Assessing the Differential Effect of Web Usability Dimensions on Perceived Usefulness of a B2C E-Commerce Website

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Abstract. The current invigorated wave of E-commerce initiatives, post the initial boom and dot com bubble burst is definitely more prudent. Therefore, business community is looking to academe for understanding of how usability can be increased to reap the numerous benefits of E-commerce. This study has been undertaken in context of B2C E-commerce websites and its main purpose is to analyze the differential impact of web usability dimensions on perceived usefulness. This is done by studying customers' responses regarding B2C E-commerce websites with respect to four usability dimensions. A questionnaire survey is used to collect data from select respondents (N=415) and analysis is performed using structural equation modelling (SEM). Findings suggest that although all four dimensions significantly impact perceived usefulness, system quality followed by trust are the two most important factors. The study has important implications for website designers, developers and researchers.

Keywords: B2C E-commerce, web usability, system quality, trust, content quality, support quality, perceived usefulness, technology acceptance model (TAM).

1   Introduction

Accelerated advancements in information technology domain have enabled businesses to break traditional barriers and explore new opportunities in the sphere of E-commerce. E-commerce encompasses all business activities carried on with the use of electronic media, i.e. the computer network. One of the most common models in E-commerce is Business-To-Consumer (B2C) model in which, businesses sell products and services through electronic channels directly to the customer. B2C E-commerce has grown both in diversity and transacted money value in recent years and the trend is expected to be the same in future. A report released by IAMAI and IMRB International in 2013 [15] suggests that the E-commerce market which was valued at

Rs 47,349 Cr. in December 2012 is expected to grow by 33 percent to reach Rs 62,967 Cr. by the end of 2013. A study by Forrester Research Inc. [8] on Online Retail 2011 to 2016 reveals that India's E-commerce market has shown an explosive growth of 400 percent in last five years and is expected to grow more than five-fold by 2016.

Due to phenomenal increase in B2C E-commerce sales and the hyper competitive nature of E-commerce market, it is imperative to understand the factors in a B2C website that prospective buyers perceive as relatively more useful than others. In B2C environment, customers have access to numerous websites offering similar products and services, so, if a website is not usable, users would simply access any other site that meets their needs in a more efficient and effective manner. As an organization's website is a gateway to its information, products and services, it must be usable so that customers use and transact through it. Hence website usability is an important area for research in order to understand factors customers consider important in a B2C E-commerce website.

Numerous researchers and web development practitioners have proposed various factors for measuring usability. However, not much research has been conducted that investigates the differential impact of web usability dimensions on visitor's perception of website's usefulness. In fact, no known literature addresses this issue in Indian context. Investigating the relationship between specific usability factors and perceived usefulness with B2C E-commerce website will provide developers and designers of these sites with a tool for improving the website's likelihood of success.

2   Literature Review

Researchers have suggested many definitions of website usability, for instance, Palmer [28] defines usability using download delay, navigability, content, interactivity and responsiveness. Nielsen [26] defines usability in terms of learnability, efficiency, memorability, error recovery and satisfaction. Shneiderman [33] suggests that usability can act as a balancing factor wherein inadequate functionality will render the application useless and complexity and clutter can make the interface difficult to use. ISO 9241-11 defines usability as, the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

Agarwal and Venkatesh [1] highlight five factors viz. content, ease of use, promotion, made for the medium and emotion and aver that importance of content is highest. Ranganathan and Ganapathy [30] focused their research on website design parameters and suggested that security is the best predictor of online purchase intent. Tarafdar and Zhang [34] investigated the impact of individual traits such as gender, innovativeness, computer anxiety, computer self-efficacy on website usability and found significant demographic differences. Further, Palmer [28] identified metrics namely frequency of use, likelihood of return, and user satisfaction that could be used to identify the elements of successful website design.

DeLone and McLean [5] proposed a model for conceptualizing IS success and identified six factors viz. System Quality, Information Quality, Use, User Satisfaction, Individual Impact and Organizational Impact. Basing their study on above, Molla and Licker [25] extended their model by defining a dependent variable called Customer E-commerce Satisfaction and added two dimensions namely trust and service quality. DeLone and McLean [6] updated their model by including service quality and aver that their updated model applies to the E-commerce environment [7]. Jahng et al. [16] proposed a theory of congruence for E-commerce environments and state that a "fit" between E-commerce system, product and user characteristics leads to favorable user outcomes. Liu and Arnett [20] ascertained factors critical to website success and found quality of information, service, system use, playfulness and design of the website to be the key.

It can be concluded from the discussion above that researchers have examined numerous website attributes, and there is no unified model or framework to classify them. Therefore this study attempts to fill this gap by linking website usability dimensions to perceived usefulness and identifying their relative importance.

2.1   Review of Constructs Used in the Study

For the present research five constructs have been studied comprising of four independent variables viz. system quality, trust, information quality and support quality jointly called as web usability dimensions and one dependent variable i.e. perceived usefulness. Web usability dimensions refer to the factors that directly impact perceived usefulness with a B2C website and are very briefly described in the following paragraphs.

System quality refers to the desired characteristics of an E-commerce system. According to Grover et al. [12], it is concerned with performance characteristics of the information system (IS) being studied. System quality research in the E-commerce literature has focused mainly on aspects such as navigability [23],[28]; response time [6],[18]; availability[7],[23]; reliability[7],[36]; security[18],[36]; consistency[28], [30] and customization [18],[28]. The second dimension *Trust* refers to the level of security present in the website to prevent customer details from being accessed illegally and securing web transactions. Trust is therefore a critical factor for the success of any E-commerce venture as trust determines the level of security user feels in divulging personal information over internet. The role of trust in E-commerce has received attention from many IS researchers [11], [19], [24], [29].

In B2C E-commerce scenario, where there is no face to face contact, web vendor's website serves as an interface between vendor and customer [28] hence the importance of content on the website becomes significant. *Content quality* is defined as the degree to which content displayed on the B2C E-commerce website is proper in terms of is relevance, completeness, timeliness, accuracy, depth and breadth [23], [27] The fourth independent variable in this study is *Support Quality* which can be defined as the overall support delivered by the website such as tracking order, comparing products, feedback, reviews, search capabilities etc. Zeithaml et al. [38] define e-SQ as the extent to which a website facilitates efficient and effective shopping, purchasing and delivery of products and services.

In B2C E-commerce, the only interface between customer and retailer is the website, and it is therefore a primary influence on user perceptions and affects customer's perceived usefulness which is the dependent variable in this study. **Perceived Usefulness** is defined as the degree to which the prospective user believes that using a particular system would be free of effort, easy to be understood and used thus increasing users' job performance [4]. If user perceives the website as useful it is more likely that user will initiate the act of transacting with it and continue doing so in future as well. So in a sense perceived usefulness can be seen as one of the basic factors determining the success of a B2C website thereby reflecting its overall excellence. Liao et.al. [19], following [4] define perceived usefulness as the degree to which a consumer believes that using a particular website will increase performance in purchasing and information searching.

Perceived usefulness of a website is thus a very important part of the store's overall image as it is the usefulness of the website that initially attracts the user and can greatly influence online shopping behavior. Nielsen [26] argues that users experience usability of a site before they have committed to using it and before they have spent any money on potential purchases. So perceived usefulness can be seen as a critical success measure of a website as it is only if the users perceive the website to be useful will they interact, be satisfied and finally purchase and indulge in re-purchase behavior with it. This study patterns the system quality construct used in [5],[18],[28]; trust construct using [11],[24]; content quality after [1],[3],[20]; support quality from [1],[38] and perceived usefulness from [3],[4],[23] by adapting it to suit the present context.

3   Development of Hypotheses

In order to ascertain the differential importance of website usability dimensions on perceived usefulness, a hypothesis linking each usability dimension to perceived usefulness has been formulated in this section. Relating system quality and perceived usefulness, Seddon [32] explained that system quality has a positive impact on perceived usefulness of a website. According to [21],[26], poor E-commerce system quality has been found to have a negative influence on the perceptions of usefulness of the website in the mind of customers. Thus, the hypothesis suggested is:

Hypothesis 1 (H₁): System Quality dimension of B2C E-commerce website has a positive impact on Perceived Usefulness.

Pavlou [29] in relating trust to perceived usefulness asserts that trust becomes a predictor of perceived usefulness of a website because it enhances shopping comfort and reduces the perception that e-vendors' websites will engage in harmful and opportunistic behaviors. McCord and Ratnasingam [22] apply TAM to study the impact of trust on perceived usefulness of the website and verify that a consumer that trusts a website will perceive it as more useful. Prior empirical evidence introduces trust as an antecedent of perceived usefulness [11],[29], it can therefore be hypothesized that:

Hypothesis 2 (H₂): Trust dimension of B2C E-commerce website has a positive impact on Perceived Usefulness.

Content quality deals with attributes relating to the characteristics of content on the website. Researchers aver that quality of content and usefulness of a system are closely related with each other and that users will perceive a web site to be of greater usefulness if it provides higher quality of information [5],[30],[32]. So it can be hypothesized that:

Hypothesis 3 (H₃): Content Quality dimension of B2C E-commerce website has a positive impact on Perceived Usefulness.

Ranganathan and Ganpathy [30] relate Support quality and Perceived Usefulness by suggesting that provision of features such as product samples; movie clippings, demonstrations and product reviews increase the usability of the B2C website. According to McKinney et al. [23] and Zeithaml et al. [38], service/support quality positively influences perceived usefulness. There is therefore support for the following hypothesis:

Hypothesis 4 (H₄): Support Quality dimension of B2C E-commerce website has a positive impact on Perceived Usefulness.

4   Research Methodology

Data for the present study has been collected from both primary and secondary sources. Primary data has been collected from respondents for the purpose of the present study using questionnaire survey method. Secondary data from printed and online articles and research reports offering statistical information also forms an integral part of the study.

The questionnaire for the present study has been developed after reviewing similar studies undertaken by various researchers e.g. [1],[4],[5],[24] and adapting them to suit present context. It is aimed at taking responses of people visiting B2C E-commerce websites regarding website usability dimensions and perceived usefulness (No of items = 27) using a 5 point likert scale where 5 indicates a response of strongly agree and 1 indicates a response of strongly disagree. A pilot survey with a sample of 50 respondents was conducted based on which, wordings of three sub-parts of three questions were slightly modified to make it clearer. Thereafter, final revised questionnaire was designed using googledocs and web link of the survey, was sent to prospective respondents. Respondents for the study were selected using **judgmental sampling** on the basis of following criteria; a) more than 20 years of age; b) minimum 2-5 hours of internet usage per week; and c) purchased some product or service online in last six months. The questionnaire was administered to 620 prospective respondents and produced 450 returned responses. Of these, 35 questionnaires have been eliminated because they either appeared unreliable or were incomplete. Finally a total of 415 usable surveys provide the data for analysis.

5   Data Analysis and Findings

This section discusses findings of the analysis done using SPSS and AMOS software. After testing the reliability and validity of each construct, hypothesis formulated in the previous section are tested and finally the relative importance of website usability dimensions in determining perceived usefulness is analyzed.

5.1   Construct Reliability and Validity

Reliability is an important property of measurement and can be defined as the ratio of true variance to total variance. One of the important measures of reliability is Cronbach alpha, which measures how closely related a set of items are as a group. A "high" value of alpha i.e. more than 0.7 or above [27] is often used as evidence that the items measure an underlying (or latent) construct. The various constructs considered in the research study along with their measured variables are shown in table 1. Table 1 also depicts the mean, standard deviation and cronbach alpha statistics for various constructs. With regard to the measurement of the constructs' reliability and validity, Hair et al. [13] and Fornell and Larcker [9] suggest that composite reliability (CR) and average variance extracted (AVE) should be applied. Fornell and Larcker, [9] suggest that value of CR greater than 0.7 and value of AVE more than 0.5 indicate high reliability of the constructs measured. As shown in Table 1, all values of CR, AVE and Cronbach alpha exceed their benchmark thereby indicating high level of reliability.

Table 1. Mean, Standard Deviation, Cronbach alpha, AVE and CR values of constructs used in the study

Construct	Included Measured Variables	Mean	S.D	Cronbach Alpha	AVE	CR
System Quality (SQ)	SQ1- Availability	4.13	0.82	0.94	0.71	0.94
	SQ2- Download Delay	3.73	0.88			
	SQ3- Progressive Rendering	3.88	0.86			
	SQ4- Too Much Information	3.62	0.93			
	SQ5- Common Layout	3.74	0.94			
	SQ6- No Broken Links	3.83	0.95			
	SQ7- Navigation	3.97	0.85			
Trust (T)	T1- User Authentication	4.05	0.93	0.91	0.64	0.91
	T2- Customer Well being	3.47	1.01			
	T3- Vendor Commitment	4.08	0.86			
	T4- Having Security Certificate	3.63	0.86			
	T5- Terms & Conditions	3.75	1.00			
	T6- Chatting with Expert	3.88	0.93			

Table 1. (*Continued.*)

Construct	Included Measured Variables	Mean	S.D	Cronbach Alpha	AVE	CR
Content Quality (CQ)	CQ1- Relevant Content	3.82	0.85	0.91	0.67	0.91
	CQ2- Use of Multimedia	3.96	0.85			
	CQ3- Content depth breadth	4.01	0.79			
	CQ4- Current Information	3.69	0.88			
	CQ5- Word Clarity	3.70	0.85			
Support Quality (SuQ)	SuQ1- Product Comparison	4.09	0.88	0.92	0.71	0.92
	SuQ2- Track Order	4.09	0.88			
	SuQ3- Free Service	3.89	0.91			
	SuQ4- Customer Review	4.14	0.80			
	SuQ5- Mobile, SMS, E-mail Alert	4.16	0.84			
Perceived Usefulness (PU)	PU1- Easy to use	4.12	0.74	0.86	0.57	0.85
	PU2- Convenient	4.31	0.69			
	PU3- Makes shopping easy	4.16	0.63			
	PU4-Increases productivity	4.26	0.70			

5.2   Confirmatory Factor Analysis (CFA) Results for the Proposed Constructs

After testing individual constructs, it is important to test how well the factor structure of measured variables represent the latent constructs hence CFA is performed using AMOS software. The output of CFA is shown in figure 1. Correlation Statistics of CFA performed on constructs of the study are shown in table 2 which indicate that all constructs are valid and explain the related measured variables significantly. CFI of the model is 0.943 which is above the threshold value of 0.9[14] and RMSEA of the model is 0.06 which is below 0.08[14], indicating a good model fit.

5.3   Hypotheses Testing

Hypotheses formulated in previous section have been tested using SEM. Results are shown in table 3 along with statistics such as like unstandardized (URC) and standardized regression coefficient (SRC), squared multiple correlation (SMC) and critical ratio (CR). Result of hypothesis testing shows that system quality positively influences users' perceived usefulness. In fact it is the most significant predictor (0.86, p<0.001) of perceived usefulness and explains 74.3 percent variance in it. An explanation for this can be that, the more navigable and available a website is, the more the user is likely to find it easy to use and convenient and therefore is more likely to perceive it as useful. Findings of [18],[21],[32] concur with above finding.
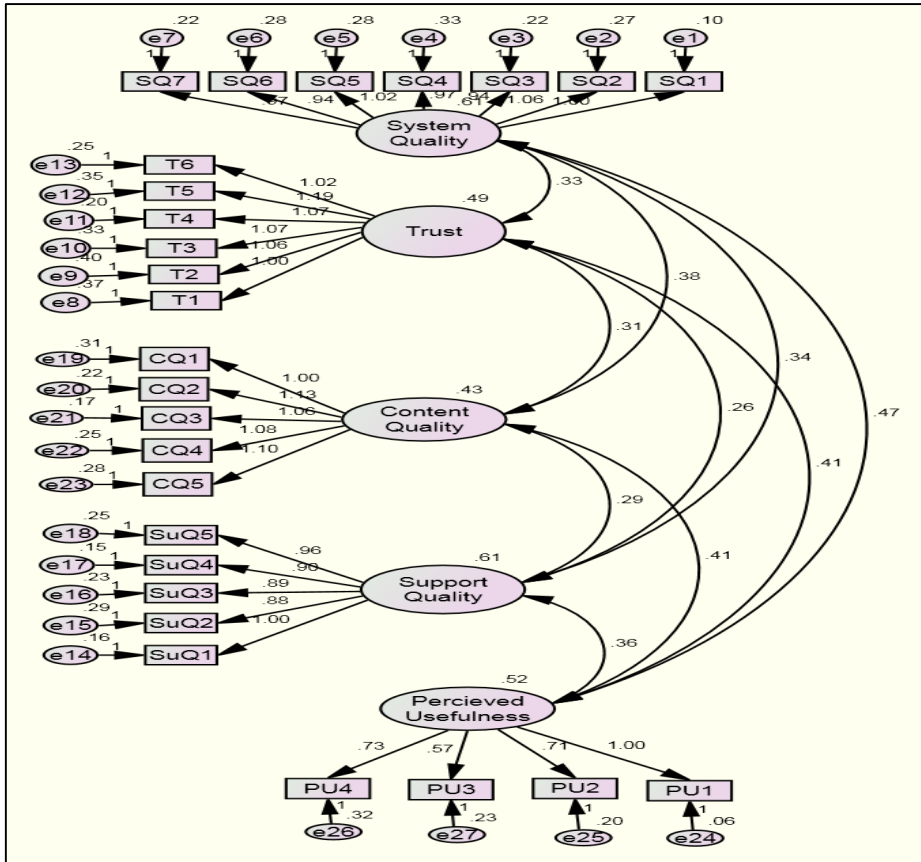
Fig. 1. Confirmatory Factor Analysis of constructs used in study

Table 2. Correlation Statistics of constructs used in study

Constructs	Pearson Correlation				
	SQ	T	CQ	SuQ	PU
System Quality (SQ)	1	0.61**	0.74**	0.56**	0.84**
Trust (T)		1	0.67**	0.48**	0.81**
Content Quality (CQ)			1	0.56**	0.76**
Support Quality (SuQ)				1	0.64**
Perceived Usefulness (PU)					1

** Significant at p<0.01

Results of the second hypothesis indicate that trust has a significant (0.70, p<0.001) impact on perceived usefulness and explains 69.3 percent variance in it, hence the hypothesis is accepted. It can thus be inferred that customers perceive those websites as more useful which are more secure as they don't have to bother about probable misuse of their vital personal information. Agreeing with the above, [22],[29] also assert that trust becomes a predictor of perceived usefulness of a website as it enhances shopping comfort.

Table 3. Regression Statistics- Impact of Web Usability Dimensions on Perceived Usefulness

Hypothesis	Independent Construct	SRC	URC	SMC	CR	Remark
H_1	System Quality	0.86	0. 85	74.3%	22.69*	Accepted
H_2	Trust	0.7	0.65	69.3%	15.69*	Accepted
H_3	Content Quality	0.74	0.71	71.2%	17.283*	Accepted
H_4	Support Quality	0.65	0.56	42.5%	13.31*	Accepted

* Significant at p<0.001

As is evident from the results of the third hypothesis, content quality quite significantly (0.74, p<0.001) impacts perceived usefulness, hence it is accepted. It can be said that the more clear, relevant, timely is the content available on the website the more customers are likely to perceive it useful. The above observation is also supported by [27],[30]. Further, the results point out that support quality also has a significant (0.65, p<0.001) impact on perceived usefulness, hence it can be understood presence of support features such as tracking order, customer review, mobile alerts etc. have a positive influence on customers' perceptions of the website, a view which is also shared by previous researchers [30],[38]. As indicated by the results above, all web usability dimensions have a significant but differential impact on perceived usefulness; hence all four hypotheses are accepted.

6   Assessing Relative Importance of Web Usability Dimensions in Determining Perceived Usefulness

The primary objective of this study is to understand relative importance of website usability dimensions in determining perceived usefulness from customers' perspective so that website designers can give due importance to the dimensions highlighted. As can be gathered from the previous section that all hypotheses have been accepted, therefore the next logical step is to understand their relative importance in ascertaining perceived usefulness. To achieve this objective, Structural Equation Modelling is applied considering System Quality, Trust, Content Quality and Support Quality as exogenous variables and Perceived Usefulness (PU) as endogenous

variable and is depicted by figure 2. The results indicate that in determining perceived usefulness of a B2C website, most important factor is system quality (0.52, p<0.001), closely followed by trust (0.516, p<0.001) and content quality (0.47, p<0.001). Though the relationship between support quality and perceived usefulness as shown in table 4 is high (0.65, p<0.001) but in presence of other constructs becomes very weak (0.19, p<0.001) as shown in table 4. It can further be observed that the impact of all dimensions though significant has also reduced such as in the case of system quality from 0.86 to 0.52.
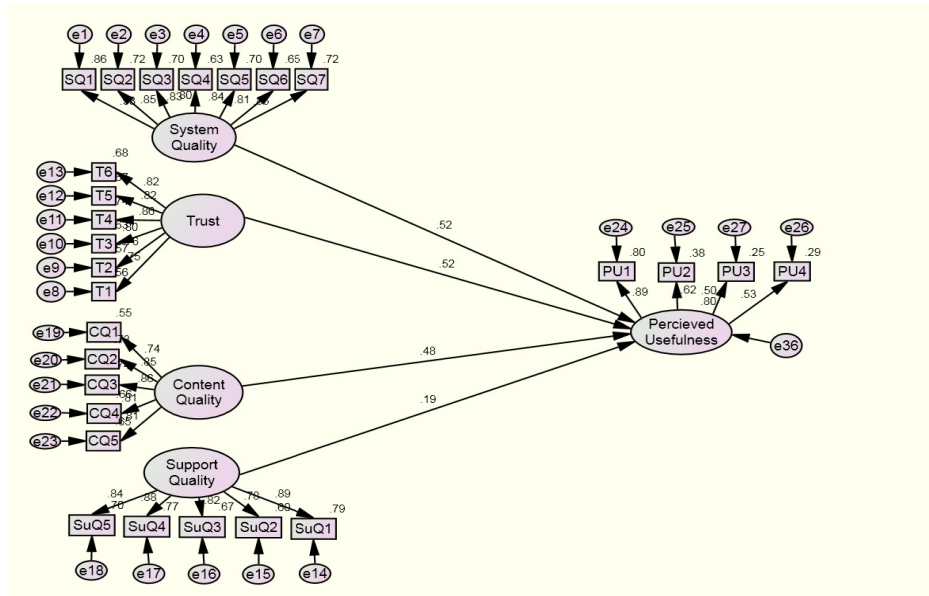

Fig. 2. Relative importance of Web Usability Dimensions according to Perceived Usefulness

Table 4. Regression statistics of Web Usability Dimensions according to Perceived Usefulness

Independent Construct	Standardized Regression Estimates	Unstandardized Regression Estimates	S.E.	C.R.	Squared Multiple Correlation
System Quality	0.52	0.33	0.02	14.59*	
Trust	0.516	0.37	0.03	12.39*	
Support Quality	0.19	0.12	0.02	5.59*	0.80
Content Quality	0.477	0.37	0.03	11.64*	

* Significant at p<0.001

This behaviour can be explained with the help of **'Moderation Effect'**. Baron and Kenny [2], state that a moderator is a variable that alters the direction or strength of the relation between a predictor and an outcome. Researchers such as [2],[10] posit that moderation effects are important to study for understanding the comparative importance of independent variables for predicting the dependent variable. As can be inferred from the above explanation and figure 2, individual impact of support quality construct on perceived usefulness which was high (0.65, p<0.001), has reduced significantly (0.19, p<0.001) as a result of dominance of other three constructs. Hence it can be said that system quality, trust and content quality moderate the relationship between support quality and perceived usefulness. Empirical results also suggest that attributes of system quality such as availability, navigability, download delay, could play a very important role in developing positive perceptions regarding websites' usability. As it is only if the website is available, navigable and has less download time, will it be accessed by the prospective buyers and the question of quality of content or the amount of trust that the website can generate comes later. Therefore, designers must pay more attention to these attributes while designing B2C websites.

7   Discussion

This study investigated the relative importance of four web usability dimensions suggested in literature as significantly impacting an individual's perceived usefulness of a B2C E-commerce website. The results indicate that these four criteria are relatively good predictors of perceived usefulness but have a differential impact on the dependent construct. Not surprisingly, system quality emerged as the most important criteria, a view shared by [3],[21],[26],[32] who have suggested that factors such as availability, navigability etc. increase the likelihood of customer perceiving the website as useful.

Content quality also surfaced as an important feature in determining perceived usefulness. Content of the B2C website is extremely important as it forms organization's core business and contains all information about products to be sold. The results of the present study are in agreement with [1],[3],[25] who endorse that as in E-commerce, customers cannot physically see, touch or feel a product, therefore there is a need to provide as much detail as possible to help them make a sound purchase decision. As the customers of a B2C website act in real time, it is imperative that information content on the website be current, clear, relevant and timely thereby helping the users to take correct and efficient decisions.

Trust plays a very important role in almost any commerce comprising of monetary transactions. As endorsed by [11],[17],[22],[29], in the present study as well Trust emerged as an important predictor of perceived usefulness. Uncertainty regarding the reliability of services, products, or providers is high in an E-commerce environment. In such a scenario, the decision regarding who to trust and with whom to do business becomes even more difficult and falls on the shoulders of individuals. Therefore, web vendors need to create an environment in which a consumer can be confident about any online transaction [37].

Interestingly, contrary to the findings of [23],[30], the construct support quality came out as a significant but a very weak predictor of perceived usefulness. This behaviour can be attributed to two reasons, first being the moderation effect of other three constructs on perceived usefulness. The second reason can be that the importance of support quality can be felt more after the prospective buyer has already had an initial feel of the website and therefore support quality is more likely to influence satisfaction with the website and the buyer's intent to purchase online than perceived usefulness.

Findings of the research have important implications for online retailers of India that desire to establish a successful web presence as it is necessary for them to ensure that their E-commerce website is, first and foremost, perceived as useful. It is only after this that the chances of the customer purchasing, returning recommending it increase. The usability dimensions and their relative importance in determining perceived usefulness can aid website designers and vendors in creating more successful and useful websites and help the vendors in providing an enriching online shopping experience to the customers. For researchers, the results suggest that each of the five constructs used in the study are reliable both in terms of internal consistency, convergent validity and construct validity. High amount of variance explained by usability dimensions implies that these factors are possibly among the most important antecedents of perceived usefulness. Thus the study forms a sound base both for researchers and practitioners.

8   Limitations and Conclusion

This research attempted to identify the differential impact of web usability dimensions on perceived usefulness. Although the findings of the present research provide meaningful implications thus advancing the understanding of Website usability, this study is not without limitations. Firstly, the present study was limited only to studying the functional aspects of the B2C websites. However, non-functional aspects of the website such as enjoyment, playfulness, fun and emotional satisfaction may also be important and contribute significantly to perceived usefulness as is highlighted by[31],[35]. Secondly the present study did not focus on specific type of products as proposed by [16] who posit that product type and its characteristics can be one of the key drivers of the website design. The study examined website usability in context to E-commerce websites only limiting its external validity to same type of websites. In addition, this study is limited by the sample set used in the analyses, the method employed in acquiring the sample set, and by the source providing the sample.

In conclusion, this study has advanced research in the area of B2C E-commerce website usability by (1) providing evidence of the reliability and validity of constructs to determine the usability of B2C E-commerce websites; (2) identifying the relative importance of website usability dimensions in determining perceived usefulness thus providing practical results that can be used immediately by practitioners in the real world, and by researchers in further analysis.

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