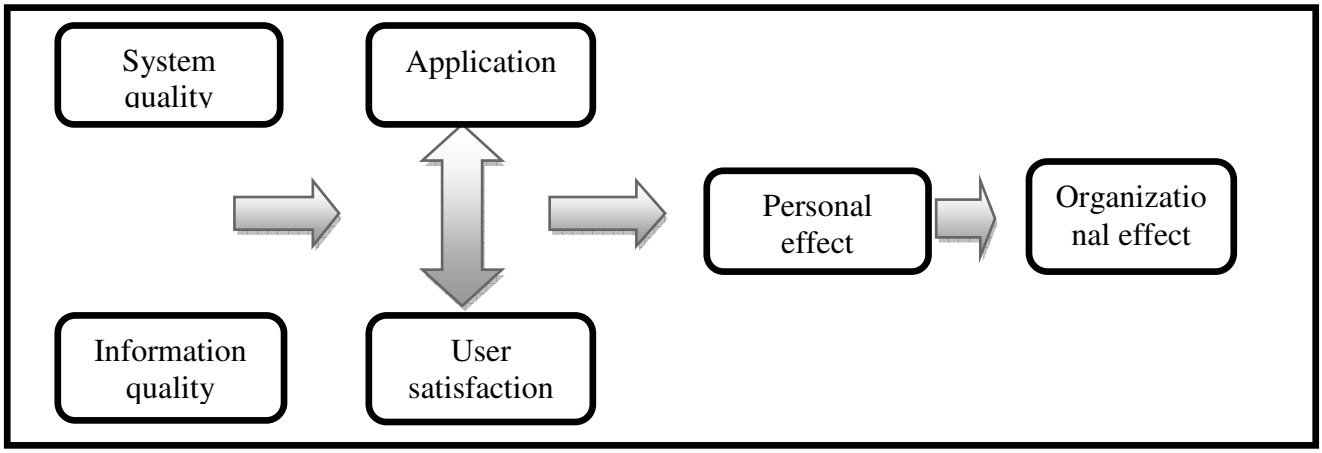

Figure-1
The success model of informatics systems

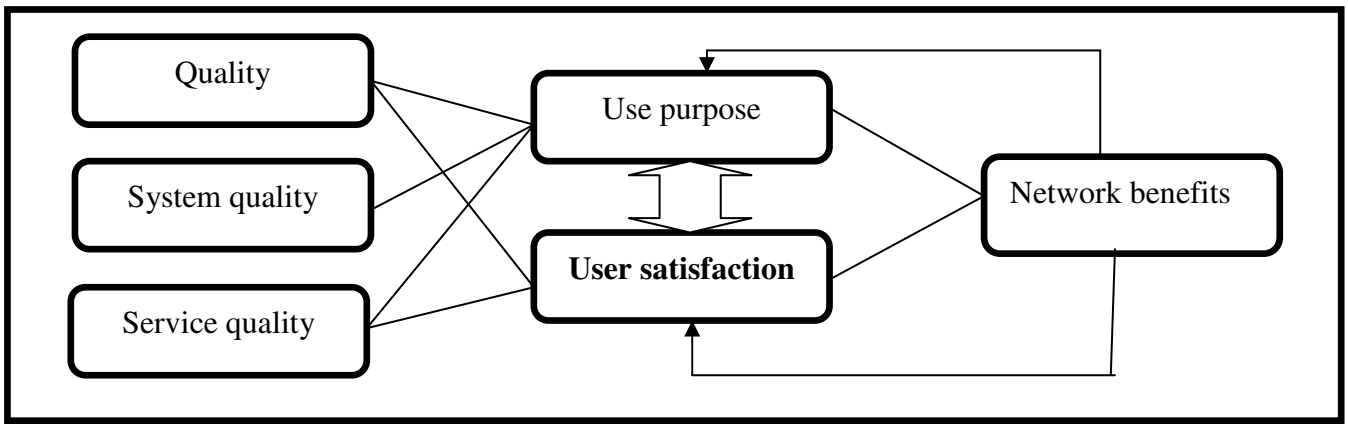

Figure-2
Reset model of Allen and Mclins

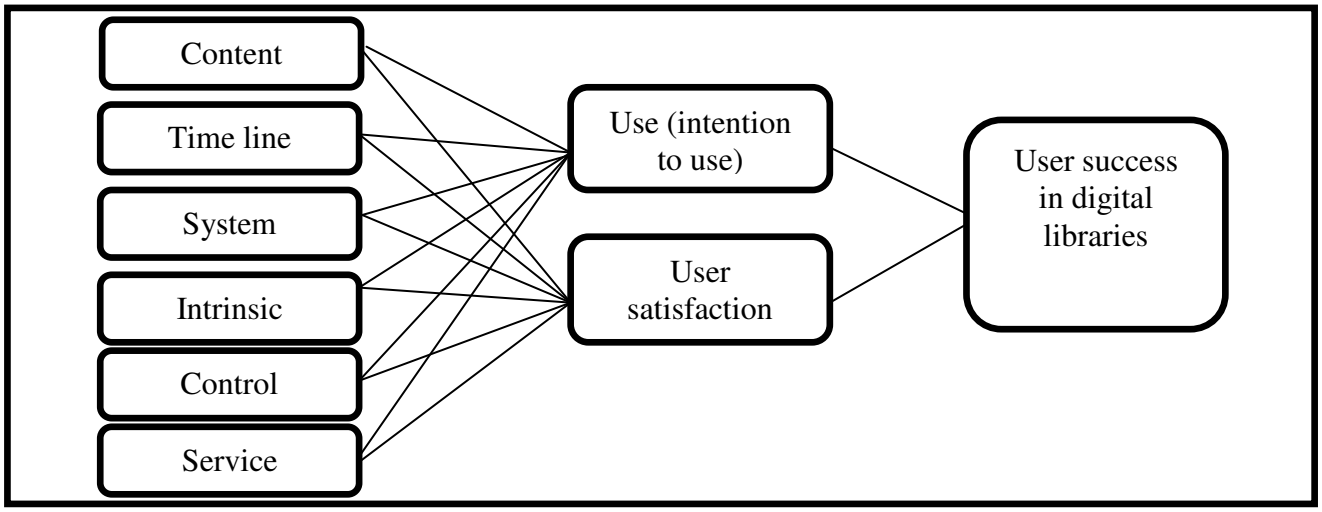

Figure-3
The conceptual model of this paper

Table-2
Cronbach α coefficients

Cronbach α	Variables	Cronbach α	Variables
0.707	Service quality	0.772	System quality
0.702	Use purpose	0.725	User success
0.702	User satisfaction	0.688	Content
0.786	Total questionnaire	0.709	Time
		0.703	Interests
		0.706	Control

Table-3
Gender

Cumulative percentage	Correct percentage	Percent	Frequency	Variable
77	77	77	77	Female
100	23	23	23	Male
	100	100	100	total

Table-4
Age

Cumulative frequency	Correct percentage	Percent	Frequency	Age
44	44	44	44	18-24
90	46	46	46	25-34
98	8	8	8	35-44
100	2	2	2	45-54
	100	100	100	Total

Table-5
Education

Cumulative frequency	Correct percentage	Percent	Frequency	Education Level
22	22	22	22	Diploma
67	45	45	45	BA
97	29	29	29	MA
100	4	4	4	PHD
	100	100	100	Total

Table-6
Total fitness indices

Success model	User satisfaction model	Use purpose model	Service quality model	Control model	Internal interest model	System quality model	Time model	Content model	indices
2	0	0	0	0	0	5	0	2	Degree of freedom
7.659	0	0	0	0	0	5.257	0	1.852	K square(CMIN)
0.221	0	0	0	0	0	0.385	0	0.396	P
1.825	0	0	0	0	0	1.051	0	0.926	CMIN/DF
0.967	1	1	1	1	1	0.980	1	0.991	Good fitness index
0.045	0	0	0	0	0	0.032	0	0.026	Remaining mean square root
0.938	1	1	1	1	1	0.998	1	1	CFI
0.069	0.044	0	0.003	0.010	0	0.023	0.005	0.000	RMSEA

Table-7
Direct path analysis results

Result	P	Regression coefficients	Hypotheses		
Rejected	0.824	0.036	use purpose	←	Content
rejected	0.087	0.249	use purpose	←	Time
rejected	0.415	0.152	use purpose	←	System quality
rejected	0.634	0.124	use purpose	←	interests
rejected	0.436	0.127	use purpose	←	control
Accepted	0.000	0.509	use purpose	←	Service quality
Accepted	0021	0.415	use purpose	←	time
rejected	0.374	0.156	use purpose	←	content
rejected	0.102	0.340	use purpose	←	System quality
rejected	0.320	0.284	use purpose	←	interests
rejected	0.568	0.105	use purpose	←	control
accepted	0.008	0.224	use purpose	←	Service quality
accepted	0.020	0.152	success	←	use purpose
accepted	0.009	0.195	success	←	User satisfaction

Table-8
Indirect path analysis (the role of user satisfaction and use purpose)

Hypotheses results	**Indirect role (regression coefficients)**	**paths**	Hypotheses
accepted	0.044	Service quality on success via user satisfaction	Hypothesis1
accepted	0.081	Time on success via user satisfaction	Hypothesis2
accepted	0.077	Service quality on success via use purpose	Hypothesis3
rejected	0.0055	Content on success via use purpose	Hypothesis4
rejected	0.030	Content on success via user satisfaction	Hypothesis5
rejected	0.038	Time on success via use purpose	Hypothesis6
rejected	0.023	System quality on success via use purpose	Hypothesis7
rejected	0.066	System quality On success via user satisfaction	Hypothesis8
rejected	0.019	Interest on success via use purpose	Hypothesis9
rejected	0.055	Interest on success via user satisfaction	Hypothesis10
rejected	0.019	Control on success via use purpose	Hypothesis11
rejected	0.020	Control on success via user satisfaction	Hypothesis12

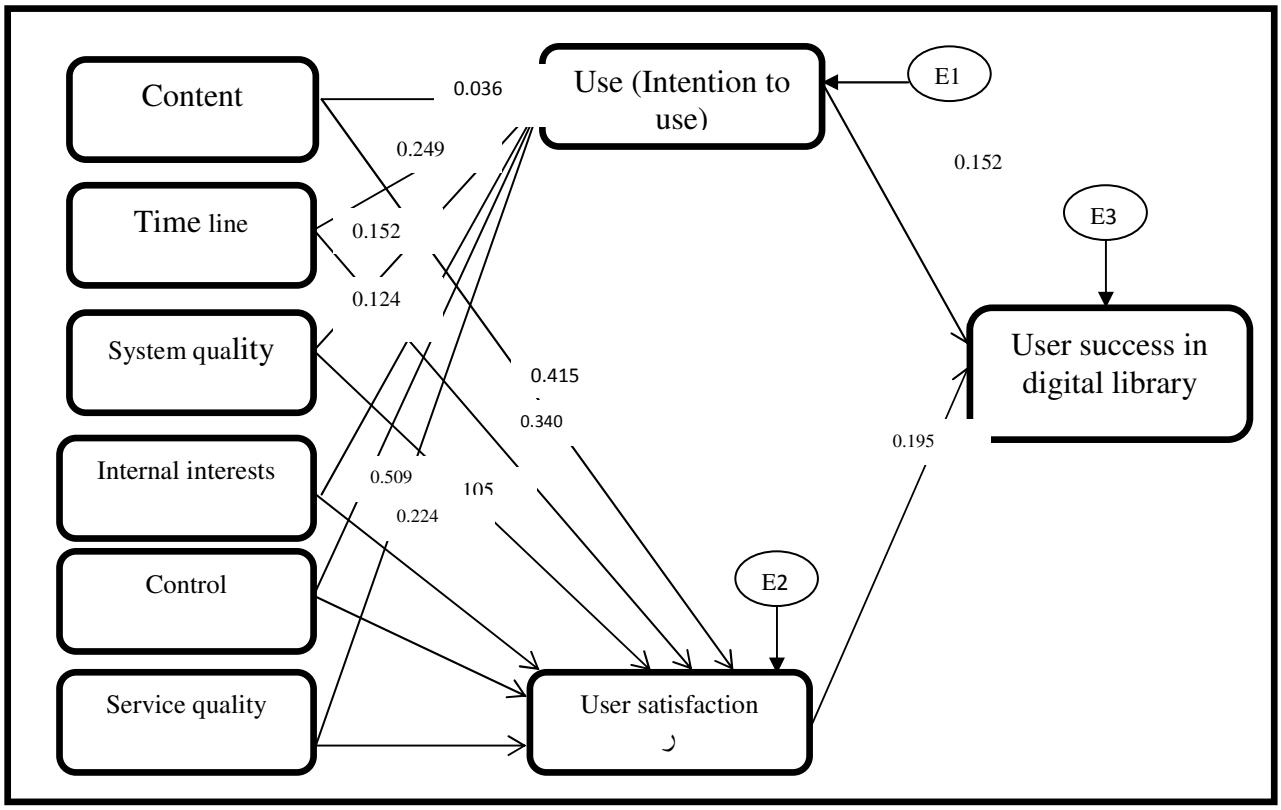

Figure-4
Regression model