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RESEARCH ARTICLE

USING POLYNOMIAL MODELING TO UNDERSTAND SERVICE QUALITY IN E–GOVERNMENT WEBSITES

Rohit Nishant
Département de systèmes d'information organisationnels, Faculté des sciences de l'administration,
Université Laval, 2325, rue de la Terrasse, QC G1V 0A6, CANADA {rohit.nishant@fsa.ulaval.ca}

Shirish C. Srivastava
Information Systems & Operations Management Department, HEC Paris, 1 Rue de la Libération,
Jouy en Josas Cedex, 78351 FRANCE {srivastava@hec.fr}

Thompson S. H. Teo
Department of Analytics and Operations, School of Business, National University of Singapore,
SINGAPORE {bizteosh@nus.edu.sg}

Appendix A

Key IS and Service Quality Research Using Nonlinear Methods

Authors	Method	Results
Fullerton and Taylor (2002)	203 respondents in auto repair service setting and 252 respondents in hairstyling service setting. Analysis using polynomial regression.	Weak support for nonlinear relationship between service quality and loyalty intentions. Strong support for nonlinear relationships between satisfaction and loyalty intentions—the effect is more positive at higher levels of satisfaction than at lower levels.
Klein et al. (2009)	150 respondents from manufacturing and service industries. Analysis using polynomial regression and response surface modeling.	Nonlinear relationship between service quality and satisfaction.
Falk et al. (2010)	Data from 456 online shoppers and 558 portal users. Analysis using nonlinear structural equation modeling.	Functional-utilitarian quality attributes lose their ability to delight customers as relationship matures. Only for more experienced customers do hedonic quality attributes exhibit an increasing effect on satisfaction.
Venkatesh and Goyal (2010)	Data from 1,143 employees over six months. Analysis using polynomial regression and response surface modeling.	Both positive and negative disconfirmation result in lower continuance intention.
Finn (2011)	Data from 20 consumers making one website visit per day for 20 successive weekdays (i.e., a total of 20 websites). Analysis using polynomial regression.	Some evidence of nonlinear effects of service quality.

Authors	Method	Results
Benlian (2013)	Survey data from 169 matched pairs of IS professionals and users. Analysis using polynomial regression and response surface modeling.	Perceptual (in)congruence between IS users and IS professionals can have a nonlinear effect on user satisfaction.
Brown et al. (2014)	Field study of 1,113 participants. Analysis using polynomial regression and response surface modeling.	Test six different models of expectation confirmation. Found assimilation contrast to be the best model to explain relationships between expectations and experiences and dependent variables (intention, use and satisfaction).
Lankton et al. (2016)	Data from three use contexts. Analysis using polynomial regression and response surface modeling.	Demonstrates that the linear/nonlinear relationship of disconfirmation with trusting intention is dependent on the level of expectation maturity (defined as the length of introductory period).

Appendix B

Survey Measures

Expected Service Quality (Kettinger and Lee 1994; Pitt et al. 1995; Teo et al. 2008)
SQEX1: When government websites promise to do something by a certain time, they will do so
SQEX2: Government websites will (i) provide dependable services
SQEX3: (ii) provide services at the times they promise
SQEX4: (iii) give prompt service to citizens
SQEX5: (iv) be responsive to citizens' request
SQEX6: (v) instill confidence in citizens
SQEX7: (vi) give personalized attention to citizens (dropped)
SQEX8: (vii) facilitate personal attention to citizens (dropped)
SQEX9: (viii) be designed with citizens' best interests at heart
SQEX10: (ix) be designed to satisfy the needs of citizens
Perceived Service Quality (Kettinger and Lee 1994; Pitt et al. 1995; Teo et al. 2008)
SQPE1: When this WEBSITE promises to do something by a certain time, it does so
SQPE2: This WEBSITE (i) provides dependable services
SQPE3: (ii) provides services at the times it promises
SQPE4: (iii) gives prompt service to users
SQPE5: (iv) is responsive to users' requests
SQPE6: (v) instills confidence in users
SQPE7: (vi) gives personalized attention to users (dropped)
SQPE8: (vii) facilitates personal attention to users (dropped)
SQPE9: (viii) is designed with users' best interests at heart
SQPE10: (ix) is designed to satisfy the needs of its users
Continued Use Intention (Bhattacherjee 2001; Teo et al. 2008)
INCO1: I intend to continue using this WEBSITE rather than discontinue it
INCO2: My intentions are to continue using this WEBSITE rather than use any alternative means (offline interaction with the government agency)
INCO3: I would not discontinue my use of this WEBSITE

Note: Items with lower factor loadings (italicized) dropped. Some of the items have been used in Teo et al. (2008)

Appendix C

Factor Loadings

	Expected Service Quality	Perceived Service Quality	Continued Use Intention
SQEX1	**.75**	.33	.32
SQEX2	**.78**	.40	.48
SQEX3	**.80**	.40	.34
SQEX4	**.75**	.36	.25
SQEX5	**.70**	.49	.26
SQEX6	**.66**	.35	.18
SQEX9	**.60**	.49	.26
SQEX10	**.69**	.52	.32
SQPE1	.50	**.73**	.37
SQPE2	.44	**.82**	.40
SQPE3	.50	**.83**	.33
SQPE4	.45	**.84**	.36
SQPE5	.45	**.81**	.42
SQPE6	.36	**.71**	.33
SQPE9	.49	**.81**	.40
SQPE10	.48	**.83**	.43
INCO1	.32	.39	**.82**
INCO2	.32	.37	**.76**
INCO3	.44	.41	**.85**

Note: SQEX, SQPE, and INCO stand for expected service quality, perceived service quality, and continued use intention, respectively.

Appendix D

Intercorrelation Matrix for Variables in the Polynomial Regression Analysis

S/N	Construct	1	2	3	4	5
1	Expected Service Quality	1				
2	Perceived Service Quality	.58*	1			
3	(Expected Service Quality)²	-.22*	-.02	1		
4	(Perceived Service Quality)²	-.13	-.40*	.35*	1	
5	Expected Service Quality × Perceived Service Quality	-.02	-.22*	.56*	.73*	1
6	Continued Use Intention	.44*	.55*	-.13	-.21	-.22

Note: *p < .05

Appendix E

Formulae to Compute Surface Test Statistics

$a_1 = (b_1 + b_2)$, where b_1 is the unstandardized coefficient for expected service quality and b_2 is the unstandardized coefficient for perceived service quality. The significance of a_1 is tested using $t = a_1 \Big/ \sqrt{\left(SE_{b1}^2 + SE_{b2}^2 + 2COV_{b1b2}\right)}$.

$a_2 = (b_3 + b_4 + b_5)$, where b_3 is the unstandardized coefficient for (expected service quality)^2, b_4 is the unstandardized coefficient for (expected service quality × perceived service quality), and b_5 is the unstandardized coefficient for (perceived service quality)^2. The significance of a_2 is tested using $t = a_2 \Big/ \sqrt{\left(SE_{b3}^2 + SE_{b4}^2 + SE_{b5}^2 + 2COV_{b3b4} + 2COV_{b4b5} + 2COV_{b3b5}\right)}$.

$a_3 = (b_1 - b_2)$. The significance of a_3 is tested using $t = a_3 \Big/ \sqrt{\left(SE_{b1}^2 + SE_{b2}^2\right) - 2COV_{b1b2}}$.

$a_4 = (b_3 - b_4 + b_5)$. The significance of a_4 is tested using $t = a_4 \Big/ \sqrt{\left(SE_{b3}^2 + SE_{b4}^2 + SE_{b5}^2\right) - 2COV_{b3b4} + 2COV_{b3b5} - 2COV_{b4b5}}$

(Shanock et al. 2010, 2014).

Appendix F

Robustness Checks

Like the estimates for mean-centered variables, the estimates for scale-centered variables also supported our findings. In addition to checking the data for outliers and using standard errors robust against potential issues of heteroscedasticity, we used robust regression, which is robust to violation of various underlying assumptions behind conventional regression. The estimates from the robust regression supported our findings. System quality and information quality may affect service quality (Xu et al. 2013). Also, information quality and system quality could influence use intention (Teo et al. 2008). Therefore, we tested a polynomial model with system quality and information quality as control variables. We controlled for heteroscedasticity and outliers. System quality and information quality were measured using scales adapted from Seddon and Kiew (1996). The estimates for our constructs (linear and higher-order terms of expected and perceived service quality) were similar to the estimates in our original polynomial model, thereby supporting the robustness of our estimates.

Appendix G

Post Hoc Analysis: Effect of Purpose of Visit

Users visit e–government websites for informational and transactional purposes (Teo et al. 2008). Informational use includes browsing, downloading, and passively observing and obtaining information. Transactional use includes activities such as messaging and transacting, where users actively engage with the government agency through the website. When visitors use e–government websites, they learn about the various functionalities and become more skilled in using IS in general. Such experiential learning, called *service learning,* occurs while human needs are addressed (Lester et al. 2005). Learning levels may differ according to purposes for visiting e–government websites. Dimensions of service quality such as reliability and responsiveness may have varying consequences depending on users, and so service quality may have different effects on continued use intentions. Thus, we examine whether purposes for visiting websites influence the relationships in our polynomial model. The analysis further contextualizes our findings. Results from the polynomial model suggest significant estimates for perceived service quality. We extended our model to include the interaction terms of expected and perceived service quality (linear and

quadratic terms) with use (active/passive). We asked respondents to list Singapore websites that they have accessed along with their broad reasons for doing so, aligned with specific options such as browsing, downloading, messaging, and transacting. We classified respondents as passive users if they accessed e–government websites for merely browsing and downloading. Others were considered active users. Our approach reveals the main functionalities. The estimates for the interaction terms of perceived service quality are significant. The interaction plot (Figure G1) suggests that for both active and passive users, use intention increases with an increase in perceived service quality. However, passive users show a steeper increase in use intention. Perhaps active users are more knowledgeable than passive users about the functions and limitations of e–government websites. Thus, service quality is more consequential for passive users.

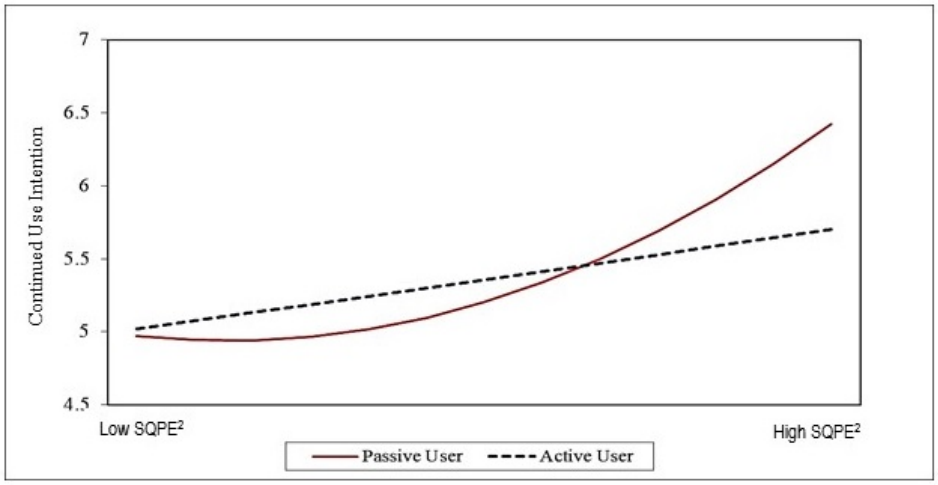

Figure G1. Influence of Purpose of Use on Use Intention

Appendix H

Distinction between Satisfaction and Use Intention in the Context of E–Government Websites

We argued that in the context of e–government websites, the implications of agreement and disagreement between perceived and expected service quality for satisfaction and for use intention could be different. The underlying rationale is that the available alternatives are inferior to the focal IS in question (e–government websites). We examined whether our assertion is empirically valid by testing a quadratic model with satisfaction as the dependent variable. We measured satisfaction using four items based on Seddon and Kiew (1996). The results showed that the estimates for different explanatory variables are often opposite in direction relative to the estimates for use intention. The response surface for satisfaction (Figure H1) is concave in nature, similar to the response surface reported in prior research (Brown et al. 2012, 2014; Venkatesh and Goyal 2010).

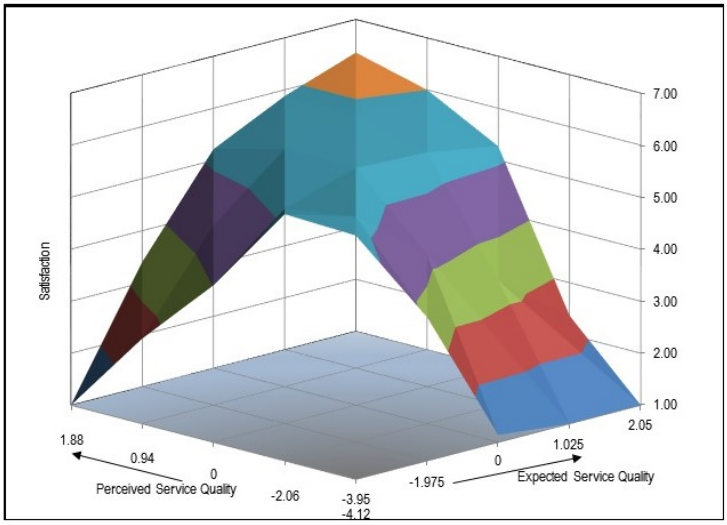

Figure H1. Response Surface Plot for Satisfaction

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